ATTACHMENT 1: UPDATED ENVIRONMENTAL MANAGEMENT PLANS

Manitoba
Transportation and Infrastructure

LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT
SUPPLEMENTAL SUBMISSION

Attachment 1
June 30, 2022

List of Updated Environmental Management Plans

Environmental Management Plan Framework, Draft Rev2

Construction Environmental Management Program, Draft Rev2

Environmental Protection Plan, Draft Rev2

Project Environmental Requirements, Draft Rev2

Access Management Plan, Draft Rev2

Quarry Management Plan, Draft Rev2

Sediment Management Plan, Draft Rev2

Surface Water Management Plan, Draft Rev2

Groundwater Management Plan, Draft Rev2

Revegetation Management Plan, Draft Rev2

Agricultural Biosecurity Management Plan, Draft Rev2

Dust Control Plan, Draft Rev2

Heritage Resources Protection Plan, Draft Rev2

Site Decommissioning Plan, Draft Rev2

Operation Environmental Management Program, Draft Rev2

Ice Management Plan, Draft Rev2

Aquatic Effects Monitoring Plan, Draft Rev2

Wetland Monitoring Plan, Draft Rev1 (new)

Wetland Compensation Plan, Draft Rev2

Wildlife Monitoring Plan, Draft Rev2

Red-headed Woodpecker Habitat Management Plan, Draft Rev2

Eastern Whip-Poor-Will Habitat Management Plan, Draft Rev2

Complaint Resolution Process, Draft Rev2

Manitoba
Transportation and Infrastructure

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Environmental Management Program Framework

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 9

1.1 Project Overview 9

1.1.1 Lake Manitoba Outlet Channel 10

1.1.2 Lake St. Martin Outlet Channel 13

1.2 Regulatory Framework 16

1.3 Environmental Management 17

1.4 Report Structure 17

2.0 ENVIRONMENTAL MANAGEMENT PROGRAM 18

2.1 EMP Overview 18

2.2 Organization 19

2.3 Roles and Responsibilities 20

2.4 Engagement and Indigenous Consultation 20

2.5 Reporting and Review Function 21

2.6 Schedule 22

3.0 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAM 23

3.1 Environmental Protection Plans 25

3.2 Project Environmental Requirements 25

3.3 Access Management Plan 26

3.4 Quarry Management Plan 26

3.5 Sediment Management Plan 26

3.6 Surface Water Management Plan 27
3.7 Groundwater Management Plan 27
3.8 Revegetation Plan 27
3.9 Agricultural Biosecurity Management Plan 28
3.10 Dust Control Plan 28
3.11 Waste Management Plan 28
3.12 Hazardous Materials Management Plan 29
3.13 Emergency Response Plan 29
3.14 Heritage Resources Protection Plan 29
3.15 Site Decommissioning Plan 30
4.0 OPERATION ENVIRONMENTAL MANAGEMENT PROGRAM 31
4.1 Ice Management Plan 32
5.0 FOLLOW-UP AND MONITORING PROGRAM 33
5.1 Environmental Assessment Verification Monitoring 33
5.1.1 Aquatic Effects Monitoring Plan 34
5.1.2 Surface Water Monitoring Plan 34
5.1.3 Groundwater Monitoring Plan 34
5.1.4 Revegetation Monitoring Plan 35
5.1.5 Wetland Monitoring Plan 35
5.1.6 Wildlife Monitoring Plan 35
5.1.7 Red-headed Woodpecker Habitat Mitigation Plan 36
5.1.8 Eastern Whip-poor-will Habitat Mitigation Plan 36
5.2 Compliance Monitoring 36
APPENDIX 1 37
APPENDIX 2 38

List of Figures

Figure A: EMP Process

Figure 1: LMOC Project Area

Figure 2: Typical Cross-Section of the Lake Manitoba Outlet Channel

Figure 3: LMOC Water Surface Profile

Figure 4: LSMOC Project Area

Figure 5: Typical Cross Section of the Lake St. Martin Outlet Channel

Figure 6: Hydraulic Profile of the LSMOC

Figure 7: Project Organization Structure

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders, and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment (EA) process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders, and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage, and operate the Project. This Environmental Management Program (EMP) framework describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management, and monitoring plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations.

The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase

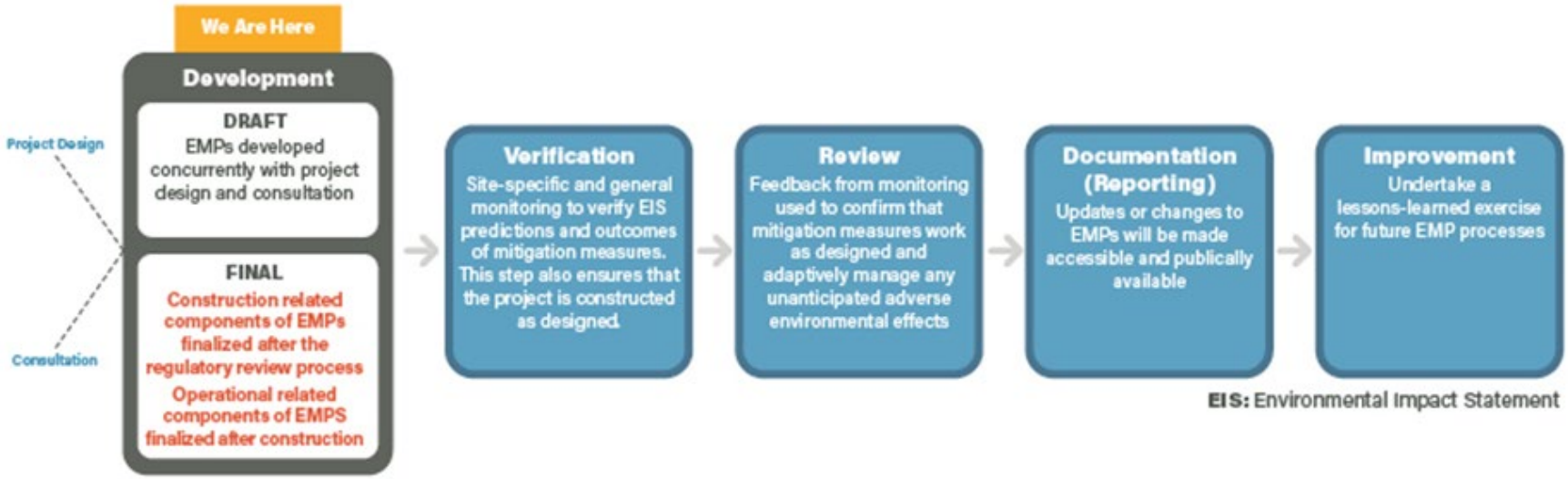


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
cfs	cubic feet per second
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EPP	Environmental Protection Plan
ft	feet
GWMP	Groundwater Management Plan
HRPP	Heritage Resources Protection Plan
IMP	Ice Management Plan
km	kilometre
kV	kilovolt
kW	kilowatt
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
m^3/s	cubic metres per second
MECP	Manitoba Conservation and Climate
OEMP	Operation Environmental Management Program
PERs	Project Environmental Requirements
PR	Provincial Road
QMP	Quarry Management Plan
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality

ROW	right-of-way
RVMP	Revegetation Management Plan
SMP	Sediment Management Plan
SWMP	Surface Water Management Plan
WCS	water control structure
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan

Glossary of Terms

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Bed load: The part of the sediment in a water body that moves by rolling or sliding along the bottom.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation, or maintenance activities, and includes all subcontractors and affiliates.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting, and enforcing compliance with contractual and regulatory requirements.

Conservation concern: Species that are either federally or provincially tracked by the *Species at Risk Act* Committee on the Status of Endangered Wildlife Species in Canada, or the Manitoba Conservation Data Centre and are considered rare or at risk of extinction are species of conservation concern.

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pumps, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with Drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the project to support the structural design of the bridge or structure.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Groundwater quality: Refers to the chemical composition of groundwater and its suitability for various uses and also varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current land use practices that may contribute anthropogenic effects.

Hydrogeology: The study of the interrelationships of geologic materials and processes with water, especially groundwater.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. Preliminary design typically supports environmental submissions that satisfy environmental and/or regulatory requirements, as well as environmental applications. In addition, during preliminary design, all major stakeholders are consulted, and their issues addressed to the extent possible.

Private quarry permit: Refers to a permit for private aggregate or quarry operations in Manitoba.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction, and operation.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting, or blasting.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the *Constitution Act* 1982. Commonly, these include hunting, trapping, fishing, or gathering rights.

Runoff: Surface water that flows overland and into streams, wetlands, or waterbodies, or into drainage systems.

Wetland: Refers to:

(a) a marsh, bog, fen, swamp or ponded shallow water, and

(b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

1.0 INTRODUCTION

1.1 Project Overview

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control management system for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. The presence of the new channels will facilitate better management and control of the water levels on these lakes by working concurrently with the existing Fairford River Water Control Structure in conveying water from Lake Manitoba, through Lake St. Martin to Lake Winnipeg in a manner that reduces or completely avoids overland inundation during high water events such as the 2011 and 2014 floods.

Associated Works of the Project include rock quarries and borrow areas, work camps, staging areas, fuel and waste storage, explosives storage, temporary access routes and realignment of existing drainage, as well as an electrical power distribution line that will be constructed and operated by Manitoba Hydro.

The Project is organized into three phases: site preparation and construction; operation and maintenance; and decommissioning and abandonment.

- **Site Preparation and Construction** – Site preparation for the Project will require vegetation clearing and grubbing of the final alignment right-of-way and excavating the channel to designed depths. In addition to constructing the above list of components, the construction phase for the Project includes preparation of equipment marshalling areas, construction camps and staging areas as well as transporting equipment, machinery, vehicles, construction materials and supplies to the Project construction and staging areas. Construction is currently anticipated to occur over a three to five-year period (Appendix 1) and is contingent on receiving the necessary environmental licenses and approvals. Temporary facilities and work areas, including quarries, laydown areas and construction camps, which will not be needed for future maintenance activities will be decommissioned and reclaimed at the end of the construction phase.
- **Operation and Maintenance** – This phase includes the periods when the control structures are managing flood and non-flood conditions, as well as any required maintenance. The LMOC and LSMOC will be operated by adjusting the gates on the respective water control structures, in response to monitoring and flood forecasting according to the operating guidelines. Operations and maintenance will adhere to Canadian Dam Safety Guidelines. A Project-specific Operation and Maintenance Manual will be developed for the Project structures to detail maintenance needs for the Project during the operation and maintenance phase. This manual will be initiated once the detailed design is completed and prior to commissioning the channels.
- **Decommissioning and Abandonment** – There are no plans to decommission or abandon the proposed Project, as it will provide flood relief to communities and landowners in the Lake Manitoba and Lake St. Martin areas in perpetuity. Should portions of the Project require decommissioning in the future, these activities will be undertaken in accordance with applicable guidelines and regulations at that time.

1.1.1 Lake Manitoba Outlet Channel

The LMOC consists of an approximately 24 kilometre (km) long outlet channel, with the inlet positioned at Watchorn Bay on Lake Manitoba and the outlet on the west side of Birch Bay on Lake St. Martin, as shown in Figure 1. The LMOC will provide a 212 cubic metres per second (m^3/s) (7,500 cubic feet per second [cfs]) increase in the flow capacity out of Lake Manitoba when its water level reaches el. 248.11 metres (m) (814 feet[ft]), and the south basin of Lake St. Martin is at el. 244.14 m (801 ft).



Figure 1: LMOC Project Area

The proposed channel will have an invert elevation of about 242.1 m at Watchorn Bay and about 239.3 m at Birch Bay. The channel will have a trapezoidal shape with a flat base varying in width from 12 m to 22 m and side slopes varying between 4H:1V to 5H:1V. Embankment dikes will be constructed on both sides of the channel in areas where existing ground levels are low and will also be used to gain access to the channel for maintenance. Spoil berms will be located behind the dikes on either side of the channel. An outside drain will be constructed and located on the west side of the channel to collect surface water runoff originating from the west and convey it into Lake Manitoba and Lake St. Martin. A long-term passive depressurization system will be incorporated into the channel to control upward aquifer pressure and maintain geotechnical integrity. A typical cross section of the channel is provided in Figure 2.

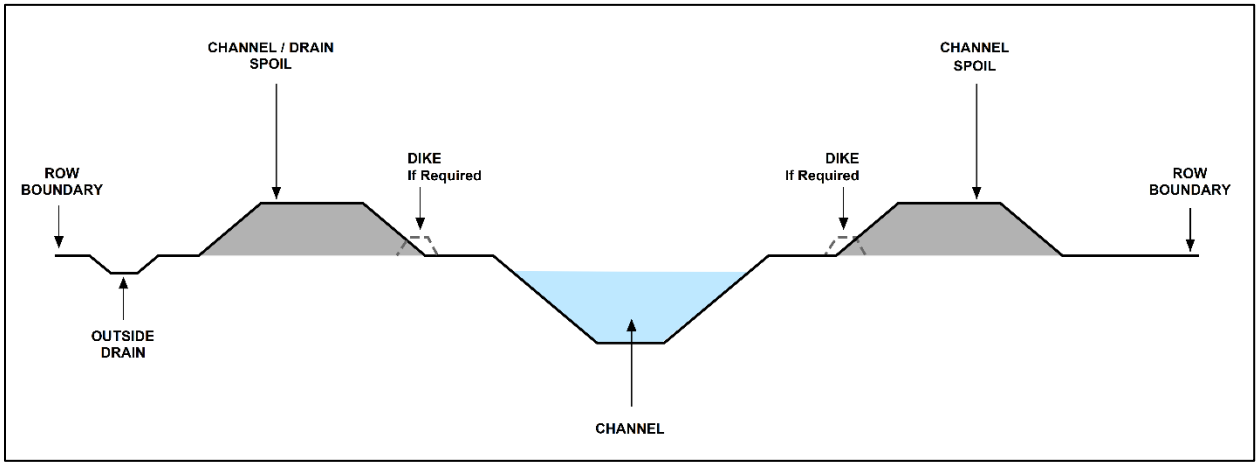


Figure 2: Typical Cross-Section of the Lake Manitoba Outlet Channel

Inlet and outlet works will be required to allow for a smooth transition of flow from Watchorn Bay into the channel and from the channel into Birch Bay. The hydraulic profile of the channel will require the lake bottom to be excavated at the channel inlet and outlet to match the proposed channel invert elevations. The excavations will be flared out and sloped upwards over a short distance out from the shoreline to meet natural lakebed elevations.

A water control structure (WCS) will be constructed at Iverson Road (approximately 21 km downstream of the inlet) to control flows through the LMOC while ensuring that the water level on Lake Manitoba water levels remains within its normal operating range when use of the channel is not required. A bridge will be integrated into the WCS to provide access across the channel. The WCS will consist of three 5.4 m wide sluice bays with vertical lift gates, upstream and downstream stoplogs, and a stilling basin with chute blocks, baffle blocks and an end sill. A gated valve will be provided in the vertical lift gates of the WCS to allow a riparian flow to be provided in the channel so as to maintain dissolved oxygen levels, if required. An ancillary building providing an enclosed space will also be constructed in proximity to the WCS to house the mechanical and electrical systems.

Permanent electrical service is required for power at the WCS to electrically raise and lower the gates, as well as to heat the gates to maintain winter operation capability. To provide this, Manitoba Hydro will upgrade an existing distribution line along Iverson Road and connect it to a pad-mount transformer that will be installed near the WCS ancillary building. A diesel genset will also be installed as an emergency backup power source at the WCS site.

The LMOC will intersect provincial highways and municipal roads. Realignment of Provincial Road (PR) 239 is required in order to accommodate the LMOC while still allowing for safe, economically feasible, and hydraulically efficient structures across the channel. Various sections of municipal road will also be realigned or extended for the purposes of maintaining residential access and agricultural activities.

A total of four new bridges are planned to span the LMOC, of which one will be combined with the WCS as described above. The other three will be dedicated multi-span bridges, constructed to maintain connectivity along the Township Line Road, realigned PR 239 (currently Carne Ridge Road) and Provincial Trunk Highway (PTH) 6.

The LMOC is designed to be operated under both open water and ice-covered conditions. The hydraulic profile for the LMOC is shown on Figure 3 for the normal operating range of the lakes (when the WCS gates are closed), as well as for the conveyance condition of 212 m^3/s (7,500 cfs) in the channel with Lake Manitoba at el. 248.11 m (814 ft) and the south basin of Lake St. Martin at el. 244.14 m (801 ft). Average velocities in the LMOC are expected to range between approximately 0.8 m/s and 1.0 m/s during passage of this conveyance condition, with locally higher velocities occurring in the vicinity of the bridges and the WCS.

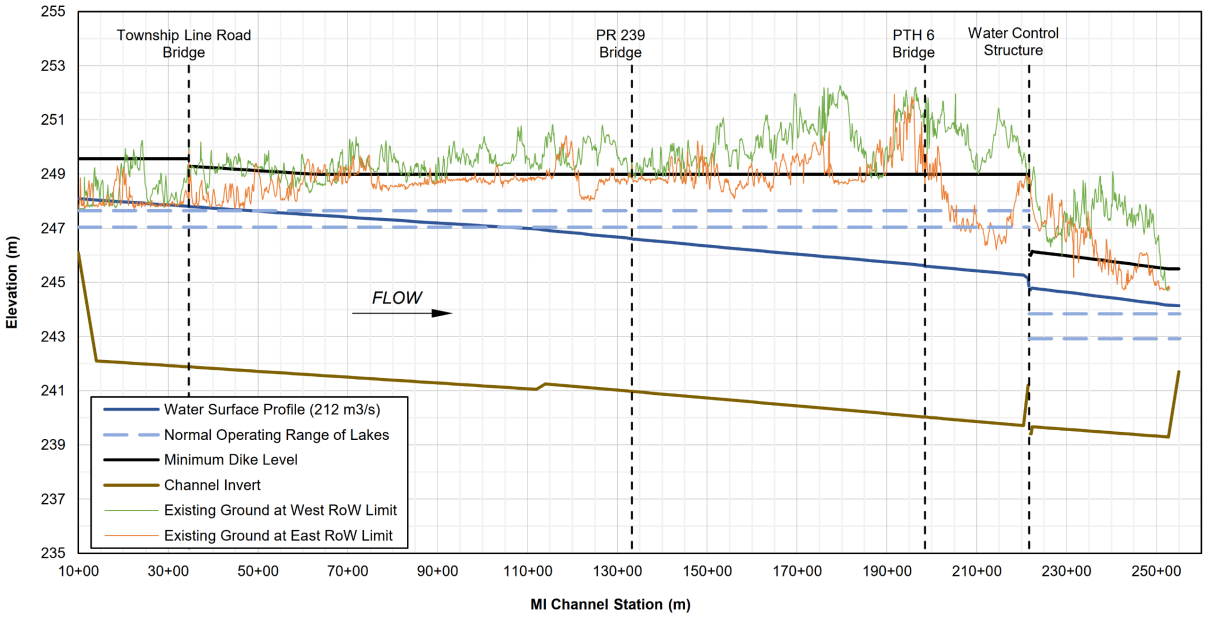


Figure 3: LMOC Water Surface Profile

1.1.2 Lake St. Martin Outlet Channel

The LSMOC Project consists of an approximately 23 km long outlet channel, with the inlet positioned at the northeast end of Lake St. Martin and the outlet south of Willow Point on Sturgeon Bay of Lake Winnipeg, as shown in Figure 4. Lake St. Martin consists of two basins (south and north basins) connected by a series of flow constrictions known as the Narrows. The LSMOC will provide 326 m^3/s (11,500 cfs) of additional outflow capacity from Lake St. Martin when the north basin water level is El. 243.18 m (797.8 ft), and the south basin water level is El. 244.14 m (801 ft).

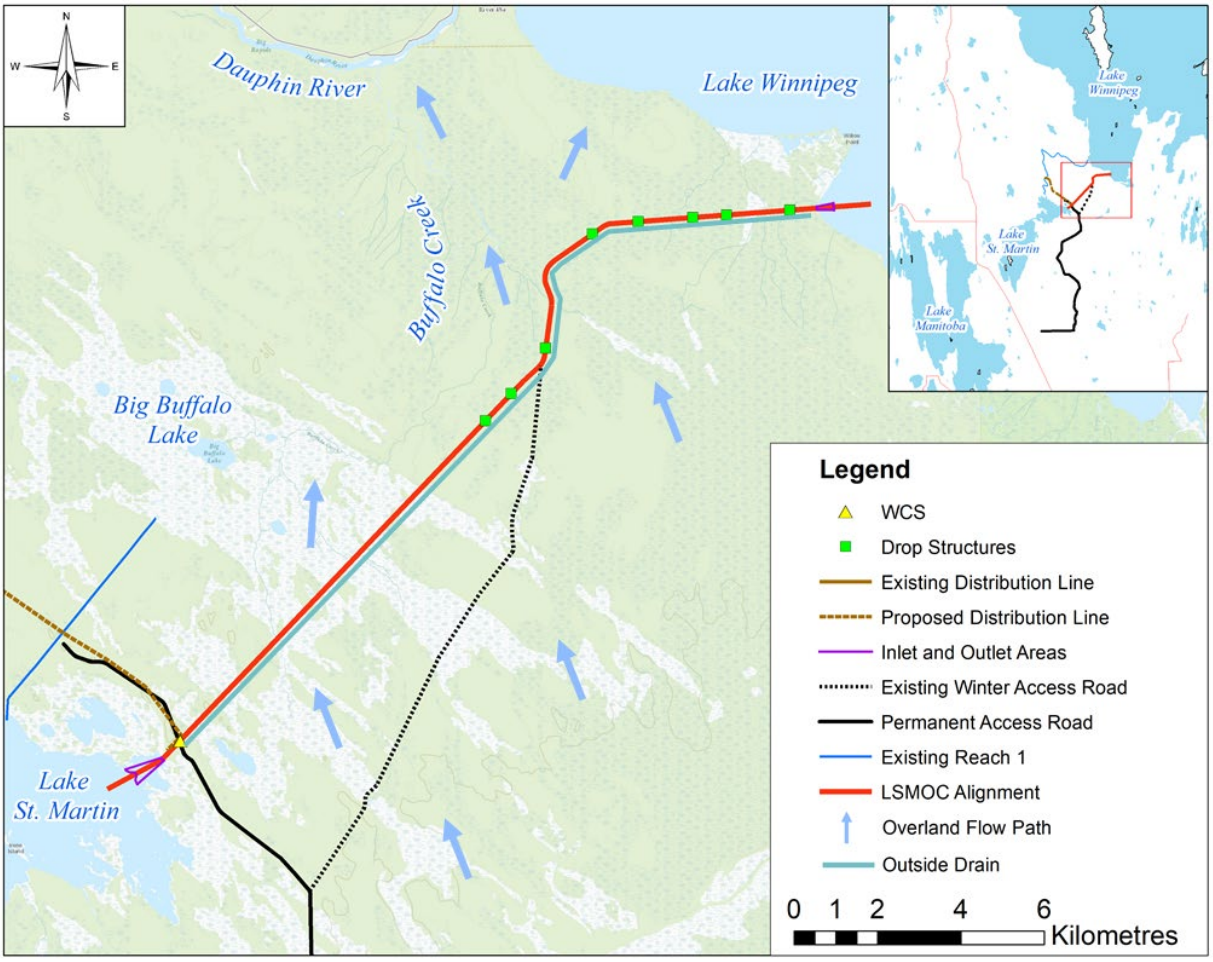


Figure 4: LSMOC Project Area

The proposed channel will have an invert elevation of approximately 240 m at the shoreline of Lake St. Martin and 215 m at the shoreline of Lake Winnipeg. The channel will have a trapezoidal cross-sectional geometry with a base width that varies from approximately 35 m to 59 m over its length. The invert slope will range from 0.021% to 0.04%. The side slopes of 5H:1V will include a bench located partway up the slope to enhance slope stability. Permanent water retaining dikes will be located on both sides of the excavated channel to contain design flows within the LSMOC and also to isolate the surface water and the upper saturated peat system from the excavated channel. To control erosion, the base and lower side slopes of the LSMOC will be armoured, while the upper side slopes will be revegetated. The channel armouring will comprise crushed limestone rock (screened to remove fines) with a median diameter of 50 mm. Spoil piles for the excavated material will be located outside of the channel dikes. Access for long term maintenance and inspection will be available via maintenance roads on top of the dikes/spoil piles on both sides of the LSMOC for the entire 23 km length. An outside drain will be constructed on the east side of the Project to intercept the surface water runoff flowing towards the LSMOC. A typical cross section for the LSMOC is provided in Figure 5.

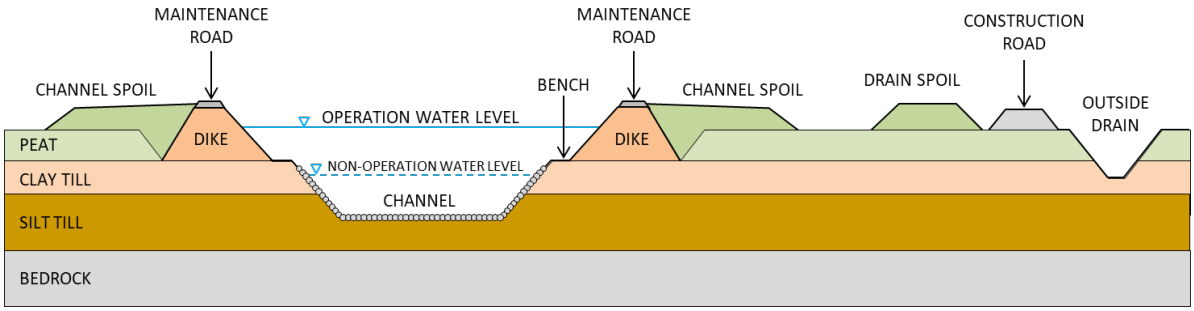


Figure 5: Typical Cross Section of the Lake St. Martin Outlet Channel

The profile of the channel will require areas of the lake bottoms to be excavated at the channel inlet and outlet to transition to the proposed channel invert elevations at the shoreline. The excavation width will flare out and the invert elevation will slope upwards from the shoreline to meet natural lakebed elevations. At the inlet, the excavation will extend approximately 1200 m from the shoreline. Since the inlet is located in a low wave energy environment within the north basin of Lake St. Martin, rockfill jetties are not required as part of the inlet works.

At the outlet, the excavation will extend approximately 200 m from the shoreline. Rock jetties will be situated along both sides of the excavation footprint over the first 100 m distance to reduce the potential for debris accumulation and sediment deposition within the excavation limits from littoral drift during non-operation of the channel. The length of the jetties was selected to limit sedimentation within the deepest portion of the outlet when the LSMOC is not in operation, while also limiting the length of the structures to minimize its footprint and cost.

A WCS is required to control flows through the LSMOC and water levels in Lake St. Martin. The structure will be constructed approximately 0.6 km inland from the Lake St. Martin shoreline. The WCS will also act as a bridge to provide access to both sides of the channel. The WCS will be a concrete structure with four bays, each 6 m wide. Two bays will have lower crests at El. 236.8 m, and two bays will have higher crests at El. 240.5 m. Heated vertical lift gates will be raised and lowered to control flow in the LSMOC. Each bay will include guides and sill beams for upstream and downstream stoplogs. Valved conduits through the WCS gates will provide a baseflow of 1.4 m^3/s to the LSMOC during periods of non-operation (i.e., WCS gates closed) to maintain appropriate water quality conditions (dissolved oxygen levels) in the channel. An ancillary building providing an enclosed space will also be constructed in proximity to the WCS to house the mechanical and electrical systems. It is currently planned that the structure will be capable of being remotely operated and will require permanent communication services.

Permanent electrical service is required for power at the WCS to electrically raise and lower the gates, as well as to heat an appropriate number of gates to maintain winter operation capability. The permanent power loads of the WCS are estimated between 450 to 550 kilowatts (kW). A 15 km long 24 kilovolt (kV) overhead distribution line is proposed to service the control structure. The distribution line will extend from an existing 24 kV line which runs along PR 513 to a 600 V pad-mount transformer at the water control structure location. A 250 kVA (600 V, 3P) diesel genset along with local controller will be installed as an emergency backup source at site. The distribution line alignment will require a 30 m wide Right of Way (ROW).

Eight drop structures are located along the LSMOC to control water velocities and shear stresses to permissible levels to prevent erosion within the channel. The drop structures will be constructed of rockfill, with a sheet pile cut-off wall at the crest. When the WCS gates are closed, the sheet pile walls at the drop structures will maintain a minimum water depth of 1 m (above the invert) everywhere in the channel to minimize the growth of aquatic vegetation. The water surface profile when the WCS gates are closed and open is shown in Figure 6. Near the drop structures, the minimum water depth during non-operation will be at least 2 m to maintain a pool of water below the surface ice cover during the winter, to minimize potential impacts to aquatic habitat (fish).

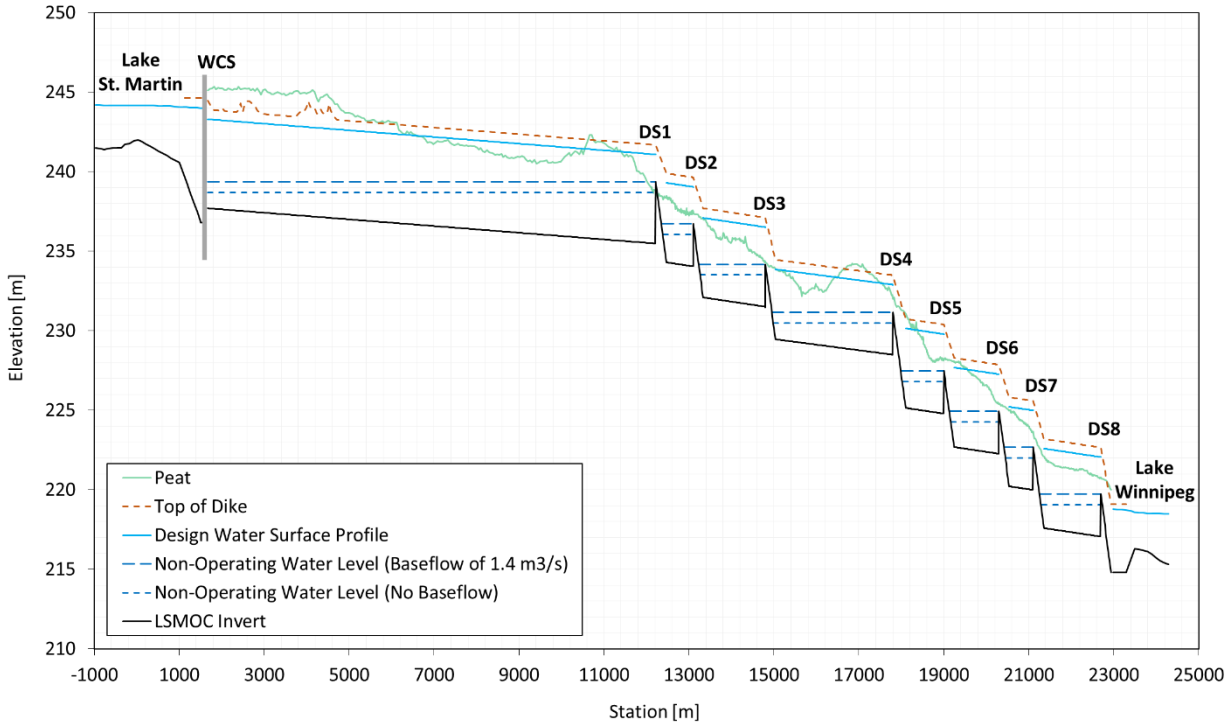


Figure 6: Hydraulic Profile of the LSMOC

1.2 Regulatory Framework

Manitoba Transportation and Infrastructure is the proponent for the proposed Project and after the receipt of the required regulatory approvals (Appendix 2), they will develop, manage and operate the Project. An Environmental Impact Statement (EIS) was prepared to meet the requirements of *The Environment Act* (Manitoba), and the *Canadian Environmental Assessment Act*, 2012. The Project is a 'Class 3' development under the Classes of Development Regulation (164/88) of *The Environment Act* (Manitoba) and therefore requires an *Environment Act* Licence. The Project is also a 'Designated Project' that requires the Minister of Environment and Climate Change's approval (via Decision Statement) pursuant to the *Canadian Environmental Assessment Act*, 2012. The Project EIS compares and describes the pre-development baseline conditions in relation to predicted conditions and identified environmental protection measures to minimize negative project effects. A comprehensive list of the relevant federal and provincial legislation for the Project is provided in Appendix 1A of the Project EIS.

1.3 Environmental Management

This EMP Framework describes the environmental management processes that will be followed during the construction and operation of the Project. The goal of the EMP is to confirm that the environmental protection measures committed to in the Project EIS and the requirements of the provincial *Environment Act* Licence and federal Decision Statement Conditions are undertaken in a timely and effective manner. An adaptive management approach that facilitates responsiveness to addressing issues and continuous improvement is an integral principle of this EMP. The EMP, as detailed in Section 2.0, provides the Manitoba Transportation and Infrastructure organization chart, describes the roles and responsibilities of the parties involved in implementing the Project, describes how information from consultation was integrated, outlines reporting and review requirements and provides a schedule of key activities.

1.4 Report Structure

This EMP Framework consists of the following sections:

- **1.0 Introduction** – Provides an overview of the Project components and phases, the regulatory framework which the Project falls under and an overview of the EMP.
- **2.0 Environmental Management Program (EMP)** – Provides an overview of the EMP and a Manitoba Transportation and Infrastructure organization chart, describes the roles and responsibilities of the parties involved in implementing the Project, describes how information from consultation was integrated, outlines reporting and review requirements and provides a schedule of key activities.
- **3.0 Construction Environmental Management Program (CEMP)** – Describes the development of an overall CEMP and provides an overview of the Project specific plans and procedures that will be developed to manage environmental concerns during the Project construction phase.
- **4.0 Operation Environmental Management Program (OEMP)–** Describes the development of an overall OEMP and provides an overview of the Project specific plans and procedures that will be developed to manage environmental concerns during the Project operation and maintenance phase.
- **5.0 Follow-Up and Monitoring Program** – Describes the environmental assessment (EA) verification monitoring and the compliance monitoring to be completed during the construction and operation phases of the Project.
- Supporting information includes lists of figures, appendices, and abbreviations and acronyms as well as a glossary of terms following the Table of Contents. The Appendices are provided at the end of the document.

2.0 ENVIRONMENTAL MANAGEMENT PROGRAM

2.1 EMP Overview

The EMP describes the environmental management processes that will be followed during construction and operation. One of the primary functions of the EMP is to demonstrate compliance with the various federal and provincial environmental regulatory requirements, including the verification that all environmental commitments are executed, monitored, evaluated for effectiveness, and that information is reported back in a timely manner to the Project management team for adjustment if required. The process of developing the EMP and associated topic-specific management plans, verifying Project EIS commitments and mitigation, review of monitoring results, and updating and improving the EMP is shown in Figure A.

The CEMP and OEMP are working documents, currently in a draft stage, that have incorporated relevant environmental effects and mitigation measures that are identified and reflective of up-to-date inputs through public and Indigenous engagement and consultation. Finalization of the CEMP and OEMP will consider applicable conditions of federal and provincial permits and/or authorization, any other pertinent findings through the design and regulatory review process, and key relevant outcomes of the ongoing public and Indigenous engagement process. The EMP is a living document that will be reviewed and updated by Manitoba Transportation and Infrastructure on a regular basis, with continuous improvement being made so that the Project is constructed, operated, and maintained in an environmentally responsible manner.

The EMP includes various environmental protection measures derived from Manitoba Transportation and Infrastructure's corporate, environmental and safety policies, which will be incorporated into relevant contract documents and inspection processes. The plans comprising the EMP will be finalized after input is obtained from potentially affected rights-holders and the regulatory review process is complete with the necessary approvals and associated conditions received.

This EMP document provides the overarching framework for the CEMP and an OEMP. To effectively address the specific issues involved with all phases of the Project, this EMP Framework document provides an overview but not the details of the CEMP and OEMP, which will be finalized prior to Project construction and ideally operation, respectively. Their finalization will consider any conditions of the *Environmental Act* Licence and associated approvals, any other pertinent findings through the regulatory review process, as well as key relevant outcomes of the ongoing Indigenous and public engagement process.

2.2 Organization

Manitoba Transportation and Infrastructure, as the overall Owner, is responsible for implementing, monitoring, and amending the environmental aspects of the Project. The overall Project organization structure, outlining the communication between Manitoba Transportation and Infrastructure, the federal and provincial regulators, construction Contractor and Indigenous Environmental Monitors is shown in Figure 7, with the roles and responsibilities outlined in Section 2.3. The Contract Administrator, while not shown in Figure 7, would work and communicate with the Manitoba Transportation and Infrastructure. Manitoba Transportation and Infrastructure has several staff and an existing overall framework that would support the construction and operational phases of the Project. The Construction Contractor resources shown in the organization structure will be more relevant during the construction phase, however, there may be a need to hire Contractors during the operation phase.

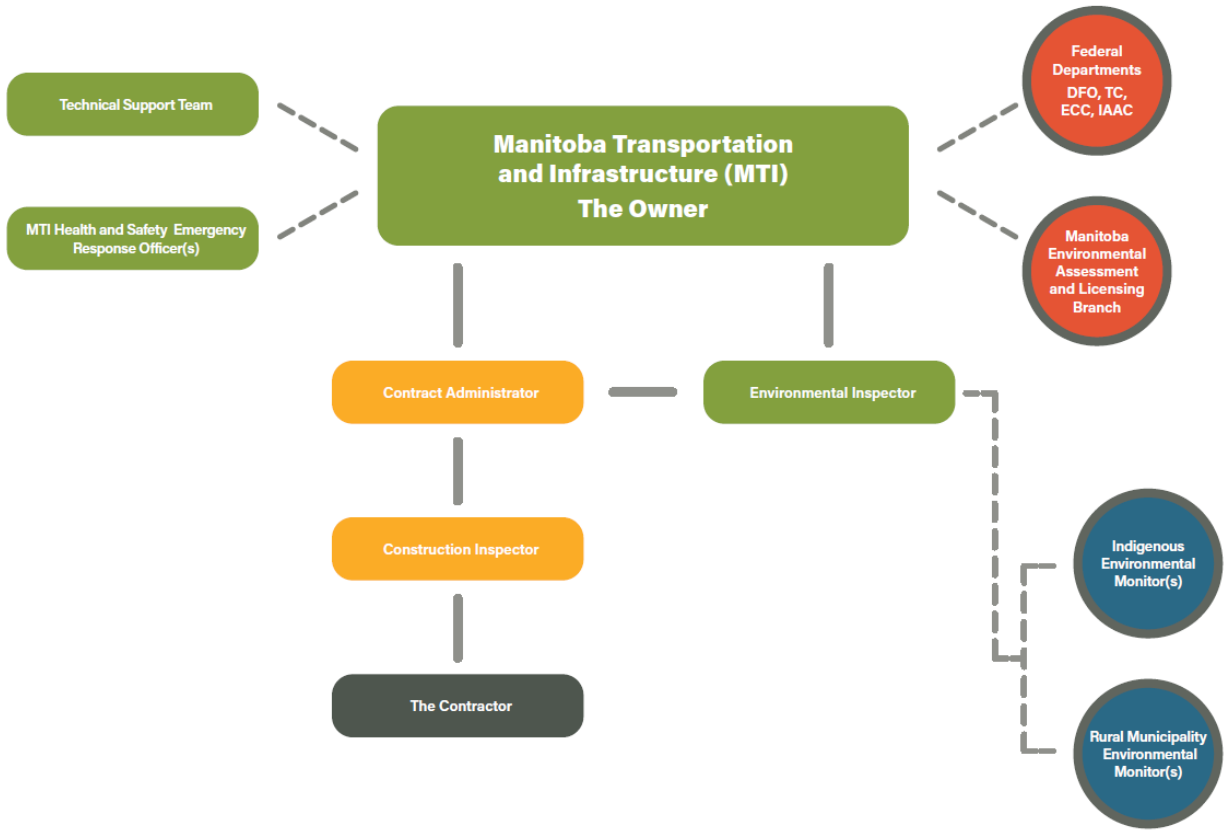


Figure 7: Project Organization Structure

2.3 Roles and Responsibilities

The roles and responsibilities of Manitoba Transportation and Infrastructure, the Contract Administrator, Contractor(s) and Indigenous Environmental Monitors involved in implementation of the Project will vary throughout the construction and operation phases. As such, the specific roles and responsibilities during these phases will be described in the respective CEMP and OEMP. However, a general description of the roles and responsibilities of the Manitoba Transportation and Infrastructure personnel identified in Figure 7 are as follows:

- Manitoba Transportation and Infrastructure, or designated representative, is responsible for completing the Project on time, on budget and ensuring overall compliance with applicable legislation, approvals and Manitoba Transportation and Infrastructure practices.
- Manitoba Transportation and Infrastructure, or designated representative, will confirm that on-site monitoring for works and activities for every contract is being carried out and will participate in weekly Manitoba Transportation and Infrastructure/Contractor meetings to confirm compliance with the construction contracts, approvals, legislation and best management practices.
- Manitoba Transportation and Infrastructure, or designated representative, will monitor the Project construction through weekly inspections and participation in weekly Contractor meetings to ensure compliance with environmental aspects of the construction contracts, environmental commitments, approvals, legislation, and best management practices.
- Manitoba Transportation and Infrastructure, or designated representative, will monitor the Project construction through weekly inspections and participation in weekly Manitoba Transportation and Infrastructure /Contractor Project Management meetings to ensure compliance with the health and safety aspects of the construction contracts, commitments, approvals, legislation, and best management practices.

2.4 Engagement and Indigenous Consultation

The development of the EMP considers the comments, concerns and issues expressed through letters, emails, discussions with community elected officials, community meetings, open houses, Traditional Knowledge and Traditional Land and Resource Use studies, stakeholder meetings, questionnaires, and the Project website, as documented in Chapter 5 of the Project EIS. This EMP also considers on-going involvement with the communities, through the Indigenous engagement and consultation process since the completion of the Project EIS.

Manitoba Transportation and Infrastructure will continue to engage with rights-holders, stakeholders, and the public. Project updates will be discussed to solicit community feedback and collaboration on Project related items. Manitoba Transportation and Infrastructure is committed to considering community input provided regarding development and implementation of the EMP. Two mechanisms established to facilitate input include the Complaint Resolution Process, and the Project Environmental Advisory Committee.

The CEMP and OEMP are working documents that have incorporated relevant environmental effects and mitigation measures that are identified and reflective of up-to-date inputs through public and Indigenous engagement and consultation. As demonstrated in the Indigenous Consultation and Stakeholder Engagement Report (ICSER; Project EIS Appendix 5C), the contents and implementation of these plans will be discussed with potentially affected rights-holders, so they have an opportunity to provide input and feedback. The CEMP, OEMP and associated environmental plans will be finalized based on input obtained from potentially affected rights-holders, and from any relevant environmental regulatory approvals' conditions.

2.5 Reporting and Review Function

The objective of reporting is to provide regulatory authorities, rights-holders, stakeholders, and the general public with timely and accurate information, such that they have opportunities to provide comments, suggestions, and opinions on the Project, the environment protection measures and the monitoring programs. Manitoba Transportation and Infrastructure and the Contractor(s) will prepare reporting to document observations and findings from the Follow-up and Monitoring Program described in Section 5.0. Manitoba Transportation and Infrastructure will ensure reporting and communication activities are conducted in accordance with requirements in the Licence, Decision Statement, other permits, authorizations, and approvals, and through the established communication channels formed as a part of the delivery of the Indigenous engagement and consultation process. Regular contact will also be made with the local Conservation Officers and with the Manitoba Environment, Climate and Parks's (MECP) Integrated Resource Management Team to keep them informed of Manitoba Transportation and Infrastructure activities as it pertains to the Project. Specific reporting requirements will be described in the CEMP and OEMP; however, typical information that will be shared as part of the reporting includes:

- progress of the Project
- up-coming construction activities in local areas
- opportunities for community involvement and dates of community information meetings
- environmental monitoring plans and activities
- measures to protect heritage and archaeological resources
- records of actions taken to address environmental incidents such as accidents, spills, leaks, and releases, the reporting and clean-up procedures used
- other items of interest

The Follow-up and Monitoring Programs results will also be reported to Manitoba Transportation and Infrastructure and senior officers, who can implement the necessary corrective action described in the specific program. This management review will maintain continuous improvement by reviewing the adequacy, suitability and effectiveness of the environmental management practices associated with the Project and the accuracy of prediction of environmental effects as the construction activities proceed. Manitoba Transportation and Infrastructure management will meet regularly to monitor on-going progress as the Project proceeds and will periodically review the EMP at a strategic level to ensure its continuing suitability, adequacy, and effectiveness. The review includes assessment of opportunities for improvement and the need for changes, including to environmental policies and objectives. On a strategic level, the

Manitoba Transportation and Infrastructure management has the authority to make decisions about the environmental protection practices and to take action, including through allocation of resources. Changes to elements of the EMP will be communicated to MECP and the Impact Assessment Agency as an amendment to this document or its appendices.

2.6 Schedule

A schedule outlining the physical activities required for completion of the Project leading up to Operation is being developed as part of the Detailed Design stage and will be provided in Appendix 1 when available. Construction is currently anticipated to occur over approximately two and half to three years followed by an additional one to two years for site clean-up, surveying and environmental offset works following the major construction works. After this, operation and maintenance will begin and continue indefinitely.

In view of the complexity and the number of individual actions required for successful completion of the Project, a project management system will be modified during detail design and updated throughout the Project. Manitoba Transportation and Infrastructure, the Contract Administrator and Contractor(s) will develop and update the scheduling and tracking for the Project contracts. Included in the project management system schedule will be critical environmental management events such as authorization submissions and reporting requirements. This will facilitate the timely, efficient, and effective planning, approval and successful implementation of construction, studies, environmental submittal requirements and Project commitments.

3.0 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAM

The purpose of the CEMP is to guide the Contractor(s) on how environmental issues will be addressed during construction and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted plans (Figure A) that guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in constructing the Project in an environmentally responsible manner. These targeted plans are described in Sections 3.1 to 3.15 and will be embedded within the CEMP or provided separately as supporting documents.

Development of the CEMP is proceeding concurrently with Project design and will be updated as design for the Project and Project components advances. As previously stated, the CEMP and the environmental plans which comprise it are developed to a Draft stage, but purposely not finalized until input is obtained from potentially affected rights-holders, and from any relevant environmental regulatory approvals' conditions. Once finalized, the CEMP will form part of the contract documents used by Contractors and will act as guidance and/or requirements to implement and enforce environmental best management practices as well as precautionary avoidance and/or mitigation measures.

Manitoba Transportation and Infrastructure is responsible for incorporating the appropriate environmental protection measures, including best management practices, into the design of Project components. Construction contract specifications will detail the technical design as well as Project-specific restrictions respecting how the work is to be completed. Worksite-specific environmental contract documents will be prepared and added to Manitoba Transportation and Infrastructure's standard specifications. The environmental plans and other plans (e.g., Health and Safety Plan) that are pertinent to Project construction will be identified and accompany the tender documents to be provided to the Contractor(s).

The CEMP addresses many of the site-specific requirements of the Contractor(s) and those that are conducting inspections to facilitate compliance with Manitoba Transportation and Infrastructure's Project-specific commitments. The plans associated with the CEMP will guide the Contractor(s) work in a manner that promotes best management practices for environmental protection for the Project components being developed.

The CEMP addresses each phase of work and incorporates specific environmental protection measures during construction at the individual work sites. The Contractor will also be responsible to provide site-specific planning (e.g., location of laydown areas) to Manitoba Transportation and Infrastructure and identify quarry and borrow areas, which will go through the required review and approval process. This information will be described in detail and thereby augment the Environmental Protection Plans (EPPs) and other plans that collectively describe how to build the Project, with information on sites to avoid or provide specific measures. Manitoba Transportation and Infrastructure is responsible for confirming that the proposed steps outlined by the Contractor are appropriate and environmentally responsible.

As indicated, the CEMP will integrate all relevant environmental regulatory approvals conditions to accompany contract documents. In other cases, Manitoba Transportation and Infrastructure requires Contractors to obtain relevant permits to conduct their work (e.g., Crown Lands work permits, casual or private quarry permits, etc.). Environmental permits or approvals obtained by the Contractor and any amendments will be identified and submitted to Manitoba Transportation and Infrastructure for compliance and record keeping purposes.

Manitoba Transportation and Infrastructure is responsible to conduct site inspections to confirm construction contract compliance with environmental specifications and legislated health and safety requirements. Manitoba Transportation and Infrastructure will also conduct an environmental audit of the construction work being done. The results of these inspections will be documented and, along with other pertinent information, contain regular progress reports to be provided to the designated regulator(s) throughout the construction phase.

Manitoba Transportation and Infrastructure will frequently meet with the Contractor(s) and require that regular updates be provided regarding progress on the environmental components of the work. Early and ongoing communication between Manitoba Transportation and Infrastructure and the Contractor is expected. In cases where a Contractor suggests methods to achieve a particular goal or objective that differ from their original site plan (i.e., component of the work such as managing erosion and sedimentation), approval will first be obtained through Manitoba Transportation and Infrastructure before any modification is allowed, based on discussions with regulators, as appropriate.

The environmental protection measures also incorporate best practices for compliance monitoring. The CEMP provides the framework for follow-up and monitoring, as described further in Section 5.0. The purpose of follow-up and monitoring is to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EA's including cumulative effects assessments
- support environmental management systems used to manage the environmental effects of projects
- Manitoba Transportation and Infrastructure will facilitate effective environmental oversight of Project development through a compliance monitoring process. Manitoba Transportation and Infrastructure will provide ongoing oversight of the Project during the construction phase and coordinate with the Contractor.

3.1 Environmental Protection Plans

EPPs form part of the Project's EMP framework and describe the suite of environmental protection measures for key individual environmental areas. The purpose of the EPPs is to support Project planning and reduce the potential for environmental effects during construction. The EPPs are focused on describing the Project activities and the associated potential effects, mitigation measures, and plans. A Construction EPP mapbook has been developed to supplement the EPP by providing site-specific mitigation measures and considerations at environmentally sensitive locations. Together, these documents are intended to facilitate the operationalization of mitigation measures outlined in the Project EIS and be used for tendering purposes. These plans will guide the Contractor(s) and are supplemented with standard specifications included in each construction contract's Project Environmental Requirements (PER) and other plans. For example, Contractors will be required to provide details relating to:

- explosive storage facilities, in independent magazines, if required for the Project
- location and spatial extent of construction camps and associated facilities
- the number, location, and size of construction laydown areas to be established along the rights-of-way for the outlet channels
- sources and quantities of borrow material
- lists of the materials that will be stored including construction vehicles, machinery, construction materials, geotextile roles, explosives, erosion control supplies and other construction materials for the Project

3.2 Project Environmental Requirements

PERs are environmentally focused requirements and commitments for construction contracts that are fundamental to Manitoba Transportation and Infrastructure's regulatory compliance. PERs contain site-specific or point-source requirements for dealing with issues (i.e., access, sediment management, quarries, etc.). They are specific and applicable to all construction and maintenance operations under the authority of any and all licences, permits, authorizations or approvals obtained for the Project. Requirements listed within the PERs are not mutually exclusive of one another and must be adhered to for all activities pertaining to construction, post-construction, maintenance, and decommissioning activities for the Project.

3.3 Access Management Plan

An Access Management Plan (AMP) identifies specific measures that will be undertaken to manage access to the Project site during the construction phase. The AMP addresses access-related issues of concern expressed by rights-holders, stakeholders and the public during the Indigenous engagement and consultation process. It also integrates technical access-related effects on the environment. The AMP describes the access control measures that relate to protection of natural resources, public and worker safety and site security. The plan includes maps that show the locations of potential safety hazards that will be present as a result of the Project and mitigation measures (signage and fencing) that have been designed to reduce the risk posed by the hazards. The objectives of the AMP are to:

- provide safe, coordinated access to the Project site.
- protect the area's natural resources for sustainable use by rights-holders.
- preserve and respect the socio-economic, cultural and heritage values of the lands around the Project.
- allow Project staff and Contractors to construct, operate and maintain the Project year-round.
- provide security for Project personnel and property.
- prescribe measures to minimize potential negative direct and indirect effects on Project access.
- protect land users from hazards resulting from construction and operation of the Project.
- minimize land user conflicts.

3.4 Quarry Management Plan

A Quarry Management Plan (QMP) describes how quarries are selected, developed, operated, and decommissioned (where applicable). This plan specifies best management practices for the selection of quarry sites and quarry development that builds upon the requirements listed in the PERs. This will confirm that quarrying activities are conducted in accordance with all applicable permitting requirements and commitments made in the Project EIS. The plan also includes details on the transport and storage of explosives and measures to ensure advanced planning and notice for blasting activities, such as requirements for Contractor submissions.

3.5 Sediment Management Plan

Sedimentation from the erosion of exposed soils can negatively influence fish and fish habitat. A Sediment Management Plan (SMP) describes measures to minimize the impacts of in-stream sediment from construction activities in or near water, river management, shoreline erosion, and commissioning of the LMOC and LSMOC. These measures include temporary construction management practices, as well as permanent mitigations measures built into the channel design, to minimize the potential for erosion and to minimize and mitigate the transport and deposition of sediment beyond construction areas or into off-site receiving water bodies. The objectives of the SMP are to:

- Define guidelines and procedures for construction to minimize the potential for erosion and sedimentation.
- Develop site-specific control measures to manage potential drainage issues (e.g., run-off).

- Develop site-specific erosion and sediment control measures to minimize adverse, sediment related, effects to the receiving waterbody.
- Develop emergency response practices to mitigate extreme design conditions, respond to unforeseen events and accidents, and minimize potential environmental impacts.
- Ensure that Contractors maintain the expectations of the SMP.

3.6 Surface Water Management Plan

A Surface Water Management Plan (SWMP) describes measures to be employed to mitigate or avoid impacts to surface water during and post-construction. These include methods to be used for the temporary diversions of surface water (including but not limited to ditches and drains, dewatering, or deposition), management of water resulting from precipitation events (e.g., winter snow accumulation in excavated channel or heavy rainfall event), and management of natural watershed flows during construction. Measures identified in this plan shall minimize impacts to the environment (e.g., fisheries) and people (e.g., consideration given to avoid localized flooding due to surface water management activities).

3.7 Groundwater Management Plan

A Groundwater Management Plan (GWMP) describes measures to take to avoid or minimize adverse effects to groundwater or from groundwater during the construction and operation of the Project. These effects may include changes in groundwater quality and quantity in the vicinity of the Project, effects on construction from groundwater or changes in the relationship of the groundwater aquifer discharge to the surface water system. The GWMP outlines measures to manage groundwater which is brought to the surface because of depressurization activities, as well as measures to prevent/mitigate groundwater impacts to local well users. It also identifies adaptive measures to take if the outlined monitoring reveals the need for additional steps.

3.8 Revegetation Plan

The Revegetation Management Plan (RVMP) identifies the locations and methods of providing new or restoring existing vegetation cover following construction activities. The establishment of site appropriate, non-invasive perennial vegetation can serve to stabilize surface soils and protect against accelerated soil loss and erosion while limiting the establishment of non-native weedy plant species. Given the large scope and scale of the Project and the natural setting around LSMOC, if site restoration and revegetation is not planned and implemented in a considerate and responsible fashion, it can have disproportionately high impact on the local and interconnected environments. The RVMP for Project components such as the LMOC, LSMOC and associated works describe:

- Areas affected by construction of the Project.
- Areas designated for revegetation treatments, such as sites along the side slopes of the channels and temporary works decommissioned after construction.
- The approach for determining rehabilitation treatments for specific disturbed areas.

- The rehabilitation treatment options for regenerating vegetation in disturbed areas, including methods for site preparation that will contribute to revegetation success.
- How the rehabilitation will be implemented.
- How the rehabilitated areas will be monitored, the process for how improvements, if required, will be made, and how and to whom the results will be reported.

3.9 Agricultural Biosecurity Management Plan

An Agricultural Biosecurity Management Plan (AgBMP) identifies biosecurity issues, risk sites and risk types as well as specific mitigation requirements such as landowner communication, notification, and equipment cleaning and disinfection requirements. The objective of this plan is to mitigate adverse effects or changes in agricultural land use. The plan pertains to the LMOC and PR 239 realignment portions of the Project, as these portions of the Project traverse agricultural land use, including cropland, grazing land, and livestock operations. Through this plan, Manitoba Transportation and Infrastructure will address biosecurity concerns related to Project activities. This Plan includes:

- Background information including a summary of agricultural land use in the Project area, regulatory context and industry guidelines and related Project management plans.
- Summary of biosecurity risk issues, mechanisms and levels and issues related to construction and operation activities.
- Required actions by Manitoba Transportation and Infrastructure and Contractor(s) to protect agricultural biosecurity.
- Identification of specific biosecurity risk areas and controlled access points.
- Guidance for Manitoba Transportation and Infrastructure to implement the AgBMP for Project construction and operation, including roles and responsibilities, planning and preparation, facilities and equipment, worker requirements, record keeping and reporting, worker training, communication, monitoring, and implementation schedule.

3.10 Dust Control Plan

A Dust Control Plan describes the products to use and the methods of their application on PR 239, other access roads used and material stockpiles to minimize and mitigate effects from increased dust levels during the Project construction and operation. The plan also identifies the certification and submission requirements for products to be used.

3.11 Waste Management Plan

A Waste Management Plan describes how solid and non-hazardous liquid waste will be stored, managed, and disposed of during construction. The plan commits to keeping the construction area clean and orderly during and at completion of construction with waste materials and refuse removed and disposed of promptly in a manner that will not contaminate the surrounding area. Waste materials shall be recycled to a degree that is economically and practically feasible or disposed of at a Waste Disposal Ground operating under the

authority of a permit issued pursuant to Manitoba Waste Disposal Grounds Regulation 150/91 of *The Environment Act*. All sewage and seepage from on-site sanitary facilities will be disposed of at a local licenced facility and in accordance with the Manitoba Onsite Wastewater Management Systems Regulation 83/2003 of *The Environment Act*.

3.12 Hazardous Materials Management Plan

A Hazardous Materials Management Plan describes safe practices for transporting, storing, managing, and disposing of hazardous materials to protect the health and safety of employees, the public and the environment. The plan includes spill response guidelines and hazardous waste management guidelines for managing specific hazardous materials. The plan also identifies the applicable federal and provincial acts and regulations for the transportation, storage, handling and disposal of dangerous goods and hazardous wastes.

3.13 Emergency Response Plan

An Emergency Response Plan (ERP) identifies how the Contractor(s) will respond to environmental emergencies in a manner that protects people and the environment during Project construction. The plan outlines emergency spill response and reporting procedures and fire prevention and response procedures. Procedures to respond to spills, accidents, or malfunctions involving the release of fuels, dangerous goods or hazardous materials/waste are described. The plan identifies who is responsible for and methods of containment, clean-up, and reporting. The plan also outlines fire prevention measures to be implemented and response and evacuation procedures to follow in the event of a fire. A Health and Safety Plan separately addresses security, responses to medical incidents, transport to hospital and emergency contacts and notification.

3.14 Heritage Resources Protection Plan

A Heritage Resources Protection Plan (HRPP) outlines measures to mitigate effects to cultural and heritage resources that can occur from ground-disturbing Project activities, such as vegetation clearing and excavation and development of temporary construction camps, staging areas, and access roads. The HRPP is being developed based on the findings of a Heritage Resource Impact Assessment conducted prior to the start of construction. The HRPP when issued Final will at a minimum:

- Include general information about the Project.
- Outline the heritage resources procedures and protection measures to be implemented during Project construction.
- Outline specific measures required for any heritage sites located within the Project Development Area and any adjacent site that may be affected by Project construction or operation.
- Identify and characterize any additional heritage resource protection measures.
- Outline the steps for reporting and follow-up related to any heritage resources unintentionally disturbed during construction.

3.15 Site Decommissioning Plan

The Site Decommissioning Plan describes the process and environmental requirements for closure and reclamation of temporary construction facilities and borrow pits.

4.0 OPERATION ENVIRONMENTAL MANAGEMENT PROGRAM

The purpose of the OEMP is to guide how environmental issues will be addressed and adverse effects of operation and maintenance activities will be mitigated. The OEMP demonstrates Manitoba Transportation and Infrastructure's commitment to protection of the environment and compliance with the various federal and provincial environmental regulatory requirements. Standard operating procedures and environmental best management practices will be implemented during operation to promote the protection of environmental values potentially affected by the Project. The OEMP is a tool to ensure that the environmental management measures are executed, monitored, evaluated for effectiveness and that any required information is reported to Manitoba Transportation and Infrastructure for adjustments. The OEMP outlines the responsibilities of the various parties involved, provides a summary of potential activities related to Project operation and the subsequent potential environmental effects, and discusses the applicable environmental management measures, monitoring, and reporting procedures.

An OEMP is being developed for operation of the LMOC and LSMOC and will be finalized prior to completion of the construction phase. It is currently anticipated that a separate OEMP is not required for development of the PR 239 realignment. The road will be operated and maintained in a manner consistent with Manitoba Transportation and Infrastructure's practice for the current PR 239 and other public roads throughout the Province of Manitoba. Additionally, the distribution lines that will be powering the water control structures will be owned and operated by Manitoba Hydro and, as such, constructed and operated in a manner consistent with their best management practices and guidelines.

The OEMP describes the environmental protection measures to be implemented after construction is complete to address potential effects associated with the long-term operation and maintenance activities. As detailed for the CEMP, the OEMP and the associated environmental plans will be updated based on updates to the CEMP during construction and will also benefit from any additional input obtained from potentially affected rights-holders, the general public and regulators.

The OEMP is supported by the same targeted plans developed to manage issues during construction, as described in Sections 3.1 to 3.15, but prior to construction completion they would be revised and adapted to suit the specific needs during the operation phase and incorporate lessons learned through implementing the CEMP. The objectives of the supporting OEMP plans are similar to those described with respect to construction activities, with a focus on operational conditions. For example, the SMP would focus on minimizing the impacts of in-stream sediment from operation of the LMOC and LSMOC, particularly after a flood. These plans are embedded within the OEMP or provided as separate supporting documents. Additional Project operation-specific plans including an Ice Management Plan (IMP), as described in Section 4.1, are developed for implementation during the operations phase.

As with the CEMP, the OEMP outlines the recommended best practices for compliance monitoring (inspections). Ongoing monitoring regarding the functionality of the outlet channels and associated infrastructure will occur regularly during non-flood periods. The frequency and type of compliance

monitoring is expected to increase immediately before, during and after the flood operation of control structures in the LMOC and LSMOC. As such, Manitoba Transportation and Infrastructure has a role in ongoing environmental inspections of the Project infrastructure and components. Manitoba Transportation and Infrastructure will generate documentation related to the findings of these investigations, including Project functionality.

As with the CEMP, the OEMP provides the framework for the follow-up and monitoring program during the operation phase, as described further in Section 5.0. This includes continued monitoring to verify key predictions of the Project EIS, with a focus on the effectiveness of key mitigation measures that are proposed to be implemented. Reports generated through this process will be made available to regulators for review as required.

4.1 Ice Management Plan

An IMP describes measures to be employed to mitigate or avoid changes in regional and/or local ice processes and impacts to the environment or public and worker safety post construction associated with changes in ice processes. The LMOC and LSMOC will be operated in accordance with the Operating Rules developed for the Project, which includes considerations for ice management. The plan describes the location of signs indicating potential areas of thin ice at the LMOC and LSMOC inlet and outlet to provide public and worker safety.

5.0 FOLLOW-UP AND MONITORING PROGRAM

The follow-up and monitoring program for the Project includes EA Verification Monitoring and Compliance Monitoring to be completed during both the construction and operation phases of the Project, as described in the following sections, and shown as the 'verification' box in Figure A. This program and the associated topic-specific monitoring plans are developed in accordance with the requirements described in both federal and provincial guidance documents for the Project. As results become available from the follow-up and monitoring program, they will be provided to regulators, posted to the Project website, and shared during any meetings or open houses. Manitoba Transportation and Infrastructure and its consultants will consider the results from the follow-up and monitoring programs and input received from rights-holders, regulators, and others in its review of the status of the environmental protection activities on an on-going basis and amend programs, as necessary. As the proponent/owner of the Project, Manitoba Transportation and Infrastructure will make final decisions on adjustments to environmental activities.

An adaptive management approach will be followed, whereby lessons learned, and improvements identified during the inspection, follow-up and monitoring programs will be applied to continually improve subsequent environmental protection activities. Manitoba Transportation and Infrastructure will also monitor the application of action plans and emergency response procedures for environmental protection and human health and safety.

5.1 Environmental Assessment Verification Monitoring

The follow-up and monitoring program, as described in Project EIS Chapter 12, will verify the accuracy of key components of the EA and determine the effectiveness of measures taken to mitigate the adverse environmental effects of the Project, through the following:

- Verify predictions of environmental effects identified in the EA.
- Determine the effectiveness of mitigation measures in order to modify or implement new measures where required.
- Support the implementation of adaptive management measures to address unanticipated adverse environmental effects.
- Provide information on environmental effects and mitigation that can be used to improve and/or support future EA's including cumulative effects assessments.
- Support environmental management systems used to manage the environmental effects of projects.

Various topic-specific monitoring plans have been developed for the Project, as described in the following sub-sections. Manitoba Transportation and Infrastructure will engage in-house environmental staff and potentially contract specialized environmental consultants to conduct monitoring of specific components of the environment in accordance with these monitoring plans and as required with assistance from local Indigenous people. These plans are developed to a Draft stage to meet regulatory requirements, but purposely not finalized until input is obtained from potentially affected rights-holders and appropriate federal and provincial authorities. Additional monitoring or adjustments to the plans will be made in consideration of the responses received.

5.1.1 Aquatic Effects Monitoring Plan

As part of EA verification, this includes any ongoing surface water quality monitoring as well as fish-related sampling. The plan provides information on the methodologies to address monitoring requirements outlined in the Project EIS. Monitoring study design is described in terms of the frequency of monitoring, field methods, parameters to be measured, data analysis and how benchmarks will be used to guide follow-up management actions. The Aquatic Effects Monitoring Plan (AEMP) describes monitoring activities that will commence during construction and in association with two flood events that occur post-construction. The specific objectives of the AEMP are to:

- Determine if the effects assessment predictions in the aquatic environment sections of the Project EIS (including surface water quality and fish and fish habitat are correct.
- Determine the effectiveness of mitigation measures.
- Assess the need for additional mitigation measures if initial measures are not adequate.
- Determine the effectiveness of any additional/adapted measures.
- Confirm compliance with regulatory requirements relevant to surface water quality and fish and fish habitat set out in the Project approvals (compliance monitoring).

5.1.2 Surface Water Monitoring Plan

Surface water monitoring will be conducted to assess whether there are changes to the water levels or quality of the surface water in the Local Assessment Area as a result of construction or operations. Surface water levels and quality will be monitored in proximity to the Project prior to construction (baseline), during construction, and following construction (for a period of two years). Longer-term operation monitoring (which includes consideration of the frequency of use of the LMOC and LSMOC) will take place beyond the 2-year post-commissioning period as outlined in the AEMP and the Operation and Maintenance Manual. This will help to identify if the management measures implemented as part of the SWMP are effective at mitigating impacts to surface water. Water discharged from the Project construction area to surface water will be monitored to ensure it complies with applicable Canadian Council of Ministers of the Environment and Manitoba Water Quality Standards, Objectives and Guidelines criteria for the Protection of Freshwater Aquatic Life. Finalization of surface water quality monitoring objectives will be undertaken at Detailed Design with consideration for the other environmental management and monitoring plans.

5.1.3 Groundwater Monitoring Plan

Groundwater monitoring will be conducted to assess whether there are changes to the volume and accessibility or quality of the groundwater in the Local Assessment Area as a result of construction or operations. Groundwater elevations and quality will be monitored in proximity to the Project prior to construction (baseline), during construction, and following construction (for a period of two years). Recommendations will also be provided for long term groundwater monitoring based on the Project monitoring data and an assessment of Project effects. This will help to identify if the management measures implemented as part of the GWMP are effective at mitigating impacts to groundwater. Groundwater discharged to surface water during construction will be monitored to ensure it complies with applicable Canadian Council of Ministers of the Environment and Manitoba Water Quality Standards, Objectives and

Guidelines criteria for the Protection of Freshwater Aquatic Life. Finalization of groundwater quality monitoring objectives will be undertaken at Detailed Design with consideration for the other environmental management and monitoring plans.

5.1.4 Revegetation Monitoring Plan

As part of pre-construction sampling being completed in 2020, rare plant surveys are being completed along the final channel alignment and a RVMP has been developed. Pre-construction monitoring work involves an evaluation of species of conservation concern present. The RVMP provides detailed methods on how predicted changes to vegetation species diversity will be verified and how the effectiveness of mitigation strategies (e.g., revegetation) will be evaluated. The RVMP also includes assessing revegetation success shortly after construction and for several years following construction. Monitoring will be focused on assessing the rate of establishment of a healthy vegetation cover, and the quick recognition and mitigation of soil erosion. Areas of poor vegetation growth will also be identified for additional seeding. To avoid growth and establishment of regulated weeds, soil piles will be monitored for weed growth during construction.

5.1.5 Wetland Monitoring Plan

The Wetland Monitoring Plan (WetMP) has been prepared in response to comments received from regulators, rights-holders, and other stakeholders to assesses potential effects on wetlands outside of the project development area that do not receive offsetting through the Wetland Compensation Plan. The WetMP includes an assessment of changes to class/size of wetlands, surface and groundwater quality and quantity, vegetation cover (plant species compositions/abundance) and wildlife habitat from changes to groundwater and surface water regimes. The purpose of the WetMP is to provide a comprehensive, integrated monitoring plan that tests key predictions of the Project EIS with respect to wetland effects, determines the effectiveness of mitigation measures, and the requirement for, and nature of associated follow-up where required. The plan integrates prior information collected for the Project EIS, information collected through pre-construction vegetation and wetland surveys and associated mapping completed in 2020, and feedback received from rights-holders, regulators, and various stakeholders.

5.1.6 Wildlife Monitoring Plan

The purpose of the Wildlife Monitoring Plan (WMP) is to describe the monitoring activities that will be undertaken to address follow-up requirements identified in Chapter 12 of the Project EIS. Follow-up requirements are actions implemented to verify key EA predictions, to reduce potential adverse effects on wildlife and their habitat(s), and to confirm compliance with regulatory requirements (compliance monitoring contained in the EPP).

The wildlife assessment identified potential changes to wildlife habitat, mortality risk, and movement during construction and operation of the Project. The monitoring criteria established for the WMP were informed by concerns raised through the Project EIS review and subsequent information requests received from federal and provincial regulators, rights-holders, and stakeholders. Thus, the monitoring criteria reflect measurable and meaningful parameters to verify key Project EIS predictions and to evaluate the effectiveness of mitigation measures as they relate to the potential changes described above.

5.1.7 Red-headed Woodpecker Habitat Mitigation Plan

The purpose of the Red-headed Woodpecker Habitat Mitigation Plan is to describe the red-headed woodpecker habitat mitigation and monitoring activities that will be implemented along the LMOC outlet channel ROW for a federally listed endangered species. Manitoba Transportation and Infrastructure is using the precautionary approach and committing to additional mitigation and monitoring measures to reduce potential Project-related effects to red-headed woodpecker habitat, despite no evidence that critical breeding habitat will be directly affected by the Project.

5.1.8 Eastern Whip-poor-will Habitat Mitigation Plan

The purpose of Eastern Whip-poor-will Habitat Mitigation Plan is to describe the habitat mitigation and monitoring activities that will be implemented along the outlet channel ROWs for a federally listed threatened species. Manitoba Transportation and Infrastructure is using the precautionary approach and committing to additional mitigation and monitoring measures to reduce potential Project-related effects to eastern whip-poor-will habitat, despite no evidence that critical breeding habitat will be directly affected by the Project.

5.2 Compliance Monitoring

Manitoba Transportation and Infrastructure will facilitate effective environmental oversight of Project development through a compliance monitoring process. This compliance monitoring verifies whether the plans (including the PERs and EPPs) are being followed during construction and operation and whether required mitigation measures are being effectively implemented. The compliance monitoring also confirms compliance with the regulatory requirements and authorizations for the Project.

Manitoba Transportation and Infrastructure will provide ongoing oversight of the Project during the construction and operation phases and coordinate with the Contract Administrator and Contractor(s). The specific roles and responsibilities for Manitoba Transportation and Infrastructure, the Contract Administrator and Contractor(s) in relation to monitoring are identified in the CEMP and OEMP. The compliance monitoring developed during the construction phase may evolve and be adapted into the operation phase in response to varying conditions between construction and operation. The environmental protection measures also incorporate best practices for compliance monitoring.

Manitoba Transportation and Infrastructure standards for monitoring dams and flood control channels will be implemented during operation to ensure it is operated and maintained in a safe manner consistent with the Canadian Dam Association Dam Safety Guidelines. Ice conditions within the channel be monitored, particularly when the channel is operated at higher winter discharges, to ensure that adequate freeboard remains on the channel dikes to prevent a winter overtopping breach. A Project-specific Operation and Maintenance Manual will be developed for the Project structures to detail monitoring and maintenance needs for the Project during the operation and maintenance phase.

APPENDIX 1

Project Schedule

Under-development

APPENDIX 2

The Environment Act License & *Canadian Environmental Assessment Act*, 2012 Decision Statement, and Conditions

To be appended once received

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Construction Environmental Management Program

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vii

1.0 INTRODUCTION 1

1.1 Project Description 2

1.2 Licensing and Authorization 5

2.0 PRIMARY RESPONSIBILITIES 6

2.1 Manitoba Transportation and Infrastructure (the Owner) 7

2.2 Contract Administrator 8

2.3 Contractor 9

2.4 Environmental Monitor 10

3.0 ACTIVITY DESCRIPTION 11

3.1 LMOC Construction Methodology 11

3.1.1 Site Preparation 11

3.1.2 Channel 12

3.1.3 Inlet and Outlet 13

3.1.4 Bridges and Water Control Structure 13

3.2 LSMOC Construction Methodology 13

3.2.1 Site Preparation 13

3.2.2 Channel 14

3.2.3 Inlet and Outlet 15

3.2.4 Water Control Structure 15

3.3 Control Measures 15

4.0 POTENTIAL ENVIRONMENTAL EFFECTS 17

5.0 ENVIRONMENTAL MANAGEMENT AND PROTECTION 20

5.1 Atmospheric Environment 20

5.2 Soil 21

5.3 Groundwater 21

5.3.1 Background 21

5.3.2 Potential Changes 22

5.3.3 Management Measures 22

5.4 Surface Water 23

5.5 Erosion and Sediment Control 24

5.6 Fisheries and Aquatic Ecosystem 25

5.7 Vegetation 26

5.8 Wildlife 27

5.9 Land and Resource Use 28

5.10 Heritage Resources 28

5.11 Materials and Waste Management 29

5.12 Emergency Spill Response and Reporting Procedures 30

5.13 Fire Prevention and Response Procedure 31

6.0 COMMUNICATION 33

6.1 Pre-Job Briefings 33

6.2 Project Meetings 33

6.3 External Communication 33

7.0 TRAINING 34

8.0 MONITORING 35

8.1 Monitoring 35

8.2 Reporting 35

8.3 Record Keeping 36

APPENDIX 1 38

APPENDIX 2 47

List of Tables

Table 1-1: Applicable Federal and Provincial Legislation

List of Figures

Figure A: EMP Process

Figure 1: LMOC Location

Figure 2: LSMOC Location

Figure 3: Project Construction Organization Structure

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Construction Environmental Management Program (CEMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under The *Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act* 2012, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of The *Environmental Act* provincial licence, *Canadian Environmental Assessment Act* 2012 federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

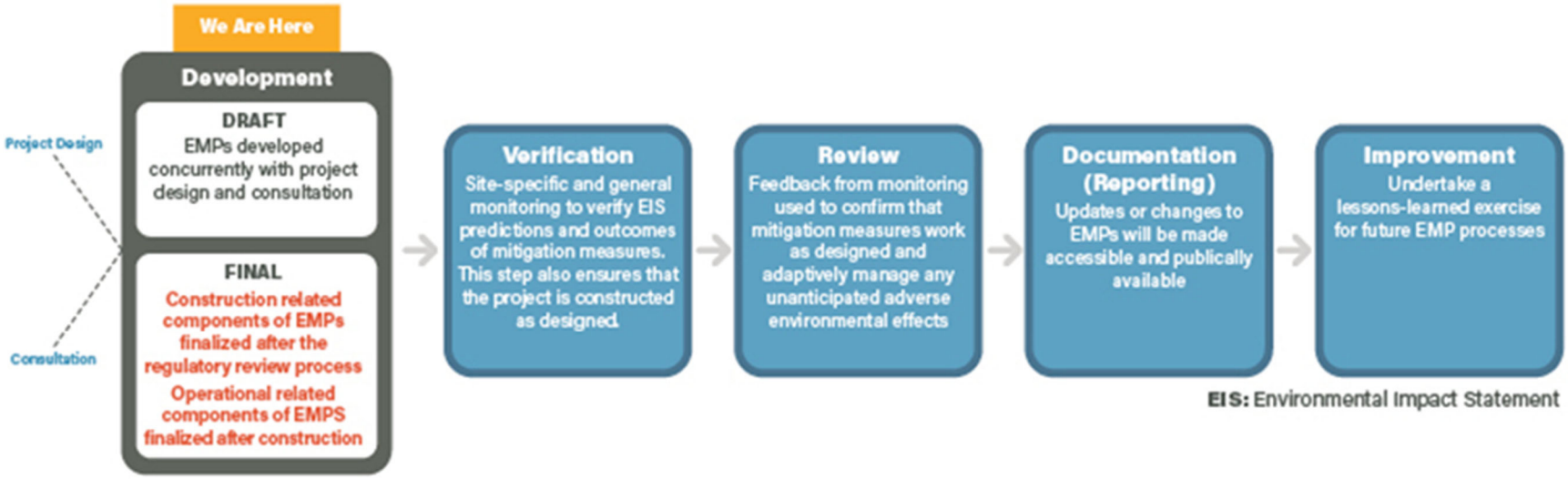


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	Percent
AgBMP	Agricultural Biosecurity Management Plan
AEMP	Aquatics Effects Monitoring Plan
AMP	Access Management Plan
BMP	Best Management Practices
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
cfs	cubic feet per second
CRP	Complaint Resolution Process
DFO	Fisheries and Oceans Canada
EIS	Environmental Impact Statement
EPP	Environmental Protection Plan
ER	Environmental Representative
ERP	Emergency Response Procedures
FN	First Nation
GWMP	Groundwater Management Plan
HRPP	Heritage Resources Protection Plan
km	Kilometre
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MECP	Manitoba Environment, Climate and Parks
OEMP	Operation Environmental Management Program
PDA	Project Development Area
PER	Project Environmental Requirements

PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
PTH	Provincial Trunk Highway
QMP	Quarry Management Plan
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SAR	Species at Risk
SARA	*Species At Risk Act*
SMP	Sediment Management Plan
SOCC	Species of Conservation Concern
SWMP	Surface Water Management Plan
WCS	Water Control Structure
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan
WHMIS	Workplace Hazardous Materials Information System

Glossary of Terms

Aquatic habitat: The living and non-living components of a lake, river, wetland or other waters upon which aquatic life depends.

Aquatic ecosystem: All living organisms in an area of a lake, river, wetland or other waters and the non-living components of the environment upon which they depend, as well as all their interactions, both among living and non-living components.

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Aquitard: A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

Artesian aquifer: A body of rock or sediment containing groundwater that is under greater than hydrostatic pressure: that is a confined aquifer. When an artesian aquifer is penetrated by a well, the water level will rise above the top of the aquifer; a flowing artesian well is when the water level will rise above ground surface.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Biodegradable: A substance or object capable of being decomposed by bacteria or other living organisms.

Carbonates: A rock made up primarily of carbonate minerals (minerals containing the CO3 anionic structure). Examples include: limestone, dolostone, and marble (metamorphosed limestone or dolomite) are the most commonly encountered carbonate rocks.

Carbonate aquifer: See Aquifer; see Carbonates. Refers to an aquifer comprised of a carbonate bedrock.

Cofferdam: An enclosure, usually only partially obstructing a river, from which water is pumped to expose the bottom to permit construction.

Confined aquifer: An aquifer that is bounded above and below by formations of distinctly lower permeability than that of the aquifer itself. An aquifer containing confined ground water. See artesian.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Critical habitat: The resources and environmental conditions required for persistence of local populations of listed wildlife species, listed as extirpated, endangered, or threatened under the Species at Risk Act, throughout their current distribution in Canada.

Deleterious substance: A substance which, if administered, would likely cause bodily injury. In terms of the *Fisheries Act*: "Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or (b) any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water".

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pump, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the Project if not developed previously to support the structural design of the bridge or structure.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dolomite: A sedimentary rock composed mostly of dolomite [CaMg (CO3)2] which often forms from limestone as the calcium is partly replaced by magnesium, usually as water solutions move through the limestone.

Domestic well: A water well used to supply water for the domestic needs of an individual residence or systems of four or fewer service connections.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Glaciolacustrine: Pertaining to, derived from, or deposited in glacial lakes; especially said of the deposits and landforms composed of suspended material brought by meltwater streams flowing into lakes bordering the glacier, such as deltas, kame deltas, and varved sediments.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Groundwater quality: Refers to the chemical composition of groundwater and its suitability for various uses. Varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current land use practices that may contribute anthropogenic effects.

Groundwater recharge: The natural or intentional infiltration of surface water into the zone of saturation. Groundwater recharge occurs either naturally as the net gain from precipitation, or artificially as the result of human influence.

Hydraulic profile: The graphical representation of the water level through a channel based on the water level of the receiving water, control points, and the head loss.

Aquatic Invasive species: Aquatic or plant species that are growing outside the country or region of origin and outcompeting or replacing native species.

Invert (channel): The stream bed or floor within a structure or channel.

Piezometric pressure: A measurement at a discrete location expressing the potentiometric surface which is an imaginary surface representing the pressure of groundwater in an aquifer that is defined by the level to which water will rise in a well.

Pool: A deep, slow-moving area of a stream; an artificially confined body of water above a dam or weir.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. Preliminary design typically supports environmental submissions that satisfy environmental and/or regulatory requirements, as well as environmental applications. In addition, during preliminary design, all major stakeholders are consulted, and their issues addressed to the extent possible.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting or blasting.

Recharge: Water added to an aquifer or the process of adding water to an aquifer.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Riparian vegetation: Vegetation growing along the banks of rivers and streams, at the interface between water and land.

Riprap: A stone covering used to protect soil or surface bedrock from erosion by water or the elements.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Species of conservation concern: Species that are tracked either federally (*Species at Risk Act*, Committee on the Status of Endangered Wildlife in Canada), or provincially (*The Endangered Species and Ecosystems Act* and Manitoba Conservation Data Centre) and are considered rare or at risk of extinction.

Suspended sediment: Particulate matter that is held in the water column due to movement of the water.

Technical Support Team: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure to provide specialized technical support services for Project construction, maintenance, or operation. Specialized support may include, but is not limited to design, contracting, contract disputes, auditing, inspections, construction methods and sequencing.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Turbidity: A measure of the relative clarity of water.

Wetland: Refers to:

> (a) a marsh, bog, fen, swamp or ponded shallow water, and
>
> (b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

1.0 INTRODUCTION

The Construction Environmental Management Program (CEMP) has been prepared as part of the design, tendering and contract administration of the Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) for Manitoba Transportation and Infrastructure. This CEMP has been prepared based on industry standard practices and the description provided in Section 3.7 of the Project Environmental Impact Statement (EIS) for the Project. The construction Contractors will be required to abide by the procedures and measures identified within the CEMP.

The purpose of the CEMP is to describe the environmental management processes and measures that will be implemented to minimize environmental effects during construction of the Project. It organizes the various mechanisms required to confirm that the environmental management measures are executed, monitored, and evaluated for effectiveness, and that information is reported on to allow for adjustments, as required. The CEMP describes Manitoba Transportation and Infrastructure's commitment to protection of the environment and compliance with the various federal and provincial environmental regulatory requirements.

This CEMP document describes the responsibilities of the various parties involved, provides a summary of construction activities and potential environmental effects, and provides an overview of the various environmental management measures, monitoring and reporting procedures to be applied during the Project construction. The CEMP and supporting management plans will guide the Contractor(s) construction of Project components in a manner that promotes Best Management Practices (BMPs) for environmental protection.

The CEMP is supported by several specific or targeted management and monitoring plans that have been submitted as separate documents, with the exception of the Waste Management Plan, Hazardous Materials Management Plan and Emergency Response Procedures (ERP), which are described within this CEMP document. Many of these management plans are interrelated and rely on each other for management and monitoring aspects. These topic-specific management plans also include references to other documents developed to support the topic further. As listed in Section 3.7.2 of the Project EIS, these targeted management and monitoring plans consist of the following:

- Management Plans:
  - Environmental Protection Plan (EPP)
  - Project Environmental Requirements (PERs)
  - Access Management Plan (AMP)
  - Quarry Management Plan (QMP)
  - Sediment Management Plan (SMP)
  - Surface Water Management Plan (SWMP)
  - Groundwater Management Plan (GWMP)
  - Revegetation Management Plan (RVMP)
  - Agricultural Biosecurity Management Plan (AgBMP)
  - Dust Control Plan

  - Waste Management Plan (see Section 5.11)
  - Hazardous Materials Management Plan (see Section 5.11)
  - Emergency Response Procedures (see Section 5.12)
  - Heritage Resources Protection Plan (HRPP)
  - Wetland Compensation Plan (WCP)
  - Site Decommissioning Plan
  - Complaint Resolution Process (CRP)
- Monitoring Plans:
  - Inspection and compliance monitoring (part of the SWMP, SMP, RVMP and GWMP)
  - Aquatic Effects Monitoring Plan (AEMP)
  - Wildlife Monitoring Plan (WMP)
  - Wetland Monitoring Plan (WetMP)

Environmental management measures described herein and in the supporting management plans are derived from Manitoba Transportation and Infrastructure's corporate environmental and safety policies and incorporate other BMPs such as those outlined in the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, the Forest Management Guidelines for Riparian Management Areas, and/or the Boreal Wetlands Conservation Codes of Practice.

This CEMP document is preliminary based on the current stage of design and will be expanded and updated after regulatory approvals and before the start of construction. The updates and finalization of the CEMP will reflect completion of detailed design, construction work scheduling, current site conditions, input obtained from consultation and engagement, requirements of the environmental approvals, permits and licenses, and other applicable environmental plans and reports. The CEMP is a living document that will be reviewed and updated by Manitoba Transportation and Infrastructure on a regular basis, with continuous improvement being made so that the Project is constructed in an environmentally responsible manner.

1.1 Project Description

The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure. A detailed description is provided in the EMP Framework document, and the Project location is shown in Figure 1 and Figure 2.

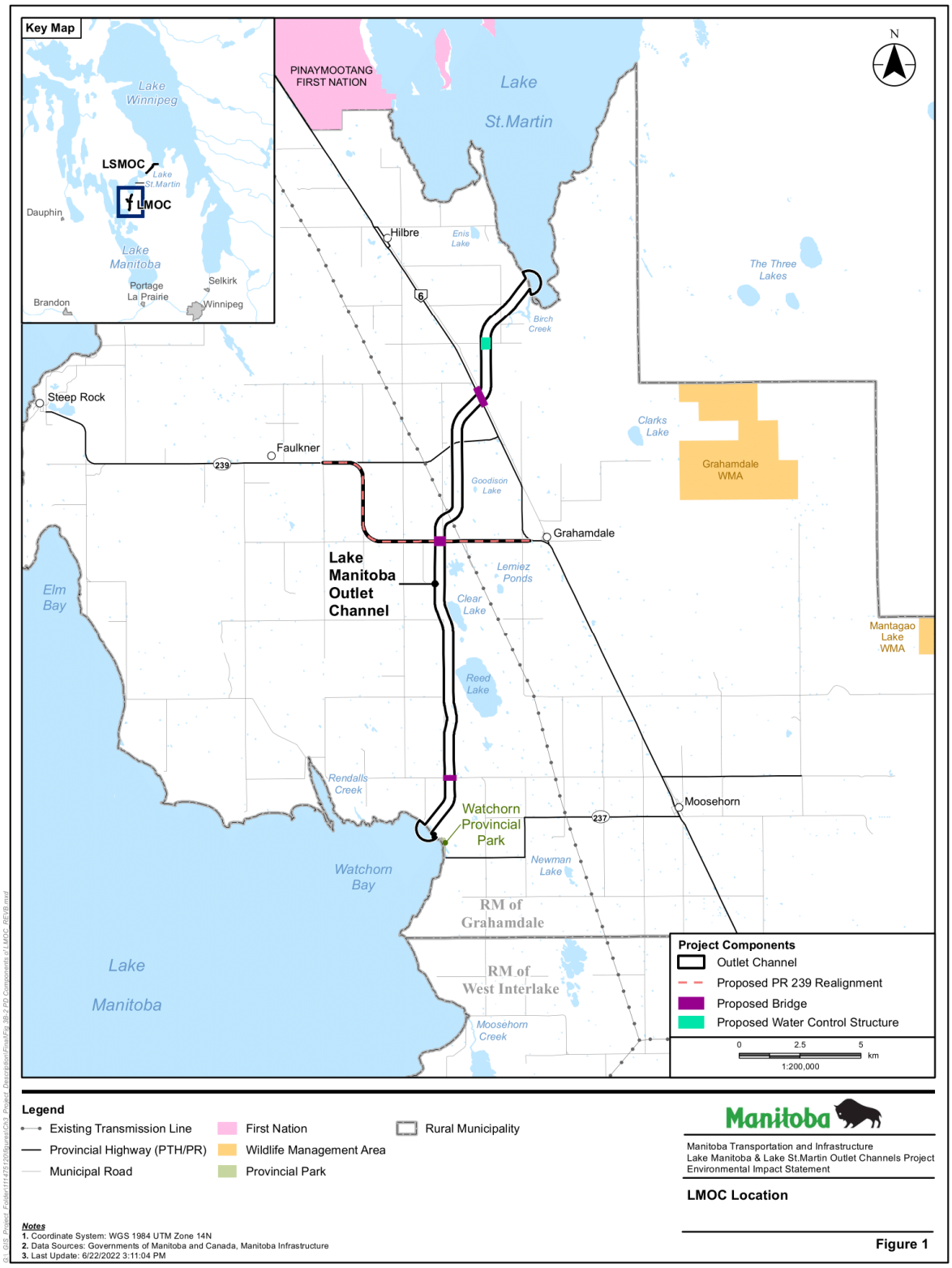


Figure 1: LMOC Location

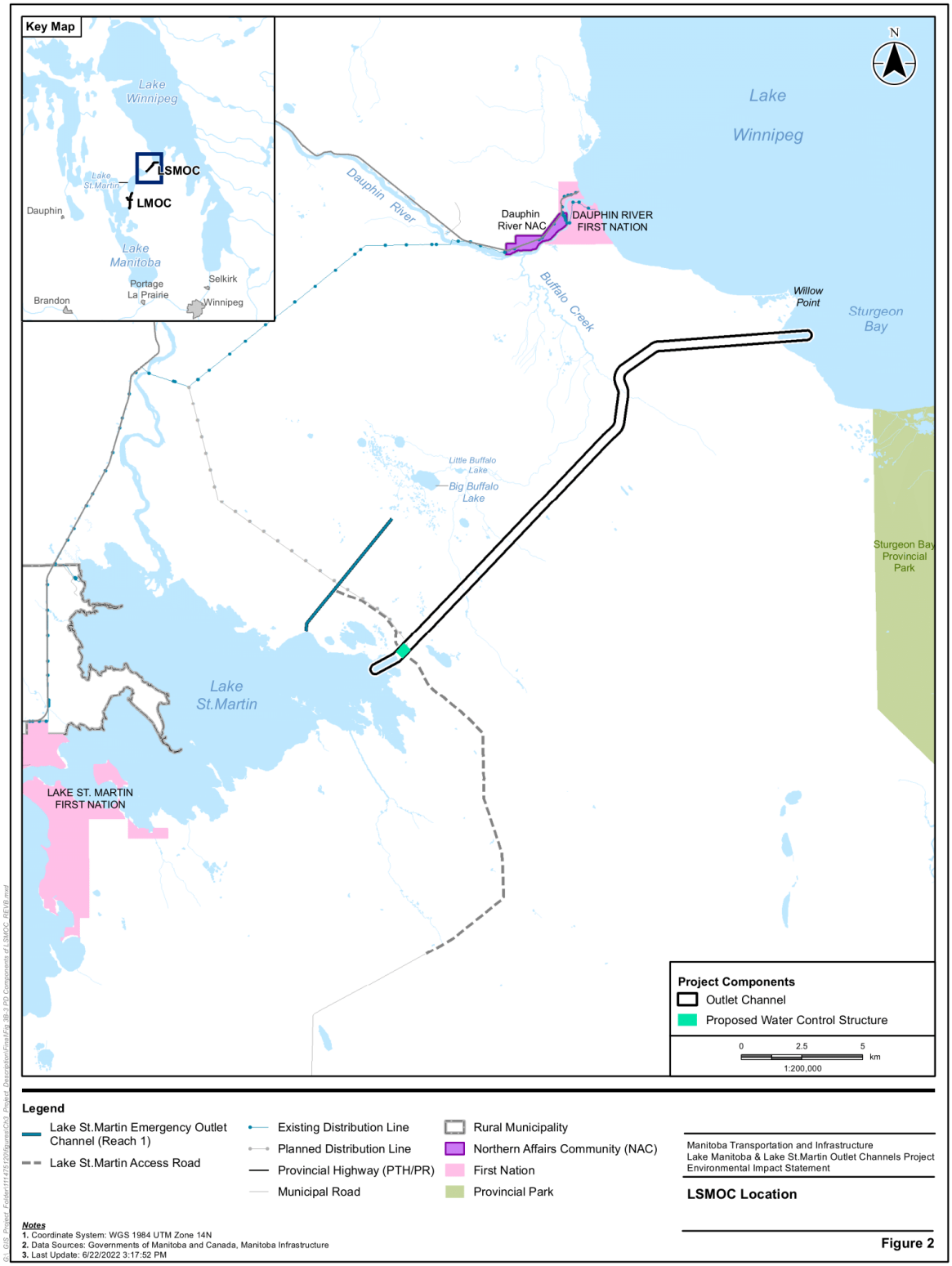


Figure 2: LSMOC Location

The Lake Manitoba Outlet Channel (LMOC) is located within the Rural Municipality (RM) of Grahamdale in Manitoba's Interlake Region, approximately 220 kilometres (km) northwest of the City of Winnipeg. It will run from Watchorn Bay on Lake Manitoba northeast to Birch Bay on Lake St. Martin and will primarily be located on private agricultural lands that will be purchased. There are more than 60 residences within 3.0 km of the LMOC, the nearest of which is approximately 0.5 km from the proposed channel. The communities of Moosehorn and Pinaymootang First Nation (FN) are located approximately 10.9 km and 9.3 km respectively, from the LMOC. The channel intersects portions of 26-8-W1, 27-8-W1, 28-8-W1, and 29-8-W1. The approximate UTM coordinates (North American Datum 1983) Zone 14 U are 5681518 N 529841 E for the inlet and 5704032 N 534074 E for the outlet.

The Lake St. Martin Outlet Channel (LSMOC) is located approximately 220 km northwest of the City of Winnipeg in Manitoba's Interlake Region between the northeastern most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg. This area is currently considered semi-remote as road access is seasonal, with the nearest permanent residence located approximately 6.1 km from the channel in Dauphin River FN. Dauphin River FN and Lake St. Martin FN reserve boundaries are located approximately 4.6 km and 12.0 km respectively, from the LSMOC. The LSMOC will occur entirely within Crown Land, which is located within the area covered by Treaty No. 2. The channel intersects portions of 32-5-W1, 32-6-W1, 33-5-W1 and 34-4-W1. The approximate UTM coordinates (North American Datum 1983) Zone 14 U are 5738284 N 557122 E for the inlet and 5751400 N 572725 E for the outlet.

1.2 Licensing and Authorization

The proposed Project is a designated project under the *Canadian Environmental Assessment Act*, 2012 (CEAA, 2012), and therefore requires an Environmental Assessment. Pursuant to Section 15(d) of the CEAA, 2012, the Impact Assessment Agency of Canada (the Agency) is the authority responsible for federal review of the proposed Project and issued Guidelines for the Preparation of an EIS for the Project. Other key federal legislation, under which approvals may be required, includes the *Fisheries Act*, *Navigation Protection Act*, *Migratory Birds Convention Act* and *Species at Risk Act* (SARA).

The proposed Project is considered a 'Class 3' development under the Classes of Development Regulation (164/88) of *The Environment Act* (Manitoba) and therefore requires an *Environment Act* Licence. Manitoba Environment, Climate and Parks (MECP) Environmental Approvals Branch is the authority responsible for provincial review of the proposed Project and provided EIS Guidelines for the Project. In addition to addressing the EIS Guidelines, provincial permits will be required under several acts to address various Project activities, such as *The Crown Lands Act* (camp development on provincial Crown lands), *The Mines and Minerals Act* (quarry development), *The Wildfires Act* (burning) and *The Dangerous Goods Handling and Transportation Act* (petroleum storage tanks).

While field investigations have been on-going to support design of the LMOC and LSMOC, no construction work or site preparation activity is to begin without having obtained the proper federal and provincial permits or authorization for the work. Federal and provincial legislation relevant to the proposed Project is summarized in Appendix 1.

2.0 PRIMARY RESPONSIBILITIES

All parties involved in this Project need to be aware of their responsibilities so that the CEMP is effectively and efficiently implemented and therefore maximizes environmental protection during construction. The primary responsibilities of Manitoba Transportation and Infrastructure as the Proponent and Owner, the Contract Administrator and the Contractor are listed in the following sections. Figure 3 shows the overall Project organization structure during construction, outlining the communication between Manitoba Transportation and Infrastructure, the federal and provincial regulators, Contractors and Inspectors, and Monitors

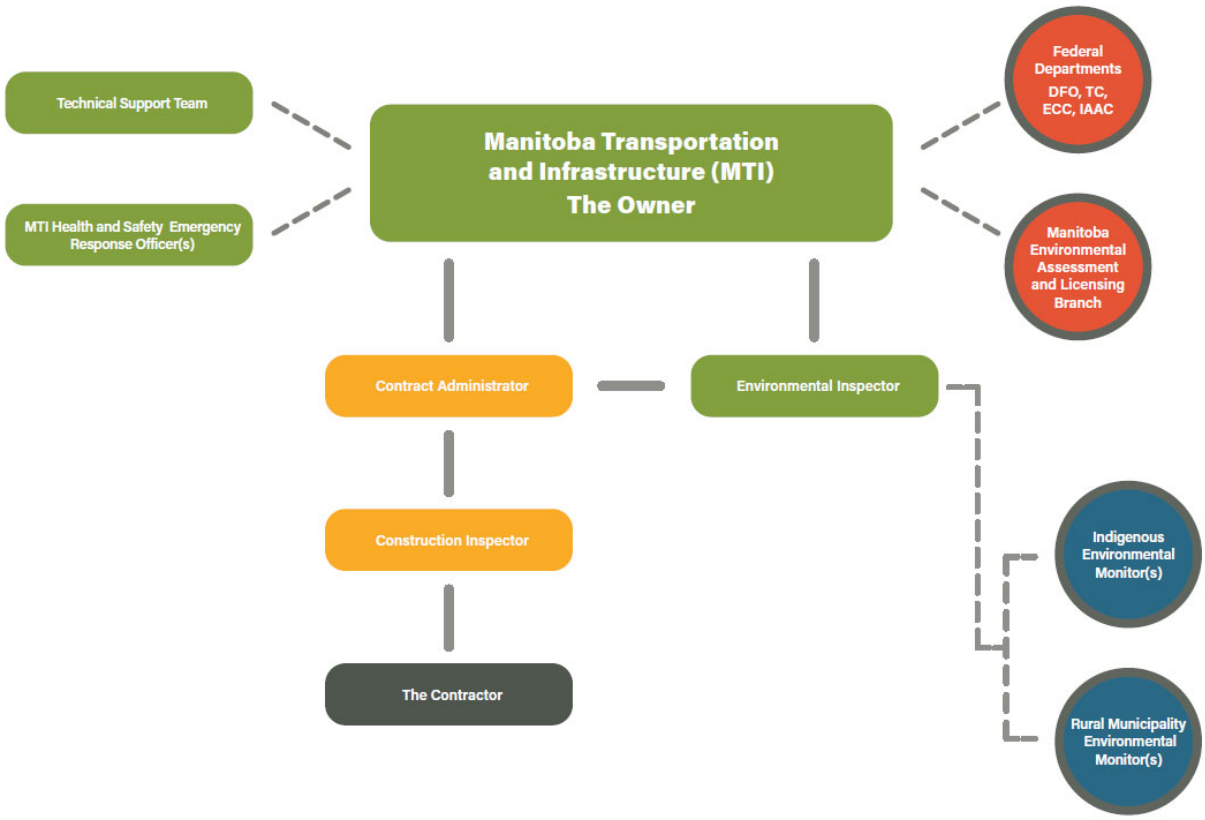


Figure 3: Project Construction Organization Structure

2.1 Manitoba Transportation and Infrastructure (the Owner)

As the proponent and Owner of the Project, Manitoba Transportation and Infrastructure will be responsible for incorporating the appropriate environmental protection measures, including BMPs, into the design of Project components. Construction contract specifications will detail the technical design as well as Project-specific restrictions respecting how the work is to be completed. All relevant plans, such as the PERs and management plans, will be among the information that will accompany the tender document(s) to be provided to prospective Contractor(s).

As the Project proponent and owner, Manitoba Transportation and Infrastructure is responsible for implementing, monitoring and amending the environmental aspects of the Project. To help avoid and control communicable diseases (including COVID-19) within its work-places and worker accommodations, Manitoba Transportation and Infrastructure will adhere to Manitoba Public Health Orders.

As demonstrated in (Figure 3) Manitoba Transportation and Infrastructure, as the Owner, will have personnel and designates in place to oversee Project activities. These individuals will be supported by advice from a Manitoba Transportation and Infrastructure Technical Support Team comprised of environmental, health and safety, and design personnel. Manitoba Transportation and Infrastructure will coordinate information sharing between on-site activities and off-site support teams. Manitoba Transportation and Infrastructure, with the support of the Technical Support Team, will also have the following responsibilities under the CEMP:

- Liaise with the Federal Responsible Authorities and Manitoba Regulators concerning authorization requirements, monitoring and follow-up.
- Provide approval, based on discussions with the Owner, in cases where a Contractor suggests methods to achieve a particular goal or objective that differ from their original site plan.
- Obtain the Fisheries Act authorization from the Department of Fisheries and Oceans Canada (DFO), as required, for in-water or near water work.
- Obtain the Canadian Navigable Waters Act permit/authorization from Transport Canada, as required, for the construction of permanent or temporary waterbody crossings and/or other in-water structures.
- Obtain the required Water Rights Act authorization from Manitoba Environment, Climate and Parks (MECP) for de-watering and the associated Live Fish Handling Permit (Assuming de-watering and/or fish/mussel salvage will be required (see Section 5.5).

The Inspector(s) will regularly report on field activities. Any information that is to be distributed to the Technical Support Team and other essential Manitoba Transportation and Infrastructure representatives will be forwarded for distribution. The Owner's Inspector will carry out the following functions:

- Inspect for compliance with the requirements outlined in permits and/or authorization associated with the Project.
- Inform the Technical Support Team and Contractor of appropriate environmental requirements and provide them a copy of relevant permits/authorizations.
- Confirm that site specific plans outlined by the Contractor are appropriate and environmentally responsible.

- Monitor the work site and document through inspection forms to verify that the PERs and other environmental mitigation and management measures are implemented and that the site is maintained in accordance with the Contract Documents. Conduct an environmental audit of the construction work being done.
- Summarize the findings of routine environmental monitoring and environmental audits of the work site in an inspection report to be retained on file and provided by the Owner to the designated regulator(s) throughout the construction phase.
- Frequently meet with the Contractor and require that regular updates be provided regarding progress on the environmental components of the work.
- Initiate and hold meetings, as required, to advise the Contractor of deficiencies in the environmental management measures, to address the deficiencies, and direct the Contractor to take appropriate and timely corrective action.
- Liaise with the Contractor and Technical Support Team regarding deficiencies in the environmental management measures implemented, Contract Documents or in other environmental matters that involve the Contractor.
- In cases of recognized non-compliance with the legal requirements, or where the Contractor fails to take appropriate timely measures to protect the environment, or fails to correct recurring deficiencies, direct the Contractor to suspend work until the appropriate measures have been met.

2.2 Contract Administrator

The Contract Administrator will be responsible to perform the following functions to facilitate environmental protection during the administration of the contract:

- Be familiar with the appropriate environmental requirements applicable to construction of the Project.
- Review the Contractor's construction submittals and make recommendation to the Owner as to whether they are appropriate for the anticipated site conditions.
- Liaise with the Owner to address concerns with the proposed construction submittals.
- Provide Contract Administrator Inspections to assist the Owner Inspector with monitoring of the work and site to confirm the Contractor implements environmental specifications and environmental management measures and maintains the site in accordance with the Contract Documents.
- Confirm that required reports received from the Contractor are forwarded to the Owner.
- While on site, notify the Owner of recognized non-compliance with the legal requirements or where the Contractor fails to take appropriate timely measures to protect the environment or fails to correct recurring deficiencies, so that the Owner can determine the need and/or extent of cessation of work associated with the particular incident. The Contract Administrator will issue an immediate cease work order in the event of a non-compliance that will have an immediate and severe effect on the environment.
- Immediately notify the Manitoba Transportation and Infrastructure Technical Support Team of orders to suspend work, or of environmental incidents, complaints or enquiries.

2.3 Contractor

The Project Contractor(s) will take the lead role in implementing the environmental management measures during the construction activities, as outlined in this CEMP, the associated plans and established through the Contract Documents. The Contractor will also be responsible to provide site specific planning (e.g., location of laydown areas) in writing in advance of starting construction for Contract Administrator Review and Owner approval. This information will be described in detail and thereby augment the EPP and other plans (e.g., PERs) that collectively describe how to build the Project, with information on sites to avoid or provide specific measures. To confirm environmental protection during construction the Contractor will perform the following functions:

- Obtain relevant permits (as required) to conduct their work (e.g., Crown Lands work permits, quarry permits, etc., as described in Appendix 1). Environmental permits or approvals obtained by the Contractor and any amendments will be identified and submitted to Manitoba Transportation and Infrastructure for compliance and record keeping purposes.
- Develop necessary submittals in accordance with the related Contract Documents, including the PERs, and permits/authorizations associated with the work.
- Requests for a change in environmental management measures initiated by the Contractor shall be forwarded to the Contract Administrator for submission to the Owner. The Owner will need to approve these changes and may require discussions with Federal Authorities and Manitoba Regulators.
- Provide training for staff and ensure Subcontractors are trained and empowered to identify, address and report potential environmental issues, as needed. Training and orientation sessions shall be documented, and copies provided to the Contract Administrator and Owner for their records and to document compliance with the Project EIS.
- Confirm that Subcontractors understand and comply with the related Contract Documents.
- Identify a dedicated environmental coordinator and other knowledgeable individual(s) who will act as the on-site emergency response coordinator(s). These individuals will liaise closely with the Contract Administrator and Owner to ensure environmental permits and requirements are adhered to. They will also have the authority to redirect manpower to respond to non-compliance, a spill or environmental emergency.
- Implement the environmental management measures, maintain environmental control and protection devices, and monitor the site for the effectiveness of the environmental management measures in accordance with the related Contract Documents and documentation requirements.
- Maintain a record file at the site in which documents relevant information relating to materials handling, spills, leaks, releases, and the implementation and adjustment of the environmental management measures. Relevant information and/or significant events are to be documented and provided to the Contract Administrator and Owner in a timely fashion and as dictated by legislation and or Contract Documents where applicable.

- Immediately report environmental incidents (e.g., spills, species at risk [SAR], nuisance wildlife, aquatic invasive species, wildfires) to the Owner, Contract Administrator, or Inspector so that the proper authorities can be notified and provide a copy of the incident report to the Owner, Contract Administrator, or Inspector. The Contractor will also be responsible for meeting reporting requirements for permits they hold.
- Take preventative action when it is identified that violation of an environmental act or regulation or a considerable impact to the environment will occur, such as work shut down, in consultation with the Contract Administrator, Inspector and/or Owner.
- Attend meetings initiated by the Contract Administrator or Owner to address concerns or deficiencies in the environmental management measures and follow-up on direction provided to take appropriate and timely corrective action.

2.4 Environmental Monitor

The role of the Environmental Monitor(s) will be developed through consultation with rights-holders and the RM of Grahamdale. At this time, it is anticipated that they will be responsible to perform the following functions to confirm that environmental protection measures are implemented during Project construction:

- Inspect for compliance with the requirements outlined in permits and/or authorization associated with the Project.
- Monitor the work site and document through daily inspection forms to verify that the PERs, environmental specifications and environmental management measures are implemented and that the site is maintained in accordance with the Contract Documents.
- Provide information to the Environmental Advisory Committee and the Owner of potential deficiencies in the environmental management measures.
- Immediately report environmental incidents (e.g., spills, species at risk [SAR], nuisance wildlife, aquatic invasive species, wildfires) to the Contract Administrator and the Owner so that the proper authorities can be notified.
- Attend meetings initiated by the Contract Administrator and/or the Owner to address concerns or deficiencies in the environmental management measures and follow-up on direction provided to take appropriate and timely corrective action.

3.0 ACTIVITY DESCRIPTION

Construction of the Project will include vegetation clearing and grubbing; excavation of peat, till and rock material; material hauling; placement and grading of dike structures and spoil material; revegetation; pile driving; sheet pile installation; installation of groundwater aquifer depressurization wells; and pouring concrete. The till material excavated during construction will be utilized to construct dikes along both sides of the channels where existing ground levels are low. Excavated material not used for dike construction will be spoiled adjacent to the channels within the right-of-way (ROW). Limestone rock riprap will be extracted most likely from existing quarry areas (to be confirmed during detail design stage) and will be used in several locations to mitigate against erosion including at the inlet, outlet, bridges, water control structures (WCS) and drop structures. Similarly, the outlet channels will be armoured to protect against erosion and sedimentation.

Construction and material details will be in accordance with the Contract Specifications and Drawings. The limits of clearing will be restricted to the approved areas. Any land outside of these areas shall not be altered without precise direction from the Contract Administrator or the Owner. A schedule outlining the physical activities required for completion of the Project is being developed as part of detailed design.

Refer to Figure 1 for the location of the LMOC, and Figure 2 for the location of the LSMOC.

3.1 LMOC Construction Methodology

A brief high-level overview of the general construction methodology for the LMOC is provided in the following sections. The construction sequencing plan will be developed during detailed design.

3.1.1 Site Preparation

Site preparation will be the first activity to be undertaken, as it must be completed before construction can commence in all work areas. This will include tree clearing, construction of drainage works, and establishment of bridge detours to facilitate bridge construction.

Tree clearing will be done in the fall and winter months (September 1 to March 31 of the following year) to avoid interference with the nesting window for migratory birds. Grubbing will not take place at the same time as tree clearing to minimize the risk of promoting the proliferation of invasive weed species (as discussed in the AgBMP), and thus will be part of individual construction contracts. This will also reduce the potential for erosion and sediment transport prior to the start of individual construction contracts.

Permanent drainage to the west of the channel is needed to manage surface water runoff in the area and prevent it from flowing into the construction zones. Overland drainage from the west will be collected in a permanent outside drain to be constructed just to the west of the LMOC and routed to Lake Manitoba and Lake St. Martin. This drain will also be used to convey water from local construction dewatering and groundwater depressurization works along the LMOC.

Bridge detours would ideally be put in place during the construction season preceding bridge construction to avoid risk of delays.

3.1.2 Channel

The main consideration in the construction methodology and sequencing for the LMOC is managing the risks associated with the potential for basal heave and resulting fracture of the till aquitard and/or slope instability due to the high bedrock piezometric pressures that exist over the entire channel alignment. It is anticipated that an active (i.e., pumped) depressurization system will be used to lower the piezometric level at various locations along the LMOC to limit the potential for excavation-related basal heave and slope instability during construction.

To reduce the required duration of active depressurization pumping, the construction methodology involves completing the channel excavation in several discrete segments that are separated from each other by a narrow natural land barrier (plug). Targeted depressurization pumping would take place to lower the piezometric pressure within each segment, as required. Once excavation of a segment is complete, along with installation of any long-term passive groundwater depressurization works, the plug would be removed to allow that segment to fill with water to restore weight to the till aquitard and thus no longer require active pumping to address basal heave risks. Flooding of the dry segment prior to plug removal will be undertaken to reduce the water level differential across the plug and thus limit erosive forces when plug removal is underway. Appropriate erosion and sedimentation controls, such as turbidity curtains, would be in place during the plug removal activities. A fish salvage will be required within the isolated area should fish be present, as described in the AEMP.

Excavation activities within each segment are expected to advance in stages to further limit the duration of active groundwater depressurization pumping required, while managing the risks associated with basal heave, slope instability and potential fracturing of the till aquitard. In general, initial excavation of a segment would be advanced to full width down to a level where the risk of basal heave is considered acceptable. This initial excavation would not require any depressurization pumping and thus could take place in either the winter or summer months. The remainder of the excavation within a segment would then be completed to the final geometry with active depressurization pumping in place, as required, and ideally would be completed in the summer months to avoid the complications of having to pump and manage water in sub-freezing temperatures.

Channel construction is envisioned to commence from each of the lakes and progress inland towards the WCS. This will allow each successively completed segment to then be opened to the lake, and thus use the lake water to restore weight to the till aquitard. At the upstream end of the LMOC, the work would be sequenced to allow construction activities for the inlet, Township Line Road bridge and the channel segment connecting them to be completed around the same time to allow this area to be opened to Lake Manitoba. Channel excavation segments would then be progressively advanced downstream towards the WCS, with the construction activities for the PR 239 bridge and Provincial Trunk Highway (PTH) 6 bridge sequenced such that they are completed around the same time as the channel excavation segments at those locations. A similar strategy would be used at the downstream end of the LMOC where the channel excavation would be advanced from Lake St. Martin upstream towards the WCS.

An alternate construction methodology is also under consideration, as a potential mitigation effort, that would involve limiting active aquifer depressurization activities to the areas near the bridges, WCS, and potentially other discrete areas within the channel and accepting some construction risk of groundwater seepage into the channel excavation. This will require a trench to be sub-cut into the base of the channel (below final grade) that would be backfilled with graded material to act as a filter. The trench would create a controlled path for groundwater seepage, as well as a location to divert and collect water that comes into excavation. This would reduce the amount of active depressurization pumping required and in turn, reduce the impacts to the regional groundwater system during construction.

3.1.3 Inlet and Outlet

It is presently expected that construction of the inlet and outlet works will take place in the wet with the construction area isolated by a double turbidity curtain to prevent or minimize the migration of disturbed sediments into the lake. This work would take place in the summer, between July 1 and September 14, to be outside of the restricted spring (April 1 to June 15), summer (May 1 to June 30) and fall (September 15 to April 30) fish spawning windows. A fish salvage program will be required within the isolated area.

Alternate construction methods may be proposed by the contractor, such as isolating the area with a cofferdam that would be constructed behind a turbidity curtain. In this case, only the construction and removal of the cofferdam would need to take place outside of the restricted spawning windows; however, the overall construction time frame and impacted in-water area would be expected to be greater.

3.1.4 Bridges and Water Control Structure

Localized excavation and foundation preparation is required for construction of the bridges and the WCS. It is expected that these work areas will be isolated from the rest of the channel with natural land plugs. These work areas would be kept small to limit the amount of pumping required to facilitate aquifer depressurization requirements and manage surface water runoff within the excavation.

Detour roads will be established at each of the bridge locations and at the WCS to maintain traffic while those structures are being constructed.

3.2 LSMOC Construction Methodology

A brief high-level overview of the general construction methodology and a preliminary construction sequencing plan has been developed for the LSMOC as part of preliminary design and is summarized in the following sections.

3.2.1 Site Preparation

Site preparation will be the first activity to be undertaken. Along the channel alignment, this will include tree clearing, peat excavation, construction access road development, and construction of drainage works. A corridor will also be cleared to facilitate construction of a distribution line that will supply power to the Water Control Structure. The work will be performed in the fall and winter months (September 1 to March 31 of the

following year) to allow for access over the frozen peatland, to simplify water management requirements, and to avoid interference with the nesting window for migratory birds.

Construction of the permanent outside drain (to the east of the channel alignment) and excavation of the peat within the Project Development Area (PDA) will reduce (but not eliminate) surface water runoff and groundwater seepage into the work area, as well as promote drainage within the channel construction limits thus improving access to the underlying mineral soils.

Overland drainage from the east side of the channel location will be collected in the outside drain and routed towards Lake Winnipeg. Temporary discharge of the drain into the existing Reach 3 of the emergency outlet channel (EOC) may also be considered during construction depending on the final construction duration and schedule.

A pilot ditch along the centerline of the channel (within the mineral soil) will be constructed to collect and drain seepage/surface runoff entering the excavation area during construction, particularly in EOC Reach 2 and the Reach 3 Extension where there is currently no existing excavation. This will improve drainage of the materials underlying peat and promote better access conditions for the subsequent earthworks contracts.

3.2.2 Channel

Earthwork activities are anticipated to start at the downstream end of each construction reach, gradually progressing upstream to promote gravity drainage of the work areas. Earth plugs will be left in place to isolate excavation work areas and manage surface water drainage during construction.

Due to elevated confined bedrock piezometric pressures along the channel alignment, excavation activities are expected to advance in stages to manage risks associated with basal heave and fracturing of the till aquitard. Excavation within the mineral soil (following peat excavation) will be performed in stages. Stage 1 involves advancing channel excavation at full width to an invert where the factor of safety against the potential for basal heave is acceptable. Stage 2 involves advancing a new pilot channel to full channel completion depth along the channel centerline. The intent is to promote concentration of potential heaved or fractured till interconnections between the bedrock aquifer and channel invert along the centreline, while improving drainage to the remaining excavation areas moving toward the excavation slopes (Stage 3), and also reducing the underlying confined bedrock aquifer piezometric pressures due to drainage within the deepened pilot channel. Stage 3 involves expanding the new pilot ditch to full channel width, completing the excavation to the final geometry. Following channel excavation, armour stone or riprap will be installed where required.

Construction of the channel dikes and channel excavation to be used as fill source will need to occur above freezing temperatures to facilitate subgrade preparation and material compaction. The remaining channel excavation activities could occur at any time. Construction of the drop structures can occur at the Contractor’s discretion during or after completion of channel excavation. Each work area will have associated roadworks, revegetation, and armour/riprap placement which can occur as soon as possible as channel excavation and dike construction advances.

3.2.3 Inlet and Outlet

The inlet and outlet are anticipated to be constructed in the dry. The work areas will be isolated from the lakes with cofferdams, which will be installed and removed outside of the restricted spring (April 1 to June 15), summer (May 1 to June 30), and fall (September 15 to April 30) fish spawning windows. Construction activities in the area isolated from the lakes will then proceed at the discretion of the Contractor for approximately a one-year period.

Alternate construction methods may be proposed by the Contractor, such as excavation in the wet behind a double turbidity curtain or winter excavation in locations where the lake ice freezes to the lake bottom. Any in-water works associated with these alternative construction methods will also abide by the restricted fish spawning windows.

3.2.4 Water Control Structure

The WCS will require localized excavation and foundation preparation. Due to high bedrock piezometric pressures (at times artesian) within the bedrock aquifer in the vicinity of the WCS, an active depressurization system will be required. Reduction of piezometric pressures within the bedrock and the till overburden is required to maintain stability of the temporary excavation slopes. The depressurization system will also be used to control, monitor, and dewater the work area once the bedrock is exposed in the excavation, and as it is being prepared for the construction of the WCS.

A distribution line will be constructed by Manitoba Hydro to provide power to the WCS. The line will extend west from the WCS to connect to the existing distribution system. Construction of the distribution line will occur in the winter to facilitate access to the alignment, which will primarily run through native peatland.

3.3 Control Measures

Standards have been established so that on-site activities are carried out with due regard for the environment. The following items summarize general environmental protection measures that will be applied on this Project, some of which are described in greater detail in the supporting management plans:

- Prior to commencement of the site work, a pre-construction meeting shall be held between the Owner, the Contract Administrator and the Contractor to discuss environmental concerns, laws, rules, regulations, and permits applicable to the Project area.
- The Owner will rely on the Contract Administrator and Inspector to monitor the implementation of this CEMP.
- Equipment mobilized from outside the Project area shall arrive on the site in a clean condition and will be kept in good working order and free of fuel, oil or fluid leaks and/or potential for leaks (for example, cracked or worn hoses). Machinery that is found to be leaking fuel, oil or other fluids will be moved off the work site immediately for repair.
- Work activities shall be confined to the designated site area.
- Efforts shall be made to prevent and control contamination of waterbodies.

- Exhaust and engine systems of equipment and vehicles shall be in good working condition and free of dried grass and other combustibles.
- Fire extinguishers will be available for fighting fires. The authorities having jurisdiction shall be notified immediately should a fire occur. All equipment and personnel shall be made available to control a fire. No fires shall be permitted unless approved by the site supervisor and with a burn permit, where required.
- Oil changes, refueling and lubricating of equipment shall be conducted in designated areas a minimum of 100 metres (m) from waterbodies to minimize the potential for water pollution. All reasonable precautions shall be taken to ensure that refueling only takes place within an area approved by the Owner. These designated areas will be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection. Drip trays shall be placed under equipment being repaired or refueled and trays shall be cleaned after each use. Spent oils, lubricants, fuels and filters, etc., shall be collected and either recycled or disposed of at an approved location according to the hazardous materials guidelines and the PERs.
- Materials required for spill containment and clean-up will be available at work sites and designated areas. Vehicles will carry materials and equipment for emergency spill containment.
- In the event of an unexpected occurrence of an environmental incident or uncovering of a heritage resource, the Contractor shall immediately notify the Contract Administrator and the Owner. Additional follow-up will be required to involve an archaeologist or other specialist that can make a determination on the proper mitigation measure to take (e.g., recover an artifact).

4.0 POTENTIAL ENVIRONMENTAL EFFECTS

Manitoba Transportation and Infrastructure submitted a Project EIS for the proposed Lake Manitoba and Lake St. Martin Outlet Channels in March 2020. The identification and assessment of potential environmental effects and associated mitigation measures to manage adverse effects, which are detailed in the Project EIS, have been preliminarily summarized in this CEMP. This CEMP is a working document, currently in a draft stage, that has incorporated relevant environmental effects and mitigation measures that are identified and reflective of up-to-date inputs from public and Indigenous engagement and consultation, engineering design and the environmental assessment. The finalization of this CEMP will consider applicable conditions of federal and provincial permits and/or authorization, any other pertinent findings through the design and regulatory review process, and key relevant outcomes of the ongoing public and Indigenous engagement process. This CEMP focuses on managing environmental effects during construction and, therefore, only the potential adverse effects associated with construction are included as summarized below:

- Fugitive dust will be emitted from surface disturbance activities and the construction equipment usage is a source of greenhouse gas and particulate emissions that will adversely affect the local air quality. Construction activities will also result in temporary and localized increased noise from heavy machinery and ambient light levels from portable lighting.
- There is a risk of deleterious substances during construction affecting the soil quality, seeping into the groundwater, or entering the surrounding waterbodies and negatively influencing terrestrial and aquatic species and habitat. Possible sources include fuel spills or releases from equipment operation, during refueling or improper storage and handling of fuel. Additionally, hazardous material spills may occur as the result of improper handling, use, or storage of these materials on-site and while being transported to site.
- Construction of the channels will result in changes to the existing groundwater conditions within the perched peat (around LSMOC), overburden clay/till, and confined bedrock aquifer piezometric pressure conditions along the channels. Potential effects may include changes in groundwater flows, levels and quality through interaction with surface water.
- Construction of the channels will result in changes in local drainage areas and drainage patterns. LSMOC will intercept surface water drainage from the upper reaches of the Buffalo Creek system, as well as some areas of ephemeral streams and wetlands. LMOC will block existing surface water drainage paths from the portion of the watershed located to the west of the LMOC.
- Clearing, excavation and other Project construction activities could result in the release and transport of sediment and/or debris to waterways. Erosion due to precipitation and runoff can introduce sediment to the downstream receiving water bodies which can negatively affect fish and fish habitat. Further, construction of the inlet and outlet structures and excavation of the lake beds has the potential to disturb and re-suspend sediment in Lake Manitoba (LMOC inlet), Lake St. Martin (LMOC outlet and LSMOC inlet) and Lake Winnipeg (LSMOC outlet).

- Fish habitat will be permanently altered or destroyed during construction. Additionally, fish health and mortality could potentially be affected during construction activities within or near water through the potential release of deleterious substances to streams and lakes adjacent to or downstream of the channels.
- The Project may facilitate conveyance of invasive or undesirable aquatic species, such as common carp, zebra mussel, spiny water flea and toxic algae. Aquatic invasive species could be transported to and spread in the Project area on machinery and equipment used in water during construction activities. The introduction and spread of invasive species can reduce the diversity and populations of native species and can modify habitat.
- The loss and disturbance of vegetation and wetlands associated with clearing activities will change the landscape, community and species diversity and allow for the introduction and potential spread of invasive plant species. Granular construction material and equipment used for construction activities can be a source of non-native and invasive plant species, which can displace native plant communities and modify vegetation composition and structure in the area.
- The Project site preparation and construction phases will result in changes to the physical landscape, including habitat fragmentation, alteration and loss. Numerous migratory birds and SAR have the potential to breed in the habitat types within the Local Assessment Area (LAA) and will be affected by the habitat loss or alteration resulting from Project construction. The Project has potential to affect federally designated critical habitat of two bird SAR: eastern whip-poor-will and red-headed woodpecker. Eastern whip-poor-will critical habitat is located within the LSMOC ROW at the inlet and red-headed woodpecker critical habitat is located along the PR 239 realignment. Both species are listed as Threatened and are protected federally and provincially under SARA and The Endangered Species and Ecosystem Act.
- During construction, there is potential for increased wildlife mortality risk. Ground-nesting birds and species with decreased mobility (e.g., amphibians, small mammals) are most susceptible to direct mortality during site preparation as individuals may be unable to escape construction activities. Land clearing could also put bat maternity roosts at risk, particularly in areas where large diameter trees are removed for LSMOC. Construction of Project components by excavation and earth moving have the potential to increase wildlife mortality risk because individuals, particularly small mammals such as mice and voles and amphibians, may be crushed by equipment, or become entrapped in open excavations. Increased traffic volumes during construction activities has the potential to result in increased mortality risk to wildlife, including migratory birds, due to potential vehicle collisions in the LAA.
- Site preparation and construction activities have the potential to affect a change in wildlife movement by creating physical and sensory (noise, vibration and light) barriers. During construction, noise and activity associated with heavy equipment and personnel is anticipated to deter wildlife from using or crossing the active construction portions of the LMOC and LSMOC Project Development Area (PDA) for the short-term. The LSMOC will bisect a potentially sensitive terrestrial corridor between large patches of contiguous habitat and may present a semi-permeable barrier for marten dispersal.

- Project construction activities have the potential to affect recreational land use. Channel excavation for the ROW may physically interfere with snow mobile activities and limit the ability of recreationalists from accessing recreation areas. Construction of the channel inlet and outlet has the potential for interference with recreational fishing.
- The Project will potentially impact traditional use areas for hunting, trapping, fishing and gathering in the vicinity of LSMOC. The habitat fragmentation and loss, sensory disturbance and wildlife mortality associated with LSMOC construction activities, as previously described, could temporarily and permanently displace some wildlife and movement patterns that could result in a reduction of hunting and trapping success rates. Additionally, the presence of construction workers could result in an increase in competition for species harvested by Indigenous commercial fishers and anglers.
- Ground-disturbing Project activities, such as vegetation clearing and excavation, as well as development of temporary construction camps, staging areas and access roads, have the potential to interact with heritage resources by subsurface disturbance and alteration of the horizontal and vertical locations of intact archaeological features or objects contained therein. This in turn has the potential to affect cultural and spiritual sites and sacred areas.
- Due to the storage of combustible materials or wastes, operation of internal combustion engines (e.g., vehicles, heavy equipment) and the presence of workers during Project construction, brush and wildfires could be ignited. In particular, the accumulation of slash during clearing can contribute material for wildfires and hot combustion engines on vehicles driving over dry grass or fields can cause wildfires. An accidental fire could adversely affect air quality, vegetation, wildlife, land and resource use, infrastructure and services, economy and human health.

5.0 ENVIRONMENTAL MANAGEMENT AND PROTECTION

The environmental management and protection measures described in the following sections are proposed to mitigate potential temporary and/or permanent impacts resulting from the construction phase of this Project. They are consistent with the PERs. As previously noted, these management and protection measures will be supported by several specific or targeted management plans that provide greater details and have been submitted as separate documents. Unless otherwise stated, these measures also apply the PR 239 realignment and other temporary works associated with the Project.

5.1 Atmospheric Environment

Increased dust is not a concern during winter construction activities; however, summer construction activities shall be conducted by methods that minimize the raising of dust. The Contractor shall implement dust control practices, as described in the Dust Control Plan, during construction activities such as excavation, and transporting of materials, to mitigate the generation of dust and other particulate matter. Vehicles used to haul materials to or from the work site shall have the load covered with a tarpaulin cover during transport to minimize dust and prevent material from falling out. Material stockpiles or spoil piles prone to wind erosion shall be maintained as to minimize release of particulate matter or dust. This will include, but is not limited to, covering or stabilization of material stockpiled at the work site as required. The application of dust suppressants, preferably water, shall be limited to the roadway, driveway or designated area. The amount of dust suppressant applied should not exceed the minimum amount required to effectively suppress dust and will be visually monitored to ensure excess does not pool or run-off and impact adjacent waterbodies.

To mitigate impacts to ambient air quality and reduce increased greenhouse gases associated with construction vehicle emissions, engines and exhaust systems will be properly maintained, vehicle idling times and cold starts will be reduced to the extent possible. Additionally, the use of a work camp will reduce emissions associated with transportation of staff to and from the construction site during.

Due to the remote location of the LSMOC, there are no nearby residents that will be affected by the increased noise associated with heavy machinery and equipment during construction. However, the LMOC is located in a developed area such that nearby residents may be affected by the increased noise associated with heavy machinery and equipment during construction. Accordingly, machinery and factory supplied noise-abatement equipment (e.g., mufflers) will be maintained in good working order and machinery idling will be minimized. Additionally, Manitoba Infrastructure and Transportation will implement a Complaint Resolution Process as a formal mechanism to respond to noise complaints. Measures for mitigating the potential effects of noise on wildlife are described in Section 5.8.

To limit potential effects from the use of the mobile lighting during construction full cut-off luminaire will be used wherever possible to reduce glare, light trespass, and sky glow from the Project lighting. Lighting procedures will be designed to avoid excessive use of the mobile flood lighting units and reduce potential

effects by turning off lighting when they are not required. As much as is possible, lighting will be located such that unavoidable light spill off the working area is not directed toward possible receptors.

5.2 Soil

Soil quality in the PDA may be adversely affected during construction from leaks and accidental spills or release of fuels or other hazardous substances. Mitigation to avert impacts to soil quality includes preventing leaks, spills and releases by providing secondary containment for fuel and hazardous material storage, requiring drip trays for equipment, refueling and conducting maintenance only in designated areas and in accordance with the PERs, providing spill clean-up equipment and materials in vehicles, and providing an emergency (spill) response plan. If a spill should occur, the Contractor would be responsible to provide notification within 24 hours and contaminated soil will be appropriately disposed of at a licensed facility or stored in a designated storage area to prevent secondary contamination. Quantities of hazardous materials removed will be recorded (e.g., weigh bills) and provided to Manitoba Transportation and Infrastructure. More details on measures to protect against and clean-up the potential accidental discharge of contaminants such as fuel, hazardous materials, hazardous waste and non-hazardous waste are discussed in Section 5.11 and 5.12 of this CEMP.

5.3 Groundwater

5.3.1 Background

LMOC

A confined carbonate bedrock aquifer (commonly referred to in Manitoba as the “Carbonate Aquifer System”) is present in the area of the LMOC, which is overlain by 5 m to 18 m of till. Artesian pressures are present in the vicinity of the LMOC, with piezometric heads that can typically be up to 5 m above the ground surface. The bedrock aquifer is recharged via rainfall and snowmelt regionally. Groundwater recharge areas local to the LMOC are from upland areas as well as from local recharge zones to the east and west of the LMOC. Groundwater flow in the carbonate aquifer is interpreted to be from the LMOC area towards Lake Manitoba and Lake St. Martin.

LSMOC

Two distinct groundwater systems are known to be present within the region of the LSMOC, within the upper saturated peat and the lower confined carbonate bedrock aquifer. The upper, saturated peat unit is perched above the clays (where present) and underlying till units. The peat is recharged directly from surface rainfall and snowmelt and the flows within the peat will be locally controlled. The water table within the peat is at or near ground surface, with an overall hydraulic gradient, including surficial flow, to the east. Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat groundwater flow system, and the underlying confined carbonate bedrock aquifer system. Aside from regional surface water drainage patterns, the low permeability nature of the aquitard is a key element in maintaining perched water levels in the surficial peat and confined head in the bedrock aquifer and overlying silt till. The lower, confined bedrock aquifer is comprised of a Paleozoic rock sequence commonly referred to in Manitoba as the

Carbonate Aquifer System. This aquifer system is isolated from the peat unit by the upper clay zone and underling tills.

The confined bedrock aquifer is recharged via rainfall and snowmelt regionally. Groundwater recharge areas local to the LSMOC are located on topographically high ground areas with thin sediment cover south of Lake St. Martin, and also to the southwest at the Lake St. Martin Narrows where there are bedrock outcrops at ground surface. There are several artesian groundwater spring sites in the vicinity of the LSMOC. These are important because they provide a natural pressure relief of the bedrock aquifer system in the region of the LSMOC. The groundwater flow system is interpreted to be bound by discharge to naturally occurring spring sites, to Lake St. Martin, and to Lake Winnipeg. Groundwater is also likely to discharge into the Dauphin River to the northwest and to the Mantagao River to the east.

5.3.2 Potential Changes

Construction of the LMOC and LSMOC will result in potential changes to the existing groundwater conditions within the perched peat (LSMOC only), overburden clay/till, and confined bedrock aquifer piezometric pressure conditions along the channels. These will include water level changes in aquifers, potential water quality changes, and changes in the relationship of the groundwater aquifer discharge to the surface water system. In areas where the excess confined bedrock aquifer pressures are elevated relative to the thickness of the confining till and silty clay aquitard units, particularly during channel excavation and unloading of the confining aquitard units, there is a risk of basal heave/hydraulic fracturing of the till. This would induce a connection of the bedrock aquifer to discharge at the base of the excavation, possibly producing some uncontrolled groundwater discharge to the channel excavation area(s). The creation of new groundwater discharge pathways into the channels will locally increase the direct connection of exfiltrating groundwater to channel surface water, originating from the underlying bedrock aquifer.

5.3.3 Management Measures

Groundwater management measures that will be implemented to mitigate or protect against impacts to groundwater or from groundwater during construction of the channels are detailed in the GWMP.

Active depressurization of high groundwater pressure with temporary groundwater depressurization systems pumping from bedrock wells are anticipated to be required to facilitate excavation of the LMOC as well as foundation excavations for construction of the WCS and bridge footings. The relief of artesian pressure along the LMOC will locally depressurize the carbonate aquifer. The zone of influence will expand over a limited distance and domestic water supply well pressure, as well as artesian-dependent well operation, will be affected in this area. While most domestic water supply wells are drilled to an elevation deep enough into the bedrock that the water will remain in the well, pumping will be required to mitigate the loss of artesian pressure for artesian-dependent well operations.

Excavation of the LSMOC will be done in stages with an initial central drainage channel to control and direct areas of groundwater discharge and allow for controlled pressure relief of the bedrock aquifer groundwater system. This passive depressurization will minimize the potential for uncontrolled discharge in large areas of the LSMOC base, particularly closer to the side slopes, where stability conditions are most sensitive in terms

of overall channel excavation. Active depressurization of high groundwater pressures with temporary groundwater depressurization systems pumping from bedrock wells are anticipated to be required to facilitate deep foundation excavations for construction of the WCS and potentially the sheet pile cut-off at drop structures. The relief of artesian pressure along the LSMOC will locally depressurize the carbonate aquifer; however, the zone of influence will expand over a limited distance, with no potential to affect domestic water supply wells and the regional recharge-discharge relationships will remain the same.

Groundwater quality will be monitored in regular intervals during and after the construction phase of the Project as described in the GWMP. This level of monitoring falls outside of the mandate of the CEMP; however, will occur concurrently and continue beyond the construction phase of the Project (see Section 8.1).

5.4 Surface Water

Surface water management measures that will be implemented to manage drainage and mitigate the potential transport and deposition of sediments beyond areas disturbed during construction of the channels are detailed in the SWMP. Erosion and sediment control measures shall be implemented to prevent the introduction of sediment, as described in the SMP. The Contractor shall not block or impede drainage outside the limits of construction and staging areas without written authorization from the Owner.

Several options are being considered, as part of detailed design, to re-water the Big Buffalo Lake Wetland Complex and Buffalo Creek on the west side of the LSMOC. The purpose of the options is to mitigate the loss in surface water runoff and potential subsurface flow as a result of channel construction. Options being further investigated include discharge by gravity feed from Lake St. Martin with a ditch and gated intake structure and/or discharge groundwater through construction of a passive well system.

Groundwater from the construction depressurization will need to be discharged to a suitable drainage course. The options for the LMOC could include existing municipal drains, existing lakes or Birch Creek, Watchorn Creek or the outside drain being constructed on the west side of the channel if available at that stage. The options for the LSMOC could include existing lakes and creeks on the west side of the channel or the outside drain being constructed on the east side of the channel. The quality of the groundwater from the bedrock aquifer is expected to meet surface water guidelines, but it will be tested prior to initiating discharge each year to confirm this.

Surface water quality in the PDA may be adversely affected during construction from leaks and accidental spills or release of fuels or other hazardous substances. Mitigation to avert impacts to surface water quality includes preventing leaks, spills and releases by providing secondary containment for fuel and hazardous material storage, requiring drip trays for equipment, refueling and conducting maintenance only in designated areas (located an appropriate distance from surface water) and in accordance with the PERs, providing spill clean-up equipment and materials in vehicles, and providing an emergency (spill) response plan. If a spill should occur, the Contractor would be responsible to provide notification within 24 hours, and to document the event with an incident report. Measures to protect against and clean-up the potential accidental discharge of contaminants such as fuel, hazardous materials, hazardous waste and non-hazardous waste are discussed in Sections 5.11 and 5.12 of this CEMP.

Water quality will be monitored in regular intervals during and after the construction phase of the Project as described in the SWMP and AEMP. This level of monitoring falls outside of the mandate of the CEMP; however, will occur concurrently and continue beyond the construction phase of the Project (see Section 8.1).

5.5 Erosion and Sediment Control

Erosion and sediment control measures that will be implemented to mitigate the potential transport and deposition of sediments beyond areas disturbed during construction of the channels are detailed in the SMP. These temporary measures are in addition to the various permanent mitigation measures that were built into the channel design such as the rock jetties and drop structures (where applicable), as well as riprap and armoring to protect against erosion. Establishing and maintaining vegetative cover on the slopes, embankments and adjacent perimeter drainage ditches will also provide permanent mitigation against erosion damages from flooding and heavy precipitation. These measures consider the drainage management for the Project to facilitate their intended purpose to minimize and mitigate the transport and deposition of sediment beyond construction areas and into off-site receiving water bodies.

Contractor requirements for environmental protection are based on best practices in the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, the PERs developed by Manitoba Transportation and Infrastructure and Manitoba Transportation and Infrastructure's Manual of Erosion and Sedimentation Control During Highway Construction.

Sedimentation from the erosion of exposed soils can negatively influence fish and fish habitat. To mitigate this effect, the Contractor shall install effective erosion and sediment control measures in accordance with the SMP, Contract Documents and Manitoba Transportation and Infrastructure's PER prior to commencing work and manage water runoff during construction to prevent undesirable soil movement or soil releases and discharges to a waterbody. Erosion and sediment control measures shall be maintained in disturbed sites until soils have stabilized and revegetation of disturbed areas is achieved. Necessary repairs and adjustments to erosion and sediment control measures shall be made immediately to ensure that measures are effective in controlling erosion and sedimentation. Measures include, but are not limited to, rock riprap, erosion control blankets, check dams, straw waddles, silt fences, floating silt barriers (turbidity curtain) and sediment ponds. If erosion control blankets are used the product shall be 100% biodegradable, composed of natural fibers including netting, filling and thread.

When de-watering is required on site, as part of the water management plans, sediment ponds shall be constructed. Discharge from construction activities shall be diverted into a sediment pond to allow suspended material to settle out before the water re-enters a natural waterbody. All pump discharge points shall be lined with clean rock or other acceptable flow dissipating applications to prevent erosion and the release of suspended sediments. The Contractor shall take necessary precautions to ensure contaminants (including sediments) do not enter Lake Manitoba, Lake St. Martin, Lake Winnipeg or other surrounding waterbodies during the construction process.

5.6 Fisheries and Aquatic Ecosystem

Construction of the channels will permanently alter or destroy fish habitat, particularly associated with the excavation of the lake bed at the inlet and outlet, construction of the rockfill groynes at the LSMOC inlet and outlet; blockage of drainage courses and creeks along the channel length; changing groundwater inflows to water bodies adjacent the channel; and potentially increasing sediment transport and deposition. The LMOC and LSMOC will create new fish habitat within the channels that will help to mitigate permanent alteration of destruction of fish habitat. A detailed description of the Project and potential effects will be provided in a submission to DFO to obtain the required *Fisheries Act* authorization for the Project prior to construction. Therefore, no specific authorization conditions have been received to date and once received will be incorporated into the final CEMP. However, standard advice typically issued with a project authorization would still be applicable for reducing potential effects during project construction. Environmental measures likely to be expressed by DFO, some of which are contained within the PERs, may include the following:

- Work shall be conducted in adherence to DFO authorization(s).
- Follow DFO's Manitoba Restricted Activity Timing Windows for the protection of Fish and Fish Habitat for instream work, as practical, particularly for instream work required "in-the-wet".
- Comply with the Manitoba Aquatic Invasive Species regulations to reduce the risk of increasing dispersal of invasive aquatic species. In particular heavy machinery will be required to be cleaned and disinfected prior to arriving on site and before moving between work areas at different lakes and drainages.
- Activities related to the Project shall be undertaken in accordance with the "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat," applicable best practices and mitigation measures identified in DFO's codes of practices, and in consideration of the Fish Swimming Performance User Guide, 2016 and provincial fisheries objectives.
- Appropriate precautions shall be taken so that potential deleterious substances (such as fuel, hydraulic fluids, oil, or sediment) do not enter a waterbody. Equipment operating near a waterbody is to be free of external fluid leaks, grease, oil and mud and the cleaning, fueling and servicing of equipment shall be conducted in a manner to prevent the entry of deleterious substances into the surface water.
- Removal of riparian vegetation shall be kept to a minimum to help maintain the stability of waterbody banks. The area over which vegetation in riparian vegetation areas is removed shall affect no more than one third (1/3) of the total woody vegetation in the ROW within 30 m of the ordinary high-water mark of a waterbody. Clearing within 30 m of a waterbody shall be done by hand and vegetative root masses found within the waterbody banks shall remain undisturbed unless specified in the Contract Documents.
- Erosion and sediment control measures shall be implemented as appropriate in compliance with Contract Documents in order to prevent the entry of sediment in waterbodies. Suitable temporary and long-term erosion control measures shall be installed where required to ensure disturbed areas are not subject to erosion prior to the establishment of vegetation. These measures are to be inspected regularly to verify that they are functioning properly until vegetation is reestablished, and necessary repairs or adjustments will be made if damage is discovered or if these measures are not effective in controlling erosion and sedimentation.

- The work area for construction of the inlet and outlet shall be isolated from the adjoining waterbody using appropriate methods (turbidity curtain, temporary cofferdam, etc.). Isolated areas should be the minimum area required to safely complete the construction activities.
- If required, de-watering of a cofferdam area shall be pumped to a settling basin or filtering system protected with flow dissipating applications and then discharged onto the riprap shoreline prior to re-entering the waterbody. Alternatively, the dewatering could be pumped through dense terrestrial vegetation a sufficient distance from the waterbody to allow sediment deposition prior to discharge water reaching a waterbody.
- Live fish or mussels salvaged within a de-watering area shall be transferred to the natural waterbody which it was from.
- Implement measures for materials handling, waste handling and disposal, and fuel handling and storage in designated areas located a minimum of 100 m from a waterbody and with secondary containment.
- Debris and material shall be removed from the ice cover (over waterbodies) on an on-going basis and disposed of in an appropriate landfill or other location.
- Implementation of an emergency response plan (ERP) for spills including educating the workforce and maintaining accessible spill control and clean-up equipment.
- Appropriately sized rock riprap will be used for armouring areas vulnerable to erosion and scour.

Water quality will be monitored in regular intervals during and after the construction phase of the Project as described in the SWMP and AEMP.

5.7 Vegetation

Clearing along the LMOC, the new PR 239 alignment, and LSMOC will entail the loss of existing native upland vegetation, primarily dense coniferous and mixedwood forest, and wetland area. Mitigation to reduce the adversity of this effect includes clearly staking or marking the work area to restrict clearing and grubbing to the construction or contract limits. In particular, the EPP will identify any environmentally sensitive sites that need to be avoided or mitigated as part of the construction. The Contractor shall not remove vegetation or excavate outside the limits of construction and staging areas without written authorization from the Owner.

Clearing and grubbing for the LMOC and LSMOC is expected to primarily occur in the winter months. For wetlands areas, priority will be given to clear and grub during dry or frozen conditions whenever possible. The topsoil (i.e., the organic layer) along both channels will be salvaged and temporarily stockpiled to be used as a seed bed to spread over the containment dikes and areas to be re-vegetated as described in the RVMP. Temporary staging areas will be located in the ROW wherever feasible and leaving short shrubs and herbaceous, graminoid and non-vascular cover in place to promote recovery of native vegetation. As part of the AMP, construction-related traffic will be restricted to the Project ROW and associated access routes. Removal of riparian vegetation will be minimized to help maintain the stability of waterbody banks. A 30 m setback will be applied to known occurrences of provincially listed Species of Conservation Concern (SOCC); however, where avoidance of SOCC is not possible, construction in sensitive areas will be restricted to the winter months (outside of the growing season). While there are no vegetation species along the LMOC and

LSMOC that are protected federally under the SARA or provincially under *The Endangered Species and Ecosystem Act*, as described in the Project EIS, SOCC also include vegetation species ranked by the Manitoba Conservation Date Centre as critically imperiled (S1), imperiled (S2) or vulnerable (S3).

As a component of the erosion and sediment control program, during construction, temporary seeding of topsoil stockpile areas is required if it will not be used to re-vegetate disturbed areas within the same growing season. Areas disturbed during construction activities will be leveled to natural or pre-existing grade and slope and then re-vegetated. Where seeding is not required, temporary site locations will be left in a manner which promotes natural re-vegetation of the site.

Construction activities including excavation, transportation of materials and blasting (if required) will result in increased fugitive dust, which can settle on vegetation in the study area resulting in impaired growth and development. Mitigation measures to control dust are outlined in Section 5.1 and described in the Dust Control Plan.

To control the spread of invasive species during construction, weed areas identified in the RVMP will require treatment prior to construction, as well as weed maintenance treatment of topsoil stockpiles. Equipment will need to be clear of debris and weeds prior to coming on to the construction site and will be inspected prior to work commencing. The weed control program will continue after construction in accordance with monitoring and maintenance measures outlined in the RVMP.

5.8 Wildlife

Given the availability of suitable habitat and known occurrences of SAR within the LAA, the SAR most likely to be affected by the direct loss or alteration of habitat are northern leopard frog, least bittern, and yellow rail in wetlands; short-eared owl and bobolink in grasslands; bank swallow and common nighthawk in quarries; and bats, eastern whip-poor-will, red-headed woodpecker, and olive-sided flycatcher in forests. Both eastern whip-poor-will and red-headed woodpecker are Threatened species protected federally and provincially under SARA and *The Endangered Species and Ecosystem Act*.

Key mitigation to reduce the adversity of wildlife habitat fragmentation and loss during construction includes restricting clearing and grubbing to the construction or contract limits unless otherwise approved. In accordance with the *Migratory Birds Convention Act* to avoid impacts to migratory birds including eastern whip-poor-will and red-headed woodpecker, tree and brush clearing will not be conducted between April 1 and August 30 of any year unless circumstances rendered for an emergency and otherwise approved by Manitoba Transportation and Infrastructure. While rarely used, if clearing needs to be conducted for an emergency during this breeding period or other critical nesting periods, a qualified biologist will conduct a nest survey to identify if active nests are present. In the event that quarry or borrow sites need to be reinstated during the breeding bird window, the surveys to determine presence or absence of nests will need to be conducted by a qualified biologist. If nests are discovered, work will be suspended, and the Inspector will be contacted.

Measures to protect large nests of sticks, active dens, burrows or other sensitive wildlife features, if encountered, will be applied as per guidance described in the PERs. No blasting will be permitted within approximately 1 km of known sensitive wildlife habitat during critical lifecycle periods. Additionally,

appropriate terrestrial buffers as identified in provincial guidelines will be adhered to. As described in the RVMP, areas disturbed during construction will be revegetated to restore wildlife habitat with consideration for sediment control and invasive plant species management. The potential to restore wildlife habitat in appropriate areas along the LMOC will include measures such as red-headed woodpecker snag installation and replacing coarse woody debris and planting shrubs to enhance eastern-whip-poor-will habitat.

To reduce wildlife mortality associated with vehicle-wildlife collisions, vehicle speed will not exceed posted speed limits and wildlife warning signs will be installed where appropriate. Project-related vehicle-wildlife collisions will be tracked as part of the WMP. Contractors will be required to keep construction camps and worksites clean with food, garbage or waste that may attract wildlife stored and disposed of in an appropriate manner so that problem wildlife attractants are not created. Nuisance wildlife will be immediately reported to the Natural Resources Officer and the Contract Administrator. Employees, workers and other staff will not hunt, trap or harass wildlife and gates or other barriers will be installed to limit public from accessing the LMOC and LSMOC ROWs.

While sensory barriers to wildlife movement will be temporary during construction the adversity will be mitigated by ensuring that equipment supplied for use on the Project is effectively “sound-reduced” by means of proper silencers, mufflers, acoustic linings, acoustic shields or acoustic sheds. Night lighting, if required, will be directed downward to reduce light disturbance to wildlife.

5.9 Land and Resource Use

Routing of the channels included the consideration of recreation and tourism. No lodges, campgrounds, resorts or cottages are traversed by the channel alignments. Mitigation to address potential Project effects on recreational land use and tourism includes restricting clearing and excavation to the limits of construction and staging areas. Additionally, Manitoba Transportation and Infrastructure will provide Project development information on the Manitoba Transportation and Infrastructure website.

To mitigate potential Project effects on resource use, Manitoba Transportation and Infrastructure will communicate the schedule of Project activities throughout the construction phases to affected rights-holders, stakeholders, recreational users and/or organizations, area resource users and MECP Regional representatives. In particular, Manitoba Transportation and Infrastructure will engage with Indigenous commercial fish harvesters and anglers to address potential conflict, disturbance, or access restrictions to fishing/harvesting areas and availability of fish resources. Construction workers will not hunt, trap or harass wildlife on the construction sites. No person will remove, disturb, spring or in any way interfere with a trap set out lawfully by another person for the purpose of taking furbearing animals.

5.10 Heritage Resources

As an outcome of the Heritage Resource Impact Assessment conducted, a HRPP has been prepared specifically to deal with potential effects to heritage resources. It outlines measures to mitigate effects to cultural and heritage resources. If heritage resources, or objects thought to be heritage resources, are discovered during site preparation and construction the Historic Resources Branch (of the Manitoba Sport, Culture and Heritage Department) will be informed immediately. The Contractor will cease construction

activities in the immediate vicinity of the heritage resources, protective barriers will be placed around heritage resource sites and heritage resources discovered will be left in their original position until the Project Archaeologist is contacted and prescribes instruction.

The current Project design and routing of the channels was influenced by the Indigenous engagement and consultation process to limit effects and concerns that were expressed in relation to changes to cultural and spiritual sites and sacred areas. Detailed recording and mapping of sites of cultural and spiritual importance will be developed by Manitoba Transportation and Infrastructure in partnership with rights-holders, leading to a decision made about the relative importance of the site and potential mitigations strategies. An appropriate ceremony will be held prior to commencement of construction under the direction of local rights-holders.

5.11 Materials and Waste Management

The Manitoba Transportation and Infrastructure Emergency Spill Response and Reporting Procedures covers the transportation, use, storage and transfer of hydraulic fluid, other mechanical lubricants, petroleum fuels, antifreeze and herbicides. To prevent potential environmental accidents and contain potential spills, hazardous materials shall be transported, stored, and handled as recommended by the suppliers and/or manufacturers, and in compliance with applicable federal, provincial, or municipal regulations. Dangerous goods/hazardous wastes are identified by and shall be handled according to *The Dangerous Goods Handling and Transportation Act* and Regulations. The Contractor shall have on-site staff that are trained and certified in the handling of the dangerous/hazardous goods being utilized on site.

Fuel storage shall be in compliance with the *Manitoba Storage and Handling of Petroleum Products and Allied Products Regulation* 188/2001. Fuel stored in drums or containers of 230 L or less will comply with the requirements of the Manitoba Fire Code. Designated area(s) will be established for fuel storage, hazardous materials handling and storage, equipment cleaning, refueling and servicing. Designated areas will be located at least 100 m from a waterbody or wetland and will be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection. Dedicated petroleum storage areas will provide additional spill containment (impervious liner and berms). Only above ground storage tanks will be used for the storage of bulk petroleum products. The tanks will be equipped with overfill protection and spill containment consisting of perimeter dikes or secondary containment in the tank design.

Equipment maintenance and inspections are a key component to preventing small leaks from contaminating the waters and riparian areas associated with a project. This is particularly important for equipment working temporarily over the wetted area or within close proximity to Lake Manitoba, Lake St. Martin, Lake Winnipeg or other waterbodies. Construction equipment will arrive on site in a clean condition and shall be kept in good working order free of external fluid leaks, grease and oil. Equipment working at the construction site will be inspected daily for small leaks. Machinery that is found to be leaking fuel, oil or other fluids will be moved off the work site immediately for repair. When equipment is stationary for extended periods of time within the work area drip trays will be installed to contain potential leaks. For mobile equipment on site, drip trays should be readily available, and used as needed. Implementation of these measures will be documented in reports as described in Section 8.2.

The Contractor shall conduct day-to-day operations in such a manner as to avoid creating conditions that will be detrimental to the surrounding area. Different waste streams shall not be mixed, and waste materials and refuse shall be removed and disposed of promptly in a manner that will not contaminate the surrounding area. Effort shall be made to prevent debris from falling into, or accumulating on, ground surfaces or into the waterway at and in the immediate vicinity of the Project. The construction area shall be kept clean and orderly during and at completion of construction. At no time during construction shall domestic solid, demolition or construction waste be permitted to accumulate for more than one day at a location on the work site, other than at a dedicated temporary waste storage site. These waste materials shall be recycled to a degree that is economically and practically feasible or disposed of at a Waste Disposal Ground operating under the authority of a permit issued pursuant to Manitoba Waste Disposal Grounds Regulation 150/91. All sewage and seepage from on-site sanitary facilities will be disposed of at a local licensed facility and in accordance with the *Manitoba Onsite Wastewater Management Systems Regulatio*n 83/2003.

Dangerous goods/hazardous waste storage areas shall be located at least 100 m away from the high-water line of the nearest water body and be contained within a diked area or another form of secondary containment. Liquid wastes or fuels shall not be permitted to be deposited upon the ground. When equipment servicing requires the drainage or pumping of lubricating oils, or other fluids from the equipment, a groundsheet of suitable material and size shall be spread on the ground to catch fluids in the event of a leak or spill. Bulk waste oil will be stored in aboveground oil tanks, which will have secondary containment and a weatherproof cover. Waste oil will be recycled by a reputable recycling agency. Used oil filters will be drained, placed into suitable storage containers and disposed of at approved facilities. Empty containers from equipment refueling and servicing will be removed to a licenced disposal site. Disposal of dangerous/ hazardous wastes shall be at approved hazardous waste facilities.

5.12 Emergency Spill Response and Reporting Procedures

The ERP applies to spills, accidents, or malfunctions involving the release of fuels, dangerous goods or hazardous materials/waste. Due care and caution shall be taken to prevent spills. In the event of a release during Project construction, Contractors will follow their own spill response plans, which will have been reviewed and approved by Manitoba Transportation and Infrastructure as part of their contracts. Manitoba Transportation and Infrastructure has developed PERs, which Contractors will have to adhere to, that describe measures to address accidents and spills, including reporting, cleanup, compliance training, inspection, and enforcement. An updated list of key contacts and telephone numbers for reporting spills, accidents or malfunctions shall be kept on site. A Workplace Hazardous Materials Information System (WHMIS) file shall be maintained on site for the hazardous materials at the work area. Prior to commencement of the work, Safety Data Sheets shall be submitted to the Owner for hazardous materials to be used on site. The Contractor shall provide training for staff and ensure subcontractors are trained and empowered to identify, address and report potential environmental problems.

Spills will be contained and cleaned up immediately by on-site personnel in accordance with the approved on-site emergency response and containment plan. In the event that petroleum products (e.g., fuel or oil) spill or leak at the work site the source of the spill should be stopped by shutting down equipment, closing valves and pumps, or plugging hoses. If possible, the spilling or dripping materials should be contained by a

spill pan and diking around the spill to prevent it from entering the drainage system. These mitigation procedures should be conducted by the operator(s) that identified/were involved in the spill or leak. Any pooled liquids should be recovered by placing in appropriate drums for temporary storage and disposal by approved agencies. The residual liquids shall be cleaned up using absorbent pads and contaminated soil and/or materials must be removed immediately and transported to an approved location for disposal. In the event that a petroleum product enters a natural waterbody (e.g., equipment leak while conducting in stream works in, or while working along the periphery of Lake Manitoba, Lake St. Martin and Lake Winnipeg), the appropriate spill kit resources must be implemented immediately.

The Contractor shall immediately report any reportable spills to MECP's Accident Reporting Line at (204) 944-4888 pursuant to *Manitoba Environmental Accident Reporting Regulation* 439/87. The Contractor shall report spills to the Owner within 24 hours, whether it was necessary to report the spill to MECP or not. A follow-up report shall be provided to the Director of MECP, at their request, for any reportable environmental accident outlining the causes(s) and proposed corrective action to prevent reoccurrence. This follow-up report will also be provided to other regulators, as required, such as DFO for example to adhere to the *Fisheries Act* Section 38(5) Duty to Notify – Deleterious Substance.

An adequate supply of suitable absorbent material and other supplies and equipment necessary to immediately cleanup inadvertent spills will be available on-site during construction, including an emergency spill kit for in water use. Each machine working on site shall also have a spill kit. Spill kits should contain at a minimum: absorbent material, high-density polyethylene groundsheets and absorbent oil booms when working near water. Storage and disposal of residual material from spill cleanup must be done in an environmentally safe manner and in accordance with applicable regulations. The Inspector and/or Contract Administrator will inspect storage areas to ensure requirements are being met.

5.13 Fire Prevention and Response Procedure

Wildfires can be a threat to people, property and activities. Advance planning, preparation and the implementation of safety measures is required to effectively respond to wildfires when they do occur. The Manitoba Emergency Plan (https://www.manitoba.ca/emo/provincial/mep.html) provides information on prevention and mitigation, preparedness, response and recovery in relation to fires. Manitoba Transportation and Infrastructure has developed PERs, which Contractors will have to adhere to, that describe measures to address burning and brush disposal. An evacuation and emergency preparedness plan addressing wildfires shall be implemented and submitted by the Contractor prior to commencing construction. On-site personnel will be trained in fire prevention, including proper disposal of hot or burning material and designated smoking areas, and response.

Fire prevention is based upon the principle of keeping fuel sources, oxygen sources and ignition sources separate. Fire prevention starts with good housekeeping, which ensures that materials are stored in the right place and do not accidentally spill and cause fire. A primary zone will be established around camp sites and other longer-term temporary structures associated with construction and maintenance activities. Flammable materials such as leaves, brush, dead limbs, and fallen trees will be cleared from the area regularly. Exhaust and engine systems of equipment and vehicles shall be in good working condition and free of dried grass and

other combustibles. Fire extinguishers shall be available in heavy and light construction equipment and in equipment storage facilities and offices for fighting fires.

Reasonable steps will be taken to prevent a fire from burning out of control or spreading from land owned or occupied for construction purposes. No fires shall be started without first taking sufficient precautions to ensure that the fire can be kept under control. Burning or smoldering matter will not be placed where it may cause a fire to spread. Brush pile burning will be located far enough away from the ROW edge to avoid damaging uncleared vegetation, and where feasible, will be located on mineral (sand and gravel) or previously cleared areas. Fires will be completely extinguished after burning of slash and burn piles and will be monitored so that no hot spots remain. Open fires are prohibited from April 1st to November 15th annually. In the event that burning is required during that period, an application for a burning permit will be submitted for approval to MECP and the conditions imposed by the burning permit will be adhered to.

In the event that a wildfire occurs, it shall be immediately reported to Manitoba Transportation and Infrastructure and to MECP at 1-800-782-0076. All construction and related activities taking place in the vicinity of a wildfire shall cease until advised by the Owner that it is safe to resume operations. Additionally, reasonable attempts will be made to extinguish the wildfire with available equipment, services and labor made available at the disposal of an officer for the purposes of wildfire protection operations.

6.0 COMMUNICATION

6.1 Pre-Job Briefings

A 'pre-job' briefing will be held at the start of the first day that a worker/subcontractor commences work on site. The meeting is intended to review the activities that the worker/subcontractor will be participating in and to express potential health, safety, and environmental issues related to their proposed work.

6.2 Project Meetings

Early and ongoing communication between Manitoba Transportation and Infrastructure, the Contractor and Inspector(s) is expected. Regular weekly progress meetings will be held to review aspects of the Project's progress. The Inspector will be responsible for providing appropriate up to date descriptions of adherence to, and the effectiveness of, environmental management measures outlined in this CEMP.

6.3 External Communication

The primary line of communication to right's holders, the public and stakeholders will be through Manitoba Transportation and Infrastructure, in addition to Project development information provided on the Manitoba Transportation and Infrastructure website. When and if required, the Contract Administrator will be responsible for developing submissions on environmental matters and issuing to Manitoba Transportation and Infrastructure, including Technical Support Staff, for distribution to Project stakeholders, identified rights-holders and government agencies. In the case of a spill requiring notification under the Manitoba reporting regulations, reporting will occur as specified in Section 5.12.

A CRP will also be implemented to provide opportunities for local residents, stakeholders and rights holders to notify Manitoba Transportation and Infrastructure of issues or concerns. Further details on this process is provided in the CRP.

7.0 TRAINING

The Contractor shall provide mandatory training and awareness sessions for their entire workforce and subcontractors prior to the start of construction, and to new personnel before they begin work. All employees involved in the storage, handling and use of dangerous goods and fuels shall have WHMIS and spill prevention and response training. Additionally, if herbicides are used, they will be applied by trained personnel who meet provincial licensing requirements. All training and orientation sessions shall be documented and issued to Manitoba Transportation and Infrastructure for their records and submission to regulators where required.

The purposes of the training and orientation sessions is to ensure Contractor personnel are aware of and understand the environmental provisions of the Contract Documents including relevant drawings, specifications and Contractor submittals and updates. This orientation is intended to cover several topics that are considered important to the newly arrived workers. In particular, the contents of this CEMP will be reviewed to ensure that environmental protection measures are followed throughout the Project. Topics of particular importance to be discussed with workers/subcontractors include:

- what is a spill or discharge
- what to do if there is a spill in water or on land
- what spills are reportable and within what time frame
- fire prevention and response
- what is a heritage resource and the management of resources encountered

The Contractor shall submit the planned frequency and records of these meetings. However, this information will likely be presented during the weekly Project/construction meetings and the daily safety meetings that are held before each shift. The Contractor shall maintain access to environmental provisions of the Contract Documents including relevant drawings, specifications and Contractor submittals and updates, in a location and manner accessible to employees, subcontractors, and agents.

8.0 MONITORING

Monitoring and reporting are critical elements of this CEMP as a method to verify that the environmental management measures outlined in Section 5.0 and the supporting topic specific management plans are being implemented, maintained and are effective in mitigating the adverse environmental effects of the Project. Additionally, it allows these measures to be adapted where necessary, and to anticipate potential unforeseen adverse environmental effects. Manitoba Transportation and Infrastructure, the Contract Administrator, the Contractor and Environmental Monitors each have responsibilities for monitoring and reporting, as outlined in Section 2.0 and shown in Figure 3. More details characterizing the monitoring and follow-up are described in the EMP Framework.

8.1 Monitoring

Monitoring includes surveillance to document progress in construction, identification of problems, issues and concerns, and environmental effects not predicted in the Project EIS. Throughout construction of the channels, the Inspector shall monitor the work activity on a daily basis to facilitate adherence to, and the effectiveness of, environmental management measures outlined in this CEMP and the supporting topic specific management plans. There will also be monitoring of surface water quality, groundwater levels and quality fish and fish habitat, vegetation and wildlife throughout the construction phase and operation of the Project where required to fulfill conditions of environmental approvals.

8.2 Reporting

On a daily basis, the Inspector will use the Environmental Daily Inspection Checklist (Appendix 2) so that mitigation methods outlined in this CEMP are regularly adhered to, when applicable. Any request for a change in environmental management measures or contract restrictions initiated by the Contractor shall be submitted to the Owner. The Inspector will complete a Weekly Environmental Inspection Form (Appendix 2) during their site visits. The form will summarize information including, but not limited to:

- a description and status of construction activities
- a description and status of environmental protection measures (in particular, erosion and sediment control)
- any deficiencies, issues or complaints and the corrective action to be taken
- environmental incident(s) reported and corrective action implemented
- summaries of key correspondence
- site photos documenting the observations

If an environmental incident/accident occurs, a separate Environmental Incident/Accident Report Form (Appendix 2) will be filled out by the Contractor with assistance from the Inspector, which describes the incident, lists the individuals involved, and details the cause of the incident and corrective actions taken to prevent the incident from occurring in the future. The Inspector will keep an Environmental Incidents

Running Record Form (Appendix 2) on site which identifies each incident that occurred and identifies "when" the actions were taken to clean up and/or prevent the incident from occurring in the future.

In the event of a reportable spill, the Inspector will immediately report to the proper authorities and provide a copy of the incident report to the Owner. As noted in Section 5.12, a follow-up report shall be provided to the Director of MECP, at their request, for a reportable spill outlining the cause(s) and proposed corrective action to prevent reoccurrence. There are also regulatory reporting obligations when hazardous substances are transported to or from the site and/or stored on site.

Upon completion of the construction components of the Project, copies of the environmental reports will be submitted to the Technical Support Team. These reports will be summarized by the Technical Support Team and an overview document of construction activities and related environmental concerns, and mitigation actions will be prepared for submission to the Owner and, if required, submission to Provincial/Federal Authorities.

8.3 Record Keeping

Record keeping includes maintaining files and documentation related to environmental management measures and associated monitoring and reporting. Copies of permits, approvals, or other authorizations required for the work to proceed shall be retained on site, along with other approvals, monitoring and compliance/enforcement orders from regulatory authorities. If an order is submitted directly to the Contractor, the Contractor shall notify Manitoba Transportation and Infrastructure in writing and provide copies of the correspondence between the regulator and the Contractors as it will have implications to regulatory reporting that may be required as part of the Project's Environmental Assessment Decision Statement or Environment Act Licence. The Contractor shall provide the Owner and the Contract Administrator with the identity of knowledgeable individual(s) who will act as the on-site emergency response coordinator(s) with the authority to redirect manpower to respond to a spill or environmental emergency. Additionally, the Contractor shall provide the identity of an environmental coordinator capable of redirecting work to address non-compliance issues. As a general requirement, work shall be photo-documented, and notification of the work will be provided to Manitoba Transportation and Infrastructure on a monthly basis for record keeping purposes.

The Contractor shall maintain a record file at the site in which relevant information relating to materials handling, spills, leaks, releases, and the implementation and adjustment of the environmental protection measures is documented. The Contractor shall maintain a copy of these records for a minimum of five (5) years after contract closeout. Relevant information and/or significant events are to be documented and provided to Manitoba Transportation and Infrastructure in a timely fashion. Records would include, but are not limited to:

- all accidents, spills, leaks, and releases and the reporting and clean-up procedures used
- any reviews, improvements, and adjustments to the environmental protection measures
- details of environmental training sessions, including the schedule of these sessions and the names of participants
- a full inventory of dangerous goods brought onto the site

- a full inventory of hazardous wastes encountered on the site
- records of waste hauled from the site for disposal, including the location, name and description of the disposal facility and waybills/manifests
- records of material hauled from the site for recycling, including the location, name and description of the person or facility the material was delivered to
- records of fuel transported and stored at the site
- records of equipment inspections and maintenance
- records of public complaints
- records of actions taken to remove deleterious substances and debris from waterbodies
- records of annual use of pesticides
- wildlife encounters and/or management measures employed

APPENDIX 1

Applicable Federal and Provincial Legislation

Table 1-1: Applicable Federal and Provincial Legislation

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Federal Legislation		
Canadian Environmental Assessment Act, 2012, SC 2012, c 19, s 52	• Physical Activities, Regulations Designating, SOR/2012-147. • Prescribed Information for the Description of a Designated Project Regulations, SOR/2012-148.	• Identifies requirements and provides guidance for environmental assessments of designated projects. • Project requires environmental assessment and approval. • Includes federal Decision Statement with conditions that must be adhered to.
Canada Water Act, RSC 1985, c C-11	• Management of water resources including conservation and utilization of water resources and provides guidelines for Canadian drinking water quality.	• Protection of water resources, including water quality.
Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33, s 64, shed 1)	• Provides a series of regulations for toxic substances.	• The potential risks of environmental pollutants and toxic substances are evaluated under this Act that addresses pollution prevention and the protection of the environment (Environment Canada) and human health (Health Canada) to contribute to sustainable development.
Explosives Act, RSC 1985, c E-17	• Explosives Regulations 2013, SOR/2013-211.	• Legislates and regulates the manufacturing, testing, acquisition, possession, sale, storage, transportation, importation and exportation of explosives. • Blasting activities, explosives storage and transport will need to be licenced.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Federal Sustainable Development Act, S.C. 2008, c. 33	• The Governor in Council may make regulations for the purpose of achieving any of the goals of this Act.	• An Act to require the development and implementation of a Federal Sustainable Development Strategy and the development of goals and targets with respect to sustainable development in Canada, and to make consequential amendments to another Act.
Fisheries Act, RSC 1985, c F-14	• Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations, SOR/2013-191. • Paragraph 36(3) Prohibits deposition of a deleterious substance of any type in water frequented by fish or in any place where the deleterious substance may enter the water, except those authorized by regulation. • Aquatic Invasive Species Reg. SOR/2015-121.	• Protects fish (as defined by the Act) from serious harm. Identifies general prohibitions, fisheries protections and pollution prevention, as well as requirements for authorization of works which may cause serious harm to fish prior to construction. • Protects against introductions of pollutants or high levels of sediment that could be deleterious to fish. • Lists invasive species that are prohibited and controlled. Identifies activities and regulatory tools to prevent the introduction of aquatic invasive species into Canadian waters and to control and manage their establishment and spread, once introduced. • Authorization or Letter of Advice required if carrying out work that may affect fish or fish habitat.
Migratory Birds Convention Act, 1994, SC 1994, c 22	• Migratory Birds Regulations, CRC, c 1035.	• To protect and conserve designated migratory birds and their nests. • Permit required to kill, capture, take, or remove or eliminate migratory birds or nests.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Navigation Protection Act, RSC 1985, c N-22	• Navigable Waters Bridges Regs. CRC, c 1231. • Navigable Waters Works Regs. CRC, c 1232.	• Protection of the right to navigation on navigable and scheduled waterways. Identifies prohibitions for the construction, placement, alteration, repair, reconstruction, removal or decommissioning or works in, on, over, under, through or across scheduled navigable water. Identifies requirements for authorization of works, and the potential for opting in for works at non-scheduled waters prior to construction. • MI will opt-in and obtain Transport Canada Authorization.
Species at Risk Act, SC 2002, c 29	• N/A	• Prohibits killing, harming or harassing endangered or threatened species at risk, provides for plans and strategies to enable the recovery and management of endangered, threatened or extirpated species, prohibits destruction of critical habitat, and allows for the management of species of special concern to prevent them from becoming endangered or threatened. • Permit required for activities affecting a wildlife species or any part of its critical habitat.
Transportation of Dangerous Goods Act, 1992, SC 1992, c 34	• Transportation of Dangerous Goods Regulations, SOR/2008-34.	• Defines methods for handling, containment and transportation of substances that could cause damage to personal safety or the environment.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Provincial Legislation		
The Environment Act, C.C.S.M. c. E125	• Classes of Development Reg. 164/88. • Environment Act Fees Reg.168/96. • Licensing Procedures Reg. 163/88. • Notice and Reporting Reg. 126/2010. • Onsite Wastewater Management Systems Reg. 83/2003.	• Classifies developments and identifies requirements for provincial licencing and environmental assessment. • Defines the application fees. • Defines information required to apply for licensing under The Environment Act. • Defines requirements regarding the notice of a licensing decision and reporting of releases to the environment. • Defines proper construction and disposal for onsite water management systems.
The Crown Lands Act, C.C.S.M. c. C340	• Crown Lands Fees Regulation 130/91. • Vehicle Use on Crown Lands Resource Roads Regulation 145/91.	• Identifies requirement for and issuance of leases, permits, easements and rights-of-way for specified works on provincial Crown lands. Work permits will be required.
The Dangerous Goods Handling and Transportation Act, C.C.S.M. c. D12	• Dangerous Goods Handling and Transportation Fees Reg. 164/2001. • Dangerous Goods Handling and Transportation Reg. 55/2003. • Environmental Accident Reporting Reg. 439/87. • Hazardous Waste Reg. 195/2015. • Storage and Handling of Petroleum Products and Allied Products Reg.188/2001.	• Identifies requirements for handling, containment and transportation of substances that could cause damage to personal safety or the environment. • Outlines reporting requirements in the case of an accidental spill. • Defines categories of hazardous wastes and registration of generators of hazardous waste. • Outlines requirements of storage systems for petroleum products. • Permit required for carriers, and to dispose of hazardous waste.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Endangered Species and Ecosystems Act, C.C.S.M. c. E111	• Threatened, Endangered and Extirpated Species Reg. 25/98.	• Regulates the protection of Manitoba's threatened and endangered species. Conserves and protects threatened and endangered ecosystems in Manitoba and promotes their recovery. • Permit needed to kill, take, collect, or capture an endangered species.
The Fires Prevention and Emergency Response Act C.C.S.M. c. F80	• N/A	• Any activities associated with combustible materials. • Provides for control of activities regarding the prevention, detection and extinguishment of fires. • Work camp occupancy permit required.
Forest Act, C.C.S.M. c. F150	• Forest Use and Management Regulation, 227/88 R	• Permit required to enter forest land to cut or remove timber.
The Groundwater and Water Well Act C.C.S.M. c. G110	• Groundwater and Water Well (General Matters) Regulation 214/2015. • Well Standards Regulation 215/2015.	• The purpose of this Act is: o to provide for the protection and stewardship of Manitoba's aquifers and groundwater; o to ensure that the construction, maintenance and sealing of wells and test holes meet standards that protect; o the environmental quality of Manitoba's aquifers and groundwater, and human health and safety; o to provide for the collection and sharing of well, aquifer and groundwater information to better understand, manage, conserve, protect, develop and use Manitoba's aquifers and groundwater.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Heritage Resources Act, C.C.S.M. c. H39.1	• Heritage Resources Forms Regulation 99/86. • Heritage Objects Designation Regulation 160/89. • Heritage Sites Designation Regulation 122/88R.	• Designates heritage sites and identifies protections for heritage resources and heritage resource sites, including the requirement to conduct a Heritage Resource Impact Assessment (HRIA). • A permit is required for the HRIA.
The Highway Traffic Act, SM 1985-86, c. 3	• Designated Construction Zones Regulation 145/2014.	• Provides guidelines and requirements for vehicles and driving on Manitoba highways.
The Mines and Minerals Act, C.C.S.M. c. M162	• Quarry Minerals Regulation, 1992, Reg.65/92. • Drilling Regulation, 1992, Reg. 63/92.	• Identifies and outlines requirements for sustainable development of mineral product exploration and production, including quarrying, in Manitoba. • Quarry permits will be required.
The Noxious Weeds Act, C.C.S.M. c. N110	• Noxious Weeds Reg. 35/96.	• Identifies noxious weeds that may adversely impact Manitoba's environment or economy, outlines responsibilities to control or destroy such weeds and prohibits their spread during construction works.
The Pesticides and Fertilizers Control Act, P40	• Pesticides and Fertilizers Licence Regulation, 216/87 R	• Application license required
The Public Health Act, P210	• N/A	• Relates to the preservation of health including conditions that may contaminate or pollute air, food or water. • Food handling permit is required for construction camps if they have kitchen facilities.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Climate and Green Plan Implementation Act	• N/A	• Provides a framework through which the government develops a plan to reduce greenhouse gas emissions, address the effects of climate change, promote sustainable development and protect Manitoba's water resources and natural areas.
The Water Protection Act, C.C.S.M. c. W65	• Aquatic Invasive Species Regulation 173/2015. • Nutrient Management Regulation 62/2008.	• Provides protection and stewardship of Manitoba's water resources and aquatic ecosystems.
The Water Resources Administration Act, C.C.S.M. c. W70	• N/A	• Outlines a framework for the use and administration of water control works, including requirements and processes for approval of operating guidelines.
The Water Resources Conservation Act C.C.S.M. c. W72	• Water Resources Conservation Regulation 179/2010.	• Provides for the conservation and protection of Manitoba's water resources, and of the ecosystems associated with and reliant upon those water resources.
The Water Rights Act, C.C.S.M. c. W80	• Water Rights Regulation 126/87.	• Identifies rights and use of water in Manitoba and prohibitions against diversion of water or operation of water works and sets requirements for permitting and protections of aquatic ecosystems. Permits may be required for drainage works.
The Wildfires Act, C.C.S.M. c. W128	• Burning Permit Areas Regulation 242/97.	• Outlines wildfire controls, duties and prohibitions. • A permit is required to burn clearing debris.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Wildlife Act, C.C.S.M. c. W130	• General Hunting Regulation, Reg. 351/87. • Hunting Areas and Zones Regulation, Reg. 220/86. • Trapping Area and Zones Regulation, Reg. 149/2001. • Wildlife Protection Regulation, Reg. 85/2003.	• Designates provincial wildlife lands, regulates licensed harvest of wildlife, and identifies other protections for wildlife in Manitoba.
The Workplace Safety and Health Act, C.C.S.M. c. W210	• Workplace Safety and Health Regulation 217/2006. • Operation of Mines Regulation 212/2011.	• Outlines safety related duties in the workplace and identifies measures to ensure that safe work practices are being followed to protect health and safety of workers.

APPENDIX 2

Environmental Inspection Forms

This will be included once developed during Detailed Design

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Environmental Protection Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS V

1.0 PURPOSE 1

2.0 ENVIRONMENTAL PROTECTION PLAN MAPBOOKS 1

2.1 Overview 1

2.2 ESS Selection 2

2.3 ESS Classification 2

2.4 ESS Summaries 4

3.0 MITIGATION MEASURES 1

APPENDIX 1 32

APPENDIX 2 48

APPENDIX 3 62

APPENDIX 4 77

APPENDIX 5 78

List of Tables

Table 1: ESS Classification and Naming Convention
Table 2: ESS Summary for LMOC/PR 239 PDA
Table 3: ESS Summary for LSMOC
Table 4: Master List of Mitigation Measures for use in Mapbooks
Table 5: Management and Contingency Plan Overview
Table 5-1: Recommended Setback Distances and Restricted Activity Periods for the Lake Manitoba and Lake St. Martin Outlet Channels Project

List of Figures

Figure A: EMP Process

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Environmental Protection Plan (EPP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

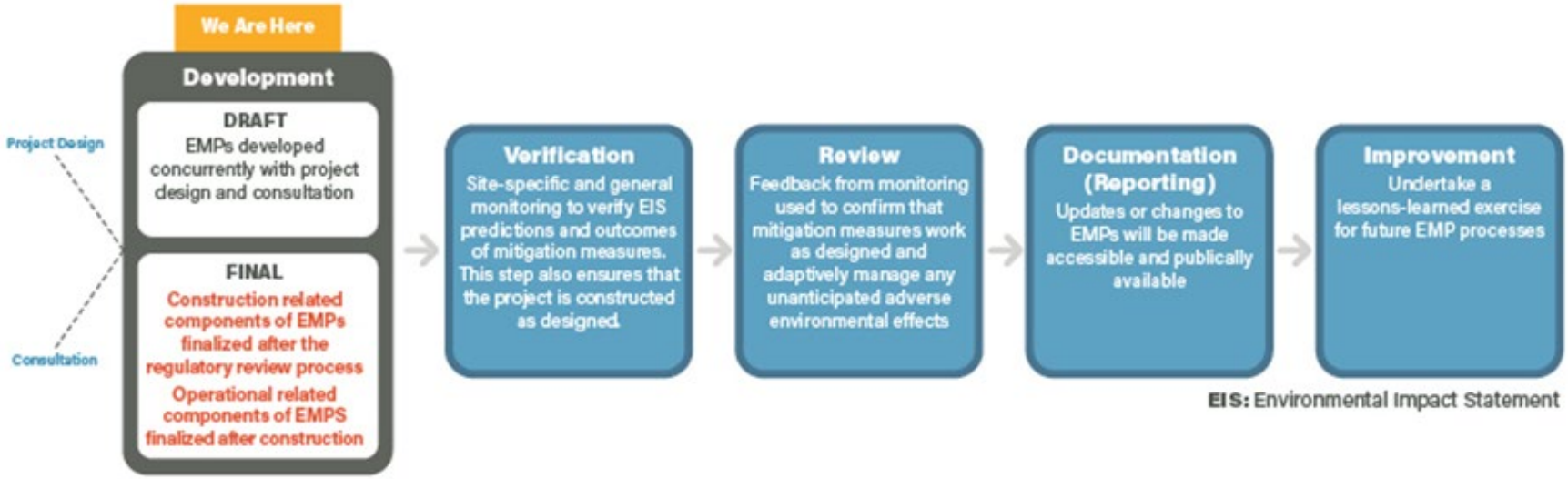


Figure A: EMP Process

LIST OF ACRONYMS

AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPP	Environmental Protection Plan
ESS	Environmentally Sensitive Site
GWMP	Groundwater Management Plan
ha	hectare
HMA	Habitat Mitigation Area
HRB	Historic Resources Branch
HRPP	Heritage Resources Protection Plan
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MB CDC	Manitoba Conservation Data Centre
OEMP	Operation Environmental Management Program
PDA	Project development area
PER	Project Environmental Requirements
PR	Provincial Road
Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RAZ	Restricted Access Zone
RM	Rural Municipality
RVMP	Revegetation Management Plan
SARA	*Species at Risk Act*
SMP	Sediment Management Plan
SOCC	species of conservation concern

1.0 PURPOSE

Manitoba Transportation and Infrastructure has developed this Environmental Protection Plan (EPP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). Environmental protection and regulatory compliance during construction will be facilitated through the use of a Construction Environmental Management Program (CEMP). The CEMP has been prepared by Manitoba Transportation and Infrastructure and will be provided to contractors at the tendering stage. The Contractor(s) will adhere to the CEMP and its associated plans as a condition of the Project construction contract(s).

This EPP has been developed to support the Project's compliance with regulatory requirements and conditions of approval. The Project is being constructed, operated, and maintained under approvals and associated conditions of the *Canadian Environmental Assessment Act 2012* (Canada) and *The Environment Act* (Manitoba). Additional permits, licences, approvals or authorizations may apply to single or multiple Project components and will be obtained as required.

The EPP will support Project planning and reduce the potential for environmental effects during construction. The EPP is focused on identifying environmentally sensitive areas that require particular attention during Project construction, and identifies the associated potential effects, and mitigation measures for such sites.

The EPP provides references to detailed environmental management plans, including Manitoba Transportation and Infrastructure's Project Environmental Requirements (PER) to support decision-making and environmental compliance during Project construction. The environmental protection measures were committed to within the Project Environmental Impact Statement (EIS) and will be referenced to demonstrate compliance commitments for the various permits, licences, and approvals obtained for the Project. Where necessary, mitigation measures have been updated to reflect feedback from regulatory filings (e.g., information request responses), Public and Indigenous consultation and engagement, and the advancement of engineering design. The environmental protection measures will be implemented throughout the Project to promote compliance with conditions of approval and reduce Project-related environmental effects.

2.0 ENVIRONMENTAL PROTECTION PLAN MAPBOOKS

2.1 Overview

The core components of the EPP are a series of EPP mapbooks located in Appendices 1 through 3. Appendix 4 is the location where copies of the relevant approvals, licenses and permits will be located, once received. The EPP mapbooks identify site-specific environmental sensitivities and the associated environmental protection measures for the construction of the Lake Manitoba Outlet Channel (LMOC), Lake St. Martin Outlet Channel (LSMOC), and Provincial Road (PR) 239 Realignment. The EPP mapbooks supplement the various environmental protection measures provided in the PERs and other management plans in the EMP and are intended for use in the field by the Owner, Contract Administrator, Contractors, Inspectors and Monitors during Project planning and construction.

The purpose of the mapping is to provide a visual inventory of all known Environmentally Sensitive Sites (ESSs) that occur within the Project Development Area (PDA) for the three Project components listed above and identify key mitigation measures that are applicable to these ESSs during Project construction. ESS are locations, features, areas, activities, or facilities that were identified during the environmental assessment process to be ecologically, socially, economically, culturally, or spiritually important or sensitive to disturbance and require protection during construction of the Project. The determination of ESS included the consideration of feedback provided by Indigenous rights-holders, the RM of Grahamdale, and regulators.

The EPP mapbooks have been developed for the Project to present the location and spatial extent of ESS. Each map will have a corresponding summary of relevant mitigation measures to address the potential environmental effects at each of the ESS. The mapping is an iterative process and will be updated and finalized prior to construction. This EPP will provide a framework for potential future updates that may be required as Project infrastructure and construction details are finalized.

The mapping is comprised of three separate series, one for each of the following Project components:

- LMOC – Appendix 1
- PR 239 Realignment (PR 239; part of the LMOC PDA) – Appendix 2
- LSMOC – Appendix 3

Each mapbook consists of a series of maps (1:5,000 scale for LMOC and LSMOC, 1:2,500 for PR239) that cover the entire length of the specified Project component and identify ESS that occur within that PDA. A list of general mitigation measures applicable to the ESS identified and specific to the construction phase of the Project will be located on the back of each map. This will be based on the mitigation measures discussed in Section 3.0.

2.2 ESS Selection

ESS mapping topics were selected by Project discipline leads and engineering teams from data sources assessed and referenced in the Project EIS submitted in 2019, as well as data collected from additional field surveys from 2019 - 2021. Traditional Knowledge data referenced and collected for the Project is considered confidential and therefore, any ESS identified from this information has not been documented in this mapping product.

2.3 ESS Classification

For mapping purposes, ESS are organized into a classification system based on the site type (e.g., heritage, land use, aquatics, etc.). The site type, or discipline, in which the ESS is assigned is referred to as the ESS "Category" and represents the highest classification level. "Category" is followed by a more detailed "Group" class, and then finally a "Name" class which provides additional detail of the site. ESS are displayed and symbolized on each map according to the Category, Group, and Name classification. For ease of reference, each ESS is also assigned a unique identification number (ID) based on this classification system. Table 1 outlines this classification and the corresponding ESS ID naming convention (see Table 2 and Table 3 for ESS Name descriptions).

The unique IDs assigned to ESSs are based on the Category and Group classification for that site. These IDs consist of two parts; an abbreviation of the ESS Category and a value from a number series assigned to each ESS Group (Table 1). Using this identification, ESS are numbered sequentially from south to north along each PDA component. ESSs that extend and occur outside the PDA are also identified on the maps, but not symbolized or identified by a unique ID. It should also be noted that wetlands are identified within the PDA, but the priority will be those segments that abut from outside or extend beyond the PDA, as measures will be taken to not discharge deleterious substances into these areas. Specific discharge sites will be established along the PDA borders that avoid these areas.

Table 1: ESS Classification and Naming Convention

ESS CATEGORY (Category Abbreviation used in ESS ID)	ESS GROUP (Number Series Representing ESS Group within a Category)	ESS-ID Series
Heritage (Her)	Heritage Sensitive Areas (100)	**Her-100**
	Heritage Trails (200)	**Her-200**
Land Use (LUse)	All Land Use Types (100)	**LUse-100**
Soils (Soil) & Agricultural Biosecurity	Manure Impacted Sites (Restricted Access Zones [RAZ]) (100)	**Soil-100**
Aquatics (AQ)	Watercourse/Waterbody Crossings (100)	**AQ-100**
	Waterbody Riparian Areas (30 m buffer of waterbody/watercourse) (B100)	**AQ-B100**
	Wetlands (200)	**AQ-200**
Vegetation (Veg)	Species of Conservation Concern (SOCC) (100)	**Veg-100**
	Invasive/Weed Species (200)	**Veg-200**
Vegetation (Veg) & Agricultural Biosecurity	Weed Infestation (RAZ) – Locations to Be Determined	**Veg-300**
Soil (Soil) & Agricultural Biosecurity	Manure Impacted Sites (RAZ)	**Soil-100**
Wildlife (Wild)	Stick Nests or Nesting Snags (100)	**Wild-100**
	Habitat for SOCC (200)	**Wild-200**
	Decadent Tree for Salvage	**Wild-DT#**
	Decadent Tree for Install	**Wild-TG#**

2.4 ESS Summaries

ESS identified in the LMOC and LSMOC PDAs are summarized in the tables below. Table 2 provides a summary of ESS identified within the LMOC PDA, including the PR 239 Realignment component (as shown in the LMOC mapping and PR 239 mapping). Table 3 provides an ESS summary of the LSMOC PDA only (shown in the LSMOC mapping).

Table 2: ESS Summary for LMOC/PR 239 PDA

ESS CATEGORY (Category Abbreviation used in ESS ID)	ESS GROUP	APPROXIMATE NUMBER OF ESS in PDA*	ESS NAME (Number in PDA)	TOTAL AREA in the LMOC/PR 239 PDA **
Heritage (Her)	Heritage Sensitive Areas	**6**	Heritage Sensitive Areas (5)	49 hectares (ha)
	Heritage Trails		Heritage Trails (1)	N/A
Land Use (LUse)	All Land Use Types	**13**	Recreation Shelter (1)	N/A
			Residential Sites (5)	N/A
			Recreational Trails (4)	N/A
Soils (Soil) & Agricultural Biosecurity	Manure Impacted Sites (RAZ)	**52**	Manure Impacted Site (2)	28 ha
Aquatics (AQ)	Watercourse/ Waterbody Crossings	**130**	Waterbodies (11)	83 ha
			Watercourses (4)	N/A
	Riparian Areas (30 m buffer of Waterbody/ Watercourse)		Riparian Areas (15)	98 ha
	Wetlands		Wetlands (Class III, IV)	237 ha
Vegetation (Veg)	SOCC	**95**	N/A (0)	N/A
	Invasive/ Weed Species		30 Plant Species (in 95 locations)	N/A

ESS CATEGORY (Category Abbreviation used in ESS ID)	ESS GROUP	APPROXIMATE NUMBER OF ESS in PDA*	ESS NAME (Number in PDA)	TOTAL AREA in the LMOC/PR 239 PDA **
Wildlife (Wild)	Stick Nests or Nesting Snags	**54**	Stick Nests (4)	N/A
			Nesting Snags (10)	N/A
	Habitat for SOCC		RHWO Habitat Management Area (40)	4 ha

Notes:

* Total number of ESS reported within the PDA is considered an approximation and may vary for some features, such as wetlands which may merge with neighbouring in larger wetlands in seasons of high-water levels, or riparian buffers which will also vary seasonally with waterbody extents/levels

** Areas reported only include extents of ESS within the PDA boundary. Areas of waterbodies and wetlands reported are approximate and may vary depending on current water levels. Areas of waterbodies reported include the major waterbodies at the inlet/outlet components of the PDA boundary.

Table 3: ESS Summary for LSMOC

ESS CATEGORY (Category Abbreviation used in ESS ID)	ESS GROUP	APPROXIMATE NUMBER OF ESS in PDA *	ESS NAME (Number in PDA)	TOTAL AREA in the LSMOC PDA)**
Heritage (Her)	Heritage Sensitive Areas	**3**	Heritage Sensitive Areas (3)	19 ha
	Heritage Trails		Heritage Trails (0)	N/A
Land Use (LUse)	All Land Use Types	**1**	Recreational Trails	N/A
Aquatics (AQ)	Watercourse/Waterbody Crossings	**44**	Waterbodies (3)	103 ha
			Watercourses (3)	N/A
	Riparian Areas (30 m buffer of Waterbody/ Watercourse)		Waterbody/ Watercourse Riparian Areas (6)	113 ha
	Wetlands		Wetlands (Class III, IV & Fen-Graminoid)(20)	264 ha
Vegetation (Veg)	SOCC	**8**	2 Plant Species (in 3 locations)	N/A
	Invasive/Weed Species		4 Plant Species (in 5 locations)	N/A
Wildlife (Wild)	Stick Nest or Nesting Snag	**0**	N/A (0)	N/A
	Habitat for SOCC		EWPW Habitat Management Area (17)	3 ha

Notes:

* Total number of ESS reported within the PDA is considered an approximation and may vary for some features, such as wetlands which may merge with neighbouring in larger wetlands in seasons of high-water levels, or riparian buffers which will also vary seasonally with waterbody extents/levels.

** Areas reported only include extents of ESS within the PDA boundary. Areas of waterbodies and wetlands reported are approximate and may vary depending on current water levels. Areas of waterbodies reported include the major waterbodies at the inlet/outlet components of the PDA boundary.

3.0 MITIGATION MEASURES

As indicated, mitigation measures that will be applied to address potential issues in the various ESS will be provided on the back of each map sheet, with references to details provided in other management plans such as the PERs. Table 4 provides the master list of mitigation measures that will be adapted for each mapbook prior to construction.

Table 4: Master List of Mitigation Measures for use in Mapbooks

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics	Waterbody (AQ-100 Series)	Standing and flowing surface waters (such as a creeks, rivers, lakes, and wetlands with open water), including seasonally and ephemerally occurring surface waters. Waterbodies within the PDA may provide habitat for fish or other species such as amphibians, and construction should occur after any sensitive life cycle activities (e.g., spring spawning/breeding) has occurred. Waterbodies adjacent to and/or connected to the PDA may be exposed to deleterious substances discharged from the PDA.	Designated Areas shall be located a minimum of 100 metres (m) from waterbody or wetland or as approved by the Contract Administrator.	PERs (Section 2.1.1)
			Construction activities shall not occur within 100 m of a waterbody with the exception of construction of a waterbody crossing or other authorized in-water or near-water works, or unless directed by the Contract Administrator. If a 100 m distance is not possible, a buffer zone of undisturbed vegetation shall be provided between the work and the waterway. Using a buffer zone width of approximately 10 m plus 1.5 times the slope gradient or 30 m, whichever is greater.	PERs (Section 2.5.1)
			There shall be no fueling, equipment maintenance, repair or washing within 100 m of the ordinary high-water mark, and measures will be used so that runoff and water used for equipment cleaning does not enter any water body. Clearing within 30 m of a waterbody shall be done by hand.	PERs (Section 2.5.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	Cleared trees and vegetation shall not obstruct waterways during any season and shall be kept above the ordinary high-water mark. Stockpiles or windrows of any material are to be kept a minimum of 100 m from any waterbody's ordinary high-water mark.	PERs (Section 2.2.2)
			Temporary spoil piles, overburden and topsoil shall not be placed within 100 m of any waterbody's ordinary high-water mark. Temporary spoil piles shall be positioned and maintained in a manner that prevents direct or indirect sediment releases into a waterbody.	PERs (Section 2.2.2)
			Temporary spoil piles will be positioned and maintained in a manner that prevents direct or indirect sediment releases into a waterbody.	PERs (Section 2.3.1)
			Effective erosion and sediment control measures shall be properly installed before starting any work to prevent undesirable soil movement or the entry of sediment into any waterbody or wetland.	PERs (Section 2.3.1)
			Contaminated water or runoff will be contained and prevented from entering any waterbody. The collected contaminated water or runoff will be hauled off site for disposal at an approved disposal facility.	PERs (Section 2.3.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	Soils shall be spread or graded in a direction away from the waterbody and never into the stream itself.	PERs (Section 2.6.3) Surface Water Management Plan (SWMP) (Section 5.1.1 and 9.1.1)
			Immediately after disturbance or upon completion of the work in or around waterbodies, waterbody banks, and riparian vegetation areas, the disturbed areas shall be restored to the original contour and gradient and cover treatment applied.	PERs (Section 2.5.1)
			Machinery fording shall be limited to a one-time event (over and back) and shall occur only if an existing crossing at another location is not available or practical to use. Fording shall only be conducted in a manner approved by the Contract Administrator.	PERs (Section 2.5.1) Revegetation Management Plan (RVMP) (Section 5.2 and 11.2)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	If minor rutting is likely to occur, waterbody bank and bed protection methods (e.g., swamp mats or rig mats) shall be used provided they do not constrict flows, block fish passage or cause sediment release into the waterbody.	PERs (Section 2.5.1)
			If rock is used to stabilize waterbody banks, it shall meet appropriate specifications, be clean and free of fine materials, and of sufficient size to resist displacement during peak flood events.	PERs (Section 2.5.1) Sediment Management Plan (SMP) (Section 4.1 and 9.1)
			The waterbody banks shall be stabilized, restored to their original shape, adequately protected from erosion and re-vegetated with native species.	PERs (Section 2.10.1)
			In-water work shall be restricted to low flow periods and shall be scheduled during a period when the waterbody is seasonally dry or frozen to the bottom whenever possible.	PERs (Section 2.5.1) SMP (Section 4.1 and 9.1) RVMP Section 5.2 and 11.2)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	Sediment-laden dewatering discharge shall be pumped to a settling basin, filtering system or through dense terrestrial vegetation of sufficient distance from the waterbody to allow sediment deposition prior to re-entry downstream of the construction area, or as directed by the Contract Administrator.	PERs (Section 2.5.3)
			The Contractor is responsible for maintaining base flows for the duration of construction activities in waterbody's requiring in-water and near water work, including those works which may require the installation of cofferdams and related structures, unless otherwise approved.	PERs (Section 2.5.4) SWMP (Section 5.1.1 and 11.1.1)
			Temporary diversion channels shall be designed to accommodate expected waterbody flow from storm, runoff or spring melt events.	PERs (Section 2.5.7) SWMP (Section 5.1.1 and 9.1.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	Water quality monitoring shall be required if described in tender documents for in-water work in fish-bearing waterbodies and may be required when working near fish bearing waterbodies or tributaries to fish bearing waterbodies to demonstrate that deleterious substances are not entering into the waterbody. Water quality monitoring shall also occur when working upstream and within 5km of a water treatment plant intake.	PERS (Section 2.5.10) SWMP (Section 6.2.2 and 10.2.2)
			Utilize culvert removal techniques that minimize impacts to the waterbody and riparian area.	PERs (Section 2.5.11)
			Contaminated runoff or water shall be contained and prevented from entering any waterbody. The collected contaminated runoff or water shall be hauled off site for disposal at an approved disposal facility.	PERs (Section 2.6.3)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	Waterbody crossing (AQ-100 Series)	Standing and flowing surface waters (such as a creeks, rivers, lakes, and wetlands with open water), including seasonally and ephemerally occurring surface waters. Waterbodies can provide habitat for fish, birds and other wildlife such as amphibians. Crossing waterbodies creates risks damages to shorelines, beds and potentially introduces deleterious substances.	Where possible, existing stream crossings shall be utilized to traverse waterbodies.	PERs (Section 2.5.9)
			All stream crossings shall be constructed in accordance with The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (https://www.gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/sguide.pdf) and DFO's Interim Code of Practice: Temporary Stream Crossings (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-crossings-traversees-temporaires-eng.html?wbdisable=true).	PERs (Section 2.5.9)
			If there is no existing crossing and the waterbody must be crossed, the Contract Administrator may approve the construction of a temporary crossing to keep all vehicles and equipment out of the waterbody.	PERs (Section 2.5.9)
			Stream crossings shall be located at straight stream sections, perpendicular to the bank. In particular, meandering bends, braided streams, alluvial fans and other unstable areas shall be avoided.	PERs (Section 2.5.9)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	*See above*	*See above*	When feasible, the construction of stream crossings shall be scheduled for the period of lowest steam flow and should be a single event.	PERs (Section 2.5.9)
			The natural alignment of the stream shall be maintained.	PERs (Section 2.5.9)
			A minimum vegetated buffer strip of 30 m shall be maintained between the worksite and waterbody except at the actual crossing location.	PERs (Section 2.5.9)
			The number of temporary stream crossings constructed shall be minimized.	PERs (Section 2.5.9)
			Temporary stream crossings shall be removed as soon as possible following completion of the work or when it is no longer required, whichever is sooner.	PERs (Section 2.5.9)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	Riparian area (AQ-B100 Series)	30 m buffer around waterbody containing woody vegetation. Riparian areas provide shade and shoreline stability for waterbodies. See Waterbodies for additional information.	Removal of riparian vegetation shall be kept to a minimum to help maintain the stability of waterbody banks. The area over which vegetation in riparian vegetation areas is removed shall affect no more than one third (1/3) of the total woody vegetation in the right-of-way (ROW) within 30 m of the ordinary high-water mark of a waterbody. Vegetative root masses found within the waterbody banks shall remain undisturbed unless specified in the Contract Documents.	PERs (Section 2.2.2)
			Immediately after disturbance or upon completion of the work in or around waterbodies, waterbody banks, and riparian vegetation areas, the disturbed areas shall be restored to the original contour and gradient and cover treatment applied.	PERs (Section 2.5.1) RVMP (Section 5.2 and 11.2)
			Utilize culvert removal techniques that minimize impacts to the waterbody and riparian area.	PERs (Section 2.5.11)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Aquatics (cont'd)	Wetlands (AQ-200 Series)	Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by the formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to wet environments. Wetlands within the PDA may support important plant species and provide habitat for wildlife species such as amphibians, and construction should occur after any sensitive life cycle activities (e.g., spring spawning/ breeding) has occurred. Wetlands adjacent to and/or connected to the PDA may be exposed to deleterious substances discharged from the PDA.	Excavation within wetlands will be completed during dry or frozen conditions whenever feasible.	PERs (Section 2.11.1)
			Exclusionary fencing will be installed around open excavations near wetlands when and where there is potential for entrapment of amphibians or other wildlife species, or as directed by the Contract Administrator.	PERs (Section 2.11.1)
			Sediment-laden dewatering discharge shall be pumped to a settling basin, filtering system or through dense terrestrial vegetation of sufficient distance from the waterbody to allow sediment deposition prior to re-entry downstream of the construction area, or as directed by the Contract Administrator.	PERs (Section 2.5.4) SMP (Section 4.1 and 9.1)
			Designated discharge sites will be established that avoid sensitive wetland areas.	PERs (Section 2.5.4) SMP (Section 4.1 and 9.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Soils	Manure-impacted site (Soil-100 Series)	Location of site impacted by current cattle operations. Manure piles contain contaminated soil and if disturbed can result in contamination of adjacent areas and waterbodies.	Manure stockpiles should be relocated from the Project footprint prior to construction.	PERs (Section 2.6.6) Agriculture Biosecurity Management Plan (AgBMP) (Section 2.3)
			A plan for treatment and/or disposal of impacted soils will be developed. This may include excavation and spreading of identified impacted soils onto agricultural lands outside of the LMOC construction area, as appropriate.	AgBMP (Section 3.2.1)
			Workers should not access identified manure impacted sites within the PDA without explicit permission from Manitoba Transportation and Infrastructure (note: manure impacted site ESS are also considered RAZs under the AgBMP).	AgBMP (Section 3.2.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Soils (cont'd)	*See above*	*See above*	Prior to general construction activities being allowed to be undertaken within an area identified as a manure impacted site ESS (RAZ), the following must occur: Areas of manure stockpiles, if present, must be confirmed and delineated in the field, and relocated from the PDA and either applied to agricultural land outside of the PDA or disposed of at an approved landfill facility following provincial regulations. Soils within areas delineated as manure-impacted sites, including under manure stockpiles and associated with former cattle feedlot operations, will be assessed for degree and extent of impacts from nutrients (nitrogen and phosphorus) through sampling and laboratory analysis. A plan for treatment and/or disposal of impacted soils will be developed in order to remediate these areas. This may include excavation and spreading of identified impacted soils onto agricultural lands outside of the LMOC PDA, as appropriate. Equipment, vehicles and workers are required to utilize fine cleaning and disinfection, as described in the AgBMP, when exiting these ESSs (RAZs under the AgBMP) prior to these sites being cleaned-up and deemed remediated.	AgBMP (Section 3.2.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Soils (cont'd)	*See above*	*See above*	Soils from these areas should not be excavated, moved or stockpiled in general soil stockpiles prior to the implementation of a site-specific management plan. General construction activities should not occur within manure impacted sites located within the PDA until these areas have been cleaned-up (i.e., manure stockpiles removed, and manure impacted soils evaluated, treated and/or disposed of) and are deemed remediated. Once deemed remediated, Manitoba Transportation and Infrastructure must provide approval for these sites to cease to be designated an ESS (or RAZ within the AgBMP), following which time general construction activities may be undertaken in these areas and general biosecurity management measures under the AgBMP will apply.	*See above*

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Vegetation	SOCC (Veg-100 Series)	Species in addition to species at risk (SAR) that are listed by the Committee on the Status of Endangered Wildlife in Canada; for listing under the *Species at Risk Act (SARA)* as special concern, threatened, or endangered, or those listed provincially under *The Endangered Species and Ecosystems Act* and by the Manitoba Conservation Data Centre (MB CDC) as provincially rare (i.e., S1 or S2 rankings).	The Contractor shall not remove, destroy or disturb species pursuant to Manitoba Regulation 25/98 of *The Endangered Species and Ecosystems Act*, or any future amendment thereof, respecting Threatened, Endangered and Extirpated Species, or species listed in the federal *SARA*.	PERs (Section 2.11.1)
			Terrestrial buffers, as identified by the MB CDC's *Recommended Development Setback Distances from Birds and/or Manitoba Sustainable Development's Forest Management Guidelines for Terrestrial Buffers* shall be adhered to for all applicable sites.	PERs (Section 2.11.1)
			A 30 m setback will be applied to known occurrences of provincially listed SOCC; however, where avoidance of SOCC is not possible, construction in sensitive areas will be restricted to the winter months (outside of the growing season).	CEMP (Section 5.7)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Vegetation (cont'd)	Invasive species (Veg-200 Series)	1) Non-native plant species to the Project agricultural region that can spread and outcompete/ replace native plant species, and 2) whose introduction will cause or will likely cause economic or environmental harm unless effectively controlled.	When weeds and invasive plant species are documented, a timely and appropriate control response should be undertaken to control the weed infestation. A site-specific weed and invasive plant control strategy will be implemented.	RVMP (Section 5.4 and 11.4)
			To prevent the transfer of weeds and terrestrial invasive species, all equipment is to be cleaned to remove all earthen material and plant debris and inspected before being brought to site and before it is removed from site. Cleaning should be carried out with a pressure washer or scrub brush. If soap is used it shall be phosphate free.	PERs (Section 2.16.1)
	Weed infestations (Veg-300 Series)	See above for general definition. Weed infestations are a larger issue that a single occurrence/individual or a few weed species and require more intensive management and monitoring to control or eradicate.	Workers should not access weed infestation ESS within the PDA without explicit permission from Manitoba Transportation and Infrastructure (note: weed infestation ESS are also considered RAZs.	AgBMP (Section 3.2.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Vegetation (cont'd)	*See above*	*See above*	Prior to general construction activities being allowed to be undertaken within an area identified as a weed infestation ESS (RAZ), the following must occur: A site-specific (i.e., ESS specific) management and monitoring plan must be developed to control or eradicate the weed infestation, as described in the RVMP. This management plan will stipulate approved activities allowed to be conducted within the weed infestation ESS (RAZ). Vehicles, equipment and workers conducting approved work within a weed infestation ESS (RAZ) (e.g., weed control, mowing) are required to utilize fine cleaning (disinfection not required), as described in the AgBMP, when exiting the ESS (RAZ). Soils from within a weed infestation ESS (RAZ) should not be excavated, moved or stockpiled prior to implementation of the site-specific management and monitoring plan.	AgBMP (Section 3.2.1) RVMP (Section 5.4 and 11.4)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Vegetation (cont'd)	*See above*	*See above*	*(cont'd from above)* Mowing of these areas should not be conducted prior to implementation of a site-specific management and monitoring plan, and if mowing is required, approved mowing of the ESS (RAZ) should only occur after mowing of areas not deemed a weed infestation ESS (RAZ) or having known weed concerns.	*See above*
			Once weeds are effectively controlled or eradicated, as described in the RVMP, the weed infestation ESS (RAZ) designation may be removed on approval by Manitoba Transportation and Infrastructure, following which time general construction activities may be undertaken in these areas and general biosecurity management measures under the AgBMP will apply.	AgBMP (Section 3.2.1) RVMP (Section 5.4 and 11.4)
Wildlife	Stick nest (Wild-100 Series)	A large nest (> 60 cm) used by larger birds such as owls, hawks, ravens, etc. Stick nests provide important habitat for bird species during spring nesting periods.	Trees containing large nests of sticks and areas where active dens or burrows occur shall be identified, left undisturbed, and reported to the Natural Resources Officer.	PERs (Section 2.11.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Wildlife (cont'd)	Eastern whip-poor-will Habitat Mitigation Area (HMA) (Wild-200 Series)	HMAs for eastern whip-poor-will (listed as endangered under the federal SARA will be enhanced with shrubs and/or trees.	Minimize clearing and ground disturbance in eastern whip-poor-will HMAs to the extent feasible during construction.	EWMP (Section 3.2)
			Enhance HMAs with shrubs and/or trees post-construction.	RVMP (Sections 5.0 and 11.2)
			Revegetation activities will occur in spring or fall depending on the construction schedule and, if applied in the fall, prescriptions may require adjustments to improve survivability of seed during winter for herbaceous cover.	RVMP (Section 5.3 and 11.3) PERs (Section 2.21.1)
	Redheaded woodpecker HMA (Wild-200 Series)	Habitat Management Areas for red-headed woodpecker (listed as endangered under the federal SARA will be enhanced with shrubs and dead standing trees (snags).	Treed habitats within the PDA will be retained where safe and technically feasible to do so.	RHMP (Section 3.0)
			Minimize clearing and ground disturbance in red-headed woodpecker HMAs to the extent feasible during construction.	RHMP (Section 3.0)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Wildlife (cont'd)	*See above*	*See above*	Terrestrial buffers, as identified by the MB CDC's Recommended Development Setback Distances from Birds and/or Manitoba Sustainable Development's Forest Management Guidelines for Terrestrial Buffers shall be adhered to for all applicable sites (see Appendix 5). The provincially recommended setback distance for vegetation clearing and construction activities of 200 m from an active red-headed woodpecker nest will be adhered to between April 15 to August 15.	PERs (Section 2.11.1)
			Enhance HMAs with shrubs and dead standing trees (snags) post-construction.	RVMP (Section 5.2 and 11.2)
	Decadent trees for salvaging (Wild-DT# Series)	Dead/decaying trees that provide or have potential to provide important nesting habitat for red-headed woodpecker. Trees have been flagged and tagged with a unique identifier.	Locations of existing trees in PDA that need to be carefully removed for storing and repositioning in Red-headed Woodpecker HMAs post-construction. Trees will be re-inspected to determine if they still meet salvage criteria. Trees deemed suitable for salvage will be flagged by Environmental Monitor prior to removal. See Decadent Tree Supplemental Technical Specifications No.3031 for details regarding the salvage of trees on LMOC.	Decadent Tree Supplemental Technical Specifications No. 3031 RHMP (Section 4.2.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Wildlife (cont'd)	Decadent tree install target (Wild-TG# Series)	Dead/decaying trees that provide important nesting habitat for red-headed woodpecker.	Locations for repositioning decadent trees. See Decadent Tree Supplemental Technical Specifications No.3031 for details regarding the installation of trees on LMOC.	RHMP (Section 4.2.1)
Land Use	Recreation trail (LUse-100 Series)	Trail used for recreation purposes such as snowmobiling. Construction activities can interrupt the use of trails and create safety risks if they continue to be used in the vicinity of the PDA.	Recreation will not be allowed along the outlet channels through the life of the Project; Manitoba Transportation and Infrastructure will install warning signs indicating no authorized personnel where required.	PERs (Section 2.21.1)
			Due to safety concerns, trails, including trapping routes, within the PDA will not be accessible to members of the public during construction, with some exceptions for Indigenous peoples who intend to carry out traditional practices to the extent that such access is safe (i.e., does not temporally and spatially overlap with construction activities), if approval is granted by Manitoba Transportation and Infrastructure in advance. The contractor and all of its associated employees will not use the trails for recreational purposes.	Access Management Plan (AMP) (Section 5.6 and 7.10)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Land Use (cont'd)	Recreation shelter (LUse-100 Series)	Location used by people during recreation activities. Construction activities can interrupt the use of shelters and create safety risks if they continue to be used in the vicinity of the PDA.	Recreation will not be allowed along the outlet channels through the life of the Project; Manitoba Transportation and Infrastructure will install warning signs indicating no authorized personnel where required.	PERs (Section 2.21.1)
	Noise Receptor (Not assigned an ESS ID because not located within the PDA)	Location of a building where people may be present and susceptible to noise disturbance.	Noise by-laws of the adjacent communities and municipal authorities shall be complied with.	PERs (Section 2.9.1)
			Residents near construction noise-generating activities will proactively be notified as required.	PERs (Section 2.9.1) CEMP (Section 5.1)
			Any operation of plant or equipment beyond dates or times as specified or regulated by applicable by-laws or adjacent communities or municipal authorities shall require an exemption in writing.	PERs (Section 2.9.1) CEMP (Section 5.1)

ESS Category	ESS Type	ESS Description	Key ESS Mitigation	EMP Plan Reference
Land Use (cont'd)	*See above*	*See above*	Temporary noise abatement barriers may be used to reduce noise levels. If noise abatement barriers are ineffective, a temporary reduction in the intensity of construction activities should be considered.	CEMP (Section 5.1)
Heritage	Sensitive heritage site (Her-100 Series)	Area containing or having high potential to contain one or more specific site with heritage value that needs to be protected.	For an ESS in which a Project Archaeologist is required to be present for heritage monitoring as directed by Historic Resources Branch (HRB), the Project Archaeologist will take the extra measures to inspect and provide direction for the excavation by mechanical means.	Heritage Resources Protection Plan (HRPP) (Section 5.1.2)
			For the remaining known heritage sites, the Environmental Monitor will take extra measures to inspect soil layers within the ESS and enact the Chance Find procedure if heritage resources are encountered. If this occurs, work at the location shall be suspended until a Historic Resource Consultant can assess the archaeological or historic artifacts encountered, and mitigation measures are confirmed with the Manitoba HRB.	HRPP (Section 5.2) PERS (Section 2.13.1)

These mitigation measures, and other management and contingency plans summarized in Table 5 have been developed to reduce the risk of adverse effects on the environment, communities, and human health and safety. The mapbooks link these measures and plans to specific ESSs along the construction areas. Management and contingency plan requirements may vary based on the Project component and risk of issues or unplanned events. In addition to adhering to these plans, Contractors working on the Project will be required to develop, implement, and maintain their own management and contingency plans to deal with Project or site-specific issues or unplanned events, as stipulated in the PERs.

Table 5: Management and Contingency Plan Overview

Management or Contingency Plan	Description
Access Management Plan	The AMP identifies specific measures that will be undertaken to manage access to the Project site during the construction phase. The AMP addresses access-related issues of concern expressed by rights-holders, stakeholders and the public during the Indigenous engagement and consultation process. It also integrates technical access-related effects on the environment. The AMP describes the access control measures that relate to protection of natural resources, public and worker safety, and site security. The plan includes maps that show the locations of potential safety hazards that will be present as a result of the Project and mitigation measures (signage and fencing) that have been designed to reduce the risk posed by the hazards. The objectives of the AMP are to: • Provide safe, coordinated access to the PDA during construction and operation. • Provide safe passage for local residents and visitors to the area (both Indigenous and non-Indigenous) through the PDA at identified crossing locations. • Support sustainable use through the protection of the area's natural resources. • Allow the Owner and contractors to construct, operate and maintain the Project year-round. • Provide security for Project personnel and property. • In addition to the objectives of the AMP, other considerations include: • Preserve and respect the socio-economic, cultural and heritage values of the lands around the Project. • Prescribe measures to minimize potential negative direct and indirect effects on Project access. • Protect land users from hazards resulting from construction and operation of the Project. • Minimize land user conflicts. • Provide public education and communication about the Project to promote safety for all and to maintain an understanding among specific relevant groups and the public-at-large regarding the access management measures being implemented and maintained, and the rationale for doing so.

Management or Contingency Plan	Description
Agricultural Biosecurity Management Plan	The Agricultural Biosecurity Management Plan (AgBMP) identifies biosecurity issues, risk sites, and risk types, as well as specific mitigation requirements such as landowner communication, notification, and equipment cleaning and disinfection requirements. The objective of this plan is to mitigate adverse effects or changes in agricultural land use. The plan pertains to the LMOC and PR 239 realignment portions of the Project, as these portions of the Project traverse agricultural land use, including cropland, pasture, and livestock operations. Through this AgBMP, Manitoba Transportation and Infrastructure will address biosecurity concerns related to Project activities. The AgBMP includes: • Background information including a summary of agricultural land use in the Project area, regulatory context, industry guidelines, and related Project management plans. • Summary of biosecurity risk issues, risk mechanisms related to construction and operation activities, and risk levels to guide biosecurity management efforts. • Required actions by Manitoba Transportation and Infrastructure and Contractor(s) to protect agricultural biosecurity. • Identification of specific biosecurity risk areas within and adjacent to the PDA and controlled access points where workers will enter and exit the PDA. • Implementation plan to guide Manitoba Transportation and Infrastructure in implementation of the AgBMP for Project construction and operation, including roles and responsibilities, planning and preparation, facilities and equipment, worker requirements, record keeping and reporting, worker training, communication, monitoring, and implementation schedule.
Complaint Resolution Process	The Complaint Resolution Process outlines the methods for complaint initiation, records management, and process tracking, as well as the process for complaint notification, investigation, and resolution.
Site Decommissioning Plan	The purpose of the Site Decommissioning Plan is to describe the processes and environmental requirements for the removal and closure of temporary designated areas, temporary access roads and quarry areas required during construction or operation of the Project.

Management or Contingency Plan	Description
Dust Control Plan	The Dust Control Plan describes the requirements and application of dust suppressants and other mitigation measures used for dust control and stabilization. This includes the products to use and the methods of their application on PR 239, other access roads used, and material stockpiles to minimize and mitigate effects from increased dust levels during the Project construction and operation. The plan also identifies the certification and submission requirements for products to be used and includes measures for monitoring of dust and air quality.
Eastern Whip-poor-will Habitat Management Plan	The Project overlaps potential critical habitat for eastern whip-poor-will (*Caprimulgus vociferus*), listed as threatened under the federal SARA (Government of Canada 2020). Manitoba Transportation and Infrastructure is using the precautionary approach and committing to additional mitigation measures to reduce potential Project-related effects to eastern whip-poor-will habitat. The purpose of the Eastern Whip-poor-will Habitat Mitigation Plan is to describe the habitat mitigation and monitoring activities that will be implemented along the outlet channel right-of-way, including the application of revegetation prescriptions and vegetation management practices, that provide habitat opportunities for eastern whip-poor-will.
Emergency Response Plan	The Emergency Response Plan is described in the CEMP and identifies how the Contractor(s) will respond to environmental emergencies in a manner that protects people and the environment during Project construction. The plan outlines emergency spill response and reporting procedures and fire prevention and response procedures. Procedures to respond to spills, accidents, or malfunctions involving the release of fuels, dangerous goods or hazardous materials/waste are described. The plan identifies who is responsible for and methods of containment, clean-up and reporting. The plan also outlines fire prevention measures to be implemented and response and evacuation procedures to follow in the event of a fire. A Health and Safety Plan separately addresses security, responses to medical incidents, transport to hospital and emergency contacts and notification.

Management or Contingency Plan	Description
Groundwater Management Plan	The Groundwater Management Plan (GWMP) describes measures to take to avoid or minimize adverse effects to groundwater or from groundwater during the construction and operation of the Project. These effects may include changes in groundwater quality and quantity in the vicinity of the Project, effects on construction from groundwater, or changes in the relationship of the groundwater aquifer discharge to the surface water system. The GWMP outlines measures to manage groundwater which is brought to the surface because of depressurization activities, as well as measures to prevent/mitigate groundwater impacts to local well users. It also identifies adaptive measures to take if the outlined monitoring reveals the need for additional steps.
Hazardous Materials Management Plan	The Hazardous Materials Management Plan is part of the CEMP and describes safe practices for transporting, storing, managing, and disposing of hazardous materials to protect the health and safety of employees, the public, and the environment. The Plan includes spill response guidelines and hazardous waste management guidelines for managing specific hazardous materials. The Plan also identifies the applicable federal and provincial acts and regulations for the transportation, storage, handling, and disposal of dangerous goods and hazardous wastes.
Heritage Resources Protection Plan	The HRPP describes measures to mitigate effects to cultural and heritage resources that can occur from ground-disturbing Project activities, such as vegetation clearing and excavation and development of temporary construction camps, staging areas, and access roads. The HRPP is based on the findings of a Heritage Resource Impact Assessment conducted prior to the start of construction. The HRPP includes the following: • Heritage resources procedures and protection measures to be implemented during Project construction. • Specific measures required for any heritage sites located within the PDA and any adjacent site that may be affected by Project construction or operation. • Identification and characterization of any additional heritage resource protection measures. • Steps for reporting and follow-up related to any heritage resources unintentionally disturbed during construction.

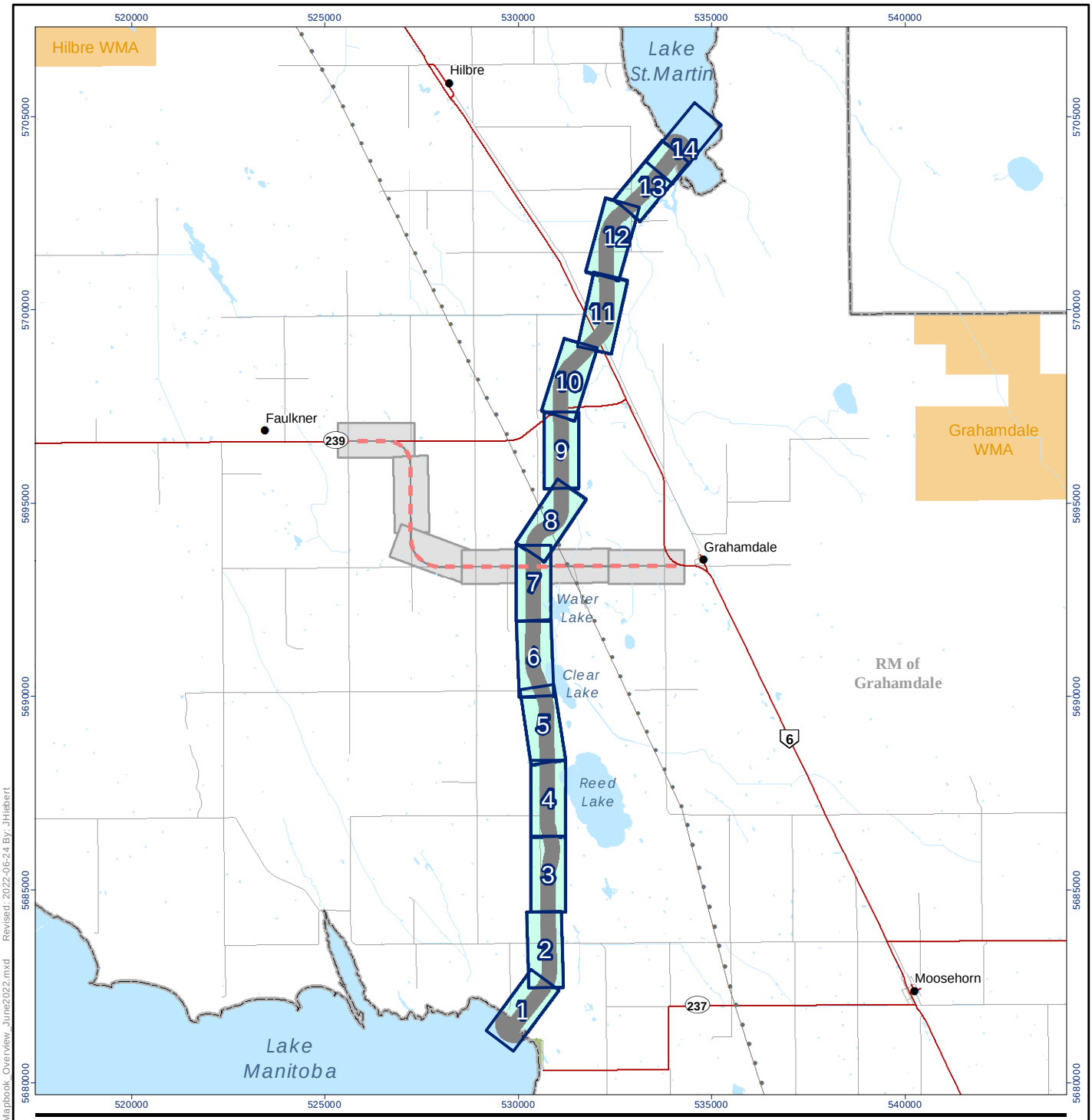
Management or Contingency Plan	Description
Project Environmental Requirements	The PERs represent requirements and commitments that are fundamental to Manitoba Transportation and Infrastructure's regulatory compliance requirements, including Project approvals, permits, licences and authorizations. They are specific to the work and activities conducted under the authority of any and all licences, permits, authorizations or approvals obtained for the Project. Requirements listed in these PERs are not mutually exclusive of one another and must be adhered to for all activities pertaining to construction, post-construction, maintenance and decommissioning activities for the Project.
Quarry Management Plan	The Quarry Management Plan describes how quarries are selected, developed, operated, and decommissioned (where applicable). This plan specifies best management practices for the selection of quarry sites and quarry development that builds upon the requirements listed in the PERs. This will confirm that quarrying activities are conducted in accordance with all applicable permitting requirements and commitments made in the Project's EIS. The plan also includes details on the transport and storage of explosives and measures to facilitate advanced planning and notice for blasting activities, such as requirements for Contractor submissions.
Red-headed Woodpecker Habitat Management Plan	The Project overlaps potential critical habitat for red-headed woodpecker (*Melanerpes erythrocephalus*), listed as endangered under the federal SARA (Government of Canada 2021). Manitoba Transportation and Infrastructure is using a precautionary approach and committing to additional mitigation measures to reduce potential Project-related effects to red-headed woodpecker habitat. The purpose of the Red-headed Woodpecker Habitat Mitigation Plan is to describe the red-headed woodpecker habitat mitigation and monitoring activities that will be implemented along the LMOC outlet channel right-of-way (ROW).

Management or Contingency Plan	Description
Revegetation Management Plan	The purpose of the RVMP is to describe the measures that will be used to establish vegetation in areas impacted by the Project. The objectives of the RVMP are as follows: • establish self-sustaining permanent plant cover • provide erosion and sediment control • control the spread of invasive plant species along the channel and into adjacent environments The RVMP provides a process to track revegetation progress, to monitor for environmental compliance, and to identify deficiencies and requirements for remedial planting work. Reclamation targets relate to plant community function and do not include targets for species richness, diversity, plant community structure or species composition. Long-term vegetation monitoring and management requirements will be developed as part of an operations and maintenance manual (to be developed). The RVMP also provides monitoring requirements for potential effects to the vegetation adjacent to the channel to identify Project-related changes to vegetation species diversity.
Sediment Management Plan	Sedimentation from the erosion of exposed soils can negatively influence fish and fish habitat. The SMP describes measures to minimize the impacts of in-stream sediment from construction activities in or near water, river management, shoreline erosion, and commissioning of the LMOC and LSMOC. These measures include temporary construction management practices, as well as permanent mitigations measures built into the channel design, to minimize the potential for erosion and to minimize and mitigate the transport and deposition of sediment beyond construction areas or into off-site receiving water bodies. The objectives of the SMP are to: • Define guidelines and procedures for construction to minimize the potential for erosion and sedimentation. • Identify site-specific erosion and sediment control measures to minimize adverse, sediment related, effects to receiving waterbodies. • Identify emergency response practices to mitigate extreme design conditions, respond to unforeseen events and accidents, and minimize potential environmental impacts.

Management or Contingency Plan	Description
Surface Water Management Plan	The SWMP describes measures to be employed to mitigate or avoid impacts to surface water during and post-construction These include methods to manage local runoff (both inside and outside of construction areas), and the associated potential transport and deposition of sediments beyond construction areas and into off-site receiving water bodies. The SWMP also identifies preliminary monitoring requirements to confirm mitigations are effective and the process for identifying and implementing adaptive measures if measures are not effective. The SWMP has been developed to address the following objectives: • Describe measures to manage local surface water during and after construction of the LMOC and LSMOC, and the associated potential for erosion, transport and deposition of sediments and pollutants beyond construction areas and into off-site receiving water bodies. • Summarize monitoring plans for surface water quality and quantity in the vicinity of the LMOC and LSMOC to verify that the measures implemented meet requirements and identify additional contingency measures to be considered for implementation in the event of emergency conditions or undesirable circumstances.
Waste Management Plan	The Waste Management Plan is located in the CEMP and describes how solid and non-hazardous liquid waste will be stored, managed, and disposed of during construction. The plan commits to keeping the construction area clean and orderly during and at completion of construction with waste materials and refuse removed and disposed of promptly in a manner that will not contaminate the surrounding area. Waste materials shall be recycled to a degree that is economically and practically feasible or disposed of at a Waste Disposal Ground operating under the authority of a permit issued pursuant to *Manitoba Waste Disposal Grounds Regulation* 150/91 of *The Environment Act*. All sewage and seepage from on-site sanitary facilities will be disposed of at a local licenced facility and in accordance with the *Manitoba Onsite Wastewater Management Systems Regulation* 83/2003 of *The Environment Act*.

APPENDIX 1

LMOC Environmental Protection Plan Mapbook





Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Stantec Consulting, Manitoba Infrastructure

Legend

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area
- Proposed PR 239 Realignment
- LMOC 5k Map Grid
- PR 293 Realignment 5k Map Grid
- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Wildlife Management
- Provincial Park
- Rural Municipality

0 1,500 3,000 metres
(At original document size of 8.5x11)
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Stantec Manitoba

Project Location
Lake Manitoba/Lake St.Martin Manitoba

Prepared by JH on 2022-06-24
TR by NB on 2022-06-24

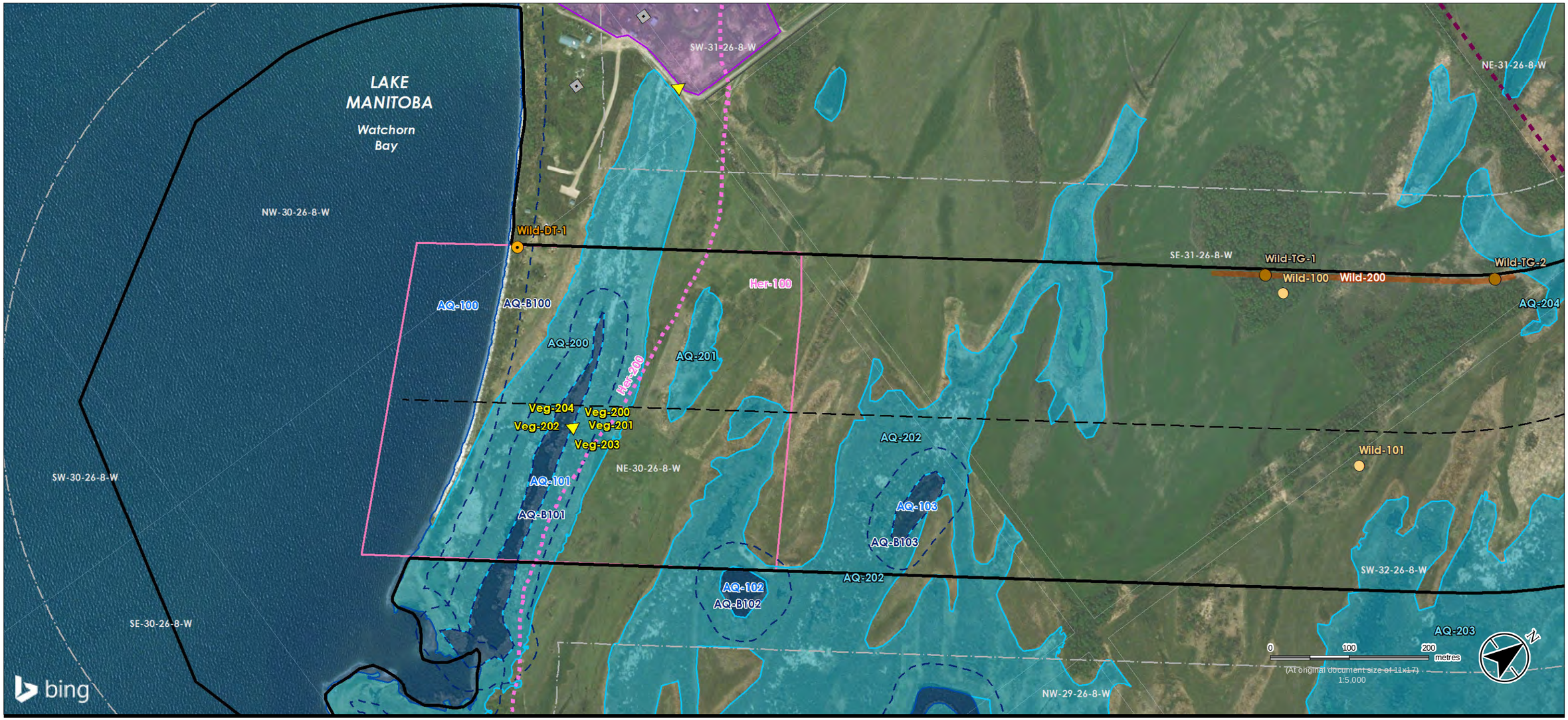
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Manitoba Transportation & Infrastructure
Lake Manitoba Outlet Channel Project

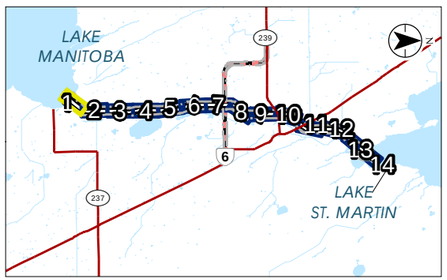
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Title
Lake Manitoba Outlet Channel CEnvPP Map Grid Overview

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)
- Stick Nest

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Heritage (Her)
- Historic Trail

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

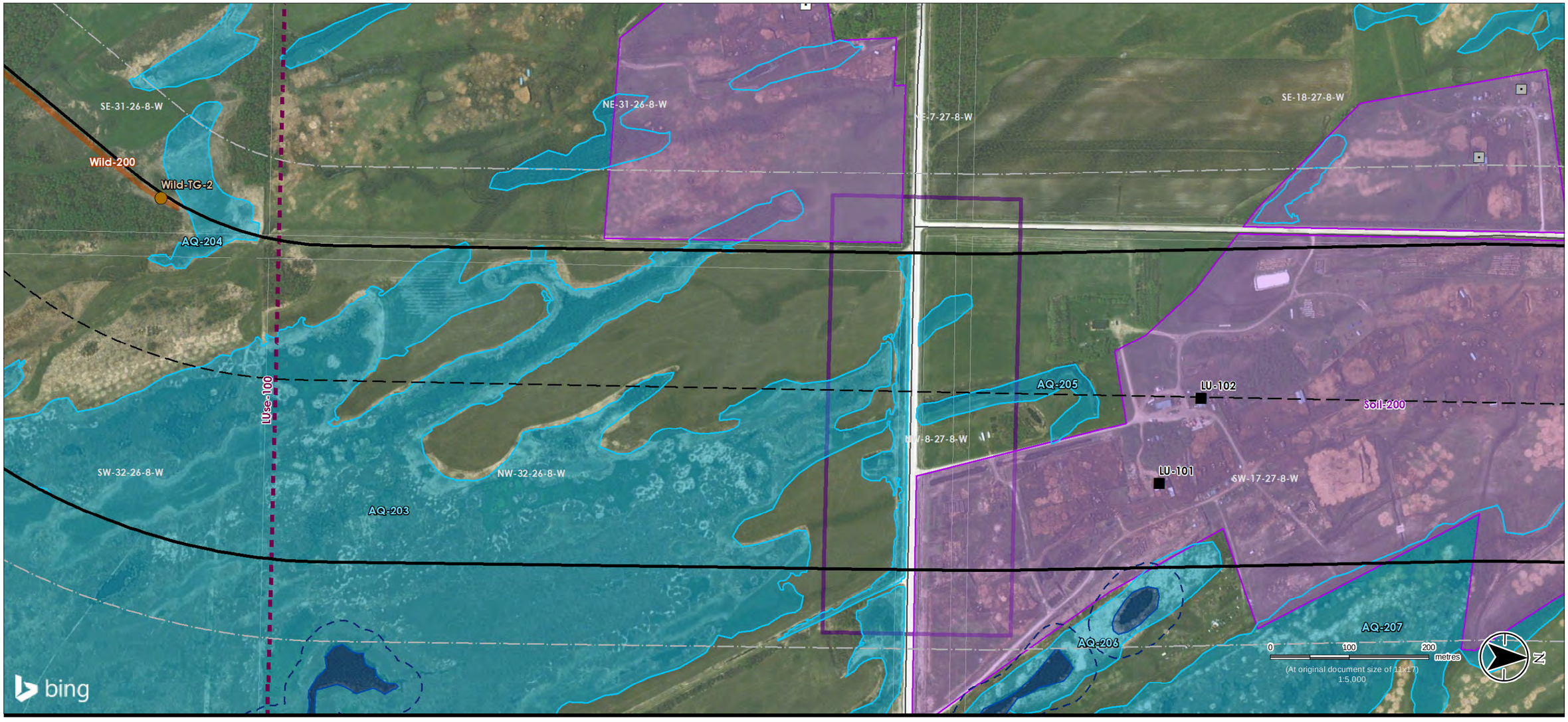
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Manitoba Transportation & Infrastructure
Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

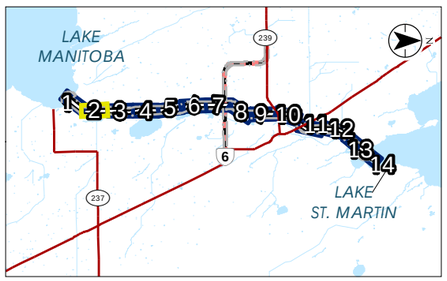
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Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline

Project Components*
- Proposed Bridge
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Land Use (LUse)
- Building

Wildlife (Wild)
- Decadent Tree Install Target (TG)

Predicted Noise Receptors During Project Construction
- Potential High Noise Receptor
- Potential Moderate Noise Receptor

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

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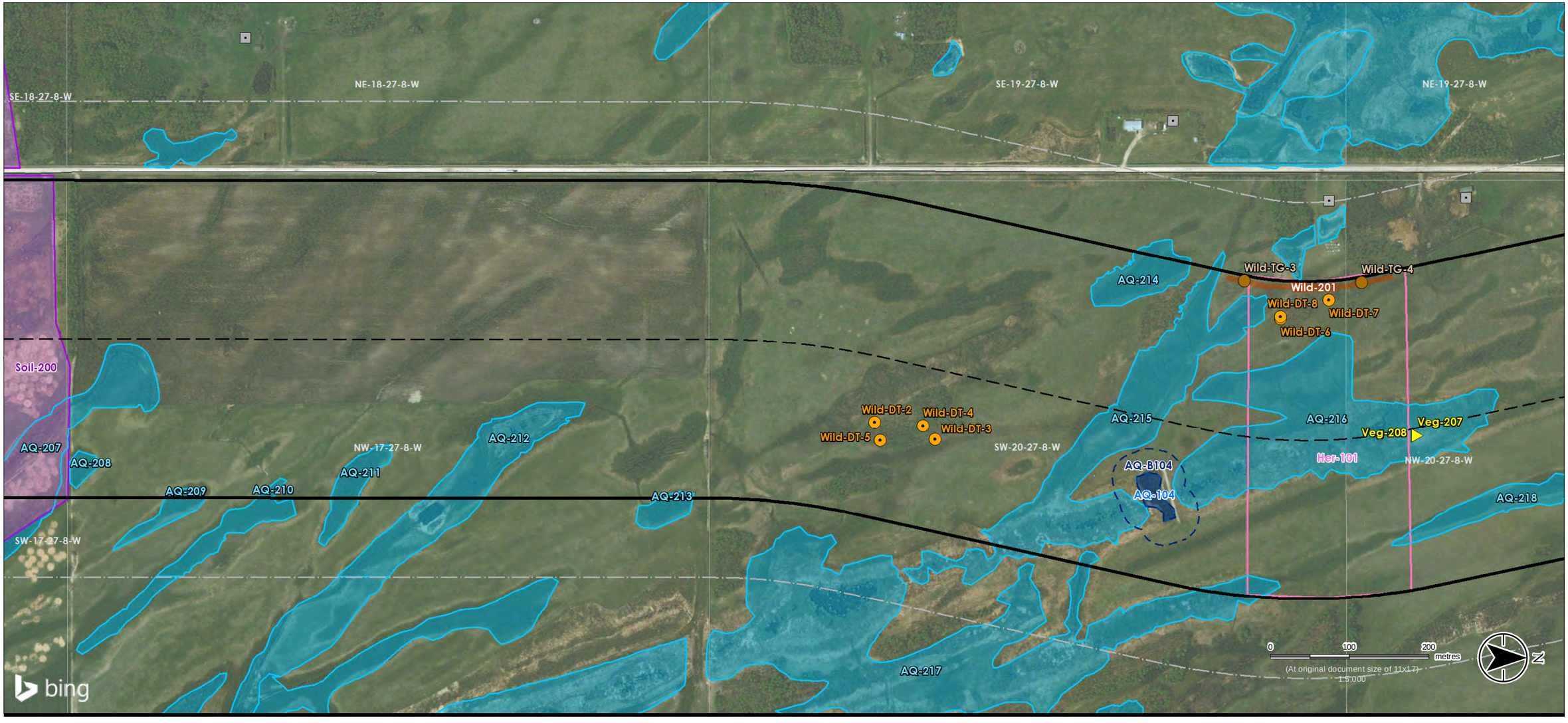
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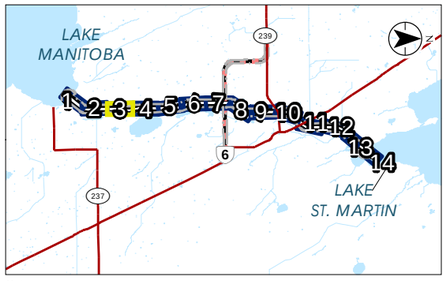
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Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
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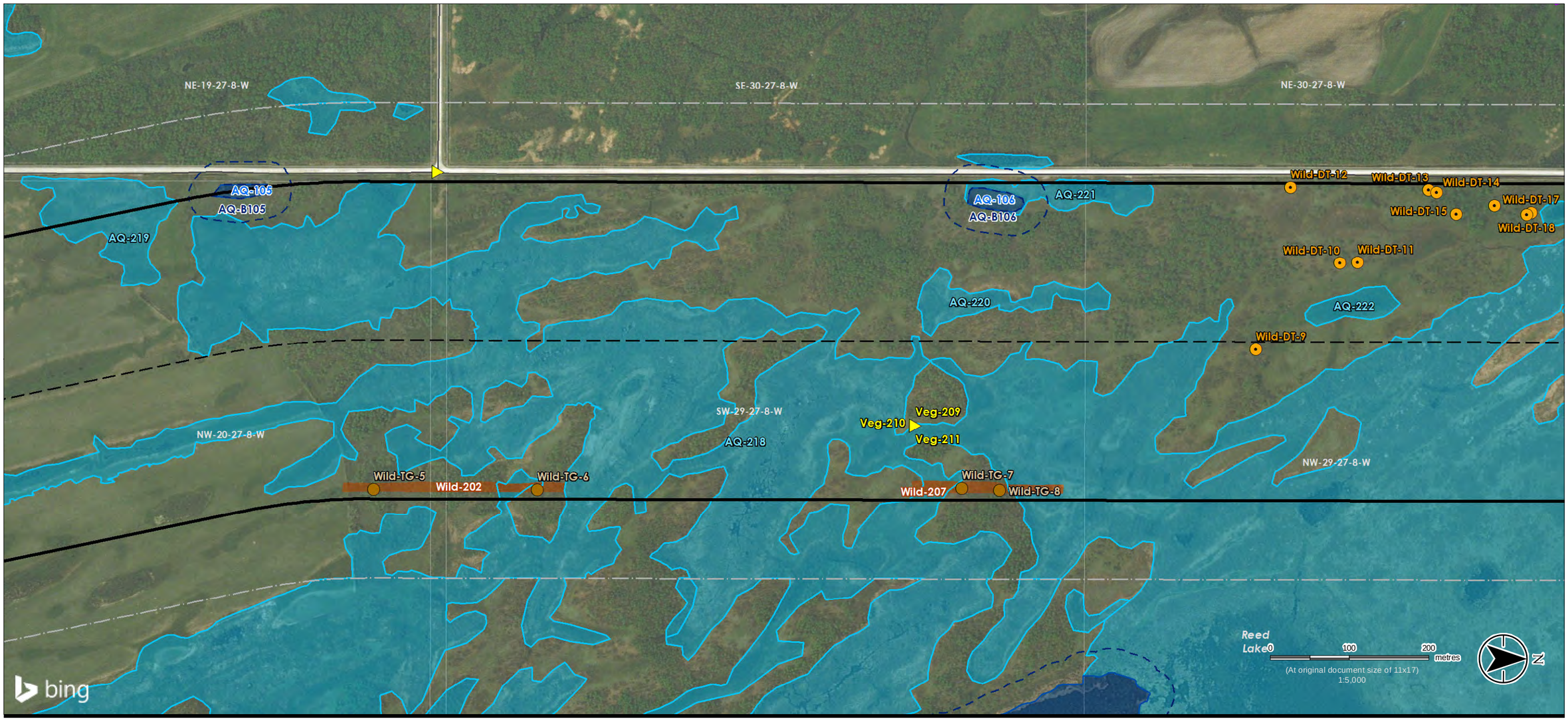
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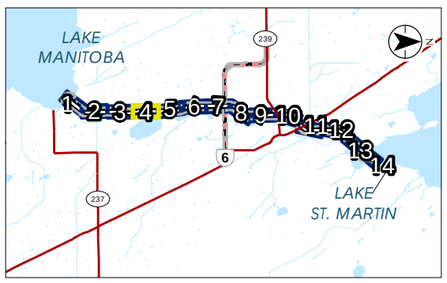
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Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Notes
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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

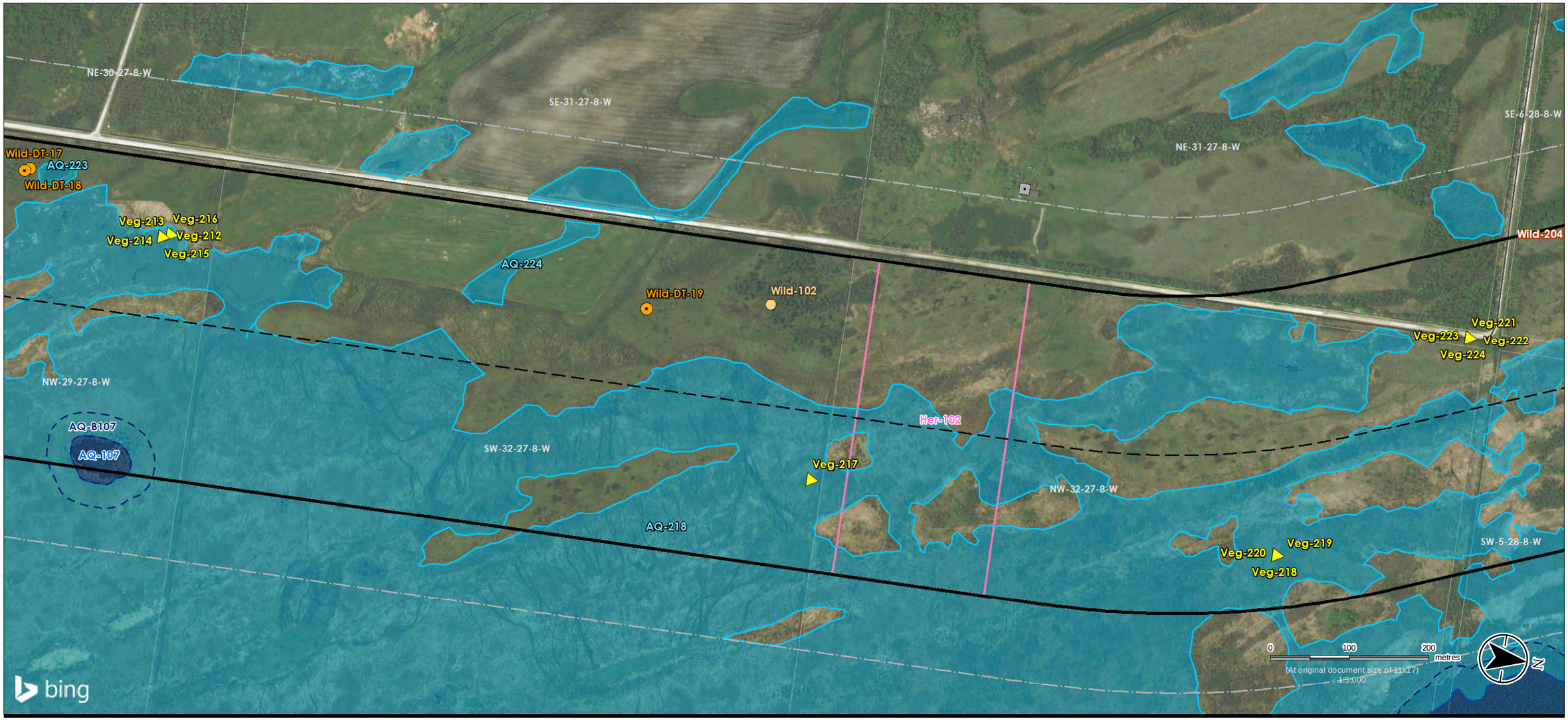
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Construction Environmental Protection Plan

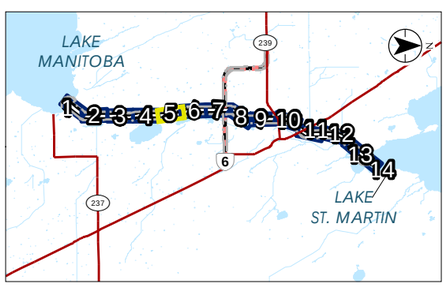
Figure No.
Map 1- 4

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
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- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Stick Nest

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
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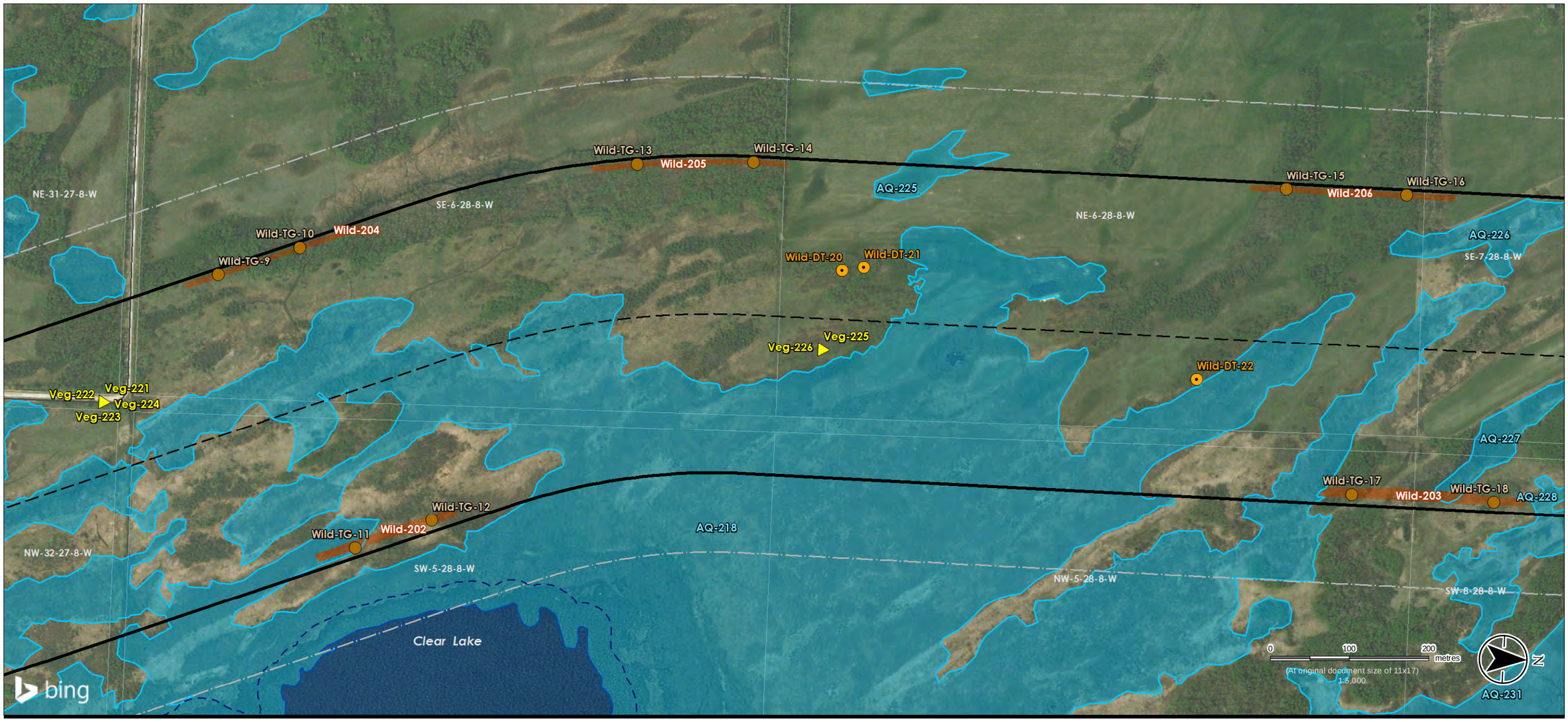
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Construction Environmental Protection Plan

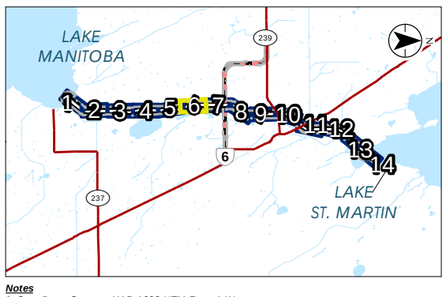
Figure No.
Map 1- 5

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Aquatics (AQ)
- Waterbody**
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Vegetation (Veg) & Agricultural Biosecurity
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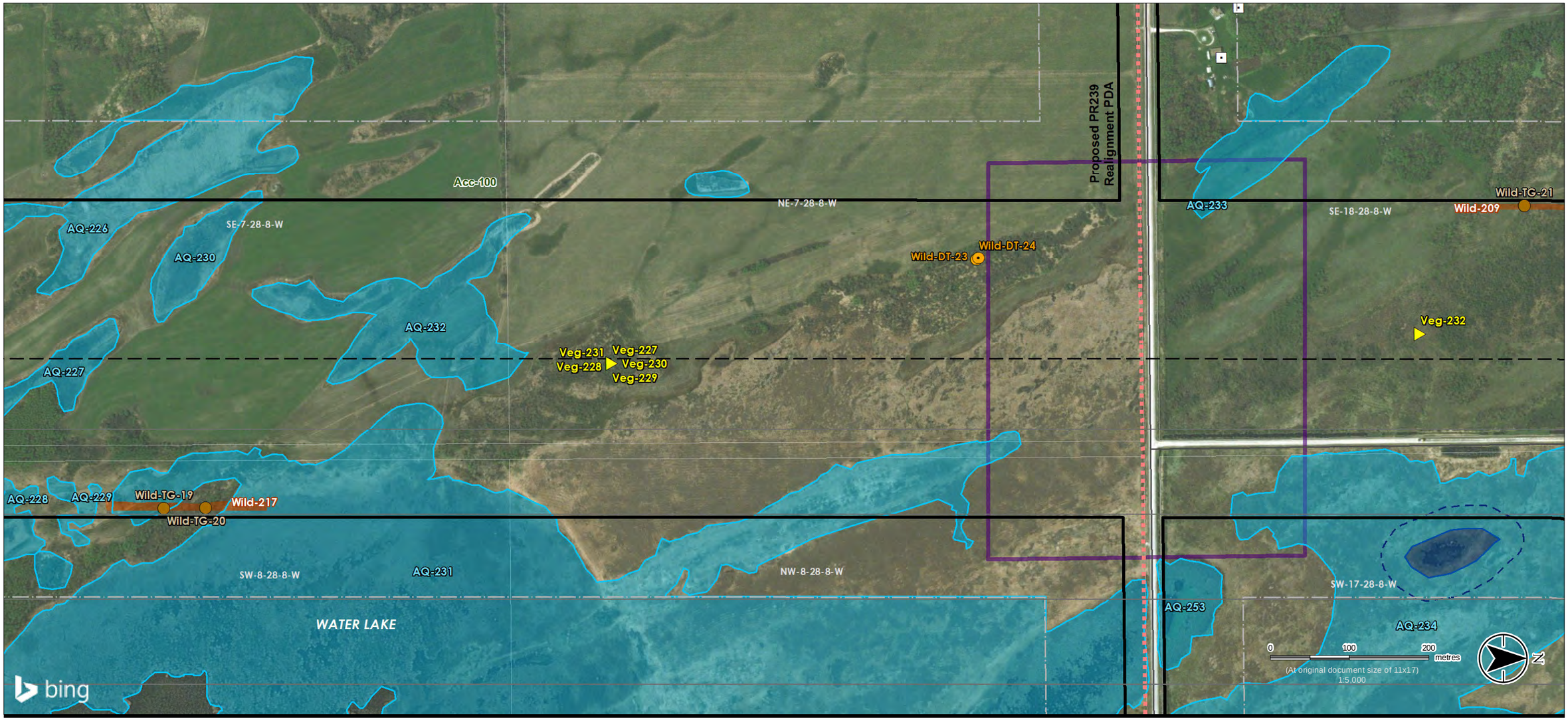
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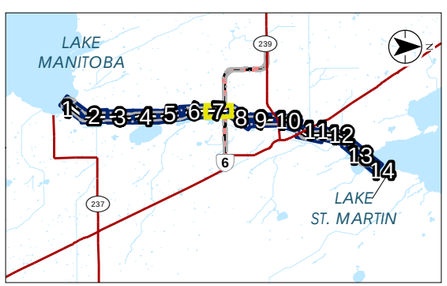
Figure No.
Map 1- 6

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline

Project Components*
- Proposed Bridge
- Proposed PR239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Predicted Noise Receptors During Project Construction
- Potential High Noise Receptor

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**

- Wetland (Class III and IV)

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
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Manitoba

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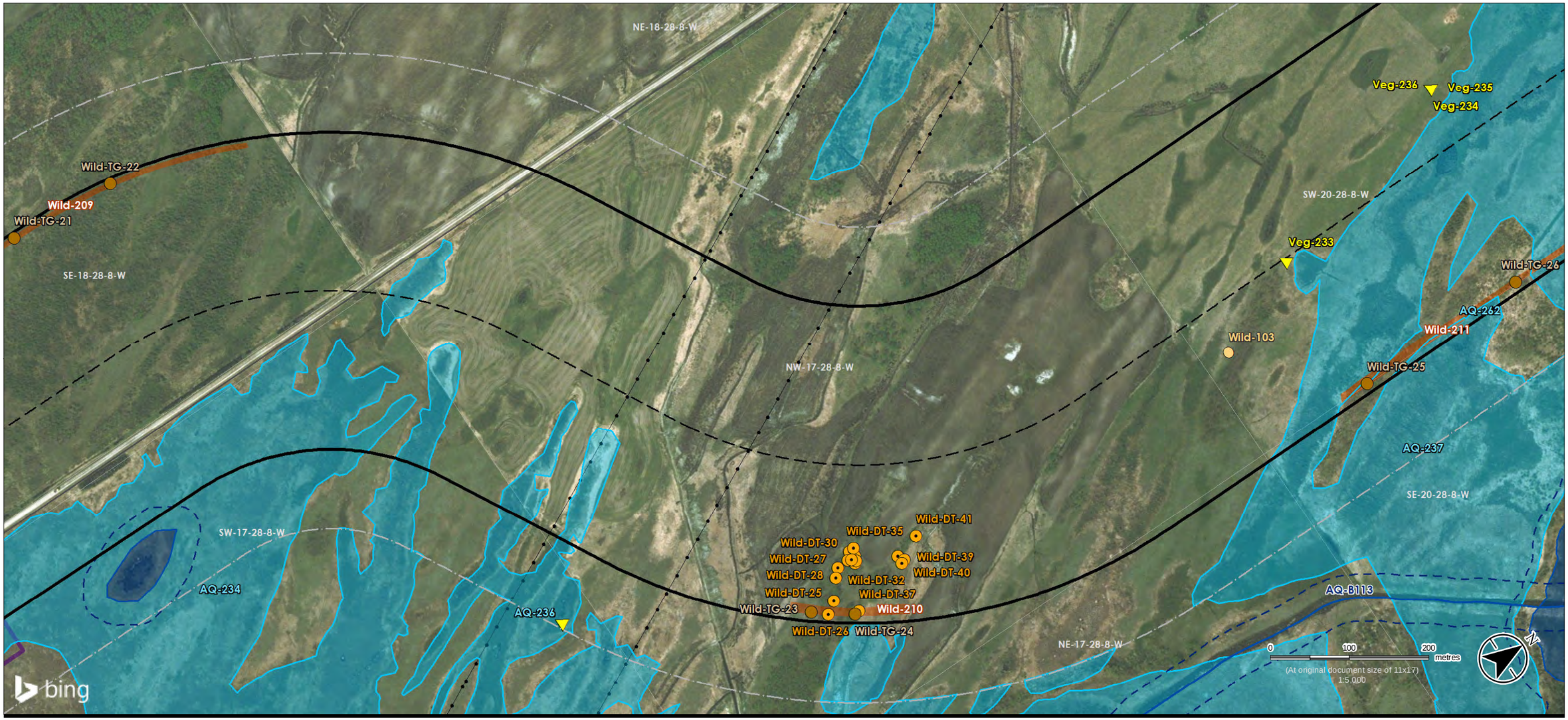
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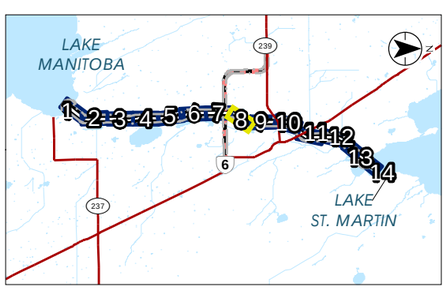
Figure No.
Map 1- 7

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline

Project Components*
- Proposed Bridge
- Existing Transmission Line
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)
- Stick Nest

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**

- Wetland (Class III and IV)

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

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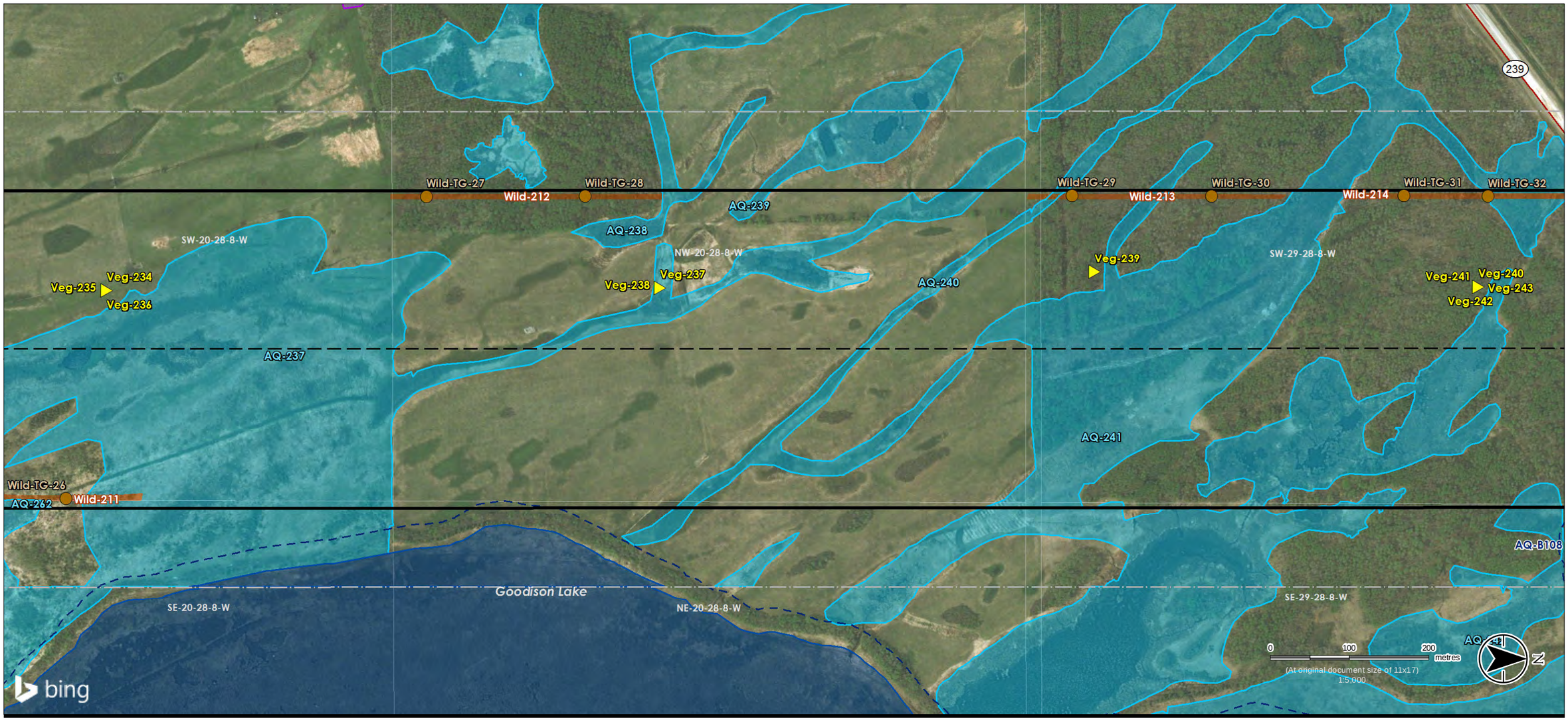
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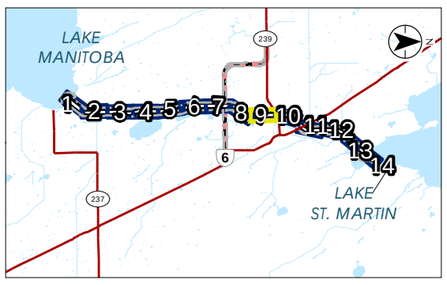
Figure No.
Map 1- 8

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Highway
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree Install Target (TG)

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
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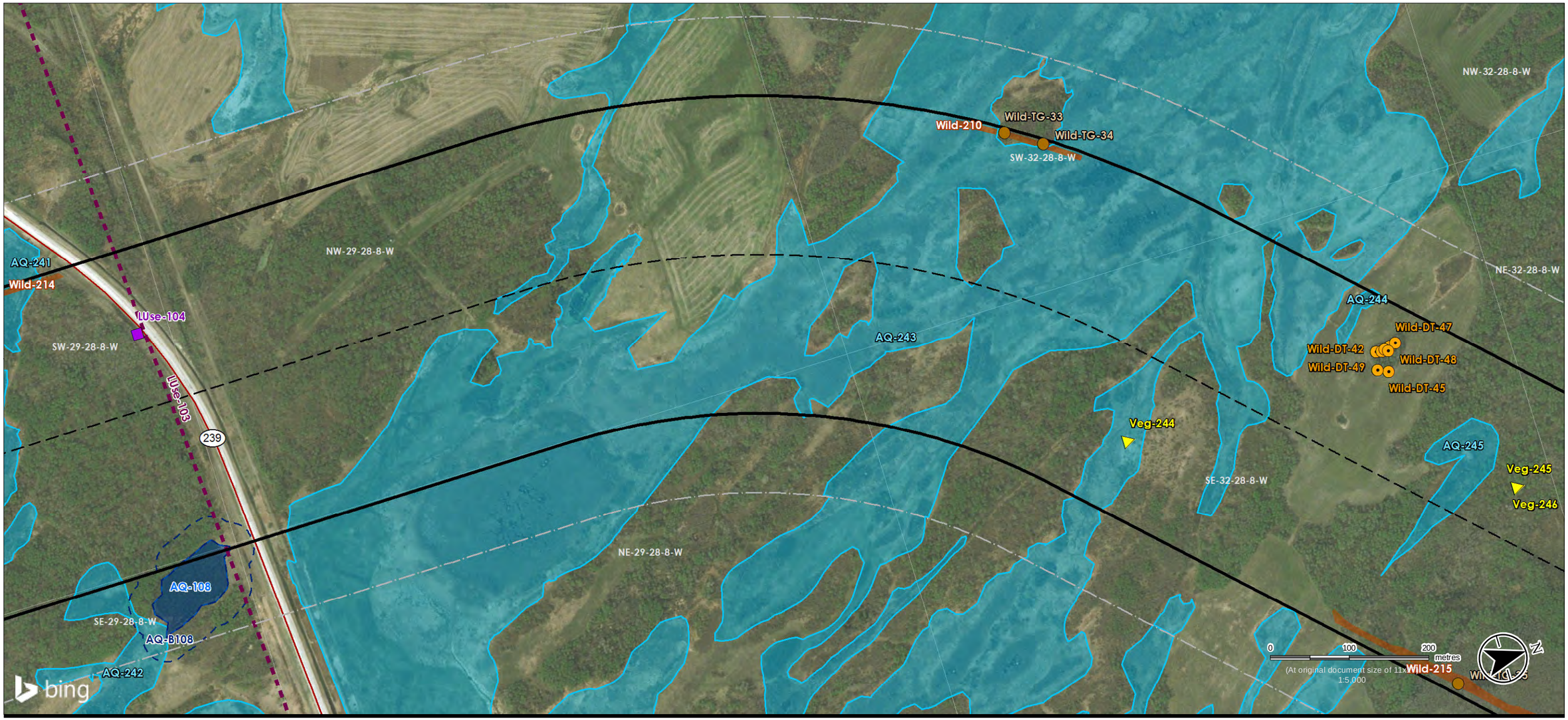
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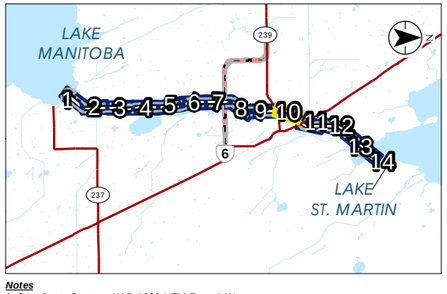
Figure No.
Map 1- 9

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Highway
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Land Use (LUse)
- Recreation - Shelter

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody**
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Wildlife
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Vegetation (Veg) & Agricultural Biosecurity
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Manitoba | Stantec

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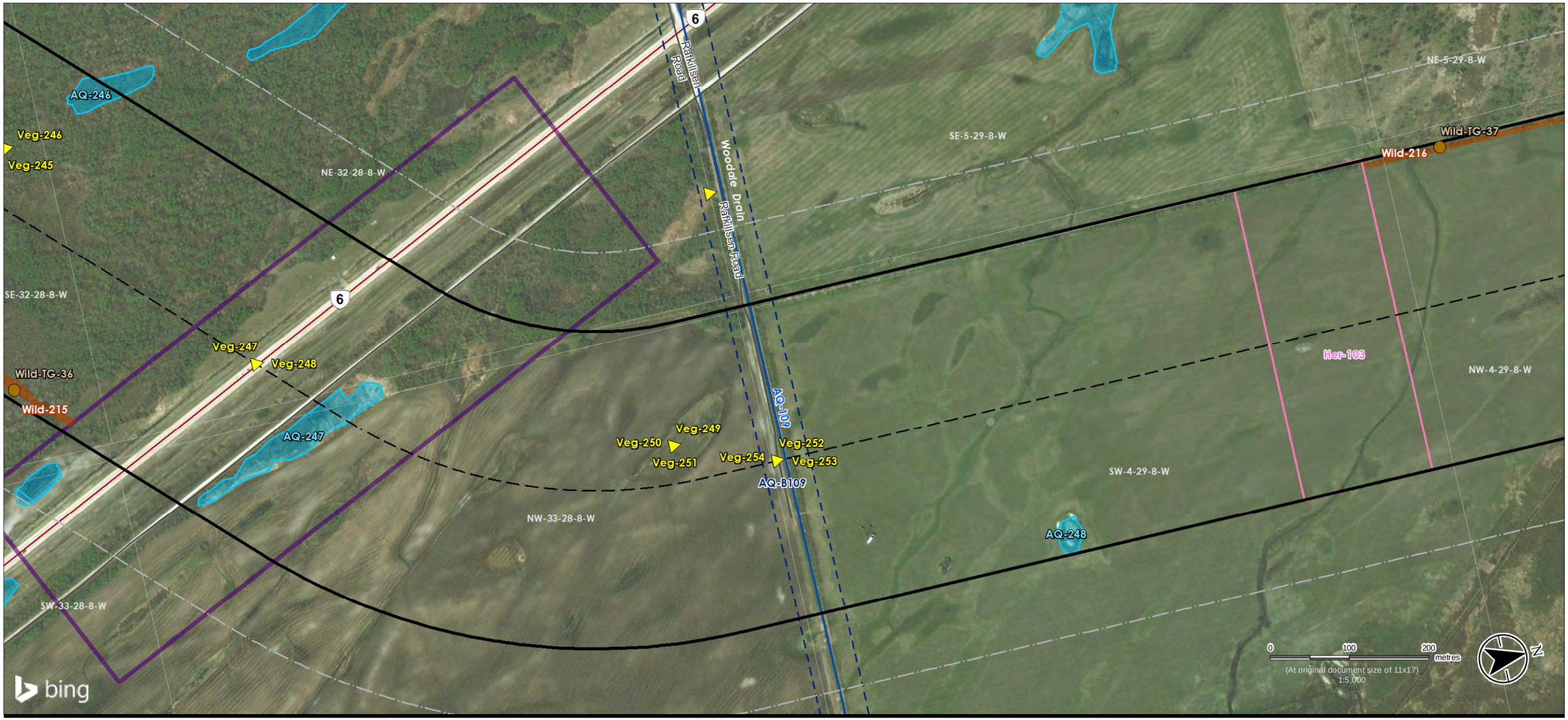
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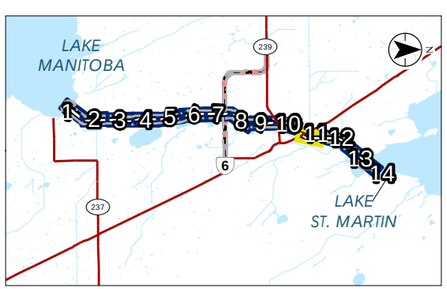
Figure No.
Map 1- 10

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline

Project Components*
- Proposed Bridge
- Highway
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree Install Target (TG)

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
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Notes:
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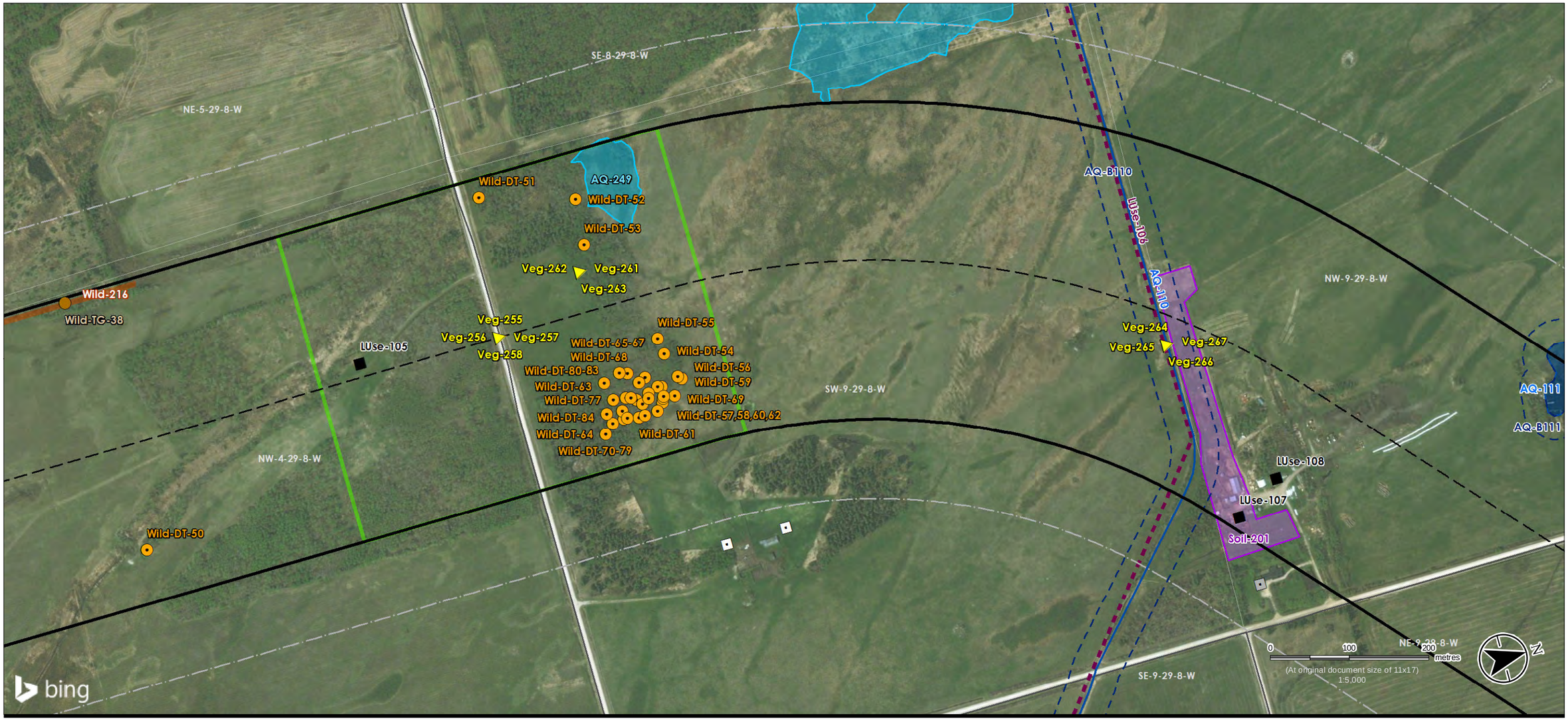
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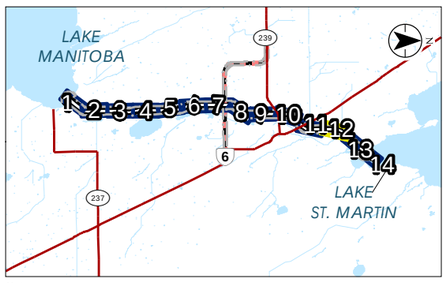
Figure No.
Map 1- 11

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline

Project Components*
- Proposed Water Control
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Land Use (LUse)
- Building

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree for Salvage (DT)
- Decadent Tree Install Target (TG)

Predicted Noise Receptors During Project Construction
- Potential High Noise Receptor
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Watercourse Crossing

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody**
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- Manure Impacted Site (Restricted Access Zone [RAZ])

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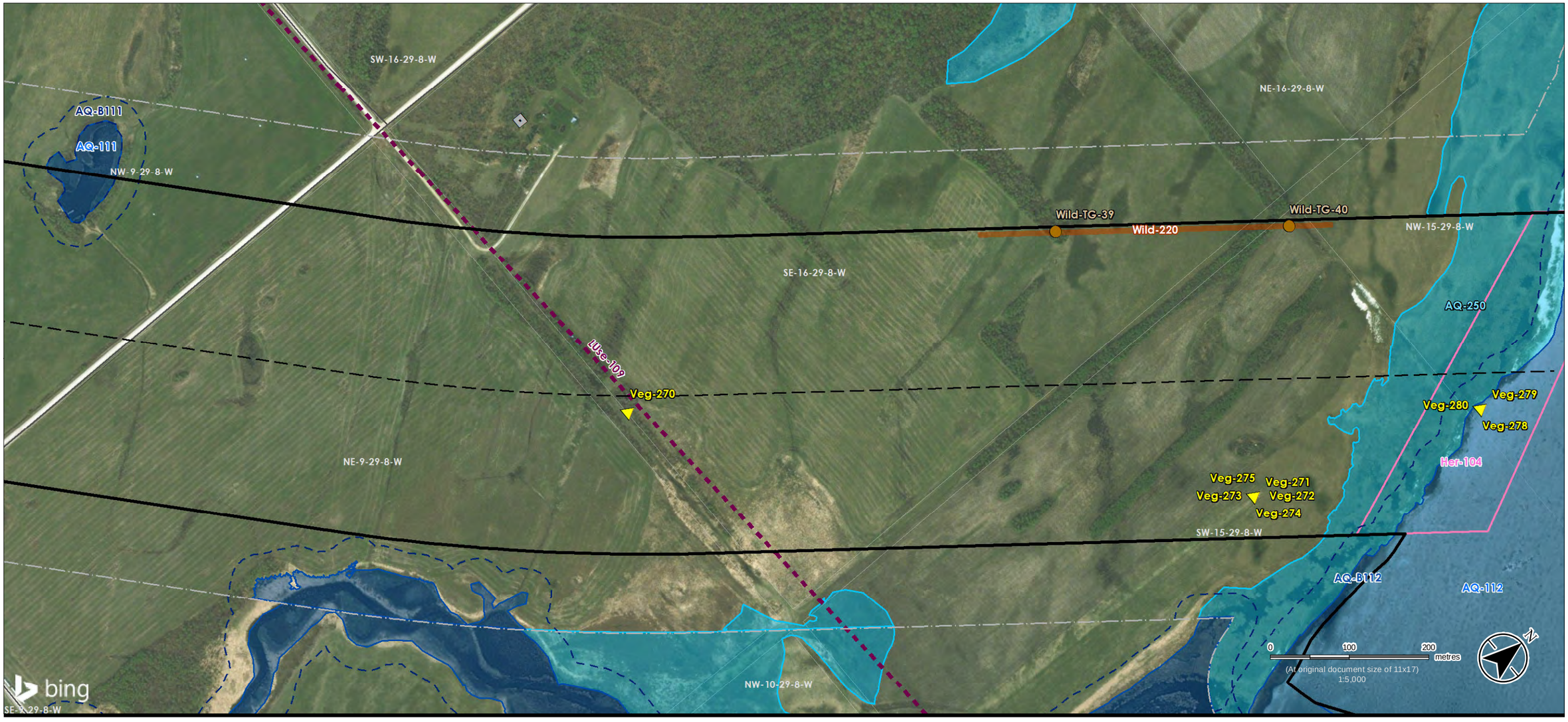
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Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

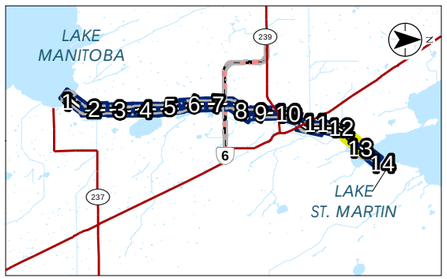
Figure No.
Map 1- 12

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree Install Target (TG)

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

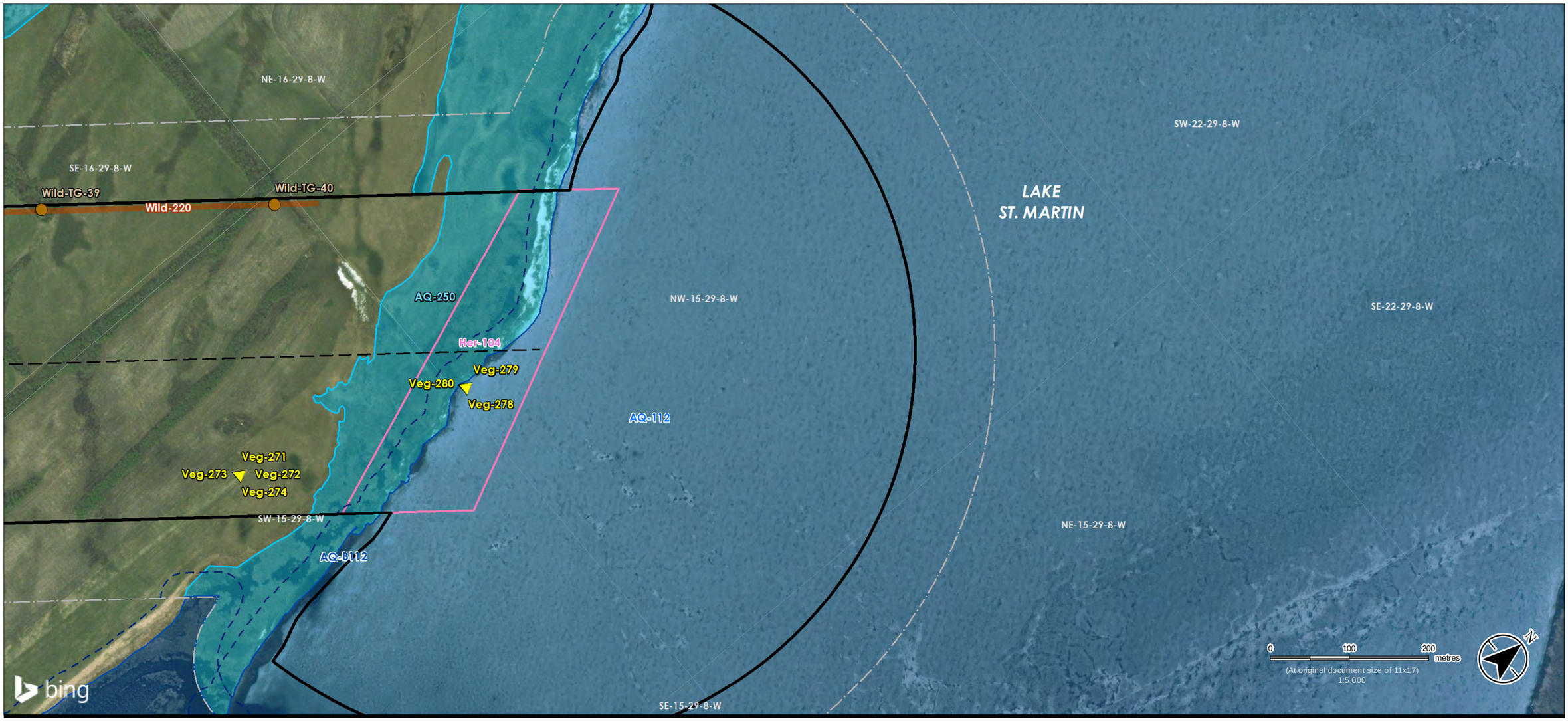
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Manitoba Transportation & Infrastructure
Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

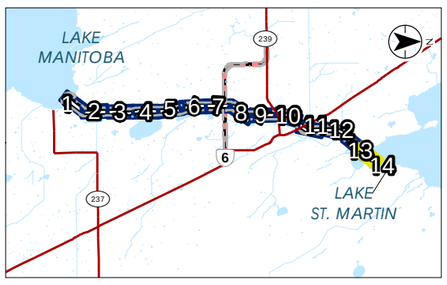
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Map 1- 13

Title
Lake Manitoba Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Wildlife (Wild)
- Decadent Tree Install Target (TG)

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/ Watercourse)**
- Wetland (Class III and IV)

Heritage (Her)
- Heritage Sensitive Area

Wildlife
- Red-headed Woodpcker Habitat Management Area

Vegetation (Veg) & Agricultural Biosecurity
- Weed Infestation (Restricted Access Zone [RAZ]) - Locations to Be Determined

Notes
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Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

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Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1- 14

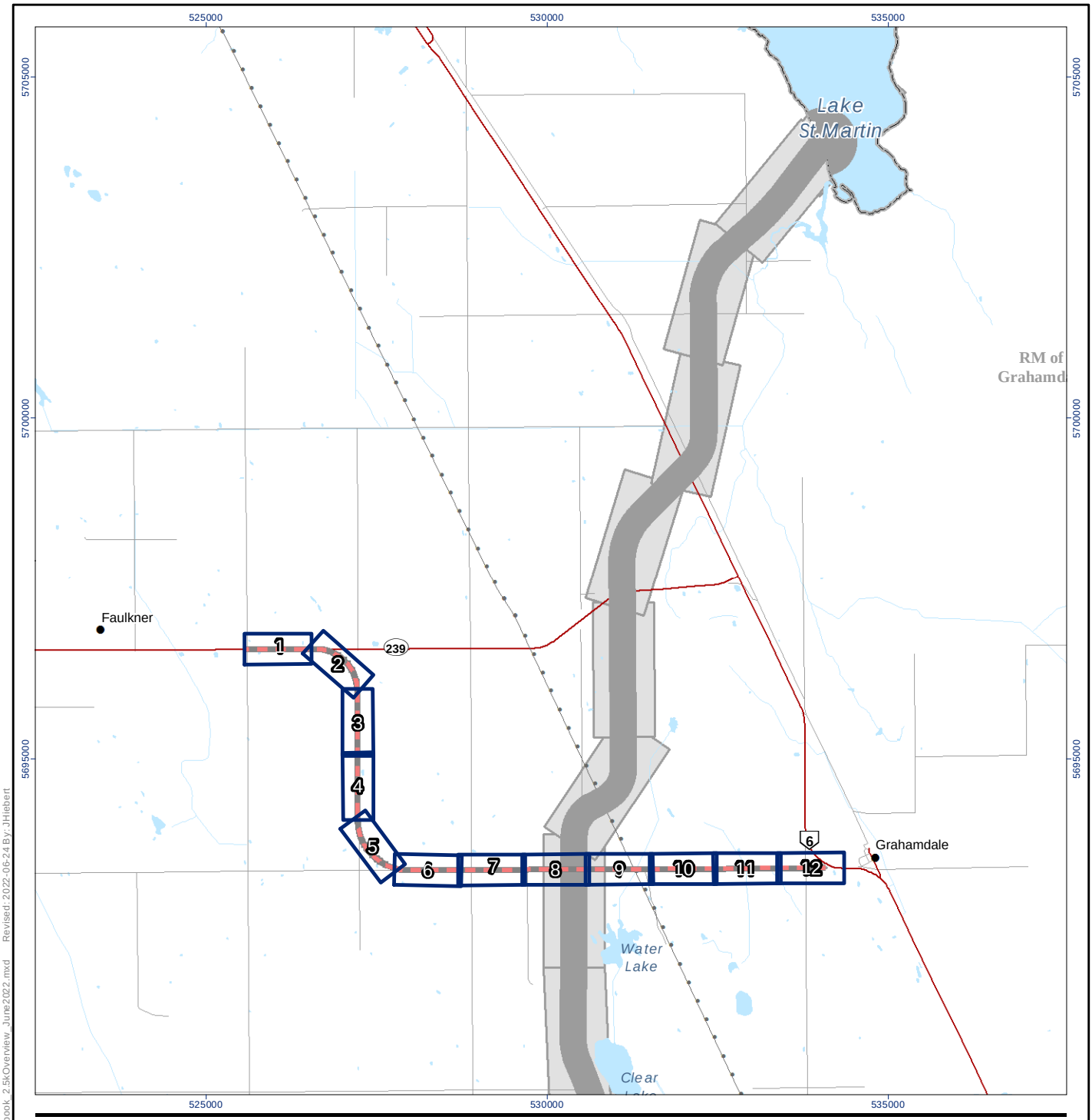
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Lake Manitoba Outlet Channel Construction Environmental Protection Plan

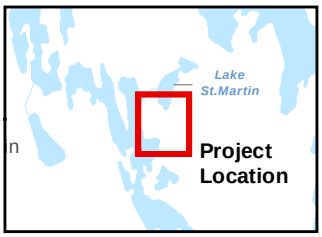
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APPENDIX 2

PR 239 Environmental Protection Plan Mapbook





Legend

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area
- Proposed PR 239 Realignment
- LMOC 5k Map Grid
- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Rural Municipality

0 1,000 2,000 metres

(At original document size of 8.5x11)
1:85,000

N

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Stantec Consulting, Manitoba Infrastructure

Stantec Manitoba

Project Location
Lake Manitoba/Lake St.Martin
Manitoba

Prepared by JH on 2022-06-24
TR by GK on 2022-06-24

Client/Project
111475120 REVA

Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel Project

Map 1-0

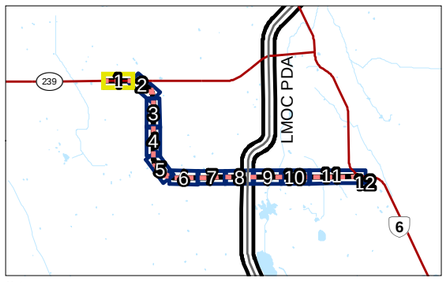
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PR 239 Realignment
CEnvPP Map Grid Overview

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Highway
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Waterbody
- Wetland

Notes

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2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP
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Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

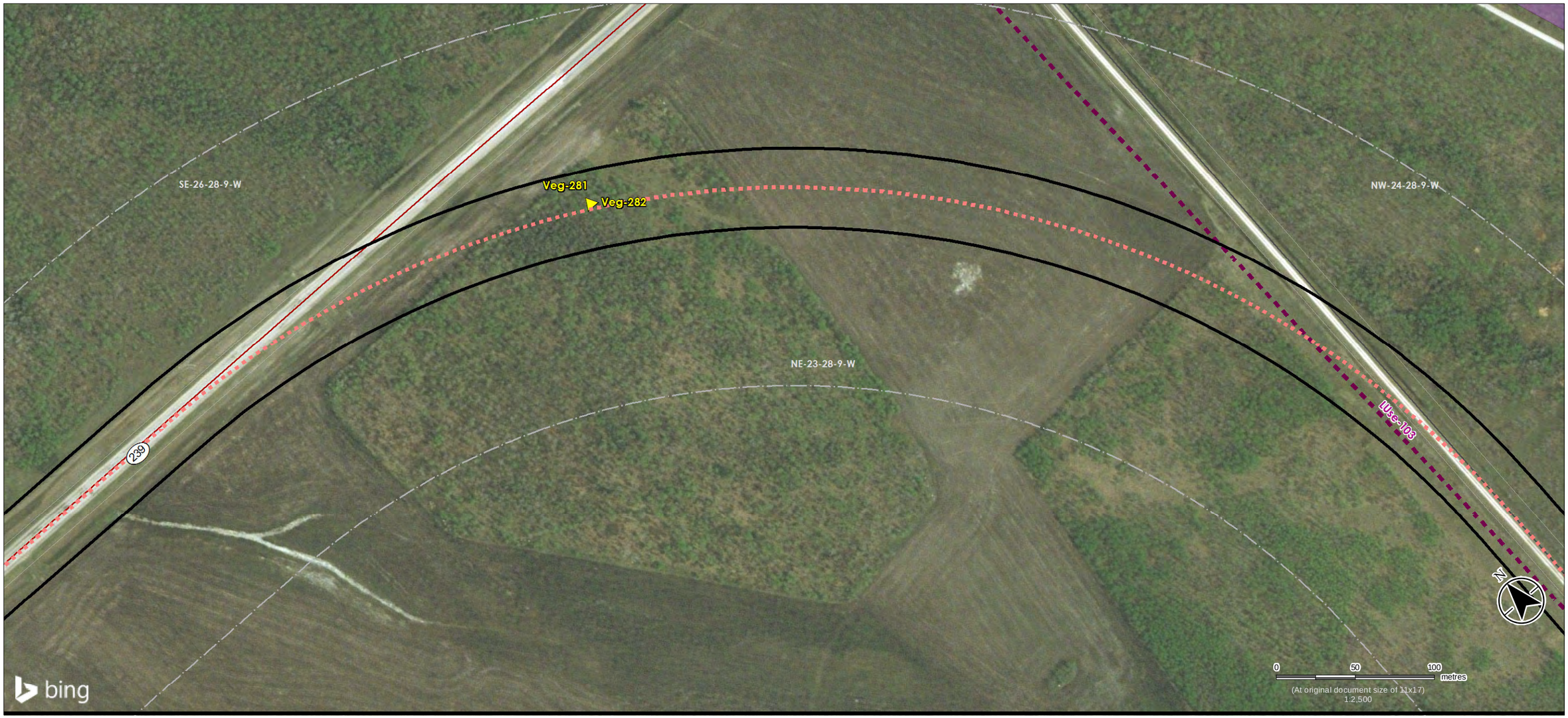
Client/Project
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PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

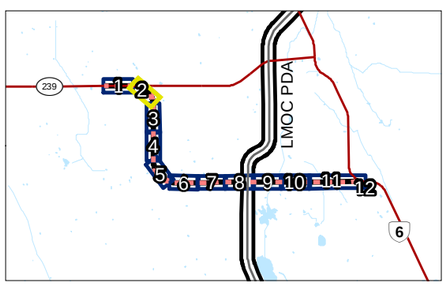
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Map 1- 1

Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Highway
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Land Use (LUse)
- Recreational Trails

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes

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2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP
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Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

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Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

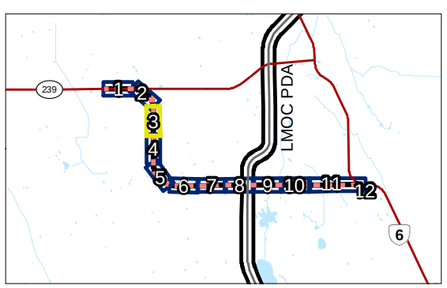
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Map 1- 2

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PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Land Use (LUse)
- Recreational Trails

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes

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Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

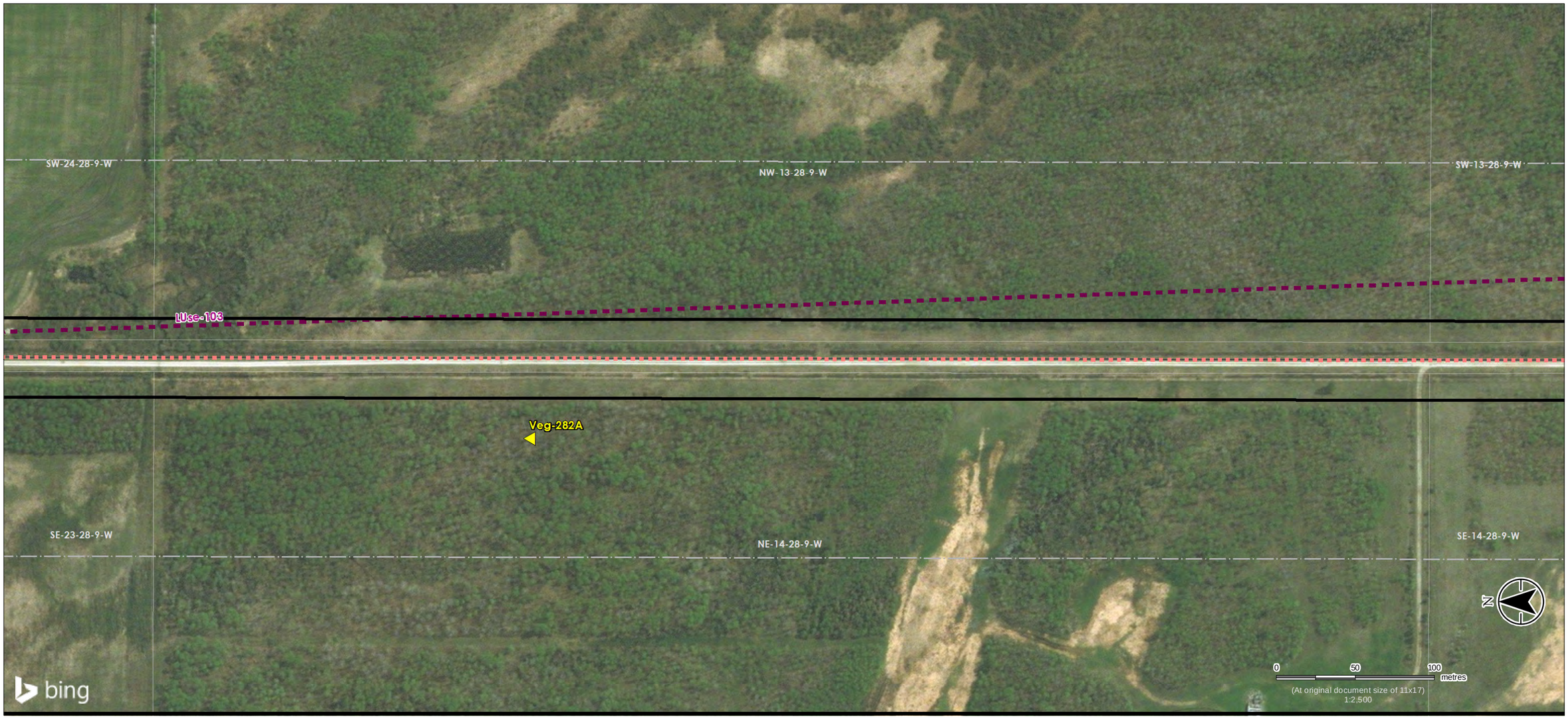
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Construction Environmental Protection Plan

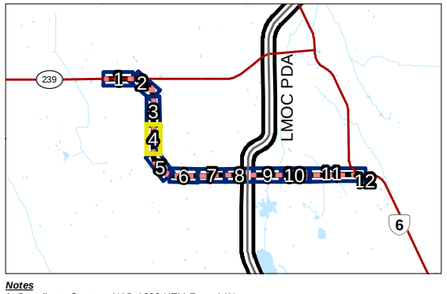
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PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Land Use (LUse)
- Recreational Trails

Notes

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Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

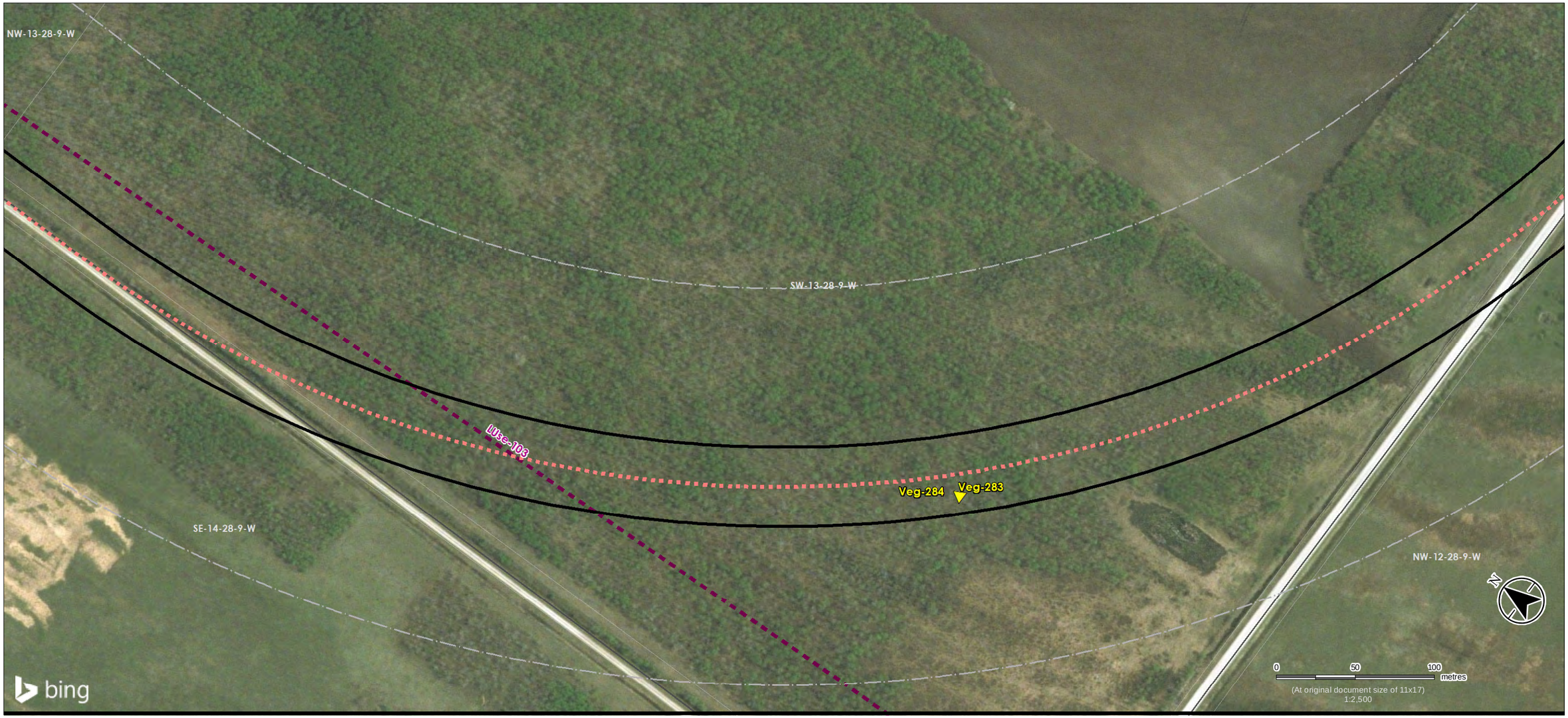
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PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

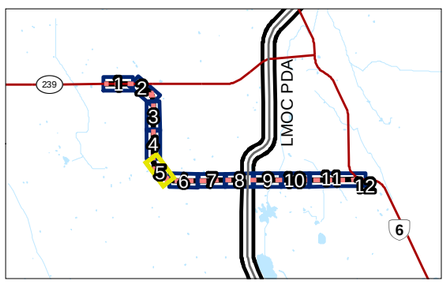
Figure No.
Map 1- 4

Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Land Use (LUse)
- Recreational Trails

Notes

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Notes:
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MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
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Technical Review by NB on 2022-06-28

Client/Project
111475120 REVE
Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
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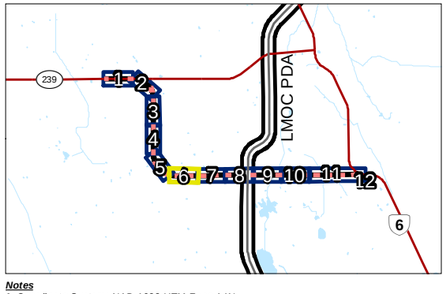
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Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Aquatics (AQ)
- Wetland

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes

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2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
3. Background Imagery: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

Client/Project
111475120 REVE
Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

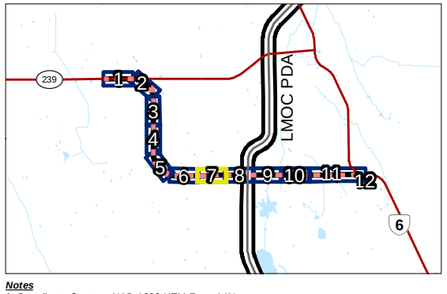
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Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Predicted Noise Receptors During Project Construction
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Wetland

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes

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2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP
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Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

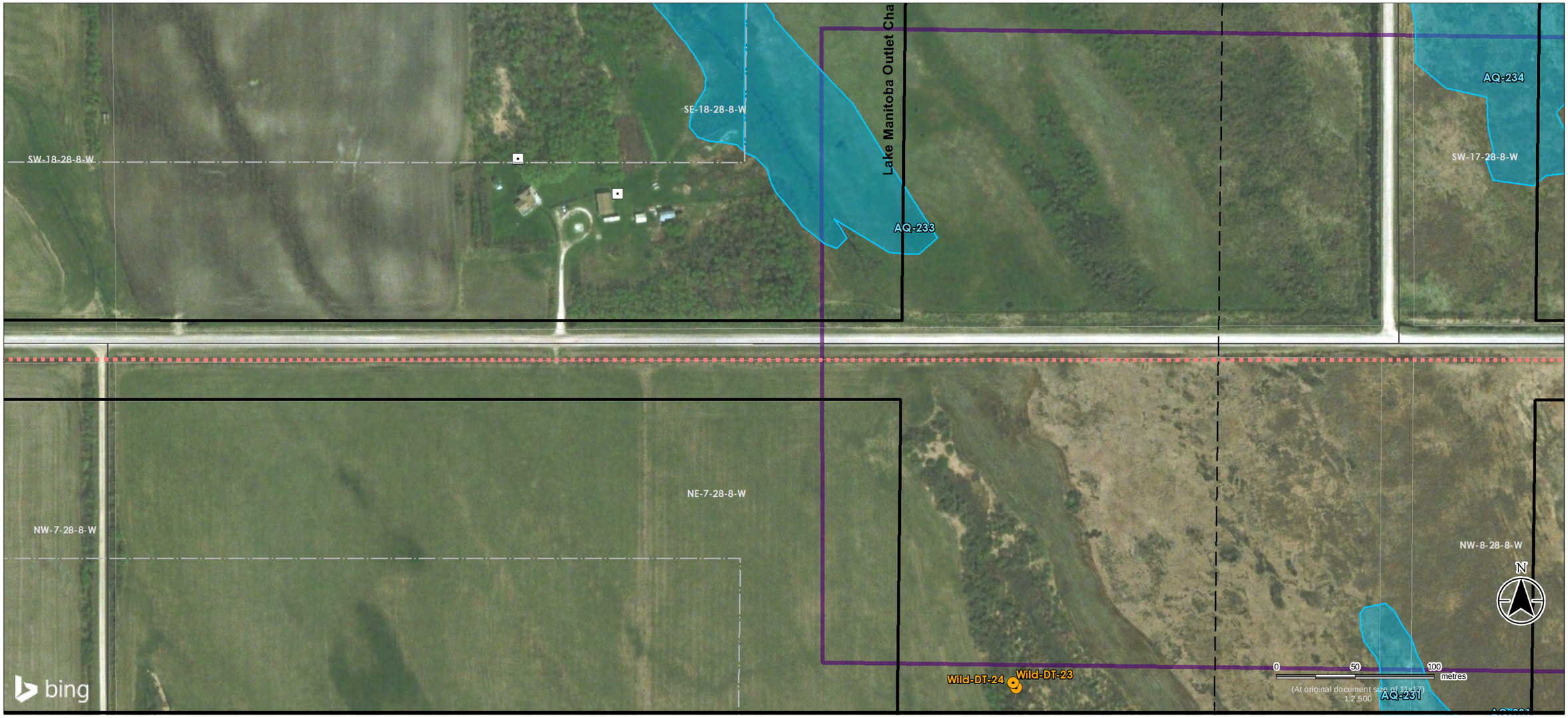
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Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
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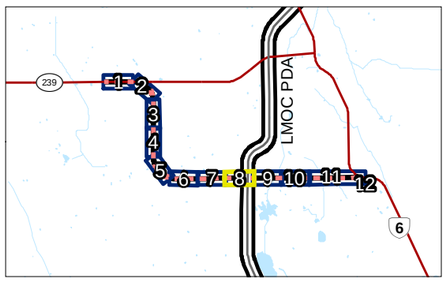
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Map 1- 7

Title
PR 239 Realignment Construction Environmental Protection Plan

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Notes
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Legend

- PR 239 Realignment Project Development Area (PDA)

Project Components*

- Proposed Bridge
- Proposed PR 239 Realignment
- Lake Manitoba Outlet Channel (LMOC) - Approximate Centerline
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Wildlife
- Decadent Tree for Salvage (DT)

Aquatics (AQ)
- Wetland

Predicted Noise Receptors During Project Construction
- Potential High High Noise Receptor

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

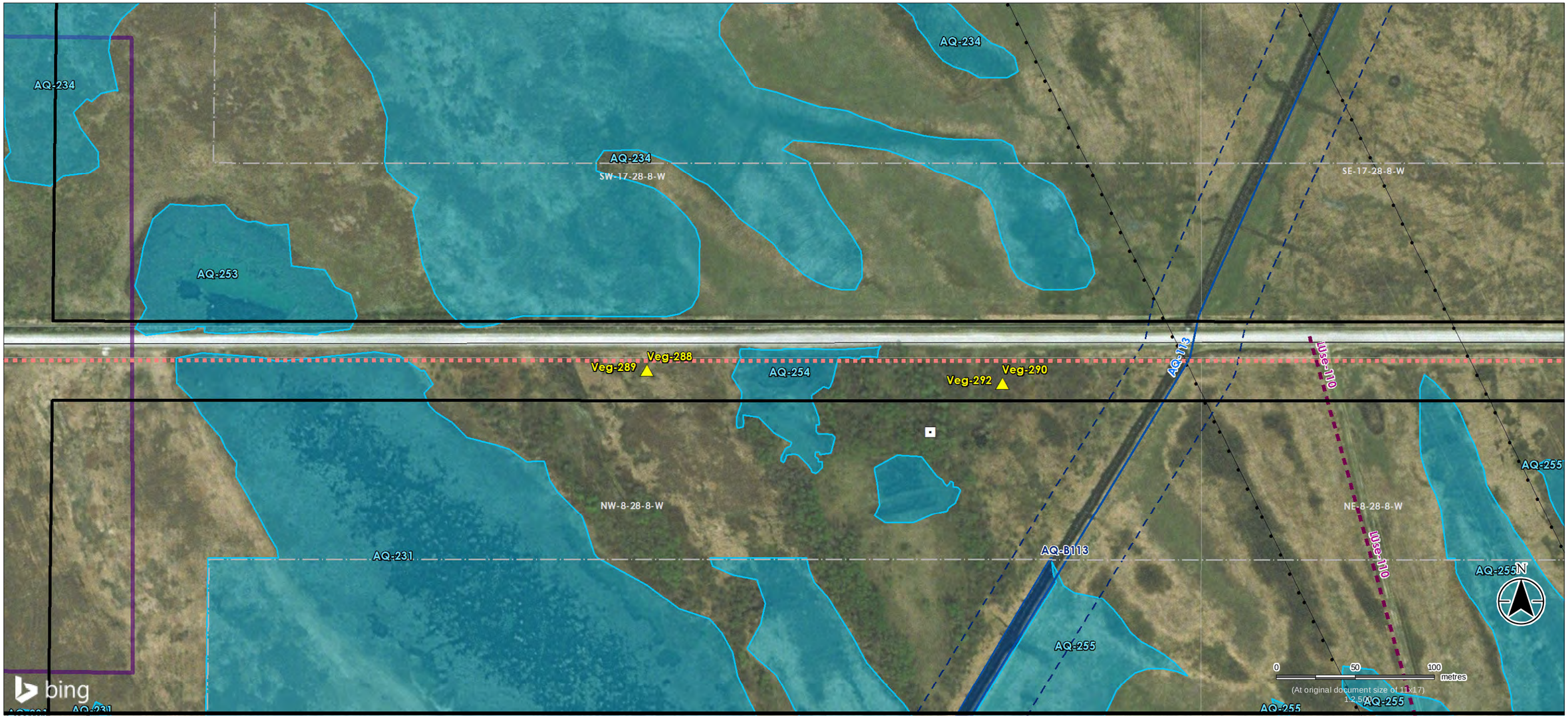
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Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel Construction Environmental Protection Plan

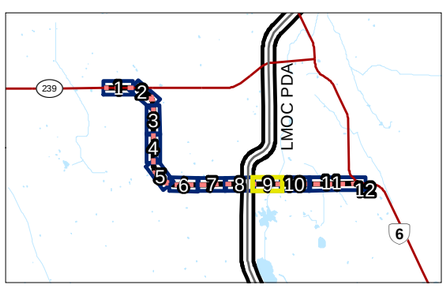
Figure No.
Map 1- 8

Title
PR 239 Realignment Construction Environmental Protection Plan

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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP

3. Background Imagery: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

Legend

- PR 239 Realignment Project Development Area (PDA)
- Project Components*
  - Proposed Bridge
  - Proposed PR 239 Realignment
  - Existing Transmission Line
  - Major Road
  - Quarter Sections
  - 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Predicted Noise Receptors During Project Construction
- Potential High Noise Receptor

Aquatics (AQ)
- Watercourse Crossing

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Waterbody
- Riparian Area (30m buffer of waterbody/watercourse)
- Wetland

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

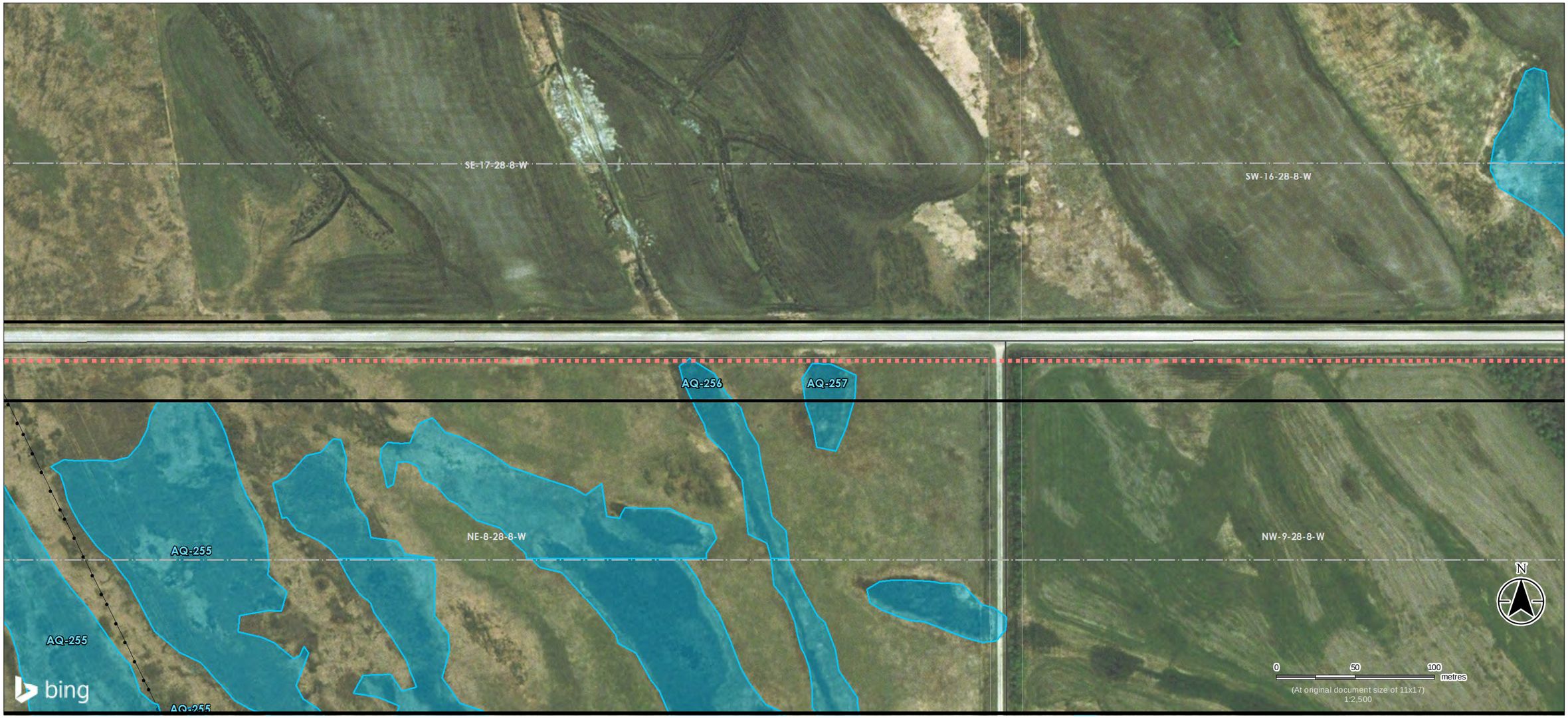
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PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

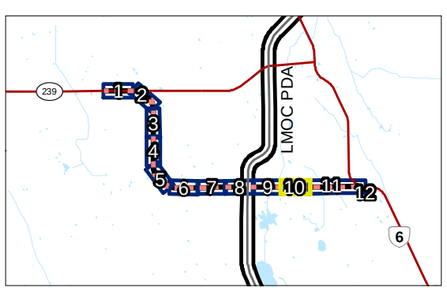
Figure No.
Map 1- 9

Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Existing Transmission Line
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Aquatics (AQ)

- Wetland

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP

3. Background Imagery: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

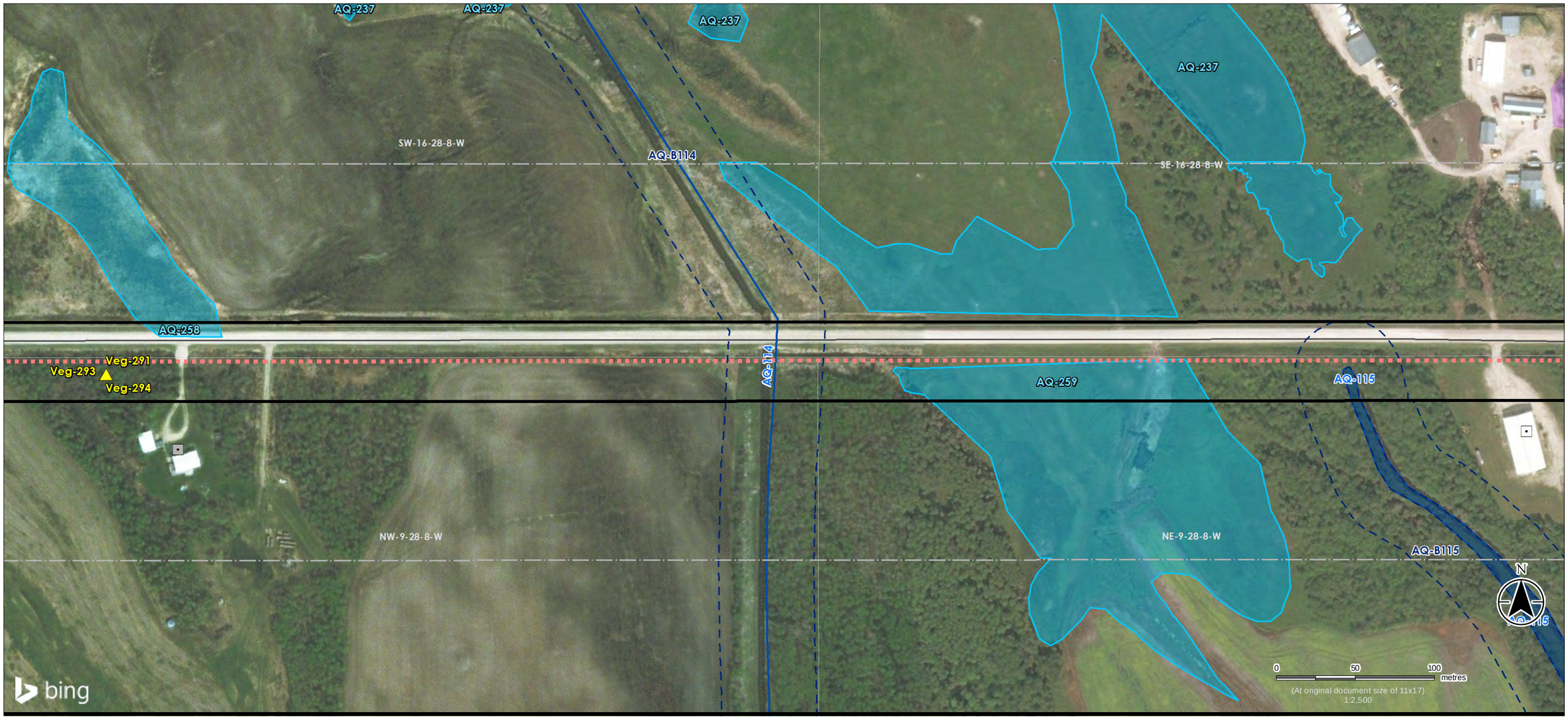
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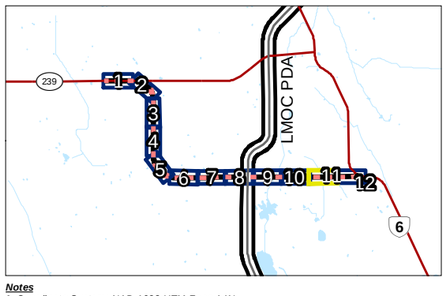
Figure No.
Map 1- 10

Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Vegetation (Veg)
- Invasive Species/Weeds

Predicted Noise Receptors During Project Construction
- Potential High Noise Receptor
- Potential Moderate Noise Receptor

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Waterbody
- Riparian Area (30m buffer of waterbody/watercourse)
- Wetland

Soils (Soil) & Agricultural Biosecurity
- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP
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Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

Client/Project
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Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

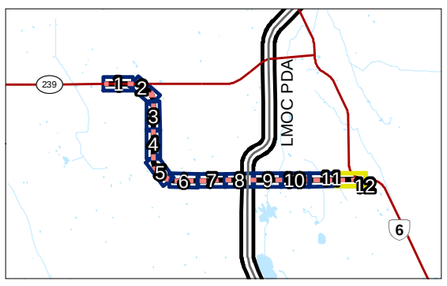
Figure No.
Map 1- 11

Title
PR 239 Realignment Construction Environmental Protection Plan

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Legend

- PR 239 Realignment Project Development Area (PDA)
- Proposed PR 239 Realignment
- Highway
- Major Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites

Predicted Noise Receptors During Project Construction

- Potential High Noise Receptor
- Potential Moderate Noise Receptor

Aquatics (AQ)

- Waterbody
- Riparian Area (30m buffer of waterbody/watercourse)
- Wetland

Soils (Soil) & Agricultural Biosecurity

- Manure Impacted Site (Restricted Access Zone [RAZ])

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.,WSP
3. Background Imagery: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by JH on 2022-06-28
Technical Review by NB on 2022-06-28

Client/Project 111475120 REVE
Manitoba Transportation and Infrastructure
PR 239 Alignment/Lake Manitoba Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1- 12

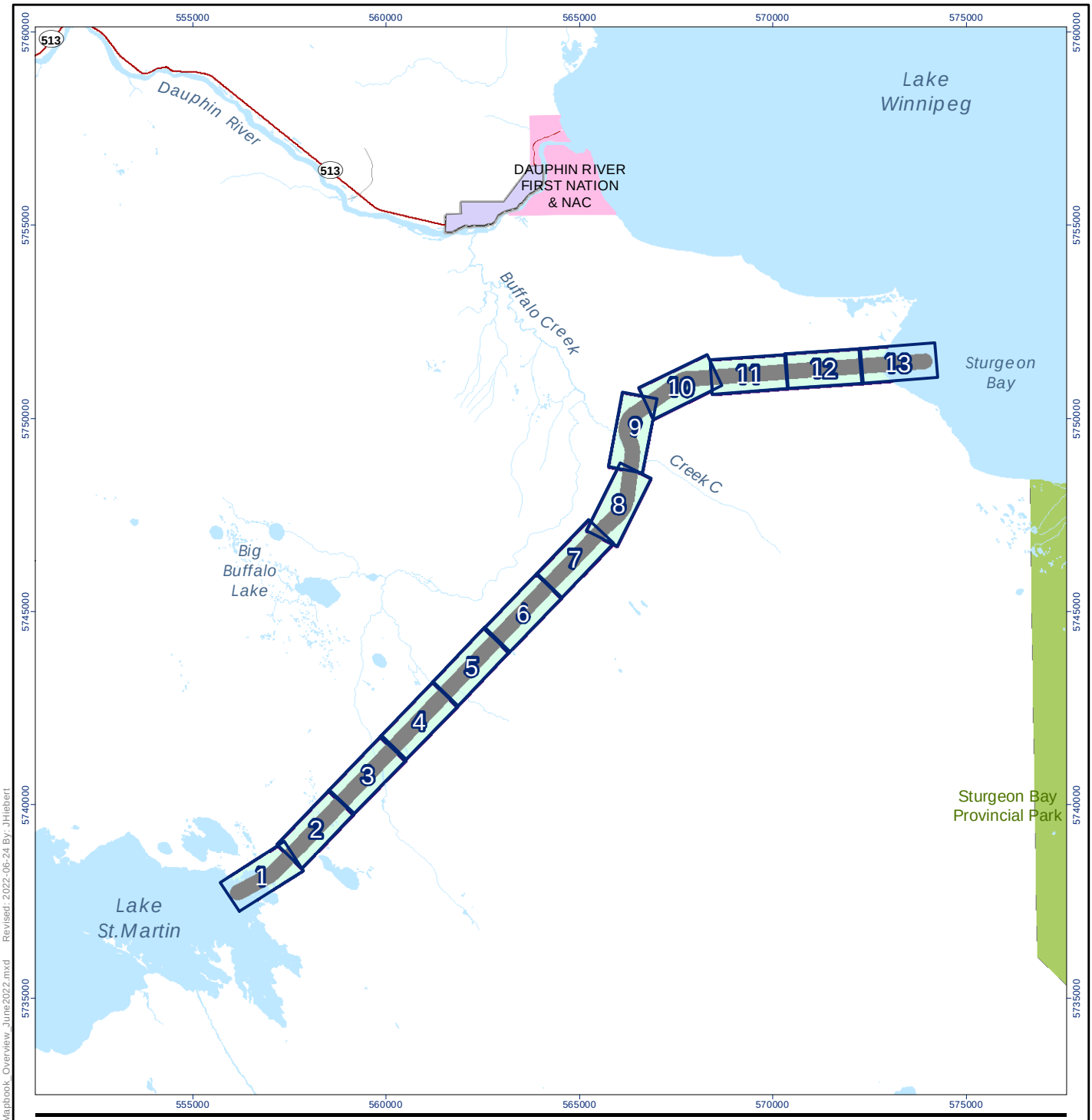
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PR 239 Realignment Construction Environmental Protection Plan

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APPENDIX 3

LSMOC Environmental Protection Plan Mapbook





Legend

- Lake St.Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC 5k Map Grid
- Provincial Highway (PTH/PR)
- Municipal Road
- Provincial Park
- Rural Municipality
- Northern Affairs Communities (NAC)
- First Nation

0 1,500 3,000 metres
(At original document size of 8.5x11)
1:150,000

N

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Stantec Consulting, Manitoba Infrastructure

Stantec Manitoba

Project Location
Lake Manitoba/Lake St.Martin
Manitoba

Prepared by JH on 2022-06-24
TR by NB on 2022-06-24

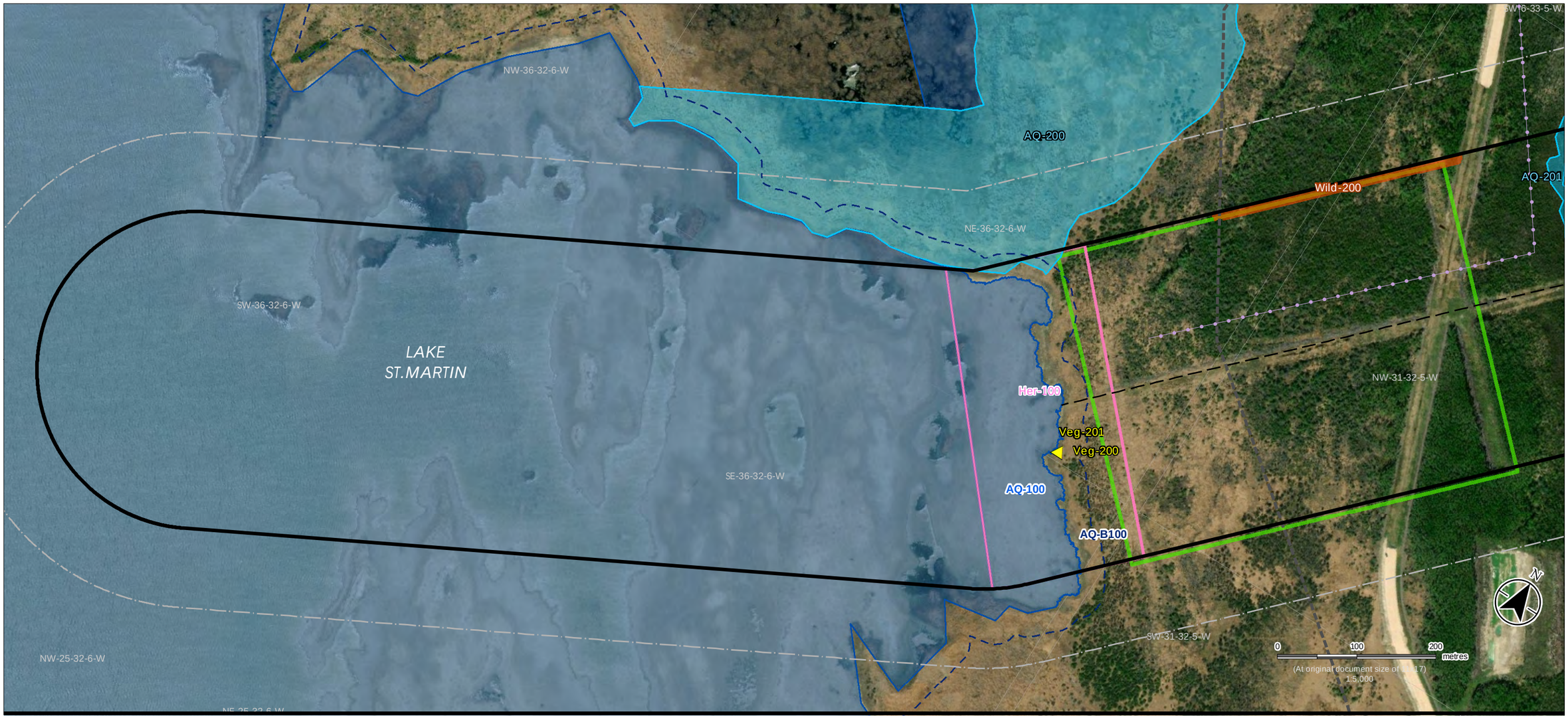
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Lake St.Martin Outlet Channel Project

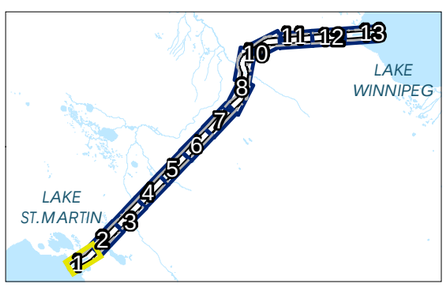
Figure No.
Map 1-0

Title
Lake St.Martin Outlet Channel CEnvPP Map Grid Overview

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3. Imagery: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)

Project Components*

- Proposed Water Control Structure
- LSMOC Approximate Centerline
- Planned Distribution Line
- Lake St. Martin Access Road
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)

- Invasive Species/Weeds

Aquatics (AQ)

- Waterbody**
- Riparian Area (30m Buffer of Waterbody/Watercourse)
- Wetland (Class III, IV & Fen-Graminoid)

Heritage (Her)

- Heritage Sensitive Area

Wildlife

- Eastern Whip-poor-wil Potential Habitat Management Area

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

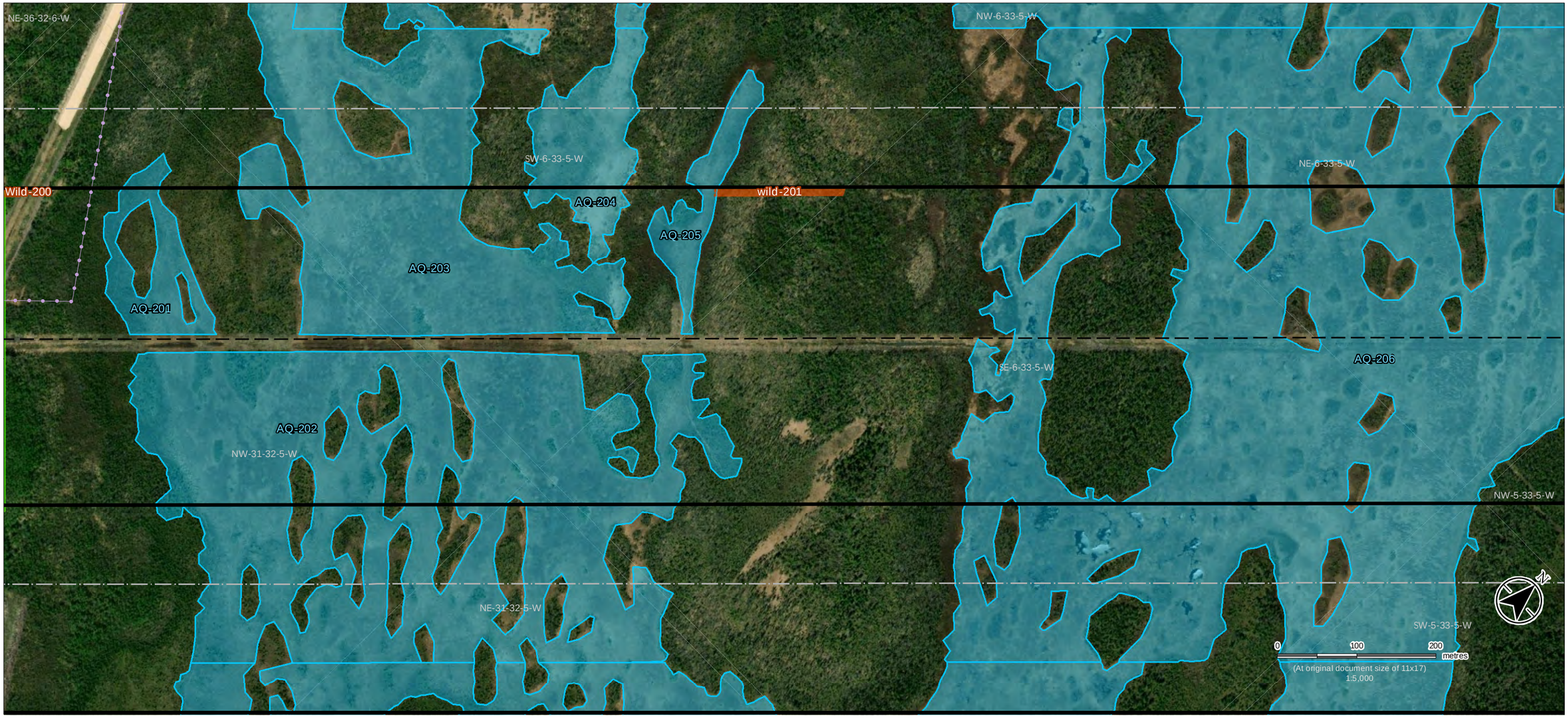
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Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

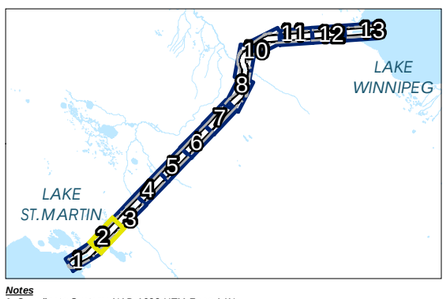
Figure No.
Map 1-1

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)

Project Components*

- Proposed Water Control Structure
- LSMOC Approximate Centerline
- Planned Distribution Line
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)

- Wetland (Class III, IV & Fen-Graminoid)

Wildlife

- Eastern Whip-poor-wil Potential Habitat Management Area

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

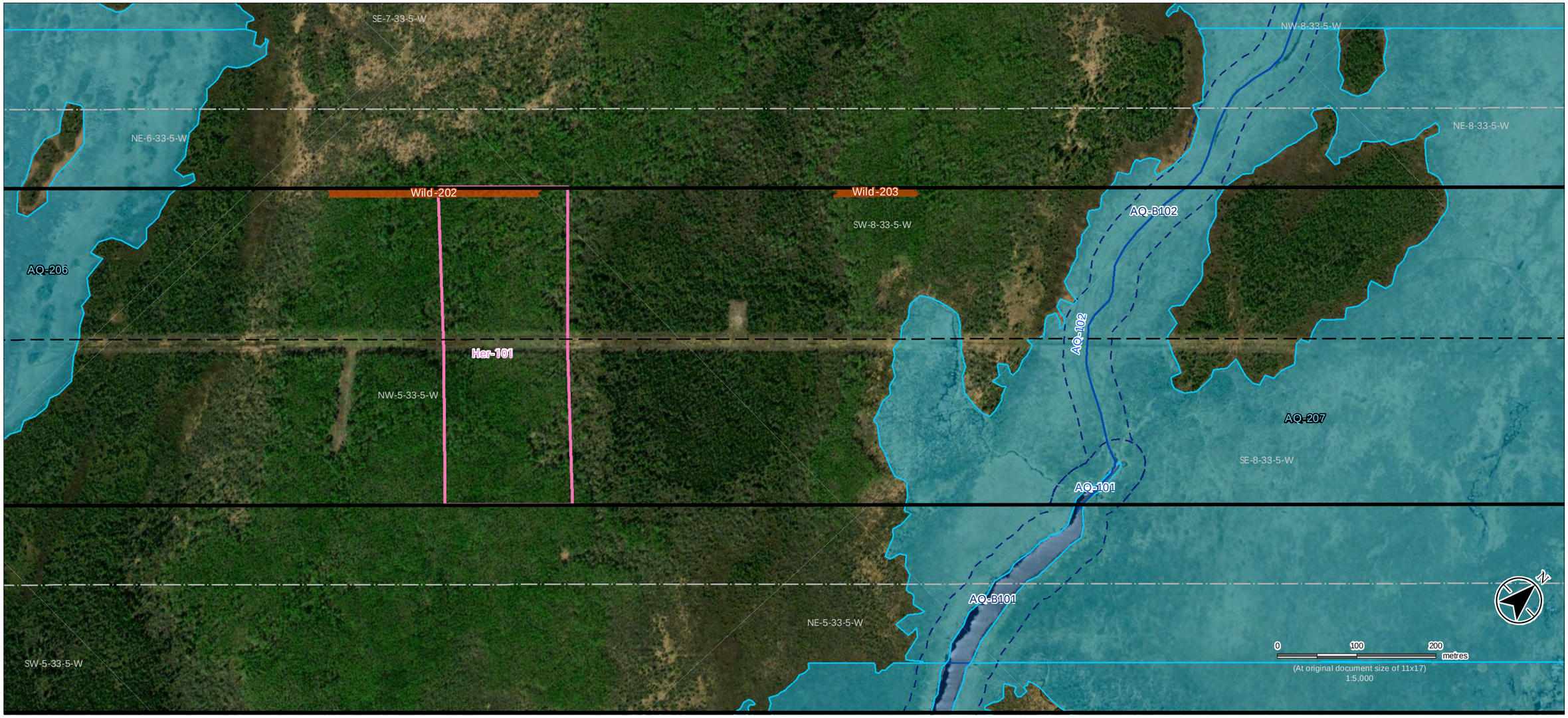
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Construction Environmental Protection Plan

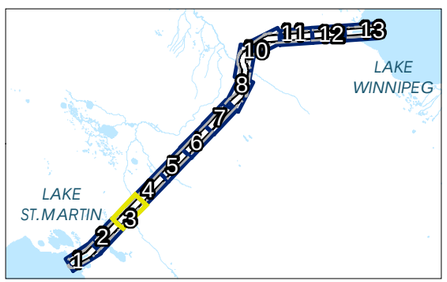
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Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/Watercourse)
- Wetland (Class III, IV & Fen-Graminoid)

Heritage (Her)
- Heritage Sensitive Area

Wildlife
- Eastern Whip-poor-wil Potential Habitat Management Area

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
3. Imagery: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St. Martin Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

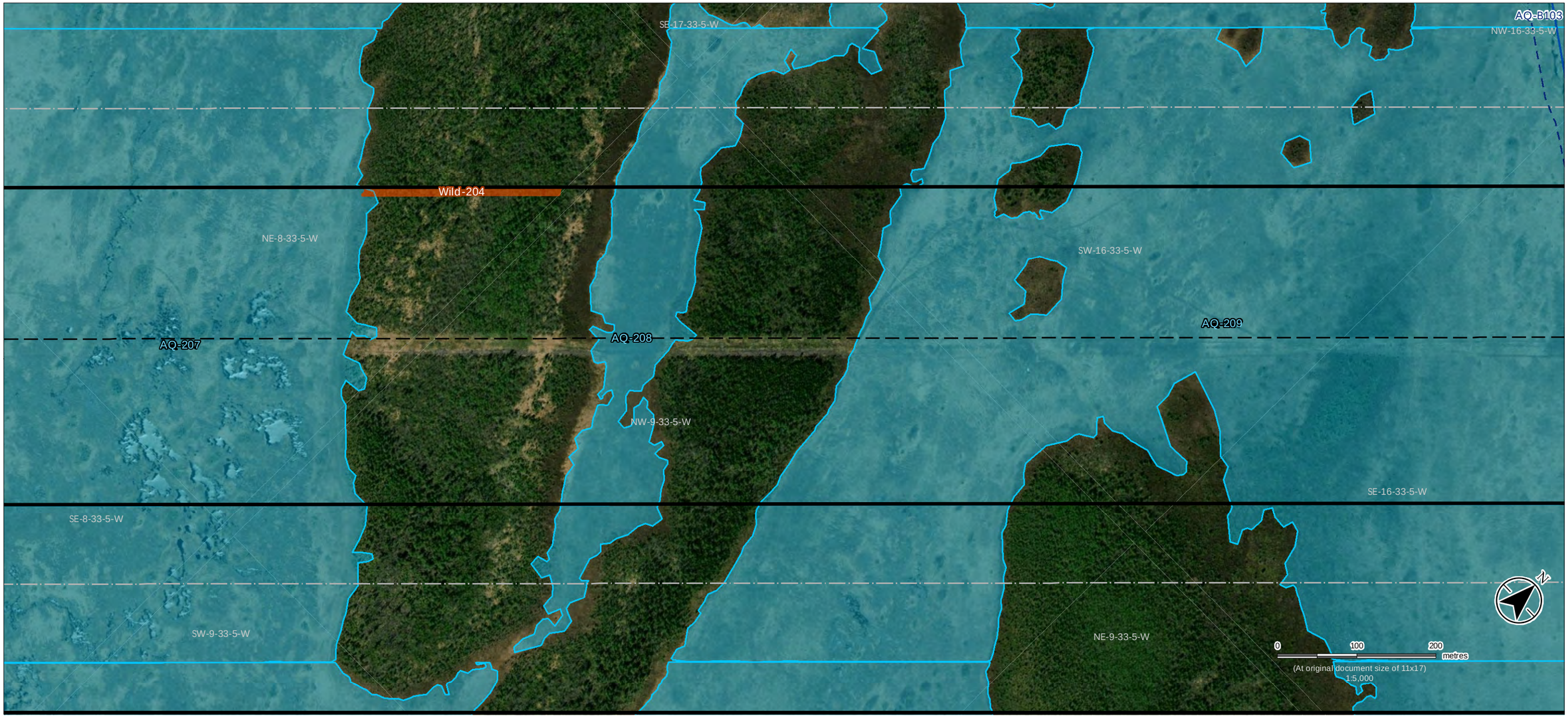
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Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

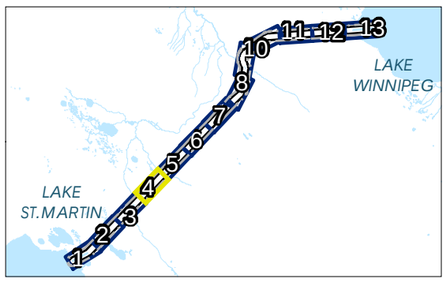
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Map 1-3

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Wetland (Class III, IV & Fen-Graminoid)

Wildlife
- Eastern Whip-poor-wil Potential Habitat Management Area

Notes

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2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
3. Imagery: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba Stantec

Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

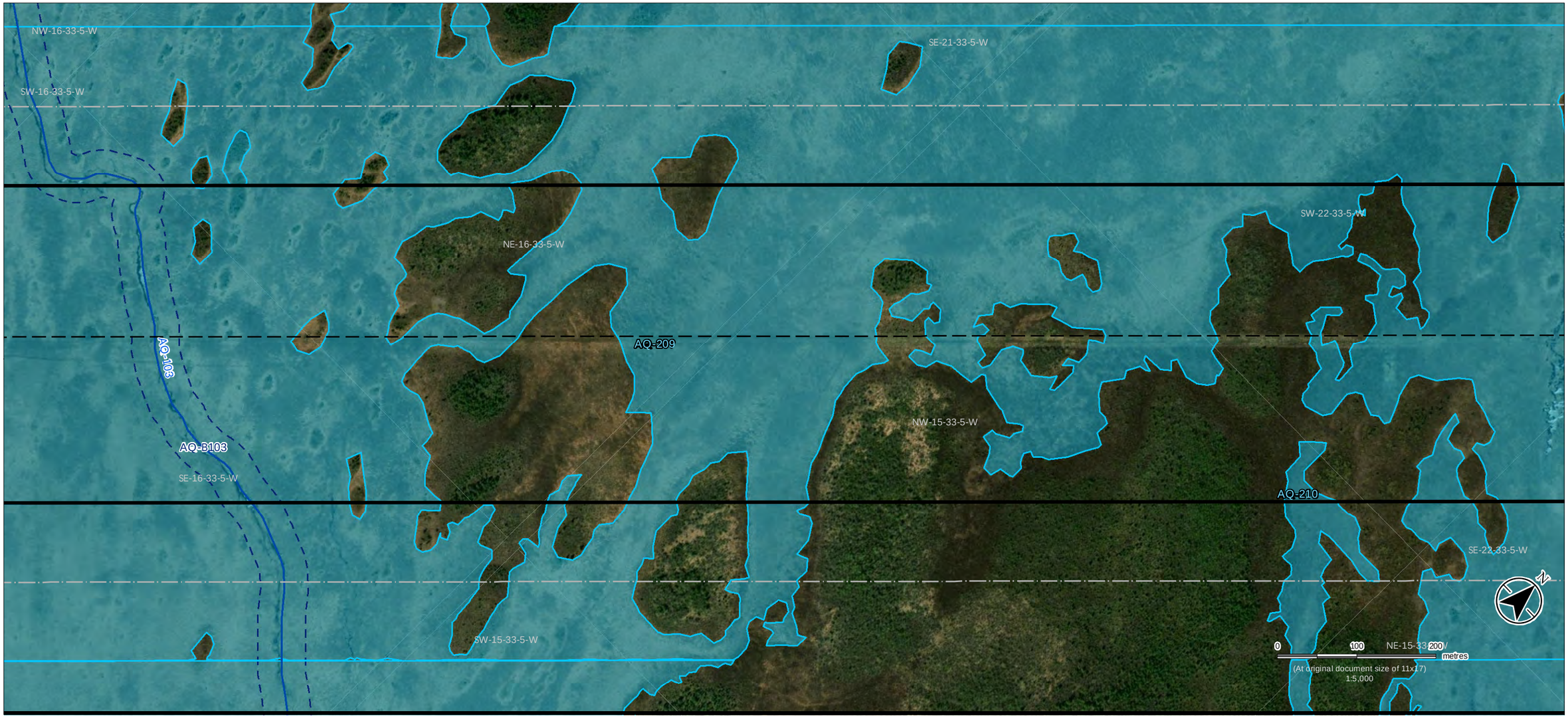
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Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1-4

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Wetland (Class III, IV & Fen-Graminoid)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
3. Imagery: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Notes:
*Details for Bridge and Water Control Structure Designs Not Yet Available
**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

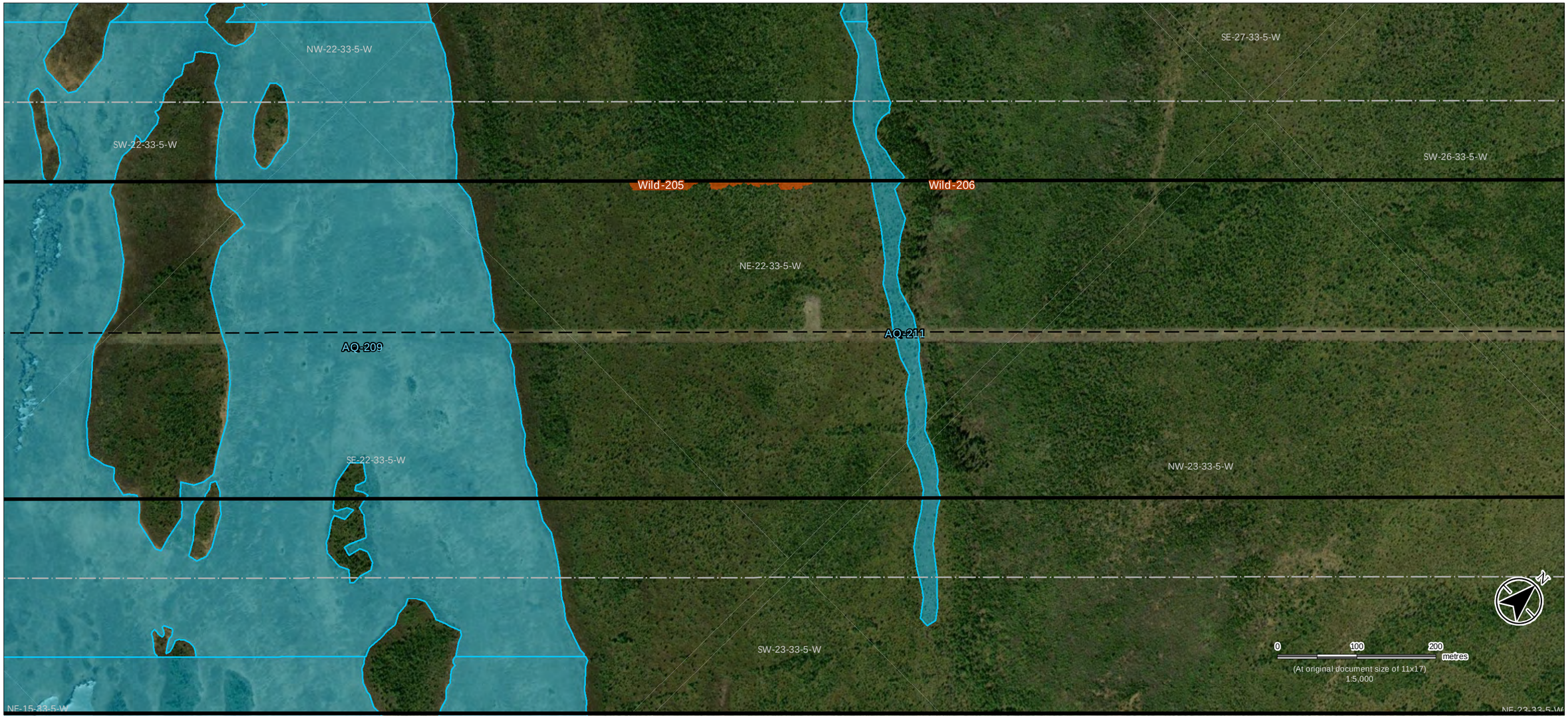
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Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1-5

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Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)

- Wetland (Class III, IV & Fen-Graminoid)

Wildlife

- Eastern Whip-poor-wil Potential Habitat Management Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc., WSP
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Notes:
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**Waterbody boundaries at inlet/outlet locations are approximate and dependent on water levels

MAPS TO BE FINALIZED PRIOR TO CONSTRUCTION

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

Prepared by JH on 2022-06-28
TR by NB on 2022-06-28

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Manitoba Transportation and Infrastructure
Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1-6

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

- Lake St. Martin Outlet Channel (LSMOC) Project Development Area (PDA)
- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)
- Wetland (Class III, IV & Fen-Graminoid)

Wildlife
- Eastern Whip-poor-wil Potential Habitat Management Area

Notes
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Project Location
Near Lake Manitoba & Lake St. Martin
Manitoba

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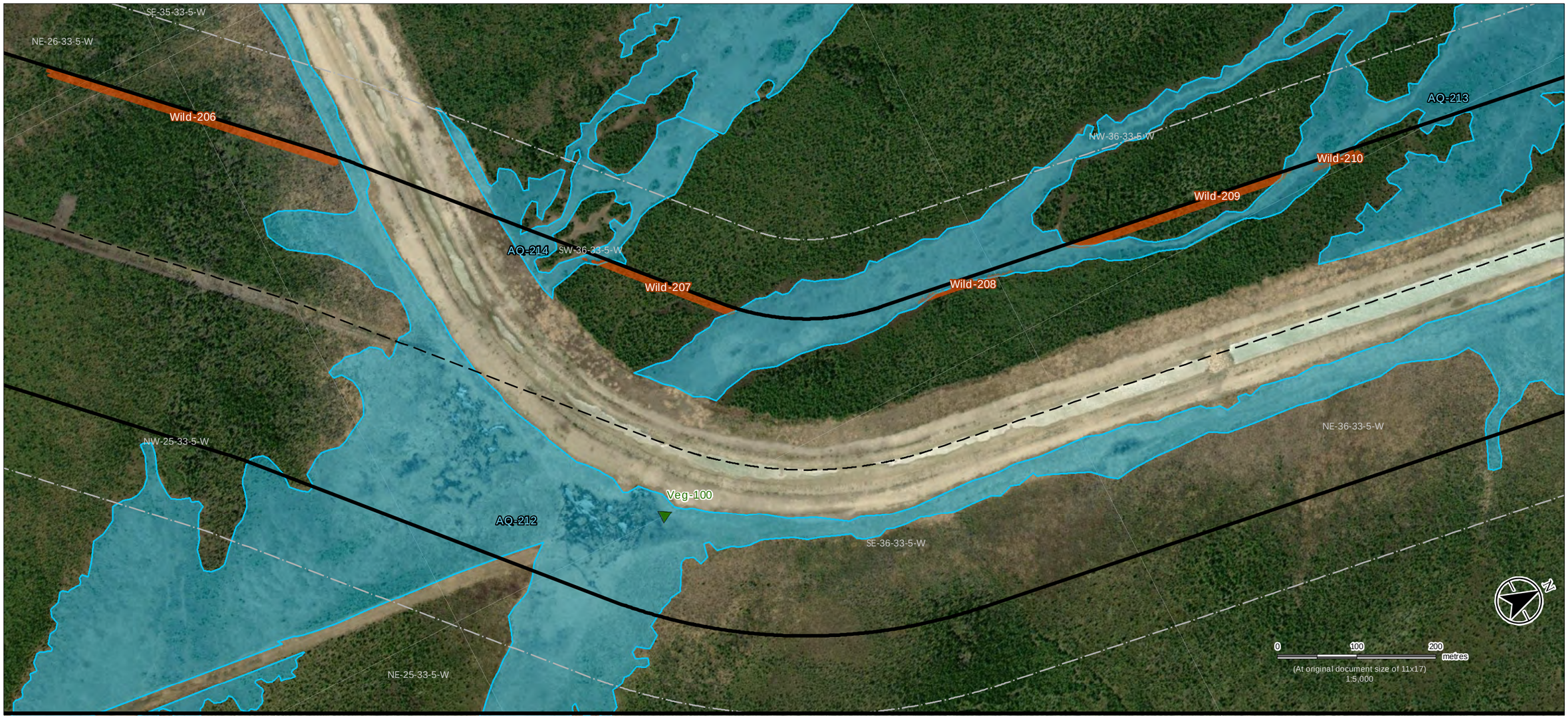
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Manitoba Transportation and Infrastructure
Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

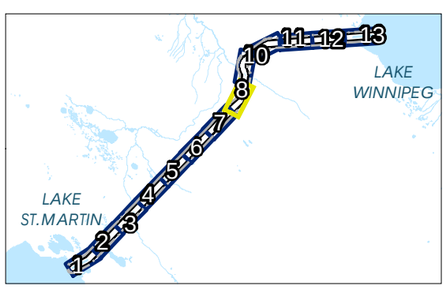
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Title
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- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Species of Conservation Concern

Aquatics (AQ)
- Wetland (Class III, IV & Fen-Graminoid)

Wildlife
- Eastern Whip-poor-wil Potential Habitat Management Area

Notes

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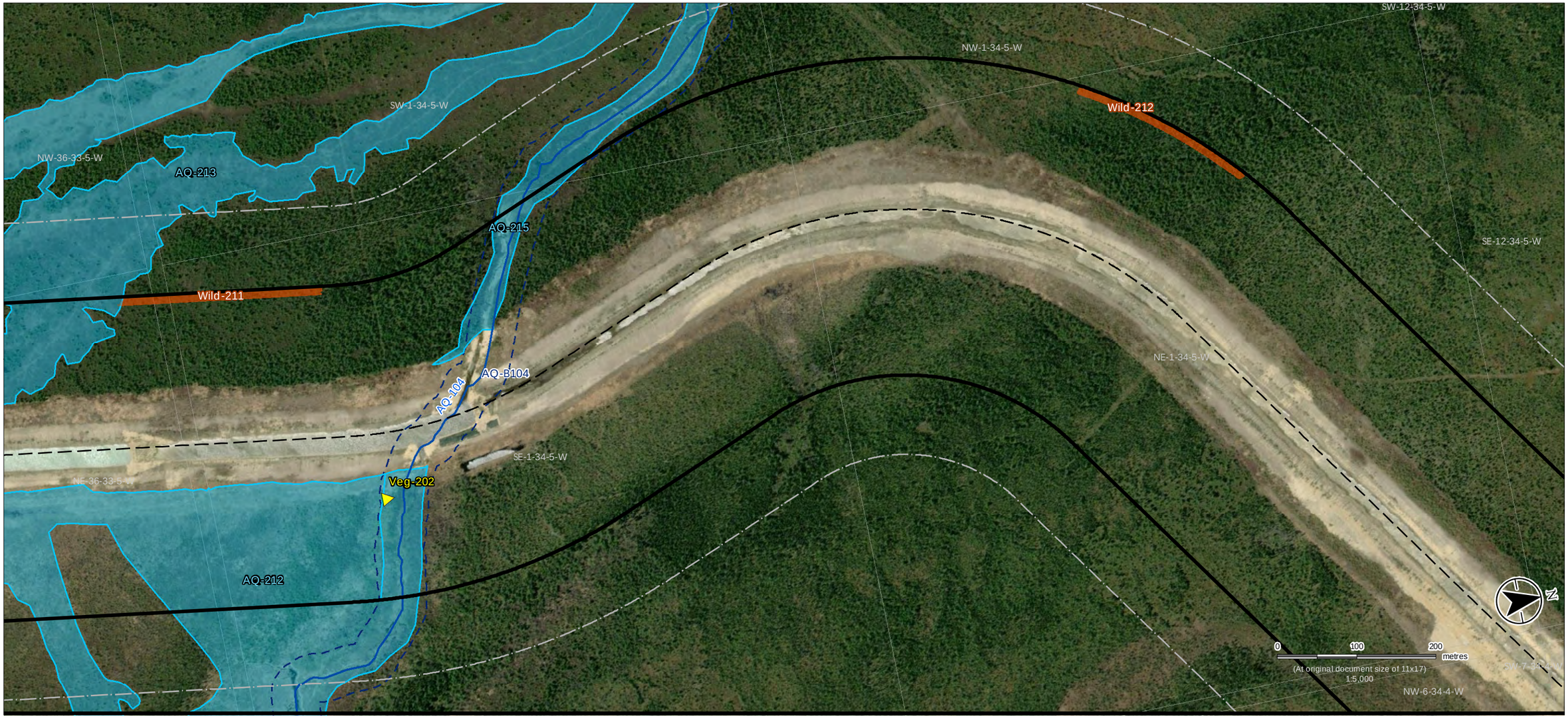
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Manitoba Transportation and Infrastructure
Lake St. Martin Outlet Channel
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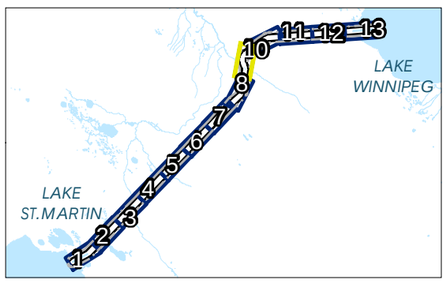
Figure No.
Map 1-8

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

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- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Aquatics (AQ)
- Watercourse Crossing

Aquatics (AQ)
- Riparian Area (30m Buffer of Waterbody/Watercourse)
- Wetland (Class III, IV & Fen-Graminoid)

Wildlife
- Eastern Whip-poor-wil Potential Habitat Management Area

Notes
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Project Location
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Manitoba

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Manitoba Transportation and Infrastructure
Lake St. Martin Outlet Channel
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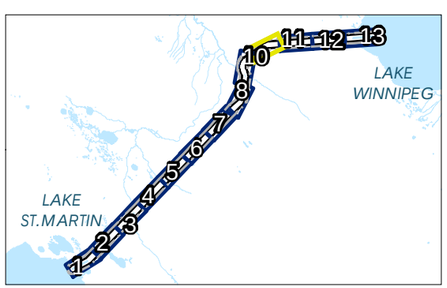
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- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Species of Conservation Concern

Land Use (LUse)
- Recreational Trails

Aquatics (AQ)
- Wetland (Class III, IV & Fen-Graminoid)

Notes

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Manitoba

Stantec

Project Location
Near Lake Manitoba & Lake St. Martin Manitoba

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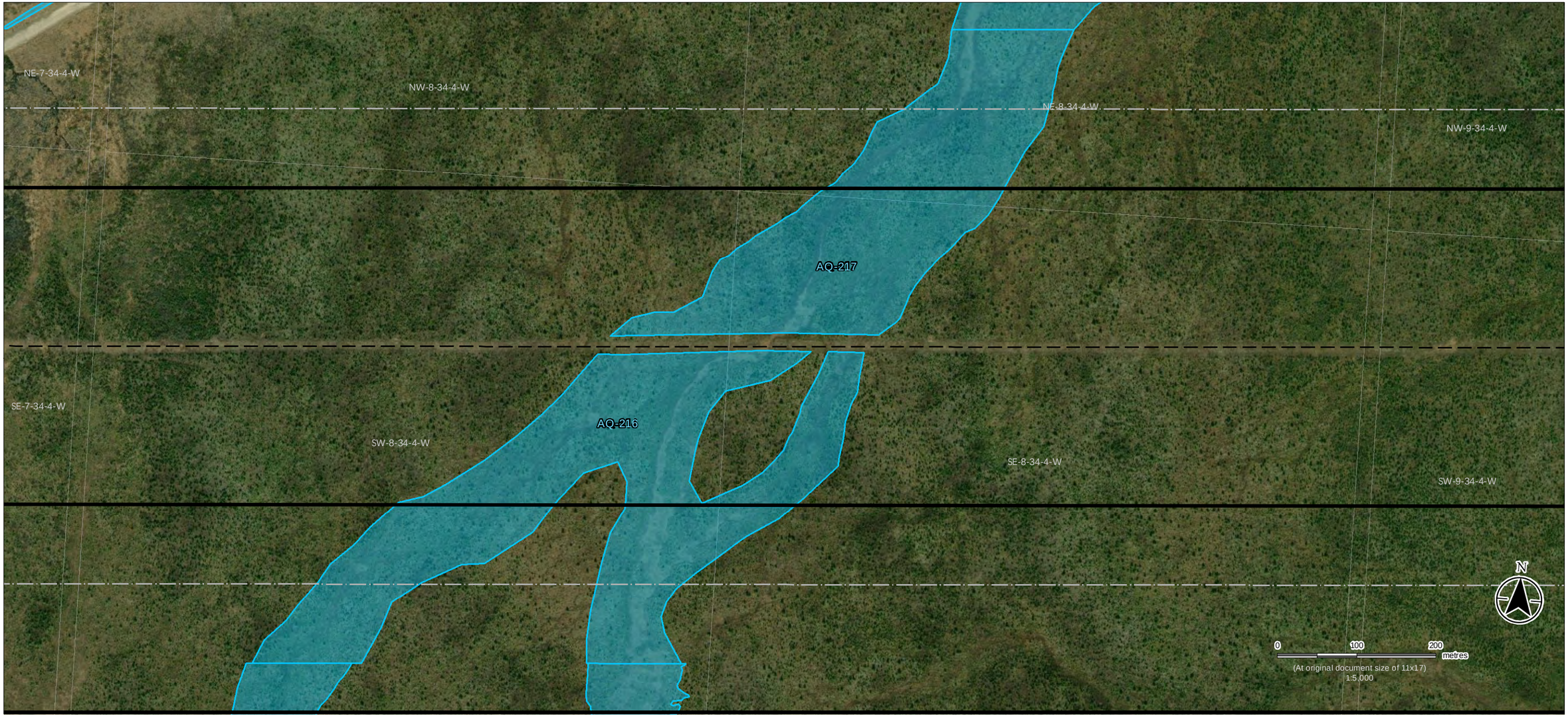
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Manitoba Transportation and Infrastructure
Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

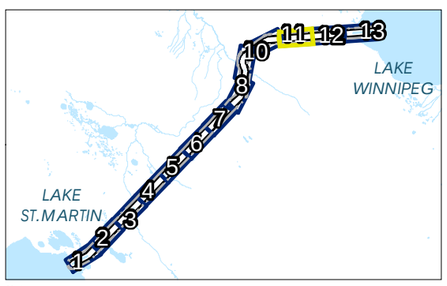
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Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)

- Wetland (Class III, IV & Fen-Graminoid)

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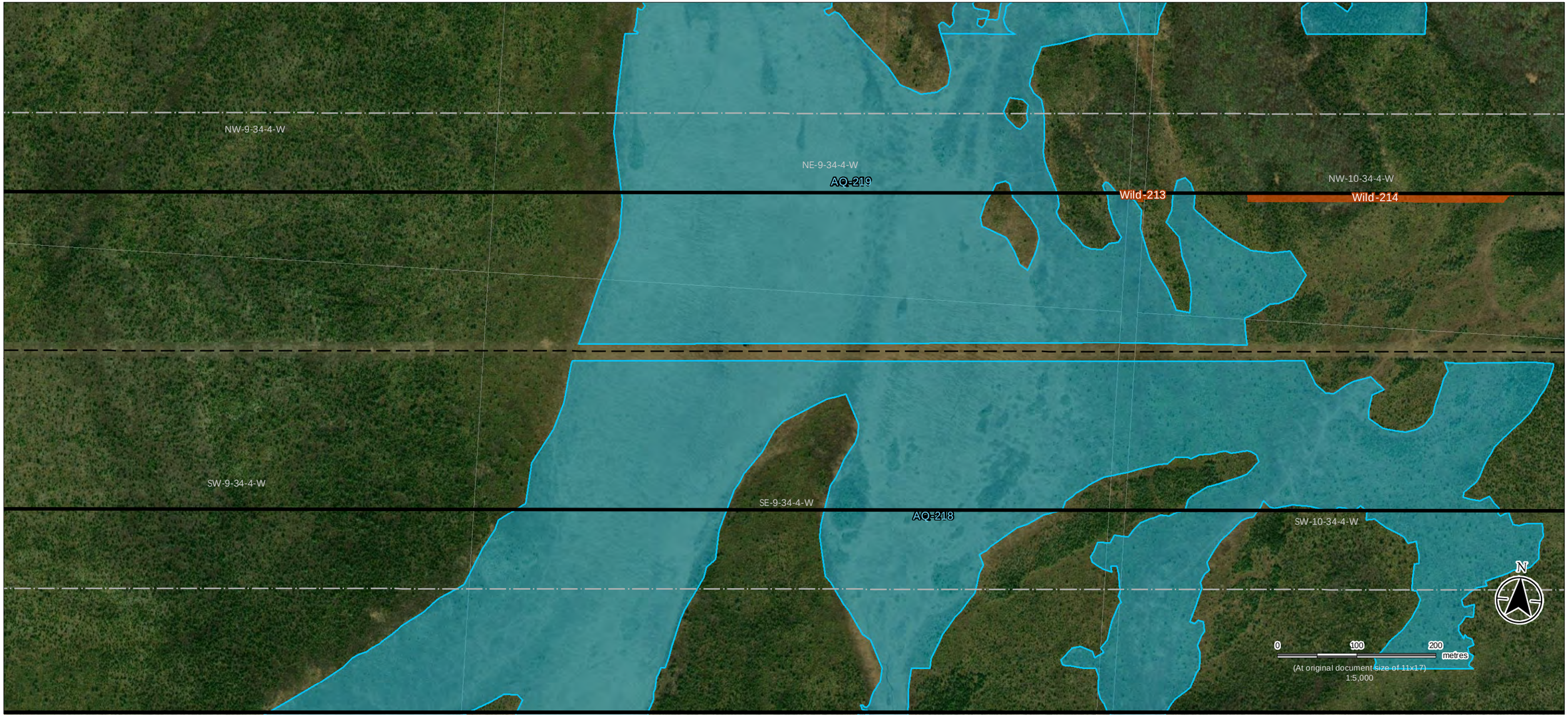
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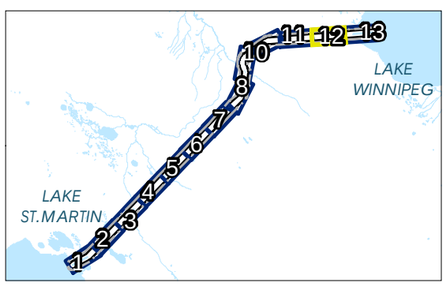
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Map 1-11

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

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- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Aquatics (AQ)

- Wetland (Class III, IV & Fen-Graminoid)

Wildlife

- Eastern Whip-poor-wil Potential Habitat Management Area

Notes

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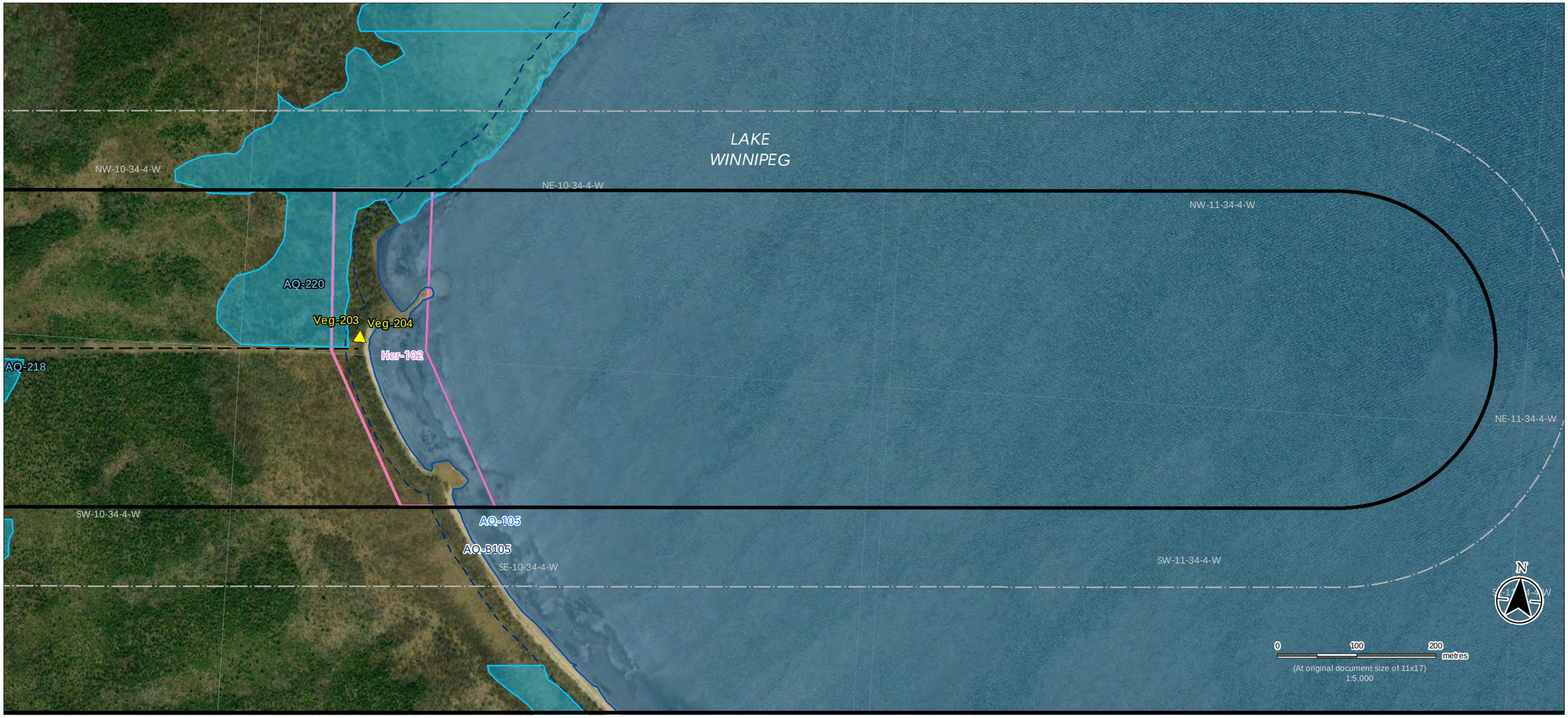
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Lake St. Martin Outlet Channel
Construction Environmental Protection Plan

Figure No.
Map 1-12

Title
Lake St. Martin Outlet Channel Construction Environmental Protection Plan

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Legend

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- LSMOC Approximate Centerline
- Quarter Sections
- 100m Buffer of PDA

Environmentally Sensitive Sites (ESS)

Vegetation (Veg)
- Invasive Species/Weeds

Aquatics (AQ)
- Waterbody**
- Riparian Area (30m Buffer of Waterbody/Watercourse)
- Wetland (Class III, IV & Fen-Graminoid)

Heritage (Her)
- Heritage Sensitive Area

Notes
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Map 1-13

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APPENDIX 4

Approvals, Licences, and Permits

To be appended once received

APPENDIX 5

Recommended Setback Distances and Restricted Activity Periods

Table 5-1: Recommended Setback Distances and Restricted Activity Periods for the Lake Manitoba and Lake St. Martin Outlet Channels Project

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (meters)[2]		
Common Name	Scientific Name			Low	Medium	High
Mammals						
American badger[a]	*Taxidae taxus*	Active den	Year round	100	500	500
Black bear[b]	*Ursus americanus*	Active den	Year round	150	150	150
Little brown myotis[a,c]	*Myotis lucifugus*	Roost	May 1 – August 31	100	500	500
Northern myotis[a,c]	*Myotis septentrionalis*	Roost	May 1 – August 31	100	500	500
Bat cave[d]	-	Cave	Year round	200	200	200
Wolverine[e]	*Gulo gulo*	Den	Year round	100	250	500
Mineral lick[b]	-	Mineral lick	Year round	120	120	120
Denning species (e.g., red fox, coyote, gray wolf, American marten, fisher, least weasel)[c]	-	Active den	Year round	50	50	50

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (meters)[2]		
Common Name	Scientific Name			Low	Medium	High
Birds						
American white pelican	*Pelecanus erythrorhynchos*	Nesting colony	April 1 - August 31	500	750	1000
Bald eagle	*Haliaeetus leucocephalus*	Active or traditional nest site	March 15 - July 15	250	500	1000
Bank swallow	*Riparia riparia*	Nesting colony	May 15 - July 31	50	150	300
Barn swallow	*Hirundo rustica*	Nest site	May 15 - Sept. 30	50	150	300
Barred owl	*Strix varia*	Active or traditional nest site	March 15 - July 15	250	500	1000
Bobolink	*Dolichonyx oryzivorus*	Nest site	May 15 - August 15	100	250	400
Boreal Owl	*Aegolius funereus*	Nest Site	March 1 - July 15	250	500	1000
Canada warbler	*Cardellina canadensis*	Nest site	May 1 - July 31	200	300	450
Common nighthawk	*Chordeiles minor*	Nest site	May 1 - August 31	100	200	500
Double-crested cormorant	*Phalacrocorax auritus*	Nesting colony	April 1 - August 31	400	500	750
Eastern whip-poor-will	*Antrostomus vociferous*	Nest site	May 15 - July 16	100	200	500
Eastern wood-pewee	*Contopus virens*	Nest site	May 15 - August 15	50	150	300

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (meters)[2]		
Common Name	Scientific Name			Low	Medium	High
Golden-winged warbler	*Vermivora chrysoptera*	Nest site	May 15 - August 6	200	300	450
Great gray owl	*Strix nebulosa*	Active or traditional nest site	Feb. 15 - July 15	250	500	1000
Grebes	-	Nesting colony	May 15 - July 15	100	200	400
Gulls/terns	-	Nesting colony	May 1 - July 15	400	500	750
Herons	-	Nesting colony	April 1 - August 31	400	500	750
Horned grebe	*Podiceps auratus*	Nest site	May 1 - Sept. 15	100	200	400
Least bittern	*Ixobrychus exilis*	Nest site	May 1 - July 31	100	200	400
Northern hawk owl	*Surnia ulula*	Nest site	Feb. 15 - July 15	250	500	1000
Osprey	*Pandion haliaetus*	Nest site	August 1 to March 31	100	100	1000
Olive-sided flycatcher	*Contopus cooperi*	Nest site	May 1 - August 31	50	150	300
Piping plover	*Charadrius melodus*	Active or traditional nest site	April 15 - August 15	200	400	600
Red-headed woodpecker	*Melanerpes erythrocephalus*	Nest site	April 15 - August 15	50	100	200
Rusty blackbird	*Euphagus carolinus*	Nest site	May 1 - July 31	50	150	300
Sharp-tailed grouse[3]	*Tympanuchus phasianellus*	Lek	Mar 15 - May 15	200	500	1000

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (meters)[2]		
Common Name	Scientific Name			Low	Medium	High
Short-eared owl	*Asio flammeus*	Nest site	April 15 - Sept. 15	200	300	500
Trumpeter swan	*Cygnus buccinator*	Nest site	April 1 - July 31	500	750	1000
Yellow rail	*Coturnicops noveboracensis*	Nest site	May 1 - July 15	100	150	350
Amphibians and Reptiles						
Northern leopard frog[a]	*Lithobates pipiens*	Hibernaculum and breeding habitat	Year round	10	200	500
Red-sided garter snake[b]	*Thamnophis sirtalis*	Hibernaculum	Year round	200	200	200
Snapping turtle[3, a]	*Chelydra serpenine*	Nest site	March 15 - June 30	0	400	400

Notes:

[1] - Recommended setback distances and restricted activity periods are derived from MB CDC's Recommended Development Setback Distances from Birds document (MB CDC 2021) unless otherwise specified (see a-e below)

[a] - Saskatchewan Ministry of Environment's Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017)

[b] - Manitoba Hydro's Manitoba-Minnesota Transmission Project Construction Environmental Protection Plan (2019)

[c] - Core maternity roost period for bats as defined by Fenton and Barclay (1980) and Barclay (1982 and 1984)

[d] - Manitoba's Forest Management Guidelines for Terrestrial Buffers (Government of Manitoba 2017)

[e] - Environment Canada's Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region (Environment Canada 2009)

[2] - Low: foot traffic, occasional/infrequent/short-term small vehicle (<1 ton) or ATV use; medium: trucks>1 ton, regular/frequent/long-term small vehicle (<1 ton) or ATV use; High: road, distribution line, or outlet channel construction, forest harvest, rock crushing, asphalt batching, quarry or gravel pit operation

[3] - Low disturbance category considered as foot traffic only; all other activities (i.e., occasional/infrequent/short-term small vehicle (<1 ton) or ATV use) considered medium disturbance; High: road, distribution line, or outlet channel construction, forest harvest, rock crushing, asphalt batching, quarry or gravel pit operation

Table References:

Barclay, R.M. 1982. Night roosting behavior of the little brown mat, *Myotis lucifugus*. Journal of Mammalogy 63(3): 464-474.

Barclay, R.M. 1984. Observations on the migration, ecology and reproductive behavior of bats at Delta Marsh, Manitoba. Canadian Field-Naturalist 98(3): 331-336.

Environment Canada. 2009. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton Alberta. 64p.

Fenton, M.B., and R.M.R. Barclay. 1980. *Myotis lucifugus*. 142 Mammalian Species, pp. 1-8.

Government of Manitoba (Sustainable Development). 2017. Forest Management Guidelines for Terrestrial Buffers (First Edition 2010). Winnipeg, Manitoba. Available at: https://gov.mb.ca/forest/pubs/practices/terrestrial_final_jan2017.pdf.

Manitoba Hydro's Manitoba-Minnesota Transmission Project Construction Environmental Protection Plan. 2019. https://www.hydro.mb.ca/docs/regulatory_affairs/projects/mmtp/epp_construction_environmental_protection_plan.pdf

MB CDC (Manitoba Conservation Data Centre). 2014. Recommended Development Setback Distances from Birds. Available at: https://www.gov.mb.ca/sd/cdc/pdf/mbcdc_bird_setbacks_full_document_2014_01_22.pdf.

SK MOE (Saskatchewan Ministry of Environment). 2017. Saskatchewan activity restriction guidelines for sensitive species (April 2017). Available at: https://publications.saskatchewan.ca/#/products/79241.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Project Environmental Requirements

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 OVERVIEW AND GUIDING PRINCIPLES 1

1.1 Project Environmental Requirements Overview 1

1.2 Pre-Construction Activities (Submittals) 2

1.3 Record Keeping 3

1.4 Compliance Inspections and Enforcement 4

1.5 Staff Orientation and Awareness 4

2.0 PROJECT ENVIRONMENTAL REQUIREMENTS 5

2.1 Designated Areas and Access 5

2.1.1 General 5

2.2 Clearing, Grubbing and Brush Disposal 6

2.2.1 General 6

2.2.2 Clearing 7

2.2.3 Grubbing 7

2.2.4 Brush Disposal 7

2.3 Erosion and Sediment Control 8

2.3.1 General 8

2.4 Groundwater Management 9

2.5 Working Within or Near Surface Water 9

2.5.1 General 9

2.5.2 Authorizations and Approvals 11

2.5.3 Timing of Work 11

2.5.4 Site Isolation and Dewatering 12
2.5.5 Fish Salvage 12
2.5.6 Mussel Salvage 13
2.5.7 Temporary Stream Diversions, Fish Passage, and Base Flows 14
2.5.8 Beaver Removal 14
2.5.9 Stream Crossings 15
2.5.10 Water Quality Monitoring 16
2.5.11 Culvert Installation, Maintenance and Replacement 16
2.5.12 Blasting Near a Waterbody 17
2.5.13 Aquatic Invasive Species 17
2.6 Machinery, Fuel Storage, Materials Handling and Storage, Spill Response and Remediation 18
2.6.1 General 18
2.6.2 Spill Response and Remediation 21
2.6.3 Materials Handling & Storage 23
2.6.4 Dangerous Goods/Hazardous Waste Handling and Disposal 23
2.6.5 Domestic Solid Wastes, Demolition and Construction Waste 24
2.6.6 Wastewater, Sewage and Manure 25
2.7 Dust Suppression 25
2.7.1 General 25
2.8 Concrete and Asphalt 26
2.8.1 General 26
2.9 Noise and Emissions 27
2.9.1 General 27
2.10 Light 27
2.11 Wildlife and Species of Conservation Concern 28
2.11.1 General 28
2.12 Wildfires 29
2.12.1 General 29

2.13 Heritage Resources 30
2.13.1 General 30
2.14 Quarries and Borrow 31
2.14.1 Quarry Site Selection 31
2.14.2 Quarry Development 31
2.15 Site Decommissioning 32
2.15.1 General 32
2.16 Revegetation and Vegetation Maintenance 33
2.16.1 General 33
2.17 Planned and Unplanned Shutdowns 34
2.17.1 General 34

List of Tables

Table 1: Manitoba's Environmental Accident Reporting Regulation – Reportable Quantities

List of Figures

Figure A: EMP Process

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders, and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders, and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage, and operate the Project. These Project Environmental Requirements (PER) are one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management, and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

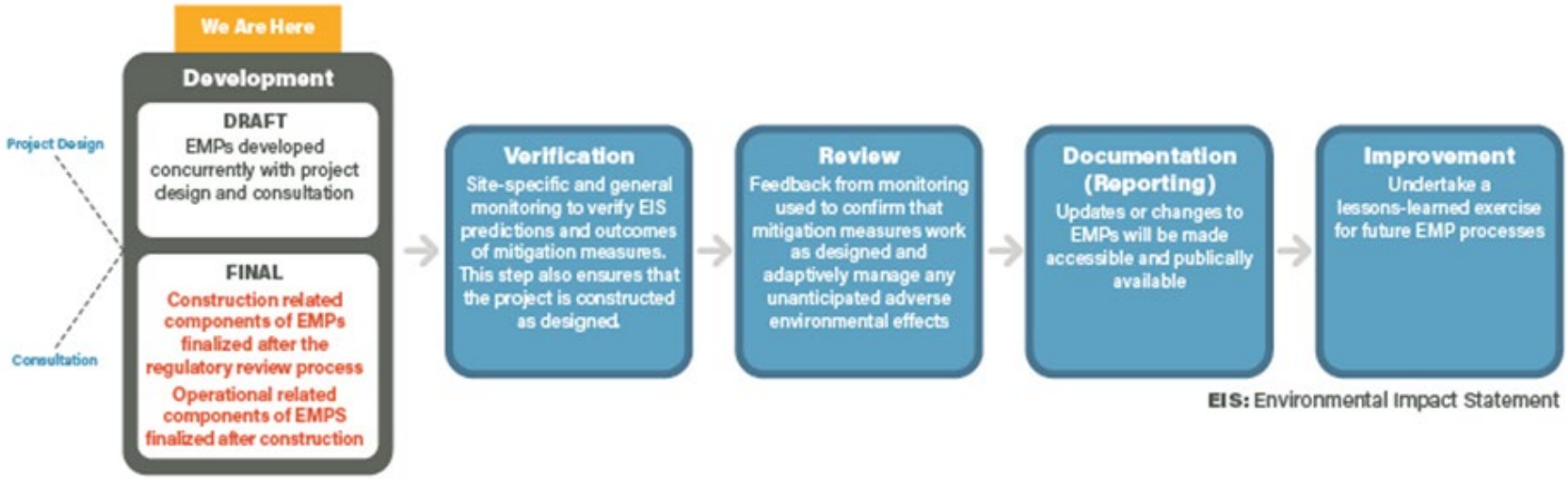


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
cm	centimetre
DFO	Fisheries and Oceans Canada
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ESS	Environmentally sensitive sites
L	litre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MECP	Manitoba Environment, Climate and Parks
MNRND	Manitoba Natural Resources and Northern Development
MSD	Material Safety Data
OEMP	Operation Environmental Management Program
PER	Project Environmental Requirements
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project
QMP	Quarry Management Plan
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SAR	Species at risk
TC	Transportation Canada
WHMIS	Workplace Hazardous Materials Information System

Glossary of Terms

Batch Plant: refers to concrete and asphalt production facilities.

Construction: refers to the period and activities associated with constructing Project infrastructure, including site preparation and decommissioning.

Decommissioning: refers to the closure and/de-construction of infrastructure or work sites.

Designated Areas: refers to specific sites that have been identified for a specific purpose which requires special approvals and/or careful documentation, maintenance, and decommissioning.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Environmentally Sensitive Site (ESS): locations, features, areas, activities, or facilities that were identified during the environmental assessment process to be ecologically, socially, economically, culturally, or spiritually important or sensitive to disturbance and require protection during construction of the Project.

Fish-Bearing: refers to waterbody containing fish as defined in the *Fisheries Act*.

Maintenance: refers to the period and activities related to Project upkeep.

Merchantable Timber: refers to woody vegetation, specifically a tree, which is a specific taper, straightness, diameter, and overall form which allows it to be harvested for commercial, community, or personal use.

Ordinary High-Water Mark: refers to the average expected elevation at which a waterbody or wetland would reach at least once in every two-year period (1:2).

Post-Construction: refers to the period and activities related to the time after which the Project is constructed and operational.

Qualified Environmental Professional: refers to designated individuals or groups with adequate certification and experience, as approved by the Contract Administrator, to perform key tasks, as indicated (e.g. fisheries and aquatics, or wildlife).

Revegetation: refers to, and includes, all works associated with site preparation, seeding and germination of plants for erosion control, aesthetics, or any other purpose.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing, or gathering rights.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation, or maintenance activities, and includes all subcontractors and affiliates.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting, and enforcing compliance with contractual and regulatory requirements.

Runoff: Surface water that flows overland and into streams, wetlands, or waterbodies, or into drainage systems

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction, and operation.

Waterbody: Standing and flowing surface waters (such as a creeks, rivers, lakes, and wetlands with open water), including seasonally and ephemerally occurring surface waters.

1.0 OVERVIEW AND GUIDING PRINCIPLES

1.1 Project Environmental Requirements Overview

The Project Environmental Requirements (PERs) form part of the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). Environmental protection and regulatory compliance during construction will be facilitated through the use of a Construction Environmental Management Program (CEMP). The CEMP has been prepared by Manitoba Transportation and Infrastructure and will be provided at the tendering stage. The Contractor(s) will adhere to the CEMP, and its associated plans as a condition of the Project contract(s).

The Project is being constructed, operated, and maintained under approvals and associated conditions under the *Canadian Environmental Assessment Act 2012* and in Manitoba, under *The Environment Act*. Additional permits, licences, approvals, or authorizations may apply to single or multiple Project components.

The PERs represent requirements and commitments that are fundamental to Manitoba Transportation and Infrastructure's regulatory compliance requirements, including Project approvals, permits, licences and authorizations. They are specific to the work and activities conducted under the authority of any and all licences, permits, authorizations or approvals obtained for the Project. Requirements listed in these PERs are not mutually exclusive of one another and must be adhered to for all activities pertaining to construction, post-construction, maintenance, and decommissioning activities for the Project.

No work or activity is to begin without having obtained applicable permits or authorizations for the work. The Contractor shall adhere to conditions specified in any and all permits, authorizations, licences, approvals and letters of advice or directive issued for the work. Where Manitoba Transportation and Infrastructure applies for permits, authorizations, licences, approvals and letters of advice or directive to any regulatory body to facilitate the Contractor's work plan, there shall be no award for damages, delay claims or other costs by the Contractor on Manitoba Transportation and Infrastructure as a result of delays in issuance or rejections of applications. Copies of necessary licences, approvals, permits, and contract documents (including this PER) shall be kept on site and readily available.

The PERs are based on long-standing approaches that have been used on other Provincial projects and proven effective in mitigating potential environmental effects from construction activities. They are intended to outline environmental requirements for Contractors and Project works. Other topic-specific environmental management plans provide further information on monitoring and mitigation measures to verify the conclusions of the Project Environmental Impact Statement (EIS) and identify the need for adaptive management (if required). The PERs are considered incidental to all Project-related works or activities and will not be measured for payment unless indicated otherwise by the Contract Administrator.

Upon award of a contract Manitoba Transportation and Infrastructure will provide the Contractor with the most current version of the PERs, and will issue updates, as required. It is anticipated that Manitoba Transportation and Infrastructure will review and update the PERs periodically as required to confirm that requirements reflect best practices and comply with changing regulation and legislation. PER updates may

occur more frequently in circumstances where legislative changes occur in advance of the PER review schedule.

The PERs are supported by an Environmental Protection Plan (EPP) and three associated mapbooks. The three mapbooks provide site-specific environmental protection measures for the construction and operation of the LMOC, LSMOC, and Provincial Road (PR)R 239, respectively. The EPP mapbooks provide site-specific environmental sensitivities and the associated environmental protection measures. The EPP mapbooks supplement the PERs and are intended for use in the field by construction contractors and environmental staff during Project planning and construction.

More specifically, environmentally sensitive sites (ESS) have been identified for the Project. ESS are locations, features, areas, activities, or facilities that were identified during the environmental assessment process to be ecologically, socially, economically, culturally, or spiritually important or sensitive to disturbance and require protection during construction of the Project. The determination of ESS will include the consideration of Indigenous traditional knowledge.

The EPP mapbooks have been developed for the Project to present the location and spatial extent of ESS. Each map has a corresponding tabular summary of information including relevant mitigation measures to address the potential environmental effects of each ESS site. The mapping is an iterative process and will be updated as required for the duration of the Project.

It should also be noted that Manitoba Transportation and Infrastructure (or its designate) will implement a Project Complaint Resolution Process (CRP) to address Project-related construction and operation complaints. The CRP will be initiated upon the submission and receipt of a Project-related complaint, including from any person, Indigenous rights-holders, or from the Rural Municipality (RM) of Grahamdale or other stakeholders. If a Project activity is found to be in compliance with the applicable environmental and licensing requirements and/or Project commitments, the complaint will be considered resolved; however, it should be noted that mitigation, monitoring, or other considerations may be required. If the Project activity is found to be out of compliance with the applicable environmental and licensing requirements and/or Project commitments, Manitoba Transportation and Infrastructure will implement corrective action, as required to transition to compliant status (e.g., in compliance with regulatory requirements, conditions of approval, and/or Project commitments).

1.2 Pre-Construction Activities (Submittals)

The Contractor shall submit the following (where applicable) for review and acceptance by the Contract Administrator no less than 14 business days in advance of the start of work:

- Details for proposed designated areas
- Environmental Emergency Plan for Spill Response and Remediation
- Material Safety Data Sheets
- A Water Quality and Fish Protection Plan including but not limited to:
    - Construction phase Erosion and Sediment Control measures
    - In-water works
    - Water quality monitoring

  - Isolation plan
  - Fish salvage
  - Mussel salvage
- Monthly reports providing the records as specified in Section 1.5
- Waste Management Plan
- Material Management Plan in the event of an Unplanned Shutdown
- Problem Wildlife Management Plan
- Cement Washout Plan
- Petroleum Storage and Equipment Fueling and Servicing Plan
- Evacuation and Emergency Preparedness Plan in the Event of a Wildfire
- Copies of all required approvals, clearances, permits, licences, and certificates issued to the Contractor, or their sub-contractors, including but not limited to:
  - Batch Plant Environment Act Licence
  - Fish collection permits
  - Septic permits
  - Groundwater well permit
- Other submittals as required

1.3 Record Keeping

The Contractor shall maintain a record file at the site in which all relevant information relating to materials handling, spills, leaks, releases, and the implementation and adjustment of the environmental protection measures is documented. The Contractor shall maintain a copy of these records for a minimum of 5 years after contract closeout. Relevant information and/or significant events are to be documented and provided to the Contract Administrator in a timely fashion. Records may include, but are not limited to:

- all accidents, spills, leaks, and releases and the reporting and clean-up procedures used
- any reviews, improvements, and adjustments to the environmental protection measures
- details of all environmental training sessions, including the schedule of these sessions and the names of participants
- a full inventory of dangerous goods brought onto the site
- a full inventory of all hazardous wastes encountered on the site
- records of all waste hauled from the site for disposal, including the location, name and description of the disposal facility and waybills/manifests
- records of all material hauled from the site for recycling, including the location, name and description of the person or facility the material was delivered to
- records of all fuel transported and stored at the site
- records of equipment inspections and maintenance
- records of all public complaints
- records of actions taken to remove deleterious substances and debris from waterbodies
- records of annual use of pesticides
- wildlife encounters and/or management measures employed

As a general requirement, all work shall be photo-documented, and notification of the work will be provided to the Manitoba Transportation and Infrastructure on a monthly basis for record keeping purposes. All construction shall be governed by the *Standard Construction Specification, Special Provisions* and the *Project Environmental Requirements* set out in the standard contract.

1.4 Compliance Inspections and Enforcement

As indicated, the PERs represent requirements and commitments that are fundamental to regulatory compliance as well as Project approvals, permits, licences and authorizations. Manitoba Transportation and Infrastructure personnel or representatives, at their discretion, may inspect work sites to confirm and verify that any and all requirements are adhered to. Failure to comply with PERs, Project approvals, permits, licences and authorizations may result in stop work orders, improvement orders, contract termination, and/or suspension or termination of approvals, permits, licences and authorizations to conduct the work.

In addition to any penalties or orders issued by Manitoba Transportation and Infrastructure, the Contractor will accept all liability and responsibility for issues of non-compliance and for any penalties issued by federal or provincial regulators. The Contractor is responsible for ensuring compliance with all applicable contract specifications, environmental legislation and regulation, Project approvals, permits, licences and/or authorizations.

1.5 Staff Orientation and Awareness

The Contractor shall provide mandatory orientation and awareness sessions for their entire workforce prior to the start of construction, and to new personnel before they begin work, to ensure all personnel working on the contract are aware of and understand the Project environmental sensitivities and relevant environmental guidelines and procedures of the Project. All training and orientation sessions shall be documented.

The Contractor shall submit the planned frequency and records of these meetings. The Contractor shall maintain access to all environmental provisions of the contract documents including relevant drawings, specifications and Contractor submittals and updates, in a location and manner accessible to all employees, subcontractors, and agents.

2.0 PROJECT ENVIRONMENTAL REQUIREMENTS

2.1 Designated Areas and Access

Designated areas and proposed accesses shall be identified for approval by the Contract Administrator prior to development and the start of work (prior to the pre-construction meeting). Designated areas shall include, but are not necessarily limited to camps, quarries, borrow, equipment maintenance, fuel and other material storage and other purposes as required. The development, maintenance and decommissioning of such sites shall be conducted in a manner which complies with all applicable legislation, regulations, permits, approvals, authorizations, or licences.

2.1.1 General

- The Contractor shall submit details for proposed designated areas for review and acceptance by the Contract Administrator in accordance with general conditions and contract documents. Submittals shall include marked up drawings, and coordinates of the proposed designated areas including access, and shall provide sufficient detail to demonstrate full compliance with these specifications. Designated Areas requiring submittals include, but are not necessarily limited to:
  - laydown and staging area(s)
  - waste storage area(s)
  - fuel storage and refueling area(s)
  - equipment servicing area(s)
  - work camp(s)
  - parking area(s)
  - cement batch plant(s)
  - cement washout area(s)
  - quarry and borrow sites
  - others as required by the Contract Administrator
- Siting of designated areas will be subject to a biophysical review to avoid ESSs or sensitive habitats.
- Designated areas will be located within the ROW, in disturbed areas and/or using existing facilities wherever possible.
- The Contractor shall construct and maintain designated areas in a manner that facilitates regular inspection activities and have adequate spacing for snow removal and storage.
- Unless otherwise authorized by the Contract Administrator, designated areas shall be contained within the designated work limits, in disturbed areas, or by using existing facilities wherever possible.
- The topsoil in designated areas shall be stripped and stockpiled for later reuse in site restoration. Granular material or other surface preparation, as approved by the Contract Administrator, shall be placed to ensure all weather accessibility.

- Locations within designated areas where equipment, hazardous material and/or wastes will be stored or maintained shall be underlain with at least 30 centimetres (cm) of impermeable soil or approved equal and lined with an impermeable groundsheet to contain spills and minimize cleanup costs. Hazardous materials must also comply with the additional requirements outlined in Section 2.5.
- Designated areas shall be located a minimum of 100 metres (m) from waterbody or wetland or as approved by the Contract Administrator.
- Designated areas will be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection.
- The Contractor shall restore the designated areas and access roads not required for on-going maintenance to their original condition (see Section 2.15 Site Decommissioning).
- There shall be no entry of personnel or equipment, or work conducted on private property without proper authority.
- Access management details for designated sites shall be developed by the Contractor in accordance with Access Management Plan (AMP) and Agricultural Biosecurity Management Plan (AgBMP) for submission, review and approval by the Contract Administrator and Manitoba Transportation and Infrastructure.

2.2 Clearing, Grubbing and Brush Disposal

Clearing and grubbing of vegetation includes the removal of vegetation (clearing) or root mass and organic material (grubbing) for site preparation or as part of specific works but does not include mowing activities. Clearing and grubbing shall be conducted in accordance with contract documents, or as instructed by the Contract Administrator.

2.2.1 General

- Clearing shall not occur between April 1st and August 30th of any year unless otherwise authorized by the Contract Administrator in order to avoid disturbance to nesting birds and other wildlife.
- If clearing within the nesting period (April 1 to August 31) is required, a nest survey may be undertaken by a qualified environmental professional if warranted and approved by the Contract Administrator.
- Clearing and grubbing shall be limited to the construction or contract limits unless otherwise approved by the Contract Administrator .
- Prior to clearing or grubbing, the work area shall be clearly staked or marked and approved by the Contract Administrator so as to prevent over-clearing. Where possible, existing vegetation shall be retained.
- Existing roads, road allowances, trails, portages, and other travel ways shall not be blocked or altered as a result of clearing and grubbing activities so as not to interfere with other users.
- All grubbed organic and topsoil layers with leaf litter and root mass shall be stockpiled in appropriate locations and retained for reclamation efforts.

- The Contractor shall take all precautions against damage to other trees, traffic structures, pole lines or property. The Contractor is liable for any damages occurring in the performance of this work.
- Clearing, grubbing, and burning operations shall be conducted in accordance with the applicable Provincial and Municipal regulations and Acts.

2.2.2 Clearing

- Clearing within 30 metres (m) of a waterbody shall be done by hand.
- Unless otherwise authorized by the Contract Administrator, all brush, and trees, except those designated to be saved shall be cut at a height not greater than 300 mm above ground level (as per general specification).
- All surface debris, excluding salvageable or merchantable timber but including fallen timber, slash limbs, brush, grass, and weeds shall be disposed of in an appropriate manner.
- There shall be no bulldozing of trees or woody debris into standing timber.
- Removal of riparian vegetation shall be kept to a minimum to help maintain the stability of waterbody banks. The area over which vegetation in riparian vegetation areas is removed shall affect no more than one third (1/3) of the total woody vegetation in the right-of-way (ROW) within 30 m of the ordinary high-water mark of a waterbody. Vegetative root masses found within the waterbody banks shall remain undisturbed unless specified in the Contract Documents.
- Trees shall be felled towards the center of the area to be cleared. Any brush falling outside the area to be cleared shall be moved back into the work area immediately and disposed of.
- Cleared trees and vegetation shall not obstruct waterways during any season and shall be kept above the ordinary high-water mark. Stockpiles or windrows of any material are to be kept a minimum of 100 m from any waterbody's ordinary high-water mark.

2.2.3 Grubbing

- Grubbing shall not occur within 2 m (2.5 yards) of standing timber in order to prevent damaging root systems of adjacent standing trees and to reduce the potential of future blow down.

2.2.4 Brush Disposal

- Timber from which forest products can be manufactured (merchantable timber) shall be cleared of limbs and neatly stockpiled piled within the work limits as directed or permitted by the Contract Administrator. All salvageable timber shall be offered to Indigenous communities for use as firewood.
- All stockpiled material located on Crown Land shall be removed or disposed of by April 30 following clearing activities, where applicable.
- Disposal of cleared trees and brush must be conducted in a manner approved by the Contract Administrator. Disposal may involve burning, compacting, piling, burying, windrowing, and compacting, limbing and chipping. Disposal methods may be restricted or prohibited in certain locations if they are deemed to result in future issues.

- All cleared vegetation, grubbed material, and debris that is to be left in place shall be piled and compacted in windrows. Windrows shall be compacted to lie as close to the ground as possible (maximum height of 0.6 m) and shall be no closer than 1 m to the bush line. Windrows are required to have a 15m break every 100m in length.
- Wood and brush piled for burning must be located at least 15 m from other wood and brush piles or standing timber. If piles are windrowed for burning a 15 m break in the windrow should occur for every 100 m of length.
- Slash shall be piled in a manner that allows for clean, efficient burning of all material. Avoid mixing soil into the slash
- Where applicable, the Contractor shall obtain a burning permit for open fires between April 1 and November 15 and must adhere to all permit conditions. Burn permits may not be issued in dry conditions. Burning is prohibited during high wind events. Burning between November 16 and March 31 does not require a burning permit; however, the supervising officer shall be advised prior to any burning. All fires shall be completely extinguished by March 31.
- All occurrences of fire spreading beyond burn piles shall be reported to the Contract Administrator and Manitoba Natural Resources and Northern Development.

2.3 Erosion and Sediment Control

Erosion and sediment control measures include long-term, temporary, or emergency stabilization of any and all soil types to prevent undesirable soil movement or soil releases and discharges to a waterbody during Project construction or operation. Erosion and Sediment Control may also include efforts to minimize substrate disturbance and sediment uplift or suspension during in-water work.

2.3.1 General

- A Sediment Management Plan (SMP) has been developed and describes measures to minimize impacts of in-stream sediment during the construction phase of the Project. This plan should be referenced for planning purposes and detailed mitigation requirements.
- Vegetation cover within the Project limits (as defined in tender contracts) shall be preserved for as long as possible or left undisturbed if it does not inhibit work. All vegetated areas that are to be preserved or left untouched shall be well staked and identified.
- Effective erosion and sediment control measures shall be properly installed before starting any work to prevent undesirable soil movement or the entry of sediment into any waterbody or wetland.
- The installation of erosion and sediment control measures shall be completed in accordance with the Contract Documents, or as approved by the Contract Administrator. Final erosion protection measures shall be installed progressively during all phases of the Project.
- Erosion and sediment control measures shall be inspected and maintained by the Contractor on a daily basis, as well as during and after every major rain, runoff, or spring melt event. Any necessary repairs and adjustments shall be made immediately to ensure that measures are effective in controlling erosion and sedimentation.

- Erosion and sediment control measures shall be maintained in all disturbed sites until soils have stabilized and complete revegetation of all disturbed areas is achieved.
- If an Erosion Control Blanket is used the product shall be 100% biodegradable, composed of natural fibers, including netting, filling, and thread.
- Efforts shall be made to minimize the duration of soil exposure and run-off shall be diverted away from exposed soils.
- Construction and maintenance activities shall be halted during heavy rains with the exception of those works pertaining to erosion and sediment control.
- Temporary spoil piles, overburden and topsoil shall not be placed within 100 m of any waterbody's ordinary high-water mark. Temporary spoil piles shall be positioned and maintained in a manner that prevents direct or indirect sediment releases into a waterbody.

2.4 Groundwater Management

The Project has the potential to impact the environment in several ways, including water level changes in aquifers, water quality changes, and changes in the relationship of the groundwater aquifer discharge to the surface water system.

- A Groundwater Management Plan (GWMP) and a SWMP have been developed for the Project and will be referenced for planning purposes prior to conducting drilling activities, working in or near water, managing drainage and for detailed mitigation requirements.
- Drill holes will be sealed as soon as possible following drilling activities or in the case of a groundwater level rise.
- Construction dewatering will be limited through appropriate construction planning and will be in accordance with terms and approval conditions of *The Groundwater and Water Well Act* and *The Water Rights Act*.

2.5 Working Within or Near Surface Water

In-water work includes any and all activities occurring within the ordinary high-water mark of a waterbody. Requirements in this section apply to work in or near fish-bearing and non-fish bearing waterbodies, fish passage, fish and mussel salvage, dewatering, temporary diversions, temporary crossings and access pads, stream crossings (bridges and culverts), blasting near a waterbody, debris and sedimentation removal, and water quality monitoring.

2.5.1 General

- The Contractor shall schedule, plan, and carry out works such that in-water work is kept to a minimum. Whenever possible, in-water work shall be staged to occur as a single event, rather than repeat activities at different times.
- A Surface Water Management Plan (SWMP) has been developed for the Project and should be referenced for planning purposes prior to working in or near water and for detailed mitigation requirements.

- Disturbance to the waterbody bed and banks shall be minimized. Use existing trails, roads or cut lines to access the site where possible to avoid disturbance to riparian vegetation.
- Construction activities shall not occur within 100 m of a waterbody with the exception of construction of a waterbody crossing or other authorized in-water or near-water works, or unless directed by the Contract Administrator.
    - If a 100 m distance is not possible, a buffer zone of undisturbed vegetation shall be provided between the work and the waterway. Using a buffer zone width of approximately 10 m plus 1.5 times the slope gradient or 30 m, whichever is greater.
- There shall be no fueling, equipment maintenance, repair or washing within 100 m of the ordinary high-water mark, and measures will be used so that runoff and water used for equipment cleaning does not enter any water body.
- All construction activities shall be suspended during adverse weather conditions (i.e., heavy rains).
- Soils shall be spread or graded in a direction away from the waterbody and never into the stream itself.
- Natural alignment of streams should be maintained to the extent feasible.
- Flow shall not be constricted by more than one third of the original stream width.
- Immediately after disturbance or upon completion of the work in or around waterbodies, waterbody banks, and riparian vegetation areas, the disturbed areas shall be restored to the original contour and gradient and cover treatment applied.
- If an area cannot be restored to its original contour and gradient due to instability or other reasons, a stable gradient shall be constructed, and cover treatment applied.
- Machinery fording shall be limited to a one-time event (over and back) and shall occur only if an existing crossing at another location is not available or practical to use. Fording shall only be conducted in a manner approved by the Contract Administrator.
- If minor rutting is likely to occur, waterbody bank and bed protection methods (e.g., swamp mats or rig mats) shall be used provided they do not constrict flows, block fish passage or cause sediment release into the waterbody.
- If rock is used to stabilize waterbody banks, it shall meet appropriate specifications, be clean and free of fine materials, and of sufficient size to resist displacement during peak flood events.
- The waterbody banks shall be stabilized, restored to their original shape, adequately protected from erosion and re-vegetated with native species.
- Any water intakes or outlet pipes in fish bearing waters shall have screens to prevent entrainment or impingement of fish and follow the measures as outlined in Fisheries and Oceans Freshwater Intake End-of-Pipe Fish Screen Guideline (https://publications.gc.ca/collections/Collection/Fs23-270-2004E.pdf).

2.5.2 Authorizations and Approvals

- Fisheries and Oceans Canada (DFO) authorization(s) or Letters of Advice may be required prior to the commencement of any in-water or near water work. Manitoba Transportation and Infrastructure shall address these requirements. The Contractor is required to provide Manitoba Transportation and Infrastructure with all Project-specific information required for these submissions a minimum 90 calendar days prior to the undertaking of in-water and/or near water works (or as otherwise directed by Manitoba Transportation and Infrastructure or the Contract Administrator), with the understanding that DFO may request additional information. Manitoba Transportation and Infrastructure shall not be responsible for delays associated with DFO authorization(s). All conditions specified in DFO authorizations, Letters of Advice and/or other DFO directives apply to the work.
- Transport Canada (TC) Navigation Protection Program Approval(s) may be required for the construction of permanent or temporary waterbody crossings and/or other in-water structures. Manitoba Transportation and Infrastructure shall obtain these permits, as required. The Contractor is required to provide Manitoba Transportation and Infrastructure with all Project-specific information required for these submissions a minimum 90 calendar days prior to the need to undertake the works (or as otherwise directed by Manitoba Transportation and Infrastructure or the Contract Administrator) with the understanding that TC may request additional information. Manitoba Transportation and Infrastructure shall not be responsible for delays associated with TC Navigation Protection Program Approval(s). All conditions specified in TC Navigation Protection Approval(s) and other directives apply to the work.
- For all temporary work and construction activities required for in-water works, Manitoba Transportation and Infrastructure will apply for required authorizations, permits, and approvals. The Contractor must supply detailed schedules and work plans to facilitate these applications and cooperate with additional information requests from regulatory bodies. It may take up to 90 or more business days to process applicable authorizations, permits required. The Contractor is bound by all conditions specified in regulatory directives applicable to the work. Manitoba Transportation and Infrastructure shall not be held responsible for any delays related to approvals.

2.5.3 Timing of Work

- In-water work shall be restricted to low flow periods and shall be scheduled during a period when the waterbody is seasonally dry or frozen to the bottom whenever possible.
- South of 53rd parallel, the Contractor shall not undertake any in-water activities in fish-bearing waters or potentially fish-bearing waters between September 15 and June 30 of the following year, during periods of high stream flow or identified spawning periods, unless otherwise authorized by DFO and Manitoba Natural Resources and Northern Development.

2.5.4 Site Isolation and Dewatering

- All work requiring site isolation and dewatering shall be conducted in accordance with contract documents, applicable permits, approvals, licences, or authorizations, or as directed by the Contract Administrator.
- Isolation structures must not constrict more than one-third of a fish-bearing waterbody.
- Sediment control measures (e.g., turbidity curtains) shall be used where appropriate prior to the installation and/or removal of any isolated structures.
- Isolated structures must be constructed and sized to prevent overtopping or failure.
- Sediment-laden dewatering discharge shall be pumped to a settling basin, filtering system or through dense terrestrial vegetation of sufficient distance from the waterbody to allow sediment deposition prior to re-entry downstream of the construction area, or as directed by the Contract Administrator.
- All pump discharge points shall be lined with clean rock or other acceptable flow-dissipating applications in order to prevent erosion and the release of suspended sediments.
- Accumulated sediment and excess material shall be removed from the isolated area before removing the isolation structure.
- Where a cofferdam shall be installed, it will be designed to accommodate any expected high flows during the construction period. All spoil material and debris shall be removed from the isolated area prior to the removal of the cofferdam. Surface drainage patterns for other Project components will be re-established where possible.

2.5.5 Fish Salvage

- A fish salvage operation must be conducted where site isolation and/or dewatering within a fish-bearing waterbody is required.
- Fish salvages shall be conducted by qualified environmental professional possessing a live fish handling permit. All fish shall be handled as little as possible and in a manner that minimizes stress and prevents fish injury or death.
- Fish salvage shall be conducted immediately after an area within a waterbody has been isolated. Partial dewatering is permissible to decrease wetted area and increase efficiency of fish capture, however, the fish salvage must be completed prior to complete dewatering of the isolated area.
- If a fish or mussel salvage is required, a Fish Salvage Plan shall be submitted by a professional certified to conduct such works and approved or modified by the Manitoba Transportation and Infrastructure Biologist.
- All captured fish shall be cataloged by species. The length and weight of a representative proportion of captured fish species shall be recorded.
- The following information shall be collected and recorded:
    - Date
    - Location (waterbody name and geographic coordinates)
    - Description of project/construction works
    - Physical habitat parameters – channel width, wetted width, size (area) and depth of salvage area, water temperature

- Fish capture method (e.g., Seine net, dip net, gill net, backpack electrofishing)
- Effort (e.g., two passes with a seine net; two people dip netting for 0.5 hours; backpack electrofishing for 350 seconds)
- Number of fish collected, by species
- Length and weight of a representative proportion of captured fish species

2.5.6 Mussel Salvage

- Where required, mussel salvages shall be conducted to remove mussels from the in-water footprint(s) of Project components.
- Mussel salvage and relocation work shall be conducted by a qualified environmental professional under and in accordance with a live fish handling permit.
- Where a species at risk (SAR), as listed under Schedule 1 of the *Species at Risk Act* is known to occur, or is found in the waterbed, work shall also be conducted under and in accordance with a SAR permit obtained from DFO. If a species at risk is found in a new area, the Contractor shall stop work, inform DFO and obtain a species at risk permit prior to continuing work.
- Mussels captured during the survey and salvage will be identified and transported while submerged to a designated location with similar habitat an appropriate distance upstream from the construction work site. (Minimum 250 m).
- Applicable measure in *Protocol for detection and relocation of freshwater mussel species at risk in Ontario Great Lakes Area (Mackie et al. 2008)* shall be used.
- Mussel surveys, salvage and relocation activities and results shall be documented in a report generated by the qualified environmental professional and submitted to Manitoba Transportation and Infrastructure for review and approval. The report shall contain detailed descriptions, photos, and drawings of site conditions including:
  - Location, habitat profile, description of methodology (including names of collectors) contact information, organization, and schedule of activities.
  - Results including photos of collected species and sites, depths, locations, and substrate in which each animal was found, numbers and the types of species found.
  - For mussel surveys conducted under SAR permit, the qualified environmental professional shall also submit a fish and mussel data collection table. Manitoba Transportation and Infrastructure will supply the template prepared by DFO to the qualified environmental professional.
  - Any death of a listed species at risk Mussel during salvage operations or associated construction must be reported immediately to Manitoba Transportation and Infrastructure. Manitoba Transportation and Infrastructure will be responsible for communicating with and the DFO SAR Biologist.

2.5.7 Temporary Stream Diversions, Fish Passage, and Base Flows

- The Contractor is responsible for maintaining base flows for the duration of construction activities in waterbody's requiring in-water and near water work, including those works which may require the installation of cofferdams and related structures, unless otherwise approved.
- Flow shall be maintained at all times to maintain downstream fish habitat and permit the safe and unimpeded passage of fish, if required. A temporary diversion channel to direct flows and fish passage around the work site shall be constructed if flows are to be constricted by more than one third of the original stream width in fish bearing waters. In non-fish, bearing waters a pumped diversion may be used to maintain flows downstream.
- Temporary stream diversions shall be designed to provide fish passage, even during low flow conditions.
- Instream diversion structures shall be constructed using erosion resistant materials.
- Temporary diversion channels shall be constructed in the dry. Gradient controls shall be used to ensure that diversion channel slopes correspond to the existing channel gradients.
- Temporary diversion channels shall be designed to accommodate expected waterbody flow from storm, runoff, or spring melt events.
- Temporary diversion channels shall be routinely inspected to identify areas of incipient erosion. Eroded areas shall be repaired promptly.
- Existing waterbodies shall not be disturbed until temporary diversion channels have been constructed.
- Diversion channels shall be opened from the downstream end first. Stabilize the connection of the diversion channel to the main waterbody. Pump flows around work site, if possible, during construction of the channel connection.
- Pumping system for pumped diversions shall be sized to accommodate any high flows of the waterbody during the construction period. Pumps shall be monitored at all times, and back-up pumps shall be readily available on-site in the event of pump failure.
- The original flows through the site shall be restored as soon as work is completed.

2.5.8 Beaver Removal

- Work plans for beaver dam removal shall be provided to the Contract Administrator for review and approval no less than 14 business days prior to the start of dam removal.
- Beaver dam removal shall be scheduled to comply with in-water work timing windows, and shall not affect a fishery, or recreational property uses that depend on the dams existence, both upstream and downstream.
- The Manitoba Natural Resources and Northern Development (MNRND) District Office shall be contacted before proceeding with the beaver dam removal. Dam removal permits or wild animal kill permits shall be obtained, as or if required, prior to removal of beaver dams or beavers. Consultation with users' identified by MNRND may be necessary before removal of beaver dams or beavers can proceed. Any safety concerns or potential downstream infrastructure shall be identified, and any potentially affected stakeholders who should be consulted will also be identified.

- Beaver removal shall be conducted in accordance with acquired wild animal kill permits.
- Removal activities shall be restricted to removal or breaching of the dam itself and shall not involve channel or shoreline modification downstream of the dam.
- When a series of dams is to be removed this shall typically be done starting from the most downstream dam and working upstream.
- The beaver dam shall be removed gradually (20 cm at a time), allowing water to release slowly to minimize sediment at the bottom of the pond from being released downstream.
- Wherever possible, beaver dams should be removed by using hand tools. Where removal by hand tools is not possible then machinery may be used.
- The width of the breach opening of the beaver dam shall not exceed the width of the original stream channel to prevent bank erosion and flooding adjacent properties.

2.5.9 Stream Crossings

- Where possible, existing stream crossings shall be utilized to traverse waterbodies.
- All stream crossings shall be constructed in accordance with The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (https://www.gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/sguide.pdf) and DFO's Interim Code of Practice: Temporary Stream Crossings (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-crossings-traversees-temporaires-eng.html?wbdisable=true).
- If there is no existing crossing and the waterbody must be crossed, the Contract Administrator may approve the construction of a temporary crossing to keep all vehicles and equipment out of the waterbody.
- Stream crossings shall be located at straight stream sections, perpendicular to the bank. In particular, meandering bends, braided streams, alluvial fans, and other unstable areas shall be avoided.
- When feasible, the construction of stream crossings shall be scheduled for the period of lowest steam flow and should be a single event.
- The natural alignment of the stream shall be maintained.
- A minimum vegetated buffer strip of 30 m shall be maintained between the worksite and waterbody except at the actual crossing location.
- The number of temporary stream crossings constructed shall be minimized.
- Temporary stream crossings shall be removed as soon as possible following completion of the work or when it is no longer required, whichever is sooner.
- Natural debris removal shall be limited to that which is necessary to protect bridge piers or abutments or to that which is blocking culverts.

2.5.10 Water Quality Monitoring

- Guidance for surface water quality monitoring is described in the Surface Water Management Plan.
- Water quality monitoring shall be required if described in tender documents for in-water work in fish-bearing waterbodies and may be required when working near fish bearing waterbodies or tributaries to fish bearing waterbodies to demonstrate that deleterious substances are not entering into the waterbody. Water quality monitoring shall also occur when working upstream and within 5km of a water treatment plant intake.
- The Contractor must advise the Contract Administrator no less than 30 business days in advance of work where water quality monitoring is or may be required. The monitoring shall be conducted prior, during and after construction activities. The Contractor shall reconfirm the schedule 7 business days and 48 hours in advance of the start of work. Any alteration to the schedule which results in direct or indirect costs to the Contract Administrator, Manitoba Transportation, and Infrastructure or its designate shall be at the Contractor's expense.
- Where water quality monitoring is being coordinated by others, the Contractor must cooperate and coordinate with Manitoba Transportation and Infrastructure and its agents. All water quality monitoring activities must be conducted or overseen by a qualified environmental professional or a suitable equivalent at the discretion of the Contract Administrator.

2.5.11 Culvert Installation, Maintenance and Replacement

- Culvert maintenance will follow DFO's Interim Code of Practice: Culvert Maintenance (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/culvert-maintenance-entretien-ponceaux-eng.html).
- Old culverts are not to remain on site and should be disposed at an appropriate disposal or recycling facility.
- Material and structures shall not be kept within 100 m of a waterbody.
- Utilize culvert removal techniques that minimize impacts to the waterbody and riparian area.
- The Contractor shall maintain a culvert gradient as close to the natural stream grade as possible.
- The Contractor shall embed culverts a minimum of 30 cm or 10% of the total culvert diameter (whichever is greater) below the normal stream bed.
- The Contractor shall avoid using frozen backfill to ensure proper compaction. Backfill shall be compacted to avoid settling, hydrostatic uplifting or side movements of the culvert that may lead to blockage of fish passage or washouts.
- Any debris and other materials that has accumulated in a culvert due to construction activities shall be removed gradually. Whenever possible, debris and other materials shall be removed by hand.
- Removal of debris (i.e., branches, stumps, other woody materials, garbage, etc.) shall be limited to the area within the culvert, immediately upstream of the culvert and to that which is necessary to maintain proper culvert function and safe fish passage.
- Accumulated debris shall be removed slowly to allow clean water to pass, to prevent downstream flooding and reduce the amount of sediment-laden water going downstream. Gradually reintroducing flow will also reduce the potential for stranding fish in upstream areas.

- Accumulated sediment removal shall be limited to within the culvert and to the level of the waterbody bed, to maintain embedment of the culvert.
- Sediment shall be removed in a manner that prevents it from moving downstream.
- Emergency debris removal using hand tools or machinery (e.g., backhoe) may be carried out at any time of year. Emergencies include situations where there is imminent risk of damage to property or the environment or is in the interest of public health or safety.

2.5.12 Blasting Near a Waterbody

- The Contractor shall plan and time blasting activities to adhere to legislated and regulated restrictions to respect key life cycle events to critical life functions of fish and wildlife.
- The Contractor shall possess all required blasting permits and certificates. Advanced notification shall be given to affected parties including site employees and the local general public prior to each blasting event.
- The use of ammonium nitrate-fuel oil mixtures in or near water frequented by fish shall be avoided to prevent the deposit of toxic by-products (ammonia).
- Blasting near fish-bearing waterbodies shall adhere to set back and weight of explosive charge guidelines as referenced in DFO document Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (https://publications.gc.ca/site/eng/82558/publication.html). Where these guidelines cannot be met, blasting plans shall be submitted to the Contract Administrator for application to DFO to obtain necessary approvals prior to commencement of blasting in areas that could affect fish habitat.

2.5.13 Aquatic Invasive Species

- Construction will comply with the provincial aquatic invasive species regulations (*The Fisheries Act*).
- Equipment that has or will come in contact with Lake Manitoba or listed control zones must be decontaminated using one of the methods described in Manitoba's Aquatic Invasive Species Regulation (See MNRND website: (https://www.manitoba.ca/stopais/spread/decontamination.html) for the most up to date list of Control zones)
- The Contractor shall ensure that equipment which has previously been in contact with an aquatic ecosystem, including but not limited to rivers, lakes, and marshes is properly cleaned so as to prevent the spread of aquatic invasive species.
    - Equipment of particular concern includes, water tanks, tank trucks, pumps, hoses, intake screens, boats and motors, and fish and water monitoring equipment.
    - Equipment which has been in contact with Lake Manitoba, Fairford River, Lake St. Martin, or Lake Winnipeg water must be washed before coming in contact with another waterbody.
- Equipment coming in contact with aquatic ecosystems must be cleaned and drained completely, dried, and inspected before and after contact. Cleaning is defined as the removal of all aquatic plants, animals, and sediments.

- In the event that aquatic invasive species are discovered during inspection the Contractor shall inform the Contract Administrator and shall remove the equipment or machinery from the work site until it has been cleaned to the satisfaction of the Contract Administrator. MNRND shall also be notified by using the web-form linked below: (http://www.gov.mb.ca/waterstewardship/stopais/ais_reporting.html
- Documentation of measures to facilitate the prevention of the spread of aquatic and terrestrial species invasive species shall be incorporated into the respective Water Quality and Fish Protection Plan and Monthly Environmental reports including:
  - History of equipment work locations and potential sources of contamination.
  - Details of cleaning / decontamination plan and procedures (methods).
  - Documentation of cleaning and decontamination (date, personnel, confirmation of methods used)

2.6 Machinery, Fuel Storage, Materials Handling and Storage, Spill Response and Remediation

Improper machinery maintenance, fuel storage, materials handling, and storage can create hazards to people, property, and the environment. The following requirements apply to all works during all Project phases.

2.6.1 General

- The Contractor is responsible for ensuring compliance with all applicable legislation, regulation, permits, approvals, licences and/or authorizations.
- A Waste Management Plan shall be prepared for the Project that will include practices for management of both general and hazardous wastes.
- Machinery shall arrive on site in a clean condition and shall be kept in good working order and free of fuel, oil, or fluid leaks. Machinery that is found to be leaking any fuel, oil or other fluids shall be moved off the work site immediately for repair.
- All fuel handling and storage shall comply with *Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001 under The Dangerous Goods Handling and Transportation Act C.C.S.M. c. D12.*
- Storage of fuel stored in drums or containers of 230 litres (L) or less shall comply with the requirements of the *Manitoba Fire Code.*
- Designated area(s) shall be established for fuel storage, materials handling, and storage, equipment cleaning, refueling, and servicing. Any designated area shall be located at least 100 m away from the high-water mark of any waterbody or wetland and shall be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection.
  - Machinery and equipment shall be washed, refueled, and serviced in such a manner that wash water shall not contaminate surface water or be discharged into a waterbody.

  - In the event that a piece of equipment must be refueled or serviced outside a designated area, the fuel shall be transported in approved containers. Absorbent pads or other precautions, such as drip trays or a high-density polyethylene groundsheet, shall be used as secondary catchment or containment in the event of spillage.
  - All mobile equipment that is not in use shall be parked within a designated area(s) where possible. Equipment exhibiting signs of leaks or spills shall be parked over secondary containment to prevent soil contamination.
- All designated areas used for petroleum storage shall be a minimum distance of 3 m from a property line or building and 15 m horizontally from hydroelectric poles and lines.
- Tank vehicles used to deliver fuel to the work site and/or used to move fuel around the work site shall meet the current Canadian Standards Association requirements for highway tanks for the shipment of dangerous goods by road (https://tc.canada.ca/en/dangerous-goods/containers/tank-trucks-trailers-tc-portable-tanks/standard-csa-b620-highway-tanks-tc-portable-tanks-transportation-dangerous-goods).
- All fuel storage containers and tank vehicles shall be inspected daily for leaks and spillage. Damaged or leaking fuel storage containers shall be promptly removed from site. All used petroleum products and other regulated hazardous wastes shall be collected and disposed of at a licensed facility in accordance with applicable legislative requirements.
- Equipment shall not be refueled from a watercraft.
- All designated sites, including but not necessarily limited to refueling, fuel storage and equipment servicing sites are to be fully remediated (i.e., returned to pre-existing condition, or below Canadian Council of Ministers of the Environment guideline) once they are no longer required or have been decommissioned. If necessary, soil testing will be performed to verify site conditions.
  - The Contractor will be liable and responsible for any required remediation and disposal of contaminated material from all applicable work sites and designated areas to an appropriate licenced facility. It is in the Contractors best interested to identify any pre-existing contamination prior to the start of work.
  - Documented proof of contamination inspection(s) and site remediation of all applicable work sites and designated areas shall be provided to the Contract Administrator prior to contract closeout.
- Petroleum products shall be transported in accordance with the *Manitoba Dangerous Goods Handling and Transportation Act.*
- Construction, installation, and removal of petroleum storage tank systems shall occur under the supervision of a registered licenced petroleum technician.
- Prior to use or filling, all petroleum storage tanks shall be registered and properly permitted, as required, with the province of Manitoba or the government of Canada (on federal lands). All permits are to be kept current.
- Petroleum storage tanks shall be grounded, and the dispensing tank shall be attached with a bonding cable to an appropriate location on the receiving tank prior to commencing fueling.

- Dedicated petroleum storage areas shall provide additional spill containment and facilitate clean up through measures such as:
  - Maximum separation from environmentally sensitive features
  - Clear identification of the materials present
  - Access restricted to authorized vehicles and employees
  - Impervious bermed storage areas
  - Dedicated spill response equipment
- Only above ground storage tanks shall be used for the storage of bulk petroleum products. The tanks shall be equipped with overfill protection and spill containment consisting of perimeter dikes or secondary containment in the tank design.
- All designated areas used for petroleum product storage shall be a minimum distance of 100 m from any water body and shall have the topsoil stripped and be underlain with at least 30 cm of impermeable soil or approved alternate and diked in such a manner as to contain any leakage or spillage. The dikes shall be designed, constructed, and maintained to retain not less than 100% of the capacity of the total number containers or 110% of the largest container, whichever is greatest. If dikes are used, the containment areas shall be dewatered after a rainfall event and the containment water disposed of as approved by the Contract Administrator and clean topsoil shall be stored and used in the restoration of the site.
- Concrete barriers shall be installed around all petroleum storage tanks to prevent collisions (as per Technical Bulletin PSF-004, March 2015: Impact Protection Requirements for Above Ground Storage Tanks Systems).
- All mobile equipment that is not in use shall be parked within a designated area.
- All employees involved in the handling and storage of fuels shall have Workplace Hazardous Materials Information System (WHMIS) and spill response training.
- All internal-combustion engines (regardless of fuel type) shall be shut down during fueling.
- There shall be no smoking and no open flames at the petroleum storage area at any time.
- Fueling procedures shall be posted where fueling occurs.
- Storage sites for petroleum products shall be secured and signs including but not limited to; hazard warnings, who to contact in case of a spill, access restrictions and under whose authority the access is restricted shall be posted.
- All petroleum storage tanks with a capacity greater than 5,000 L shall be registered with Manitoba Environment Climate and Parks (MECP). New tanks shall be registered before installation. Tanks shall be designed, installed, and operated in accordance with the *Manitoba Dangerous Goods Handling and Transportation Act* and the Federal *Transportation of Dangerous Goods Act*. Smaller stationary tanks shall adhere to requirements of the *Manitoba Fire Code*. A copy of the petroleum license shall be posted at the fueling site.
- Bulk waste oil shall be stored in aboveground oil tanks, which shall have secondary containment and a weatherproof cover. Waste oil shall be recycled by a reputable recycling agency.
- Used oil filters shall be drained, placed into suitable storage containers, and disposed of at approved facilities. The oil drained out of the used filters shall be collected and handled in the same manner as used oil.

- The Contractor shall prevent fuel, lubricants, or compounds from being released. All empty containers from equipment refueling and servicing shall be removed to a licenced disposal site. The Contractor shall be thoroughly familiar with provincial/federal spill response compliance procedures.
- Materials required for spill containment and clean-up shall be available at all work sites and designated areas. All vehicles shall carry materials and equipment for emergency spill containment.
- All petroleum product storage sites and mobile transportation units shall, at all times, be equipped with appropriate categories of equipment and volumes of fire suppression products

2.6.2 Spill Response and Remediation

- Due care and caution shall be taken to prevent spills, leaks, and releases of hazardous products at all times.
- An up-to-date list of key contacts and telephone numbers for reporting spills shall be kept on-site at all times.
- A WHMIS file shall be maintained on-site for all hazardous materials at the work area.
- Prior to commencement of the Work, Material Safety Data (MSD) shall be available on-site for all hazardous materials to be used. An updated spill response and containment plan for each dangerous good/hazardous waste shall be maintained in the work area at all times.
- **The Contractor** shall, within 24 hours of any reportable spills (Table 1), by contact the Emergency Response Program Reporting Line at (204) 944-4888 pursuant to *Manitoba Regulation* 439/87, respecting Environmental Accident Reporting.
- All spills shall be reported to the Contract Administrator within 24 hours whether it was necessary to report the spill to MNRND or not. The spill report shall include the following:
    - personnel responding to the spill
    - material spilled
    - cause of spill
    - estimated amount of material spilled
    - estimated area and volume of soil affected by the spill
    - cleanup action undertaken
    - means used to contain, transport, and dispose of the materials involved
- All spills of quantities less than those set out in Table 1 and without a potential impact to the environment shall be contained and cleaned up immediately by on-site personnel in accordance with the approved on-site emergency response and containment plan and reported to the Contract Administrator.
- In the event that there is a spill, leak, or release onto the ground surface from any piece of equipment (e.g., broken hydraulic hose) the entire affected area shall be cleaned up and all contaminated soil shall be appropriately disposed of at a licenced soil recycling facility. If contaminated soil is to be stored on site for any time a designated storage area is to be identified and prepared to prevent secondary contamination.

Table 1: Manitoba's Environmental Accident Reporting Regulation – Reportable Quantities

Classification	Hazard	Reportable Quantity
1	Explosives	All
2.1	Compressed Gas (Flammable)	100 L*
2.2	Compressed Gas	100 L*
2.3	Compressed Gas (Toxic)	All
2.4	Compressed Gas (Corrosive)	All
3	Flammable Liquids	100 L
4	Flammable Solids	1 kg
5.1 PG I, II, III	Oxidizer	1 kb or 1 L
	Oxidizer	50 Kg or 50 L
5.2	Organic Peroxide	1 Kg or 1 L
6.1 PG I	Acute Toxic	1 Kg or 1 L
PG II & III	Acute Toxic	5 Kg or 5 L
6.2	Infectious	All
7	Radioactive	Any discharge or radiation level exceeding 10 m Sv/h at the package surface and 200 uSv/h at 1 m from the package
8	Corrosive	5 Kg or 5L
9.1	Miscellaneous (Except PCB Mixtures)	50 Kg
9.1	PCB Mixtures	500 grams
9.2	Aquatic Toxic	1 Kg or 1 L
9.3	Wastes (Chronic Toxic)	5 Kg or 5 L

Notes:
*Container Capacity (refers to container water capacity)

- A spill kit or sufficient supply of materials for clean-up or spill containment (i.e., absorbent material, high density polyethylene groundsheets and absorbent oil booms when working near water) shall always be available on site and replenished as needed. If necessary, additional material shall be made available on short notice.
- The Contractor shall designate a qualified supervisor(s) as the onsite emergency response coordinator(s) who shall be on site at all times that work is being undertaken. The emergency response coordinator(s) shall have the authority to redirect manpower and equipment in order to respond in the event of a spill.
- The designated emergency response coordinator shall periodically review and if necessary, revise the on-site emergency spill response plan.
- As dangerous goods/hazardous waste storage areas are taken out of service remediation shall be conducted, including the appropriate disposal of the contaminated material to the satisfaction of the Contract Administrator.
- The Contractor shall provide documentation (e.g., disposal weigh bills) of all disposed contaminated materials to the Contract Administrator and/or Manitoba Transportation and Infrastructure.

2.6.3 Materials Handling & Storage

- All construction areas shall be kept clean and orderly at all times during and after completion of work or activities.
- Waste material shall be recycled to a degree that is economically and practically feasible.
- There shall be no indiscriminate dumping of waste and litter on or off work sites or designated areas.
- All waste materials shall be collected and contained in a designated waste storage area and in containers appropriate to the waste classification until removed from the site for recycling or disposal at an approved facility.
- Waste storage sites shall be designated for each worksite and camp as approved by the Contract Administrator.
- Different waste streams shall not be mixed.
- Contaminated runoff or water shall be contained and prevented from entering any waterbody. The collected contaminated runoff or water shall be hauled off site for disposal at an approved disposal facility.
- No on-site burning of waste or any other material is allowed unless approved by the Contract Administrator. When required, the Contractor shall be responsible for obtaining a burning permit from MNRND for burning between April 1 and November 15.

2.6.4 Dangerous Goods/Hazardous Waste Handling and Disposal

- Dangerous goods and hazardous wastes shall be identified and shall be handled in accordance with *The Dangerous Goods Handling and Transportation Act and Regulations and Health Canada's Workplace Hazardous Materials Information System*.
- The Contractor shall have staff, trained and certified in the handling of dangerous goods, present on-site whenever said dangerous goods are being utilized for the performance of the work.

- A WHMIS file shall be maintained on-site for all hazardous materials at the work area. Prior to commencement of the Work, a Project MSD sheet shall be submitted to the Contract Administrator. No material shall be brought to the site without prior submission of a Project MSD.
- Designated dangerous goods/hazardous waste storage areas shall have the topsoil stripped and be lined with at least 30 cm of impermeable material or approved equal. The dykes shall be designed, constructed and maintained to retain not less than 100% of the capacity of the total number of containers or 110% of the largest container, whichever is greatest. The topsoil shall be stored and used in the restoration of the site.
- Disposal of hazardous waste shall only be done at hazardous waste facilities licensed under *The Dangerous Goods Handling and Transportation Act.*
- All waste stored at designated hazardous waste storage areas shall be removed from the site at least once every seven (7) days.
- Hydrocarbons shall not be stored or disposed of in earthen pits.
- All pesticides shall be handled and applied by or under the direct supervision of a licensed commercial applicator, as defined in section 4.1 of the *Pesticides Regulation 94/88*, and further all pesticides shall be used in accordance with any terms and conditions of the permit.
- A pesticide use permit shall be obtained prior to the application of pesticides, if required. The Contractor shall ensure that all pesticides are applied by a licenced commercial applicator and adhere to all conditions specified in this permit. These conditions include submitting a properly completed post seasonal form to the Contract Administrator at the completion of the Contract or at the end of each calendar year confirming that any terms and conditions of the permit have been satisfied. The Contractor shall supply the following information to the Contract Administrator for this form:
    - The name of each pesticide used
    - The Pest Control Product number of each pesticide
    - Quantity in litres of each pesticide used
    - Total area treated in hectares
    - A map of the treated areas
    - Legal description of the land where practical
    - Color coded map to indicate where each type of pesticide was used

2.6.5 Domestic Solid Wastes, Demolition and Construction Waste

- Non-reusable demolition and construction debris shall be disposed of at a waste disposal ground operating under the authority of a permit pursuant to *Manitoba Regulation* 150/91 respecting Waste Disposal Grounds. Provide proof of appropriate disposal.
- All domestic solid waste containers shall be clearly marked to identify the nature and type of material to be deposited (e.g., containers for recyclable material and containers for disposal).

2.6.6 Wastewater, Sewage and Manure

- All collected sewage shall be removed from the site at least once every seven days by a registered sewage hauler, as defined in section 21(1) of the *Onsite Wastewater Management Systems Regulation* No. 83/2003 and disposed of at a wastewater treatment facility licenced under *The Environment Act.*
- All wastewater and sewage shall be collected through the provision of an outside toilet facility in compliance with the *Onsite Wastewater Management Systems Regulation No. 83/2003.*
- Manure stockpiles should be relocated from the Project footprint prior to construction.
- A plan for treatment and/or disposal of impacted soils will be developed. This may include excavation and spreading of identified impacted soils onto agricultural lands outside of the LMOC construction area, as appropriate.

2.7 Dust Suppression

The following requirements apply to all dust suppression activities for all Project phases.

2.7.1 General

- Guidance on dust management is provided in the Dust Management Plan.
- All work shall be conducted in a manner that minimizes the raising of dust from construction or maintenance operations.
- Only water or approved dust suppressants shall be used for dust control. The use of waste petroleum or petroleum by-products as dust suppressants is not allowed.
- All vehicles used to haul materials to or from the work site shall have the load covered with a tarpaulin cover during transport to minimize dust and prevent material from falling out.
- All material stockpiles or spoil piles prone to wind erosion shall be maintained as to minimize release of particulate matter or dust. This may include, but is not limited to, covering or stabilization of material stockpiled at the work site as required.
- The application of dust suppressants shall be limited to the roadway, driveway, or designated area.
- The application rate of all dust suppressants shall be carefully monitored to facilitate adequate coverage without pooling or runoff of products.
- The amount of dust suppressant applied should not exceed the minimum amount required to effectively suppress dust. Avoid over-application or application beyond the road shoulder.
- The material must not migrate or run off the traveled portion of the roadway or designated area.
- Dust suppressants must conform to the manufacturer's specifications and must not contain concentrations of contaminants that would not normally be found in the suppressant.
- Dust suppressants shall not enter and contaminate waterbodies, including surface and groundwater. Do not allow the product to leave the roadway.
- Products shall not be applied to areas of roads that are subject to flooding.
- Products shall not be applied if precipitation is occurring or forecast to occur before the product sets or cures.

- Over-application or application beyond the road shoulder shall be avoided.
- Should there be a need for a water source for compaction or dust suppression or related activity, a temporary authorization for any withdrawal greater than 25,000 L or 550 gdp shall be required from MECP Water Use Licensing Section. Contact the Manager of Water Use Licensing Section, at (204) 945-3983 prior to the commencement of the work.

2.8 Concrete and Asphalt

The following requirements apply to all concrete and asphalt works during all Project phases.

2.8.1 General

- All concrete obtained and utilized for the Project must be sourced from a concrete batch plant licensed in accordance with *The Environment Act*.
- All contractor owned batch plants must be licenced under *The Environment Act* prior to development or use.
- Concrete wash out areas must be designated at the pre-construction meeting and approved by the Contract Administrator prior to development or use.
- Waste concrete from concrete pumps and concrete trucks, cleanout materials from concrete trucks, concrete pumps and other equipment shall be deposited only in the concrete washout designated area. All of this material shall be hauled off site, for disposal at an approved landfill or to a recycling facility, not later than at the closure of the designated area.
- Concrete washout areas should be located a minimum of 100 m away from the ordinary high-water mark of a waterbody or wetland and in a non-porous soil location. All concrete washout areas shall be remediated to the satisfaction of the Contract Administrator when no longer in use or when construction activities are complete, whichever is sooner. Concrete washout areas are not to be carried over from one contract to another unless approved by the Contract Administrator.
- Concrete works shall be conducted in a manner that does not allow direct entry of concrete, concrete fines or concrete washout into a waterbody or wetland. Appropriate sealed containment to isolate a structure will be required for concrete usage within water.
- The Contractor shall comply with all requirements as laid out in the *Water Rights Act*, including but not limited to:
    - The Contractor must not release any excess cement and/or wastewater to surface waters, including wetlands,
    - Any containment area must not be connected to or drain to any surface waters, including wetlands, and
    - Any wastewater generated on site must be contained within the construction site.
- The Contractor shall comply with all requirements as laid out in *The Environment Act* Licence for the batch plant regarding utilization, cleanup and disposal of water, waste and hazardous materials at the washout site.
- Barges or shrouding shall be used to trap and prevent concrete and other bridge materials from entering a waterbody.

2.9 Noise and Emissions

The following requirements apply to all Project-related works and during all Project phases. All activities shall be undertaken by means that do not result in violation of applicable noise by-laws, or other specified thresholds. The Contractor is responsible for ensuring compliance with contract specifications, environmental legislation, permits and authorizations.

2.9.1 General

- The Complaint Resolution Process will be implemented to address Project-related construction and operation complaints related to air quality and noise.
- All plant and equipment supplied for use on the Project shall be effectively "sound-reduced" by means of proper silencers, mufflers, acoustic linings, acoustic shields or acoustic sheds.
- Noise by-laws of the adjacent communities and municipal authorities shall be complied with.
- Residents near construction noise-generating activities will proactively be notified as required.
- Any operation of plant or equipment beyond dates or times as specified or regulated by applicable by-laws or adjacent communities or municipal authorities shall require an exemption in writing.
- Project off-road construction equipment will comply with emission standards in the Canadian Off-Road Compression-Ignition Engine Emission Regulations.
- Engines and exhaust systems will be properly maintained.
- Construction vehicle idling times will be reduced to the extent possible in order to reduce emissions, as a best management practice. Cold starts will be limited to the extent possible to reduce emissions.
- Machinery and factory supplied noise-abatement equipment (e.g., mufflers) will be maintained in good working order.

2.10 Light

The following requirements apply to all Project-related works and during all Project phases.

- Lighting will be located so that the lights are not directed toward oncoming traffic on nearby roads on or off-site.
- Lights will be turned off when they are not required.
- There will be adherence to lighting design guidelines and the lighting requirements for workspaces as enforced by Labour Canada.
- Full cut-off luminaire will be used wherever possible to reduce glare, light trespass, and sky glow.
- As much as is possible, lighting will be located such that it does not impact receptors outside of the work limits.

2.11 Wildlife and Species of Conservation Concern

Wildlife includes a broad range of terrestrial, aquatic, or avian species that may be affected by various activities. This procedure is intended to compliment other targeted procedures, regulatory requirements and monitoring plans. The Contractor is responsible for ensuring compliance with contract specifications, environmental legislation, permits and authorizations.

2.11.1 General

- Construction camps and worksites shall be kept clean and tidy. All food, garbage or waste that may attract wildlife shall be stored in an appropriate manner and be disposed of at an area which has been designated as an appropriate waste disposal site.
- Nuisance wildlife shall be immediately reported to the Natural Resources Officer and the Contract Administrator.
- Employees, workers and other staff shall not hunt, trap or harass wildlife.
- The Contractor shall not remove, destroy or disturb species pursuant to Manitoba Regulation 25/98 of *The Endangered Species and Ecosystems Act*, or any future amendment thereof, respecting Threatened, Endangered and Extirpated Species, or species listed in the federal *Species at Risk Act*.
- Wildlife habitat shall not be destroyed or damaged, except pursuant to a licence, permit or other authorization issued for the Project.
- No person shall take or be in possession of or willfully destroy the nest or eggs of birds.
- No person shall remove, disturb, spring or in any way interfere with any trap set out lawfully by any other person for the purpose of taking furbearing animals.
- No blasting shall be permitted within close proximity to known sensitive wildlife habitat during critical lifecycle periods.
- Trees containing large nests of sticks and areas where active dens or burrows occur shall be identified, left undisturbed, and reported to the Natural Resources Officer.
- Terrestrial buffers, as identified by the Manitoba Conservation Data Centre's *Recommended Development Setback Distances from Birds and/or Manitoba Sustainable Development's Forest Management Guidelines for Terrestrial Buffers* (MB CDC 2021) shall be adhered to for all applicable sites.
- To reduce the possibility of vehicle collisions with wildlife, vehicle speed shall not exceed posted speed limits and wildlife warning signs shall be installed, where appropriate.
- Prior to reinstating a quarry or borrow site, the area shall be surveyed to determine presence or absence of bank swallows and or common nighthawk nests. If nests are discovered, work shall be suspended, and the Contract Administrator will be contacted for further advice.
- Prior to removing temporary structures, an inspection shall be conducted to determine the presence or absence of nesting birds. If nests are discovered, work shall be suspended, and the Contract Administrator will be contacted for further advice.

- Excavation within wetlands will be completed during dry or frozen conditions whenever feasible.
- Exclusionary fencing will be installed around open excavations near wetlands when and where there is potential for entrapment of amphibians or other wildlife species, or as directed by the Contract Administrator.

2.12 Wildfires

Wildfires can be a threat to people, property, and activities. Advance planning, preparation and the implementation of safety measures is required to effectively respond to wildfires when they do occur.

2.12.1 General

- An evacuation and emergency preparedness plan addressing wildfires shall be implemented and submitted to the Contract Administrator prior to commencing construction.
- No fires shall be started without first taking sufficient precautions so that the fire can be kept under control.
- Open fires are prohibited from April 1st to November 15th annually. In the event that burning is required during that period, an application for a burning permit shall be submitted for approval to Manitoba Natural Resources and Northern Development, where applicable. All conditions imposed by the burning permit shall be adhered to.
- No activity shall be conducted which may cause a fire to spread. Similarly, burning, or smoldering matter shall not be placed where it may cause a fire to spread.
- A primary zone shall be established around camp sites and other longer term temporary structures associated with construction and maintenance activities. Flammable materials such as leaves, brush, dead limbs, and fallen trees shall be cleared from the area regularly.
- The locations of construction camps, offices, and related structures shall be chosen in such a fashion as to minimize the risk of exposure to wildfires.
- In the event that a wildfire occurs, it shall be immediately reported to the Contract Administrator and to MNRND at 1-800-782-0076.
- All reasonable steps shall be taken to prevent a fire from burning out of control or spreading from land owned or occupied for construction purposes.
- In the event that a wildfire is identified where construction activities are taking place, all reasonable attempts shall be made to extinguish the wildfire. All available equipment, services and labor shall be made available at the disposal of an officer for the purposes of wildfire protection operations.
- All construction and related activities taking place in the vicinity of a wildfire shall cease until advised by the Contract Administrator that it is safe to resume operations.

2.13 Heritage Resources

Heritage resources are an important component of Manitoba's historical legacy which may be uncovered during a wide range of construction activities. Heritage resources may include human remains, a heritage site, a heritage object, and any work or assembly of works of nature or human endeavor that is of value for its archeological, paleontological, pre-historic, historic, cultural, natural, scientific, or aesthetic features, and may be in the form of sites or objects or a combination thereof.

2.13.1 General

- Additional information on mitigation measures can be found in the Heritage Resources Protection Plan
- Areas of heritage or cultural resources of interest will be identified in the EPP mapbooks and Special Provisions and/or construction drawings and shall be inspected prior to the start of construction.
- The Contractor will report encountered heritage resource materials immediately to the Contract Administrator.
- Work at the location shall be suspended until a Historic Resource Consultant can assess the archaeological or historic artifacts encountered, and mitigation measures are confirmed with the Manitoba Historic Resources Branch.
- All heritage resources discovered during site preparation and construction will be left in their original position until the Historic Resource Consultant is contacted and provides instruction.
- If deemed necessary by the Historic Resource Consultant or required by legislation, the Historic Resources Branch (HRB) will be informed of heritage resources, or objects thought to be heritage resources, are discovered during site preparation and construction who will determine whether additional measures are required.
- If deemed necessary by the Historic Resource Consultant or required by the HRB, protective barriers will be placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds. These barriers may be stakes or fences and will remain in place until any additional measures required by HRB are completed to the satisfaction of HRB. At that time, the barriers will be removed, and construction will proceed.
- The Historic Resource Consultant will carry out additional measures as required by the HRB.
- If human remains are encountered, the measures described above will be enacted plus informing the Royal Canadian Mounted Police for determination of jurisdiction (forensic or archaeological). If forensic, Royal Canadian Mounted Police has custody of and is responsible for recovery of remains. If archaeological, HRB has custody of and is responsible for removal of remains.
- The Heritage Resources Protection Plan will be adhered to during construction and operation phases of the Project.

2.14 Quarries and Borrow

The following requirements apply to all quarry and borrow related works during all Project phases.

2.14.1 Quarry Site Selection

- Rock, aggregate and limestone will be obtained from existing quarries where possible.
- No operator of a quarry is to establish or mine a quarry closer than 400 m from a residence unless the operator has established a vegetated berm or tree screen sufficient to shield the quarry from view from the residence.
- With the exception of quarries that are contiguous with the road ROW, all quarry operations shall maintain a 100 m buffer from the proposed road ROW. If no vegetated buffer or screen exists this distance shall be at least 150 m.
- Habitat occupied by protected species shall be avoided.
- Quarry site selection shall consider the proximity of sensitive sites including waterbodies, wildlife, heritage resources and culturally important sites (see EPP mapbooks). Setbacks will vary depending on circumstances however selected areas are to be a minimum of:
    - 100 m from a water course or waterbody
    - 100 m buffer from any large stick nest, eagle nest, heron rookery, or any other sensitive wildlife area
    - 30 m from heritage resources or identified cultural sites
    - 400 m from any residence
    - 15 m from any property boundary adjoining, private, municipal, or Crown leased land
    - Other setbacks as required
- Prior to developing quarry sites, the potential for acid rock generation will be determined. Sites found to contain acid generating rock shall not be developed or used.

2.14.2 Quarry Development

- Guidelines for quarry development are described in the Quarry Management Plan (QMP).
- The Contractor shall comply with all legislations, licenses, authorizations, and permits respecting the Project and quarry.
- The Contractor shall not commence any mobilization or drilling activities until a casual quarry permit or quarry lease have been issued by the province of Manitoba (if required).
- Should a Contractor develop a new quarry, the Contractor would be responsible for maintaining the site and promoting surface water runoff to minimize ponding after rainfall events. In the event that ponding does occur, it shall be discharged or removed using effective erosion and sediment control devices and pumps as accepted by the Contract Administrator.

- Quarries shall be developed in accordance with the site plan submitted to the Contract Administrator prior to the beginning of construction and, where applicable, the immediate quarry area plan provided to MNRND as part of the work permit (if required).
    - The major components of the Work are as follows:
        - Access Road Construction
        - Clearing and Grubbing
        - Blasting
        - Gravel Crushing and Stockpiling of Aggregate
- Quarry operations shall not encroach within 15 m of any property boundary adjoining, private, municipal, or crown leased land.
- The Contractor may be subject to operational restrictions if in close proximity to sensitive receptors, including but not limited to wildlife, fish, residences, or communities as stipulated in applicable permits or by the Contract Administrator (see EPP mapbooks for locations).
- The Contractor shall maintain the quarry site in a tidy condition and free from the accumulation of debris.
- A Site Decommissioning Plan shall be developed in accordance with all applicable permits, legislation and regulations and as approved by the Contract Administrator.
- Reclamation of temporary construction areas and aggregate/quarry sites would occur following the completion of construction once the sites are no longer needed for operation and maintenance and would be expected to follow those measures in place at the time of remediation/decommissioning and in full compliance with legislation and regulatory standards.
- Borrow pits, if required, will be left in a manner which promotes natural re-vegetation of the site:
    - Guidance on rehabilitating borrow pits is described in the QMP, Revegetation Management Plan (RVMP), and Site Decommissioning Plan.
    - In cases where seeding is required, and when conditions permit, seeding shall commence immediately upon completion of capping and trimming operations. When conditions do not permit immediate seeding, the Contractor will endeavor to ensure seeding is completed within the next growing season, unless otherwise authorized by the Contract Administrator.
    - Seeding operations shall not be carried out under adverse conditions of high winds, frozen ground, or ground covered with snow, ice, or standing water.

2.15 Site Decommissioning

All work sites are to be fully decommissioned when no longer required. The following requirements apply to decommissioning of all sites developed or used for the Project.

2.15.1 General

- All designated areas shall be leveled to natural or pre-existing grade and slope as part of decommissioning. Stockpiled topsoil and other organic matter that had been removed from the site shall be spread to promote natural re-establishment of vegetation.

- Where seeding is not required, temporary site locations shall be left in a manner which promotes natural re-vegetation of the site.
- In cases where seeding is required, and when conditions permit, it shall commence immediately upon completion of grading, capping, and trimming operations.
- When conditions do not permit immediate seeding, the Contractor shall endeavor to ensure seeding is completed within the next growing season, unless otherwise authorized by the Contract Administrator.
- Seeding operations shall not be carried out under adverse conditions of high winds, or ground covered with snow, ice, or standing water.
- Refer to the Site Decommissioning Plan for additional details.

2.16 Revegetation and Vegetation Maintenance

The following requirements apply to all revegetation or vegetation maintenance works during all Project phases.

2.16.1 General

- Immediately following construction and decommissioning, all salvaged and stockpiled organics and soils which were set aside during site development shall be spread back over the area from which they originated and shall be seeded. If local soils are not available, other organic-based covers may be used to allow seed germination.
- A Revegetation Management Plan (RVMP) has been developed for the Project and should be referenced for planning purposes and prior to conducting reclamation or reseeding activities.
- Revegetation seed mixes shall adhere to those specified in the RVMP. Seeding will commence immediately upon completion of grading, capping, and trimming operations, as conditions permit. Utilization of ditches as a heavy-machinery transportation corridor shall be minimized to the greatest extent possible.
- Where possible, sites will be left in a manner which promotes natural re-vegetation.
- Should there be a need for a water source as part of revegetation efforts, a temporary authorization shall be required from the Water Use Licensing Section of MECP. Contact the Manager of Water Use Licensing Section, at (204) 945-6118 prior to the commencement of the work. Note any water withdrawal greater than 5500 gpd requires a permit.
- Guidance on the management of terrestrial invasive species are described in the AgBMP.
- To prevent the transfer of weeds and terrestrial invasive species, all equipment is to be cleaned to remove all earthen material and plant debris and inspected before being brought to site and before it is removed from site. Cleaning should be carried out with a pressure washer or scrub brush. If soap is used it shall be phosphate free.

2.17 Planned and Unplanned Shutdowns

The following requirements for planned and unplanned shutdowns apply to all temporary or permanent stoppages of work, including but not necessarily limited to staff rotations, holidays, public health orders, stop work orders or as part of contract closeout.

2.17.1 General

- The Contractor shall relocate all equipment, supplies, and any other items used during construction to designated areas for laydown and staging or taken off site prior to any shutdown period.
- All dangerous goods/hazardous waste shall be removed from the site, including from the designated areas for waste and/or fuel storage, for any shutdown period where transportation permits and/or at the discretion of the Contract Administrator. In all instances dangerous goods/hazardous waste shall be securely stored and inspected regularly during the shutdown.
- Waste products shall be removed from the construction site during a shutdown period, including from the designated areas where transportation permits and/or at the discretion of the Contract Administrator. The demolition and construction waste products, such as gravel and waste concrete, may be left on-site as long as they are stored in a secure designated area for waste.
- The Contractor shall submit a plan to the Contract Administrator for removal and/or securing of equipment, supplies and waste materials in the event of an unplanned shutdown.
- Should an unplanned shutdown occur as a result of an event which puts human safety at risk, The Contract Administrator shall notify applicable rights-holders, landowners, stakeholders, and other necessary contacts of the event at the earliest opportunity to ensure that proper precautions are taken.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Access Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

Part 1: Introduction 1

1.0 PURPOSE AND SCOPE 1

2.0 OBJECTIVES 2

3.0 OCCUPATIONAL SAFETY, HEALTH AND RISK MANAGEMENT . 3

Part 2: Lake Manitoba Outlet Channel 4

4.0 PROJECT INFORMATION 4

4.1 Project Description 4

4.2 Site Characterization 4

4.3 Project Engagement 6

4.4 Notifications 6

5.0 CONSTRUCTION 7

5.1 Construction Access 7

5.2 General Access Restrictions 9

5.2.1 Firearms 9

5.2.2 Recreational Vehicles 9

5.3 Site Security 10

5.4 Access Control 10

5.5 Access to Waterbodies 10

5.6 Land-Based Trails 11
5.7 Decommissioning Temporary Access 11
6.0 OPERATION 12
6.1 Operation Access 12
6.2 General Access Restrictions 12
6.3 Access Control 13
6.4 Access to Waterbodies 13
6.5 Winter Travel Restrictions 14
6.6 Road Network Continuity 14
7.0 MONITORING AND ADAPTIVE MANAGEMENT 15
Part 3: Lake St. Martin Outlet Channel 16
8.0 PROJECT INFORMATION 16
8.1 Project Description 16
8.2 Site Characterization 16
8.3 Project Engagement 18
8.4 Notifications 18
9.0 CONSTRUCTION 19
9.1 Construction Access 19
9.2 General Access Restrictions 19
9.2.1 Firearms 20
9.2.2 Recreational Vehicles 20
9.3 Site Security 20
9.4 Access Control 21
9.5 Access to Waterbodies 21
9.6 Land-Based Trails 21
9.7 Traditional Land Use and Resource Use 22
9.8 Decommissioning Temporary Accesses 22

10.0 OPERATION 23
10.1 Operation Access 23
10.2 General Access Restrictions 23
10.3 Access Control 24
10.4 Access to Waterbodies 24
10.5 Winter Travel Restrictions 24
11.0 MONITORING AND ADAPTIVE MANAGEMENT 25
APPENDIX 2A 26
APPENDIX 3A 30

List of Figures

Figure A: EMP Process
Figure 1: LMOC Project Area
Figure 2: Proposed Site Access Roads
Figure 3: LSMOC Project Area
Figure 2-1: Proposed Inlet Excavation Plan View
Figure 2-2: Proposed Outlet Excavation Plan View
Figure 2-3: Safety Boom and Turbidity Curtain Details
Figure 3-1: Inlet Area General Arrangement
Figure 3-2: Outlet Area General Arrangement
Figure 3-3: Typical Details

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Access Management Plan (AMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, MTI anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations.

The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase



Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
EIS	Environmental Impact Statement
EMP	Environmental Management Program
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
OEMP	Operation Environmental Management Program
PDA	Project Development Area
PR	Provincial Road
PTH	Provincial Trunk Highway
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
WCS	Water Control Structure

Glossary of Terms

Cofferdam: An enclosure, usually only partially obstructing a waterbody, from which water is pumped to expose the bottom to permit construction.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Fish productivity: Rate of formation of organic matter over a defined period; this can include fish growth and the production of offspring.

Harvesting: Activities in which animal, plant and fish resources are obtained/conducted for domestic/recreational purposes, such as fishing, hunting, plant harvesting, and camping.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Project Development Area (PDA): is the physical space or directly affected area within which Project components and activities are located and the immediately adjacent area, including designated ROW.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting or blasting.

Shoofly: Short detour at Project site that allows traffic to be maintained during construction.

Part 1: Introduction

1.0 PURPOSE AND SCOPE

The Access Management Plan (AMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project (the Project). The AMP provides a framework for access management related to the Lake Manitoba Outlet Channel (LMOC) and the Lake St. Martin Outlet Channel (LSMOC) and related infrastructure such as the water control structures.

The purpose of the AMP is to describe access control measures that will be present during construction and operation phases as they relate to protection of natural resources, public and worker safety and site security. The AMP addresses access-related issues of concern expressed by stakeholders, the public, and rights holders during the Indigenous and Public engagement process, as well as any relevant regulatory requirements. .

The AMP is intended to be a living document that will be revised if/as required to address any changes that may be required to improve effectiveness or address issues. In particular, during the detailed design stage of the Project additional information to be added to the AMP will include a description of the construction methods to be implemented, additional general arrangement layout drawings for the Project Development Area (PDA), and typical details for items such as security gates, fencing, warning signs, and buoys.

As the overall Project has two very distinct sections (LMOC and LSMOC) in different geographic areas, different AMP strategies are required for each. The LMOC is primarily located near and through developed private farmland with several provincial and municipal roads with many road access points. The LSMOC is primarily located in isolated, undeveloped Crown land used predominantly for traditional resource use activities, with few access points. As a result, the LMOC AMP has a focus on road and land access around and through the Project site, while the LSMOC AMP focuses on the natural environmental and access issues related to traditional resource use. Both areas require an AMP that deal with common important access - related issues, but each requires a focus on the unique issues for the type of surrounding terrain. Given the unique site characteristics of each of the channels, the AMP is organized into three parts:

- Part 1 includes information that is common to both the Lake Manitoba and Lake St. Martin Outlet Channels.
- Part 2 includes information that is specific to the Lake Manitoba Outlet Channel.
- Part 3 includes information that is specific to the Lake St. Martin Outlet Channel.

2.0 OBJECTIVES

The primary objectives of the AMP are to:

- Provide safe, coordinated access to the PDA during construction and operation.
- Provide safe passage for local residents and visitors to the area (both Indigenous and non-Indigenous) through the PDA at identified crossing locations.
- Support sustainable use through the protection of the area's natural resources.
- Allow the Owner and contractors to construct, operate and maintain the Project year-round.
- Provide security for Project personnel and property.

In addition to the objectives of the AMP, other considerations include:

- Preserve and respect the socio-economic, cultural and heritage values of the lands around the Project.
- Prescribe measures to minimize potential negative direct and indirect effects on Project access.
- Protect land users from hazards resulting from construction and operation of the Project.
- Minimize land user conflicts.
- Provide public education and communication about the Project to promote safety for all and to maintain an understanding among specific relevant groups and the public-at-large regarding the access management measures being implemented and maintained, and the rationale for doing so.

3.0 OCCUPATIONAL SAFETY, HEALTH AND RISK MANAGEMENT

Occupational safety, health and risk management are issues that apply to all Manitoba Transportation and Infrastructure facilities and operations, employees, contractors, and visitors. Effectively managing risks to the safety, health and well-being of employees, visitors and the public arising out of the work activities performed by or on behalf of the Department is an important priority. The AMP will help manage the safety of Manitoba Transportation and Infrastructure employees, contractors, visitors and the public so that they are not adversely affected by Project construction or operations and that adherence to *The Workplace Safety and Health Act* and its associated regulations is achieved.

Strategies will be implemented so that the Project does not adversely affect worker and public safety, and these will include education and training, communication, fencing and signage. This AMP is organized into sections that address how information about the Project and access restrictions will be communicated from Manitoba Transportation and Infrastructure to residents of local Indigenous communities and non-Indigenous communities, access management measures that will be implemented during construction, and access management measures that will be implemented during Project operations. During the construction and operation phases, best practices relating to public safety around water control structures as outlined in industry guidelines shall be followed.

Part 2: Lake Manitoba Outlet Channel

4.0 PROJECT INFORMATION

4.1 Project Description

The Project will involve the construction and operation of the LMOC and associated components including a water control structure with power connections, bridges, realignment of Provincial Road (PR) 239, and other ancillary infrastructure. Details are provided in the EMP Framework document. The construction methodology for the LMOC is described in the Construction Environmental Management Program (CEMP).

4.2 Site Characterization

The LMOC is primarily located near and through developed private farmland with a number of provincial and municipal roads with many road access points. The location of the LMOC generally follows Birch Creek, which includes several small lakes and wetlands, from Lake Manitoba to Lake St. Martin in a north-easterly direction (Figure 1). The LMOC is situated to the west of Birch Creek.

Birch Creek and its associated wetlands forms a natural boundary between the east and west sides of the Rural Municipality (RM) of Grahamdale. There are currently six road crossings across the Birch Creek wetland area that allow traffic movements. The first and main crossing over the Birch Creek wetland area is Provincial Trunk Highway (PTH) 6, which is the major north-south corridor in this area of the province and is the primary link to Northern Manitoba. This is a paved, limited access highway. The next three crossings (Township Line Road, Carne Ridge Road, and PR 239 [Steep Rock Road]) allow east-west traffic movement from PTH 6 to the community of Steep Rock and the surrounding area on the east side of Lake Manitoba, which is composed of cottage developments and farmland. Township Line Road and Carne Ridge Road are low volume gravel roads in reasonable condition that are used by local traffic to access farmland and cottages to the south of Steep Rock. PR 239 is a paved provincial roadway that is the main access to Steep Rock and the surrounding area, as well as the primary route used to transport materials from the Graymont's Faulkner lime production (Graymont) facility to PTH 6. This road is in relatively poor condition and requires regular patching due to the age of the pavement, the heavy truck traffic from Graymont's facility and increased recreational traffic. The remaining two crossings (Iverson Road and Birch Bay Road) are to the east of PTH 6 and are very low volume narrow gravel roads that service the local farmland in the immediate area.

All of these roads will be affected by the construction of the LMOC as it will sever a number of the roads and change the traffic flow patterns, especially for the farmers with land throughout the general PDA.

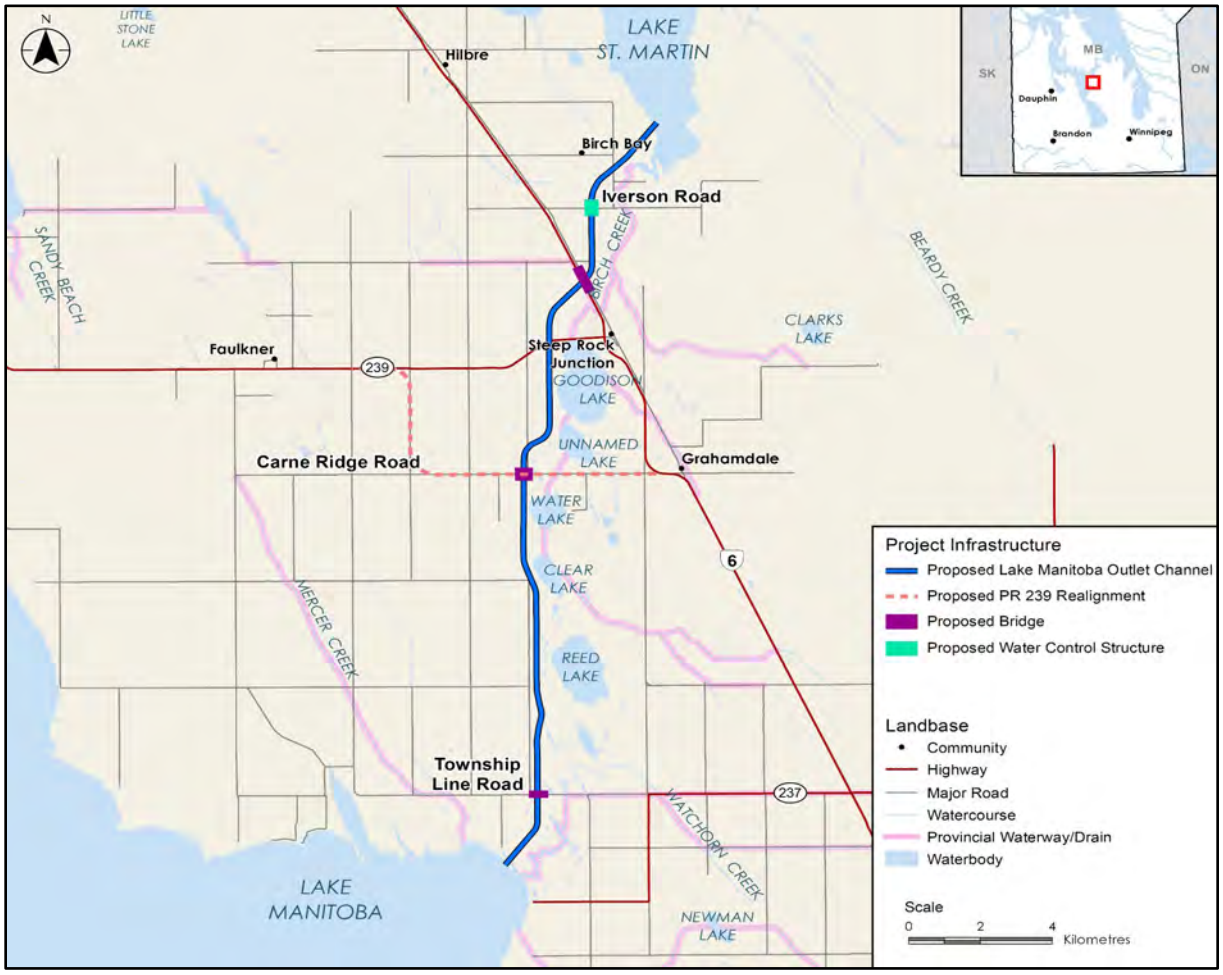


Figure 1: LMOC Project Area

4.3 Project Engagement

Since 2013, Manitoba Transportation and Infrastructure has held several open houses in the RM of Grahamdale as well as other impacted communities in Winnipeg, Portage la Prairie, Lundar and Ashern and continues to meet with the local municipal council, rights-holders, stakeholders and other interest groups to keep them apprised of Project progress.

Engagement of Project stakeholders whose access may be impacted during the LMOC construction and operation was preceded by developing a tiered list of stakeholders with the top tier comprised predominantly of the RM of Grahamdale, directly impacted property owners, and Graymont's facility at Steep Rock. These stakeholders were engaged directly to gain their input and discuss access management options. Remaining stakeholders were informed via mail outs and other suitable communication media.

Ongoing engagement will be facilitated by means of focused meetings with individual landowners, the RM of Grahamdale and other interest groups. Additionally, consultation efforts with rights-holders also continues and those consultations will assist in further development of the AMP.

As stakeholder engagement progresses, the AMP will be updated and provided for consideration by stakeholders, reviewed by the Owner and approved by the local traffic authority, the RM of Grahamdale, in collaboration with Manitoba Transportation and Infrastructure's Highway Planning and Design section. The AMP will be subject to periodic review and updates when construction sequencing and tendering strategies are finalized or new information from ongoing engagement and consultation efforts dictates adjustments.

4.4 Notifications

Manitoba Transportation and Infrastructure will provide notifications on relevant information related to this plan as a part of ongoing engagement processes for the Project. Information will be shared with the EAC for dissemination to rights-holders, the RM of Grahamdale and local landowners during the construction phase, and communication protocols will be developed with input from rights holders and stakeholders for the operations phase.

Notifications regarding potential for flooding and subsequent need for operation of the Project will follow established procedures for other flood infrastructure. A notification system is being developed so that interested individuals or groups would receive notifications from Manitoba Transportation and Infrastructure on flood outlooks and advisories as well as infrastructure operations. Any interested individual or group can sign up to receive these notifications. When immediate public notification is required, notification may include use of the National Public Alerting System. In addition to this process, Manitoba Transportation and Infrastructure has also been notifying Indigenous communities on Lake Manitoba and Lake St. Martin regarding Portage Diversion operations via email. This process could be extended to include notifications for Project operation upon request.

5.0 CONSTRUCTION

5.1 Construction Access

In consideration of public safety, access to the LMOC PDA will be restricted and controlled through a limited number of controlled access points on the west side of PDA. Emergency personnel may be exempted, depending on the situation. As far as practically possible, construction access to the Project site will be segregated from public travel routes by means of designated construction-only access routes and locations. This is also in keeping with the RM of Grahamdale's continued efforts to mitigate the anticipated impacts of construction activities on the community and road users.

As shown in Figure 2, a number of proposed access or haul roads have been identified for construction of the LMOC. PTH 6 will be the primary access route to the LMOC construction sites for the movement of equipment, materials and personnel. Secondary access to the southern and central outlet channel and bridge construction sites of the LMOC will utilize sections of PR 237 (a.k.a. Township Line Road), Carne Ridge Road (future PR 239) and the existing PR 239 (a.k.a. Steep Rock Road). Secondary access to the northern construction sites, which includes the outlet control structure and the PTH 6 bridge across the LMOC, will utilize Iverson Road as a dedicated construction access with detours for east-west public access across the LMOC, along Bankert and Birch Bay Roads.

To further mitigate the impact on the municipal road network and consequent interference with local agricultural, residential, recreational and commercial traffic, several potentially suitable locations for construction contractor's camps and lay down areas have been identified, and the conceptual locations are illustrated in Figure 2-1 of Appendix 2A. These conceptual locations will be evaluated during detailed design to assess whether they may be suitable to create permanent outlet channel infrastructure access points after construction for use by authorized personnel performing inspection, maintenance, and operations activities.

It should be noted that in general, suitable locations for contractor camps and laydown areas are determined by Contractors and Manitoba Transportation and Infrastructure's strategies for sequencing, tendering and procuring the construction. Additionally, a Project Area Entry Checkpoint will be established to provide a single, established location at which all incoming machinery must be checked for adequate cleanliness prior to entry into the Project area to access the PDA (see the Agricultural Biosecurity Management Plan (AgBMP) for additional details).

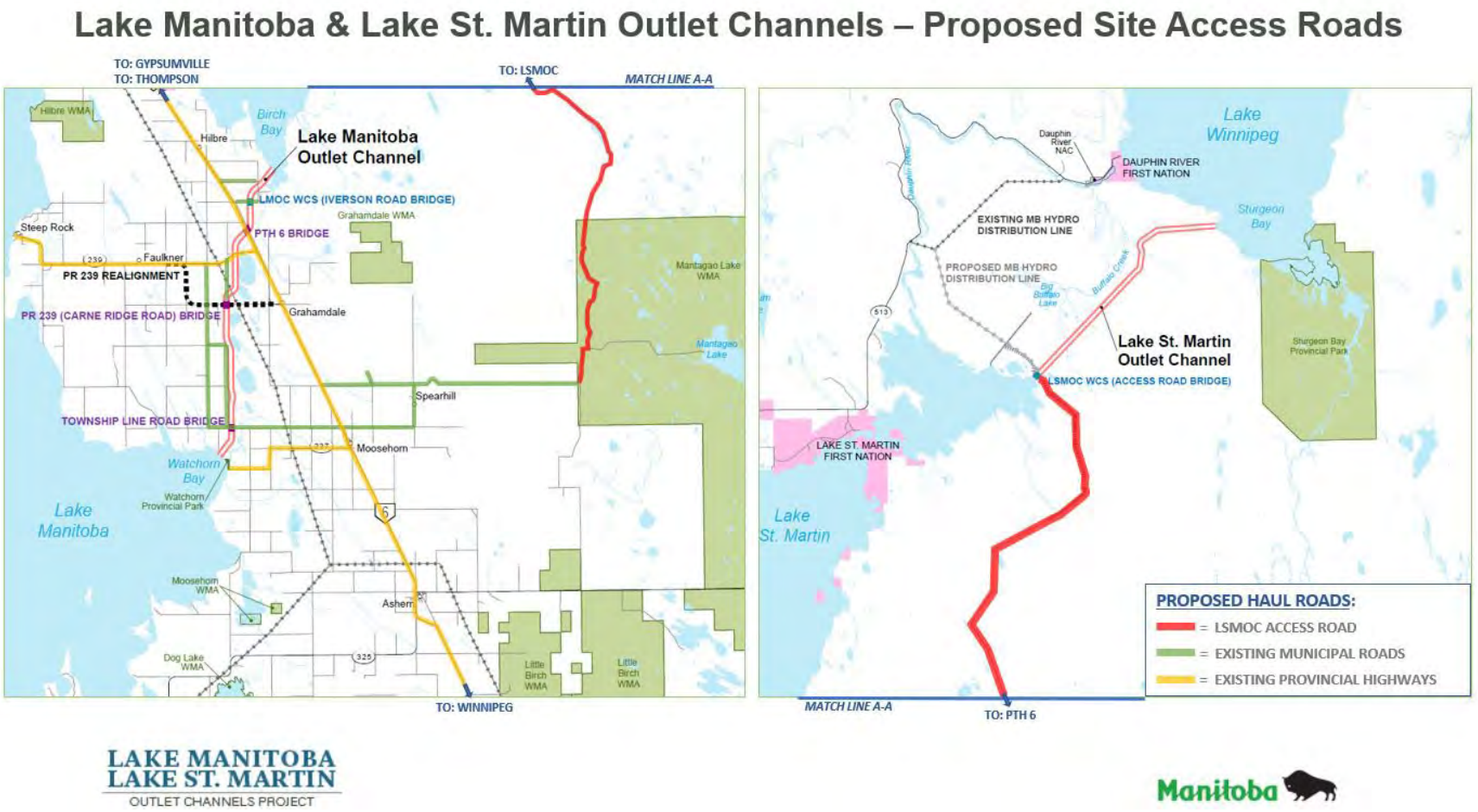


Figure 2: Proposed Site Access Roads

5.2 General Access Restrictions

During construction there will be access restrictions to the Project components. The PDA will not be accessible during construction, due to safety concerns. Access will be controlled by temporary perimeter fencing and signage in the vicinity of public roads. Access to the camp areas will be controlled and there will be no unauthorized public visits allowed to the contractor's construction camp, work areas, and laydown yards.

Use of the PDA by individuals not directly associated with the Project may be authorized for certain user groups under certain conditions. Prior to the start of construction, Manitoba Transportation and Infrastructure will establish a process to obtain permission to access the site. This process will likely include the following:

- Contacting the Owner (or designate) to request permission. Information to be provided from prospective users will include timelines of requested access, location within the PDA of requested access, and activities that the user plans to conduct.
- Upon site access during construction, users would be required to check in with the contractor's security personnel.
- Upon departure from the site during construction, users would be required to check out with the contractor's security personnel.

5.2.1 Firearms

Restrictions will be placed on firearms (e.g., rifles, handguns, shotguns, bows) as a measure to manage the safety of personnel at the site. Project workers will not be permitted to possess, transport, use, or store firearms within the PDA. In the event that a worker is found to have a firearm within the PDA, the worker will be disciplined accordingly.

5.2.2 Recreational Vehicles

Project workers will not be permitted to use, transport or store personal recreational vehicles (all-terrain vehicles, snowmobiles) on the Project site. This will help to reduce the potential impacts on habitats (ruts or damage to vegetation) and to manage access. Use of the surrounding Crown land outside of the PDA will not be restricted.

5.3 Site Security

Most of the LMOC right-of-way (ROW) is adjacent to private farmland with many potential access points. As noted previously, several proposed construction laydown areas have been strategically identified for various stages of construction. Access to active construction sites will be controlled by individual contractors with the use of dedicated security personnel, limiting and controlling access points to active construction zones, and installation of temporary perimeter fencing and signage around construction sites, camps, laydown areas and areas with potential public access concerns. Access points and construction site perimeters will be monitored during construction and security staff will record and notify the Inspector of any attempts to access the site by any unauthorized personnel.

5.4 Access Control

Access restriction measures for the Project will include road controls (gates), signage and fencing (both temporary and permanent). Certain areas (e.g., the water control structure [WCS]) will have gates and fences installed to protect the public from potential hazards created by the new construction. Signs will be posted at various locations indicating areas where public access is restricted, and in areas where members of the public need to be informed about potential safety issues (e.g., inlet, outlet and WCS areas), as a further precautionary measure. Signage will follow relevant Canadian standards and with Manitoba Transportation and Infrastructure corporate policies. Signage will be regularly monitored and maintained.

During construction of the new bridges and control structure across the LMOC, the east-west municipal roadway connectivity will be maintained by means of shoofly detours on Township Line and Carne Ridge/new PR 239 roads and the provision of a municipal road detour at Iverson Road. A shoofly detour will also be available where PTH 6 crosses the outlet channel ROW (between Carne Ridge and Iverson Roads) during construction of the new bridge at that location. The existing PR 239 will remain open until the construction of the realigned sections of new PR 239 and PTH 6, through Grahamdale, are complete. It is also anticipated that the existing PR 239 will remain open until the new PR 239 bridge crossing has been completed, at which point traffic will be switched over to the new PR 239 access, with the existing PR 239 closed across the LMOC ROW. Specific traffic flow management plans for individual construction sites will be developed as a part of detailed design and implemented by contractors to accommodate local user needs.

5.5 Access to Waterbodies

Construction activities at the inlet of the LMOC in Watchorn Bay on Lake Manitoba and the outlet of the LMOC near Birch Bay on Lake St. Martin will include excavation of the lake bed extending from the shoreline. Although the current boat traffic in these areas is minimal, to address the potential impacts of this work on navigation, safety measures, such as warning signage and marker buoys will be installed.

Signage will also be required to warn recreational vehicle operators and ice fishers of thin ice near these areas during winter months. Safety measures implemented will be in accordance with the applicable requirements from Transport Canada, *The Canadian Navigable Waters Act* and other applicable regulations and policies.

5.6 Land-Based Trails

Due to safety concerns, snowmobile trails within the Project site will not be accessible to members of the public during construction; including all snowmobile traffic within the ROW. The contractor and all of its associated employees will not be permitted to use these trails for recreational purposes.

5.7 Decommissioning Temporary Access

Temporary facilities and work areas, including laydown areas and construction camps that will not be needed for future maintenance activities, will be decommissioned and reclaimed following construction. Designated areas and temporary access roads will be leveled to natural or pre-existing grade and slope. Access routes will be contoured, de-compacted and trimmed to encourage natural revegetation. Closure of temporary construction work areas will typically consist of redistributing organic materials to encourage natural vegetation regeneration. Reseeding will occur, as required, following the Revegetation Management Plan (RVMP) for the Project. Decommissioning measures associated with temporary components are described in greater detail in the Site Decommissioning Plan.

6.0 OPERATION

To meet the objectives of the AMP, implementation of the required changes to the provincial and municipal road networks illustrated in Figure 2-1 (Appendix 2A), will need to be completed and fully functional, prior to the final completion of the LMOC.

With the road network changes completed, the impact to local road users during periods when the LMOC gates are open should be minimal. It should be limited to the additional traffic generated by the increased presence of operational staff involved with operating and maintaining the outlet channel infrastructure and environmental monitoring. During extreme flooding events, numbers of staff associated with operating, maintaining and safeguarding the outlet channel infrastructure may increase, but generally will be using the existing road network and predefined locations to gain access to different sections of the outlet channel infrastructure.

During periods when the LMOC WCS gates are closed (i.e., the majority of time), impacts to the road network and road users as a result of increased vehicular traffic will be negligible and limited to activities associated with periodic maintenance inspections and environmental monitoring. The establishment and maintenance of revegetation of the outlet channel embankments may require some additional activity initially but will diminish as permanent vegetation cover is established.

As a result of the design approach for the new PR 239 / Carne Ridge Road bridge crossing structure, the use of PR 239 for local, commercial and recreational traffic during operational periods, should not be impacted.

6.1 Operation Access

The outlet channel will have a total of four bridge structure crossings located at Township Line Road, Carne ridge Road / PR 239, PTH 6 and Iverson Road (Figure 1). It is anticipated that all of the bridge crossing structures and appurtenant roadways including the realigned sections of PR 239, will remain traversable when the gates of the LMOC are open.

Manitoba Transportation and Infrastructure maintenance and operations staff will use sections of the outlet channel embankments (spoil berms), located within the LMOC ROW, to maintain, inspect and/or operate the outlet channel infrastructure. Access to these areas will be off limits to the public.

6.2 General Access Restrictions

Access to Project infrastructure, including the outlet channel as well as the inlet, outlet and control structure, will be restricted post-construction. Infrastructure that poses a hazard or presents a security risk will be fenced, including the WCS (excluding the Iverson Road bridge crossing). The LMOC will be a critical component of provincial flood mitigation infrastructure and will also be registered as a provincial waterway. Warning signs indicating no unauthorized personnel will be installed at various locations along the LMOC.

Use of the PDA by individuals not directly associated with the Project may be authorized for certain user groups under certain conditions. Prior to the start of construction, Manitoba Transportation and Infrastructure will establish a process to obtain permission to access the site. This process will likely include the following:

- Contacting the Owner (or designate) to request permission. Information to be provided from prospective users will include timelines of requested access, location within the PDA of requested access, and activities that the user plans to conduct.
- Upon site access during construction, users would be required to check in with the contractor's security personnel.
- Upon departure from the site during construction, users would be required to check out with the contractor's security personnel.

Irregular ice formation in proximity to the bridges over the LMOC and at the WCS may present substantial safety hazards to recreational vehicle operators. These hazardous conditions may be amplified by winter operation of the channel. Despite access not being permitted to LMOC infrastructure, warning signs and markers will be installed near these structures to indicate the unsafe areas to promote safety.

6.3 Access Control

Access restriction measures for the LMOC will include road controls (gates), signage and fencing. Certain areas will have gates and fences installed to protect the public from potential hazards created by the new construction, such as at the WCS.

Signs will be posted at various locations indicating areas where public access is restricted, and in areas where members of the public need to be informed about potential safety issues, such as at the inlet, outlet and water control structure areas, as a further precautionary measure. Signage will be in line with relevant Canadian standards and with Manitoba Transportation and Infrastructure corporate policies. Signage will be regularly monitored and maintained.

6.4 Access to Waterbodies

Manitoba Transportation and Infrastructure will provide, install and maintain safety measures that may include warning signage, marker buoys and possibly safety booms, at the inlet of the LMOC in Watchorn Bay on Lake Manitoba and the outlet of the LMOC near Birch Bay on Lake St. Martin to deter the entry of watercraft into the LMOC and prohibit unauthorized use. The safety measures implemented will be in accordance with the applicable requirements from Transport Canada, *The Canadian Navigable Waters Act* and other applicable regulations and policies.

6.5 Winter Travel Restrictions

During the winter, there may be changes to how ice forms near the inlet of the LMOC in Watchorn Bay on Lake Manitoba and near the outlet of the LMOC near Birch Bay on Lake St. Martin. This may affect the ability of people to travel safely on ice with recreational vehicles in these local areas. Warning signage will be installed in front of the inlet and outlet to identify areas where unsafe ice conditions may be present.

6.6 Road Network Continuity

The construction of the LMOC will impact, and in some cases sever, the at-grade municipal roads and existing PR 239 access near PTH 6. Alterations to the municipal roads, PR 239 and PTH 6 to achieve continued access for all stakeholders have been identified in Figure 2-1 (Appendix 2A). Once approved, these changes will be scheduled, communicated and implemented as construction of the LMOC advances.

As illustrated in Figure 2-1 (Appendix 2A), the existing alignment of Birch Creek south of PTH 6, which includes a succession of small lakes and wetlands, is located on the east side of the proposed LMOC alignment. These features create a natural divide in the RM, with east-west crossings south of PTH 6 limited to Township Line Road, Carne Ridge Road and PR 239 (Steep Rock Road). By realigning PR 239 to follow the existing Carne Ridge Road alignment west of Burnett Road, the number of crossings west over the Lake Manitoba Outlet will be reduced to two. These are at Township Line Road and Carne Ridge Road, which will become the realigned portion of PR 239 (new PR 239). The realignment of PR 239 will improve recreational access to Steep Rock and the surrounding area, as well as improve public safety, by reconstructing the PTH 6/Carne Ridge Road (new PR 239) intersection. This new intersection will meet Manitoba Transportation and Infrastructure's current standards and remove the existing intersection that is on a tight curve with poor sightlines.

With the proposed road changes, and the use of shoofly and municipal detour routes, the effect on road continuity is expected to be minimal during construction and a positive change post construction.

7.0 MONITORING AND ADAPTIVE MANAGEMENT

Adaptive management is a process to improve practices by learning about their effects and then making changes in those practices as new information is available. Adaptive management uses the Project designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The AMP is a living document that may be modified to improve its effectiveness. Therefore, monitoring of the AMP will be done to:

- Determine whether the measures set out in the AMP are effective.
- Reduce uncertainty in implementing the AMP.
- Adapt and improve measures in the AMP in response to actual experience (adaptive management).

Sources of monitoring information may include the following:

- Security reports from the security guard.
- Resource user access request and Manitoba Transportation and Infrastructure's response.
- Monitoring reports developed and provided to the Owner to be acted upon, as necessary.

Information collected from monitoring and routine inspections will be used by Manitoba Transportation and Infrastructure to assess the effectiveness of plan and restriction measures on an annual basis during construction, and for the first 3 years of operation. A summary report of the results of the yearly assessment will be provided to regulators as applicable.

Based on reviews of the monitoring information, input from regulators, rights holders, the RM of Grahamdale and other stakeholders, adjustments will be made to the AMP, if required, to optimize its effectiveness in addressing safety concerns and traditional land uses. Changes to the AMP would be discussed with rights-holders, the RM of Grahamdale and regulators in advance of changes being implemented. If and where required, public access to provincial water infrastructure can be prohibited or restricted by regulation under *The Water Rights Administration Act*.

Part 3: Lake St. Martin Outlet Channel

8.0 PROJECT INFORMATION

8.1 Project Description

The Project will involve the construction and operation of the LSMOC and associated components including water control structures with power connections, drop structures, and other ancillary infrastructure. Details are provided in the EMP Framework. The construction methodology for the LSMOC is described in the CEMP.

8.2 Site Characterization

The LSMOC is located in isolated, undeveloped Crown land in Manitoba's Interlake Region between the northeastern most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg (Figure 3). This area is considered semi-remote as road access was seasonal prior to March 2022, with the nearest permanent residence located approximately 6.1 kilometres (km) from the channel in Dauphin River FN. Current access to the LSMOC site is via the Lake St. Martin Access Road (formerly a 19.5 km winter road) that extends northward from the existing forestry road (Idylwild Road) to the LSMOC channel inlet and the Emergency Outlet Channel (Reach 1), as shown in the maps provided in Appendix 3A. The current winter road access to Reach 3 will be replaced by the maintenance access road described in Section 9.1.

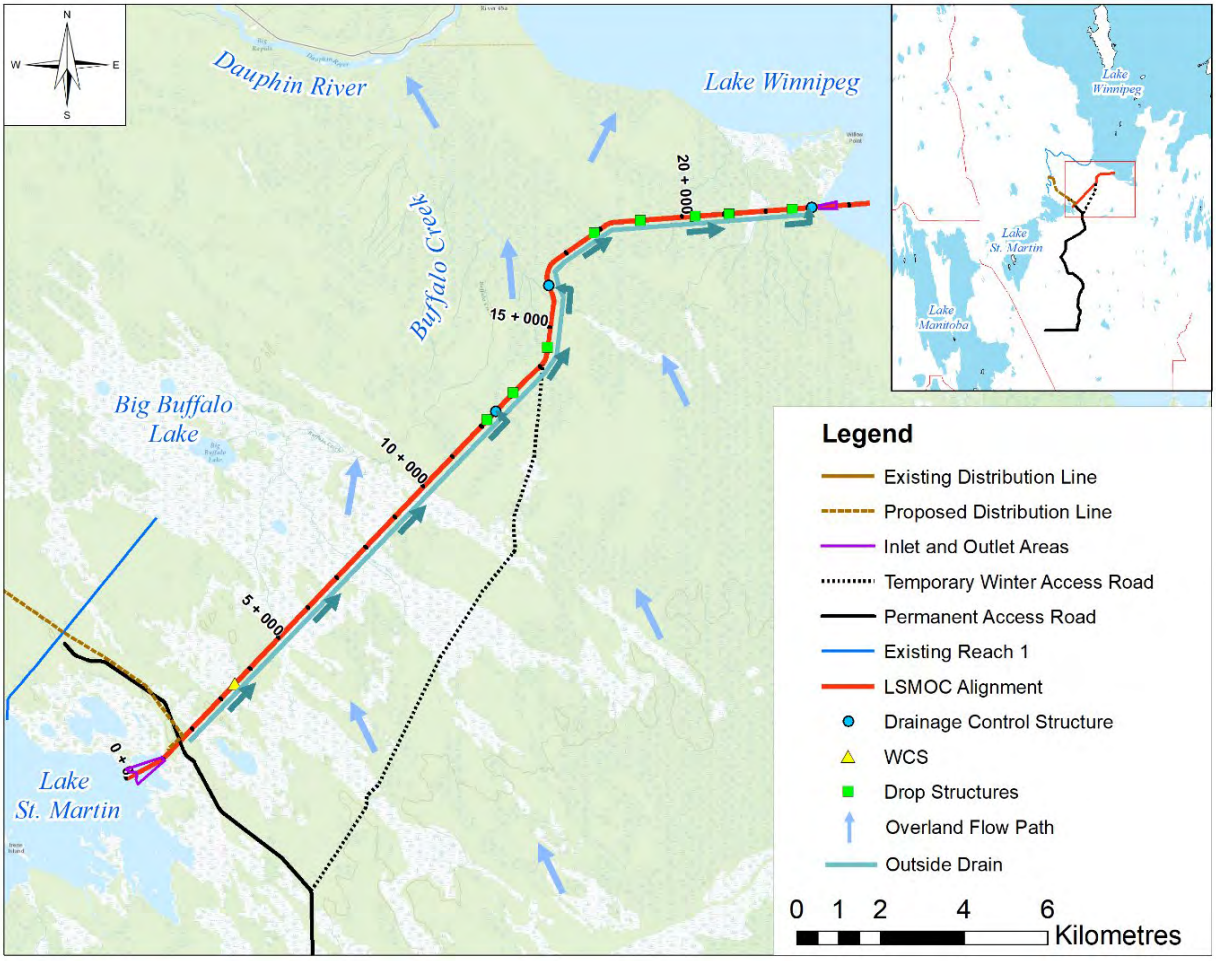


Figure 3: LSMOC Project Area

8.3 Project Engagement

Since 2013, Manitoba Transportation and Infrastructure has held several open houses in the RM of Grahamdale as well as other impacted communities in Winnipeg, Portage la Prairie, Lundar and Ashern, and continues to meet with the local municipal council, Indigenous communities, stakeholders and other interest groups to keep them apprised of Project progress.

Engagement of Project stakeholders was conducted with those whose access would most likely be impacted during LSMOC construction and operation. These rights-holders and groups were engaged directly to gain their input and discuss access management and other EMPs. Remaining stakeholders were informed via mail outs and other suitable communication media.

As stakeholder engagement and Indigenous engagement and consultation progresses, the AMP will be updated and provided for consideration by stakeholders and rights-holders, reviewed by the Owner and approved by the traffic authority (i.e., the RM of Grahamdale) in collaboration with Manitoba Transportation and Infrastructure's Highway Planning and Design section. The AMP will be subject to periodic review and updates when construction sequencing and tendering strategies are finalized or new information from ongoing engagement and consultation efforts dictates adjustments.

8.4 Notifications

Manitoba Transportation and Infrastructure will provide notifications on relevant information related to this plan as a part of ongoing engagement processes for this Project. Information will be shared with the EAC for dissemination to rights-holders, the RM of Grahamdale and local landowners during the construction phase, and communication protocols will be developed with input from rights holders and stakeholders for the operations phase.

Notifications regarding potential for flooding and subsequent need for operation of the Project will follow established procedures for other flood infrastructure. A notification system is being developed so that interested individuals or groups would receive notifications from Manitoba Transportation and Infrastructure on flood outlooks and advisories as well as infrastructure operations. Any interested individual or group can sign up to receive these notifications. When immediate public notification is required, notification may include use of the National Public Alerting System. In addition to this process, Manitoba Infrastructure has also been notifying Indigenous communities on Lake Manitoba and Lake St. Martin regarding Portage Diversion operations via email. This process could be extended to include notifications for Project operation upon request.

9.0 CONSTRUCTION

9.1 Construction Access

PTH 6 will be the main access road for the transportation of equipment, materials, and personnel from Winnipeg and other commercial centres. Construction-related access to the LSMOC will be via the Lake St. Martin Access Road (formerly a 19.5 km winter road) that extends northward from the existing forestry road (Idylwild Road) to the LSMOC channel inlet and the Emergency Outlet Channel (Reach 1), as shown in the maps provided in Appendix 3A and Figure 2. A temporary construction access road will also be developed within the LSMOC ROW. Where access routes are accessible to the public, signage will be erected indicating no unauthorized access. The only channel crossing planned for the LSMOC access road is the combined bridge and WCS.

9.2 General Access Restrictions

During construction public access will be restricted. Access will be controlled by a gate on the access road. Access to the camp area will be controlled and there will be no unauthorized public visits allowed to the access roads, borrow areas, and the contractor's construction camp, work areas, and laydown yards.

Use of the PDA by individuals not directly associated with the Project may be authorized for certain user groups under certain conditions, if it does not present a safety risk (i.e., Indigenous peoples who intend to carry out traditional practices to the extent that such access is safe). For the purposes of carrying out traditional practices, access through the PDA to the surrounding region during all phases of the Project may be authorized by the Owner or designate, depending largely on whether such access is safe. Additional details on access and use of lands are being considered.

Prior to the start of construction, Manitoba Transportation and Infrastructure will establish a process for individuals/groups to obtain permission to access the site. This process will likely include the following:

- Contacting the Owner (or designate) to request permission. Information to be provided from prospective users will include timelines of requested access, location within the PDA of requested access, and activities that the user plans to conduct.
- Upon site access during construction, users would be required to check in with the security guardhouse.
- Upon departure from the site during construction, users would be required to check out with the security guardhouse.

Construction-related traffic will be restricted to the temporary construction access within the ROW, as well as the existing access road to the LSMOC from PTH 6, to the extent practical and required during construction and maintenance. Existing trails and other travel routes will not be altered adjacent to the PDA other than as required for construction and maintenance purposes. Existing roads, road allowances, trails, portages and other travel ways will not be blocked or altered as a result of clearing and grubbing activities so as not to

interfere with other users. The Contractor will repair roads if they are damaged during construction. Transportation of workers between construction camp/accommodations and worksites will be done in groups (e.g., vans) and using the PDA itself for access, to reduce the potential number of vehicles on the road network. Work will be conducted in a manner that minimizes the raising of dust, and only water or approved dust suppressants will be used for dust control.

9.2.1 Firearms

Restrictions will be placed on firearms (e.g., rifles, handguns, shotguns, bows) as a measure to manage the safety of personnel at the site. Project workers will not be permitted to possess, transport, use, or store firearms on the Project site. In the event that a worker is found to have a firearm within the PDA, the worker will be disciplined accordingly. Some exceptions may be made for Indigenous peoples who intend to carry out traditional activities in the area, if the activity does not present a safety risk and if approval is granted by Manitoba Transportation and Infrastructure in advance.

9.2.2 Recreational Vehicles

Project workers will not be permitted to use, transport or store personal recreational vehicles (all-terrain vehicles, snowmobiles) on the Project site. This will help to reduce the potential impacts on habitats (ruts or damage to vegetation) and to manage access. Where access permission has been granted for resource users to carry out harvesting activities, recreational vehicles may be permitted if the activity does not present a safety risk, as determined by Manitoba Transportation and Infrastructure.

Use of the surrounding Crown land outside of the access road and PDA will not be restricted.

9.3 Site Security

During construction, access to the PDA will be monitored and restricted through the use of a security gatehouse. It will be staffed by a security guard 24 hours a day.

Any visitors to the LSMOC will be required to check in at the security guardhouse. The security guard will coordinate an escort for any person authorized to enter the PDA. For safety reasons, access to the PDA will only be permitted if prior arrangements have been made through Manitoba Transportation and Infrastructure.

The security guard will be responsible to notify the Inspector of any attempts to access the PDA by any unauthorized personnel.

Security staff will be responsible for the following:

- Prevent unauthorized user access.
- Distribute appropriate information to personnel entering the site.
- Confirm that approved resource harvesters are transporting any firearms in a safe manner (as described above).

- Conduct patrols of the site, including in the camp and the work areas, to inspect for un-authorized personnel and/or activities, and facilitate adherence to camp rules.
- Notify the Owner (or designate) of security issues and any instances of trespassing, who will then liaise with the RCMP as required.

9.4 Access Control

Access restriction measures for the Project will include road controls (gates), signage and fencing (both temporary and permanent). Certain areas (e.g., the WCS) will have gates and fences installed to protect the public from potential hazards created by the new construction. Warning signs will be installed along the ROW to indicate that unauthorized personnel are not permitted. Signage indicating access restrictions due to safety concerns will be prominently displayed and a security gate will be installed on the access road.

Signs will be posted at various locations indicating areas where public access and is restricted, where firearms are not allowed, and in areas where people need to be informed about potential safety issues, such as at the inlet, outlet and water control structure areas, as a further precautionary measure. Signage will be in line with relevant Canadian standards and with Manitoba Transportation and Infrastructure corporate policies. Signage will be regularly monitored and maintained.

9.5 Access to Waterbodies

Construction activities on Lake St. Martin and Lake Winnipeg will be focused around the water inlet and outlet locations, where construction will include excavation off the shoreline of the lake with the use of a cofferdam. To address the potential impacts of the Project to navigation, the inlet and outlet designs will include safety measures that will comply with Transport Canada approval requirements, such as warning signage, buoys, and a safety boom to delineate the regions of increased water velocities and to notify water users (Appendix 3A). Signage may also be required to warn of thin ice near the inlet and outlet due to winter operation. Conditions at the inlet prior to operation may present challenges for buoy or boom installation (e.g., ice conditions). Project activities at the inlet and outlet will adhere to requirements from Transport Canada under *The Canadian Navigable Waters Act*.

9.6 Land-Based Trails

Due to safety concerns, trails, including trapping routes, within the Project development area (PDA) will not be accessible to members of the public during construction, with some exceptions for Indigenous peoples who intend to carry out traditional practices to the extent that such access is safe (i.e., does not temporally and spatially overlap with construction activities), if approval is granted by Manitoba Transportation and Infrastructure in advance. The contractor and all of its associated employees will not use the trails for recreational purposes.

9.7 Traditional Land Use and Resource Use

As Project construction may impact access to traditional resources and areas of current use, a schedule of construction and Project activities will be made available to rights-holders and Northern Affairs Communities engaged on the Project, so that areas and time periods of activity can be avoided. The complaints resolution process will be used as a means to identify and resolve conflicts.

9.8 Decommissioning Temporary Accesses

Temporary facilities and work areas, including laydown areas and construction camps that will not be needed for future maintenance activities, will be decommissioned and reclaimed following construction. Designated areas and temporary access roads will be leveled to natural or pre-existing grade and slope. Access routes will be contoured, de-compacted and trimmed to encourage natural revegetation. Closure of temporary construction work areas will typically consist of redistributing organic materials to encourage natural vegetation regeneration. Reseeding will occur, as required, following the RVMP for the Project. Reclamation of aggregate/quarry sites will occur following the completion of construction once the sites are no longer needed for operation and maintenance as described further in the Quarry Management Plan.

Decommissioning measures associated with temporary components are described in greater detail in the Site Decommissioning Plan.

10.0 OPERATION

Access limitations in the PDA during the operations phase relate to fenced areas around Project infrastructure and public safety considerations near the water inlet on Lake St. Martin and near the outlet on Lake Winnipeg. When construction of the Project is completed, portions of the temporary construction infrastructure not required during operations will be decommissioned and removed including temporary access roads, borrow areas, and the contractor's construction camp, work areas, and laydown yards. Figures provided in Appendix 3A show the permanent Project infrastructure that will be in place during operations.

10.1 Operation Access

Access to the LSMOC during operation will be via the Lake St. Martin Access Road, which also extends to the Emergency Outlet Channel (Reach 1), as previously described and shown in the maps provided in Appendix 3A. Permanent all-season maintenance roads will be constructed within the PDA along each side of LSMOC to provide maintenance access along the length of the channel. The cofferdam access road will also be retained for the life of the Project as it will be used for ongoing maintenance purposes (Figure 3-3, Appendix 3A). The only channel crossing planned for the LSMOC access road is the combined bridge and WCS.

10.2 General Access Restrictions

Unauthorized access to Project infrastructure, including the outlet channel, water control structure, channel inlet and outlet, will be restricted during the operations phase of the Project. Fencing will be erected around the permanent operations infrastructure (e.g., the water control structure) that could pose a hazard and/or security risk. Recreation will not be allowed along the outlet channels through the life of the Project. Despite access not being permitted to LSMOC infrastructure, Manitoba Transportation and Infrastructure will install warning signs indicating no unauthorized personnel to promote safety. A gate will be installed at the south end of the access road to restrict public access.

Irregular ice formation at the drop structures and WCS may present substantial safety hazards to recreational vehicle operators. These hazardous conditions may be amplified by winter operation of the channel. Despite access not being permitted to LSMOC infrastructure, warning signs and markers will be installed near these structures to indicate the unsafe areas to promote safety.

10.3 Access Control

Access restriction measures for the Project will include road controls (gates), signage and fencing. Certain areas will have gates and fences installed to protect the public from potential hazards (e.g., water control structure). Warning signs will be installed along the ROW to indicate that unauthorized personnel are not permitted. Signage indicating access restrictions due to safety concerns will be prominently displayed.

Signs will be posted at various locations indicating public access is restricted, and in areas where and in areas where people need to be informed about potential safety issues, such as at the inlet, outlet and water control structure areas as a further precautionary measure. Signage will be in line with relevant Canadian standards and with Manitoba Transportation and Infrastructure corporate policies. Signage will be monitored and maintained.

10.4 Access to Waterbodies

Safety measures implemented during Project construction at the inlet on Lake St. Martin and the outlet on Lake Winnipeg will be retained for the life of the Project. These include warning signage, buoys, and safety booms (Figure 3-1, Figure 3-2 and Figure 3-3 in Appendix 3A). Safety measures will adhere to requirements from Transport Canada under *The Canadian Navigable Waters Act* and other applicable regulations and policies.

10.5 Winter Travel Restrictions

During the winter, there may be changes to how ice forms near the water inlet on Lake St. Martin and near the outlet in Lake Winnipeg. This may affect the ability of people to travel safely on ice with recreational vehicles. Warning signage will be installed in front of the water inlet and outlet to identify areas where unsafe ice conditions may be present. Buoys at the intake will remain in place year round due to risk of thin ice to recreational vehicle operators travelling on the lake in the winter.

11.0 MONITORING AND ADAPTIVE MANAGEMENT

Adaptive management is a process to improve practices by learning about their effects and then making changes in those practices as new information is available. Adaptive management uses the Project designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The AMP is a living document that may be modified to improve its effectiveness. Therefore, monitoring of the AMP will be done to:

- Determine whether the measures set out in the AMP are effective.
- Reduce uncertainty in implementing the AMP.
- Adapt and improve measures in the AMP in response to actual experience (adaptive management).

Sources of monitoring information may include the following:

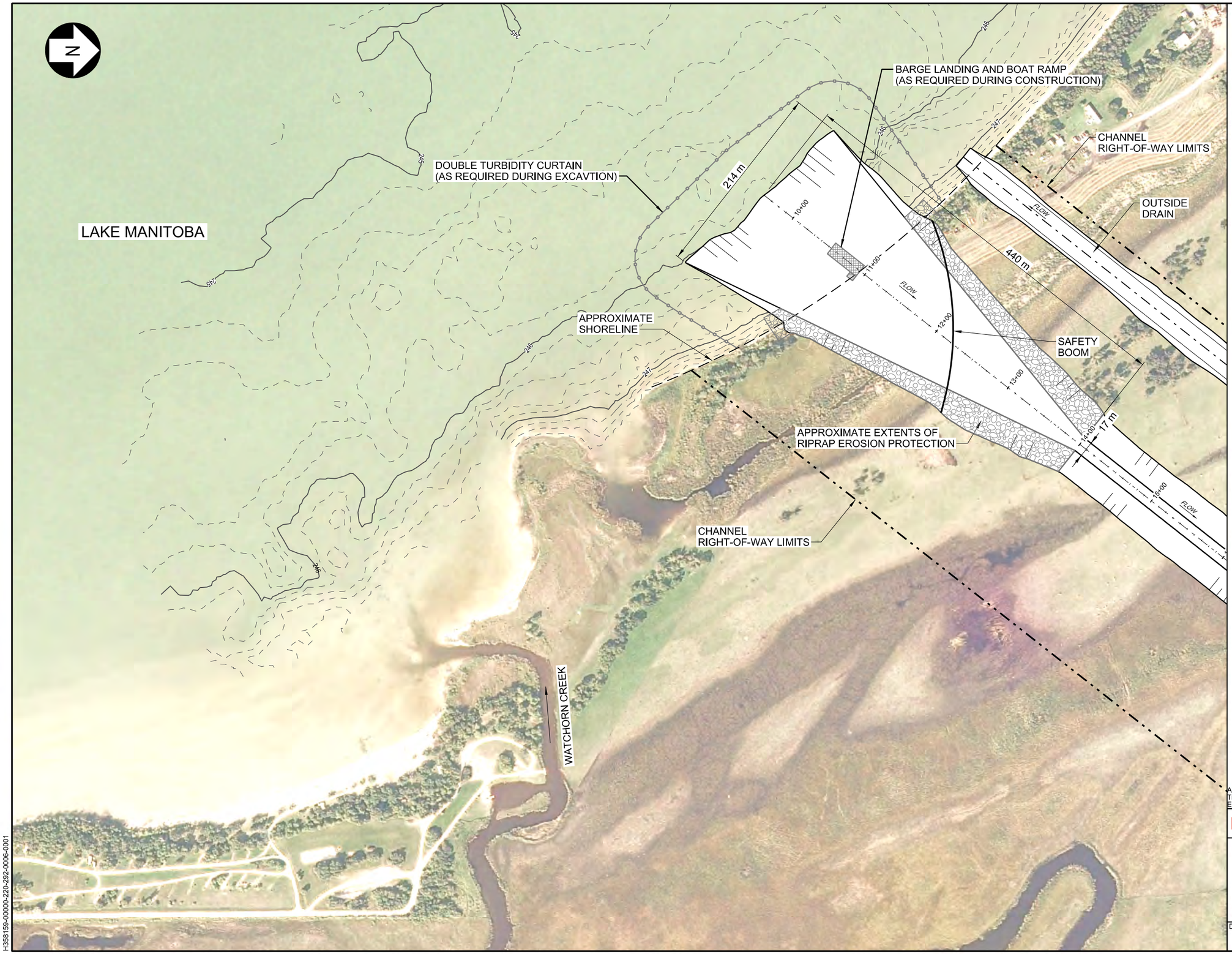
- Gate records
- Security cameras
- Security reports from the security guard
- Resource user access request and Manitoba Transportation and Infrastructure's response
- Monitoring reports developed and provided to the Owner to be acted upon, as necessary
- Monitoring and mitigation measures conducted as a result of a specific complaint received by Manitoba Transportation and Infrastructure via the Complaint Resolution Process

Information collected from monitoring and routine inspections will be used by Manitoba Transportation and Infrastructure to assess effectiveness of plan and restriction measures on an annual basis during construction, and for the first 3 years of operation. A summary report of the results of the yearly assessment will be provided to regulators as applicable.

Based on reviews of the monitoring information, input from regulators, rights holders, and the RM of Grahamdale, adjustments will be made to the AMP, if required, to optimize its effectiveness in addressing safety concerns and traditional land uses. If and where required, public access to provincial water infrastructure can be prohibited or restricted by regulation under *The Water Rights Administration Act*.

APPENDIX 2A

LMOC Maps



NOTES:

1. EXISTING GROUND SURFACE DERIVED FROM THE FOLLOWING DATA SOURCES:
   - JULY 2017 LiDAR DATA PROVIDED BY MI.
   - 2014 BATHYMETRIC SURVEY BY KGS GROUP
   - 2015/2016 BATHYMETRIC SURVEY BY AAE TECH SERVICES INC.
2. SPOIL PILES NOT SHOWN.

0 30 60 90 120 150
1:4000 SCALE IN METRES

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

DRAFT

HATCH

HATCH DOCUMENT No:

REV.

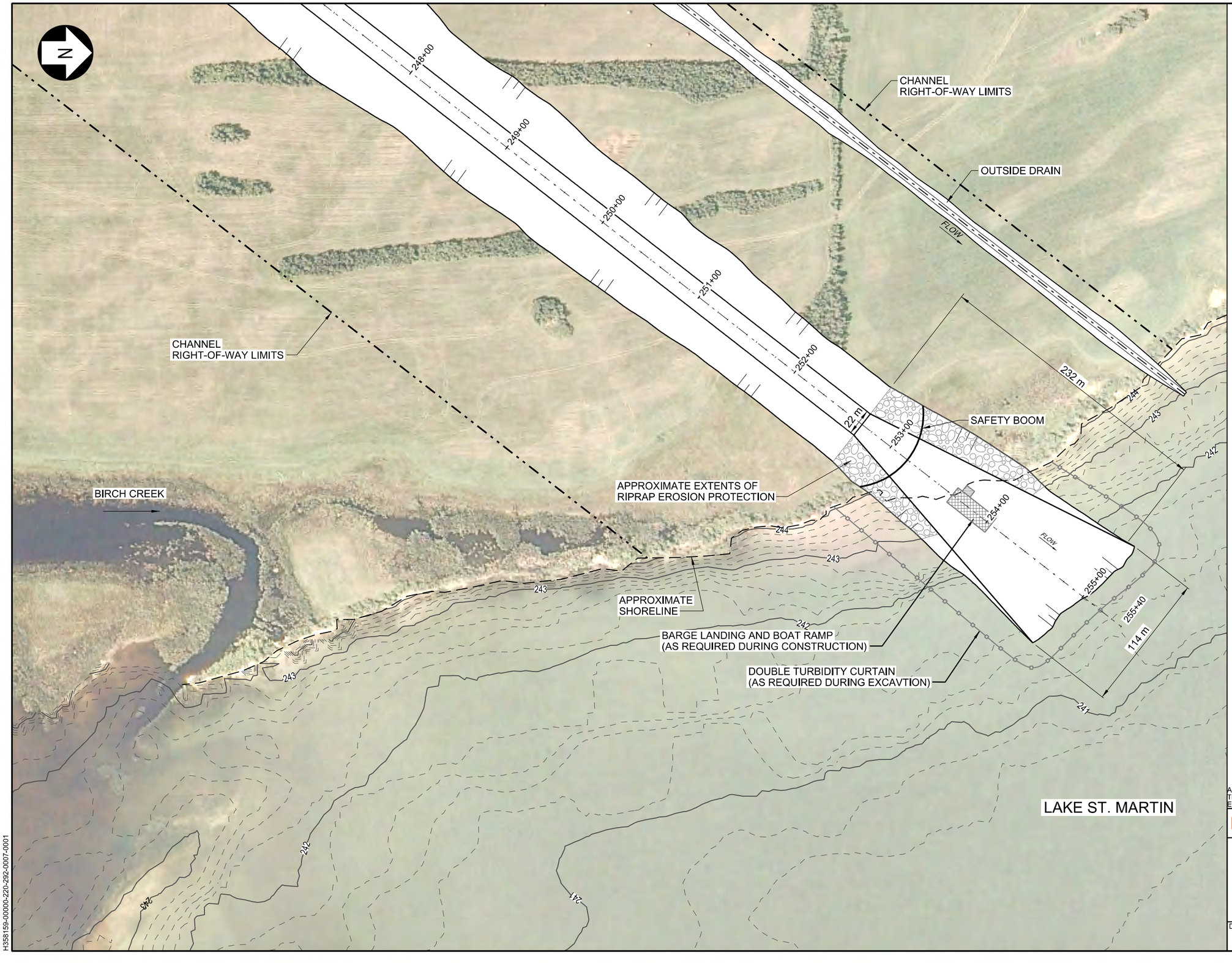
PROPOSED INLET EXCAVATION PLAN VIEW

LAKE MANITOBA OUTLET CHANNEL

DATE:
2022-04-20

SHEET SIZE: 11 x 17

H358159-00000-220-292-0006-0001



NOTES:

1. EXISTING GROUND SURFACE WAS DERIVED FROM THE FOLLOWING DATA SOURCES:
   - JULY 2017 LiDAR DATA PROVIDED BY MI.
   - 2015/2016 BATHYMETRIC SURVEY BY AAE TECH SERVICES INC.
   - 2017 BATHYMETRIC SURVEY BY NORTH/SOUTH CONSULTANTS INC.
2. SPOIL PILES NOT SHOWN.

0 20 40 60 80 100
1:3000 SCALE IN METRES

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

DRAFT

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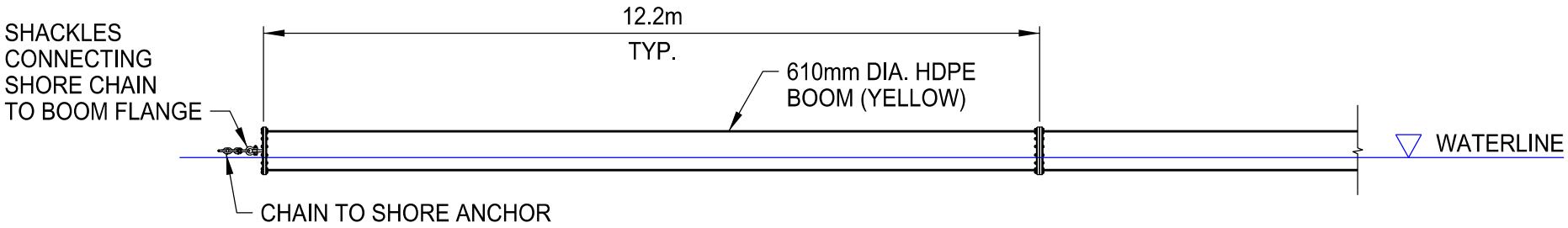
PROPOSED OUTLET EXCAVATION PLAN VIEW

LAKE MANITOBA OUTLET CHANNEL

DATE: 2022-04-20

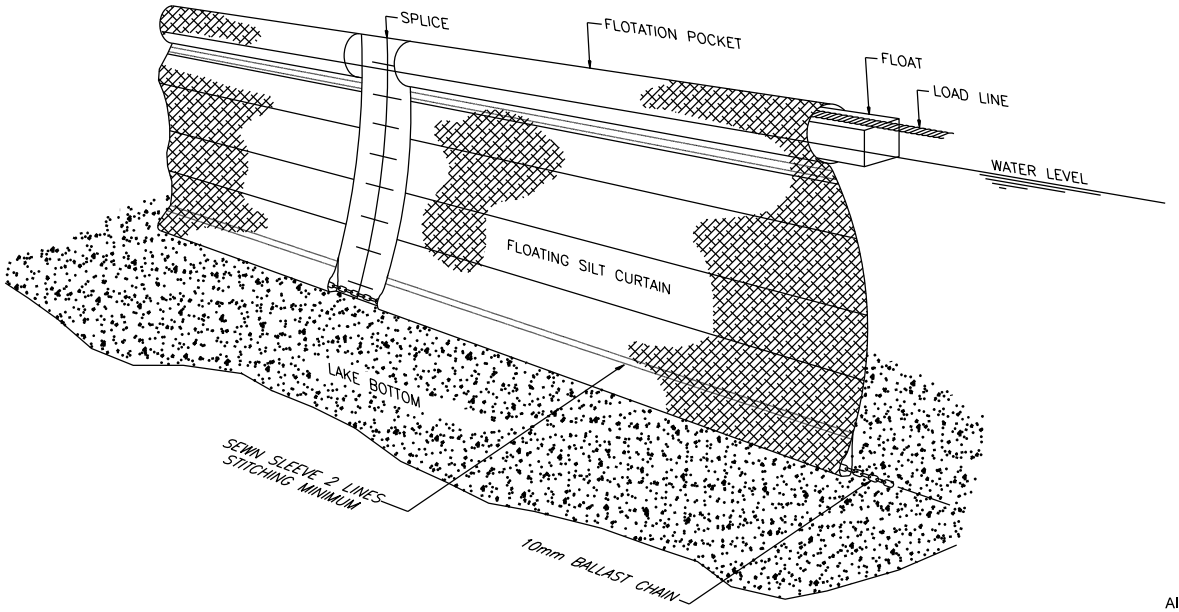
SHEET SIZE: 11 x 17

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SAFETY BOOM ELEVATION

SCALE 1:100



TURBIDITY CURTAIN

N.T.S.

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)

DRAFT

HATCH

HATCH DOCUMENT No:

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SAFETY BOOM AND
TURBIDITY CURTAIN
DETAILS

LAKE MANITOBA OUTLET CHANNEL

DATE:
2022-04-20

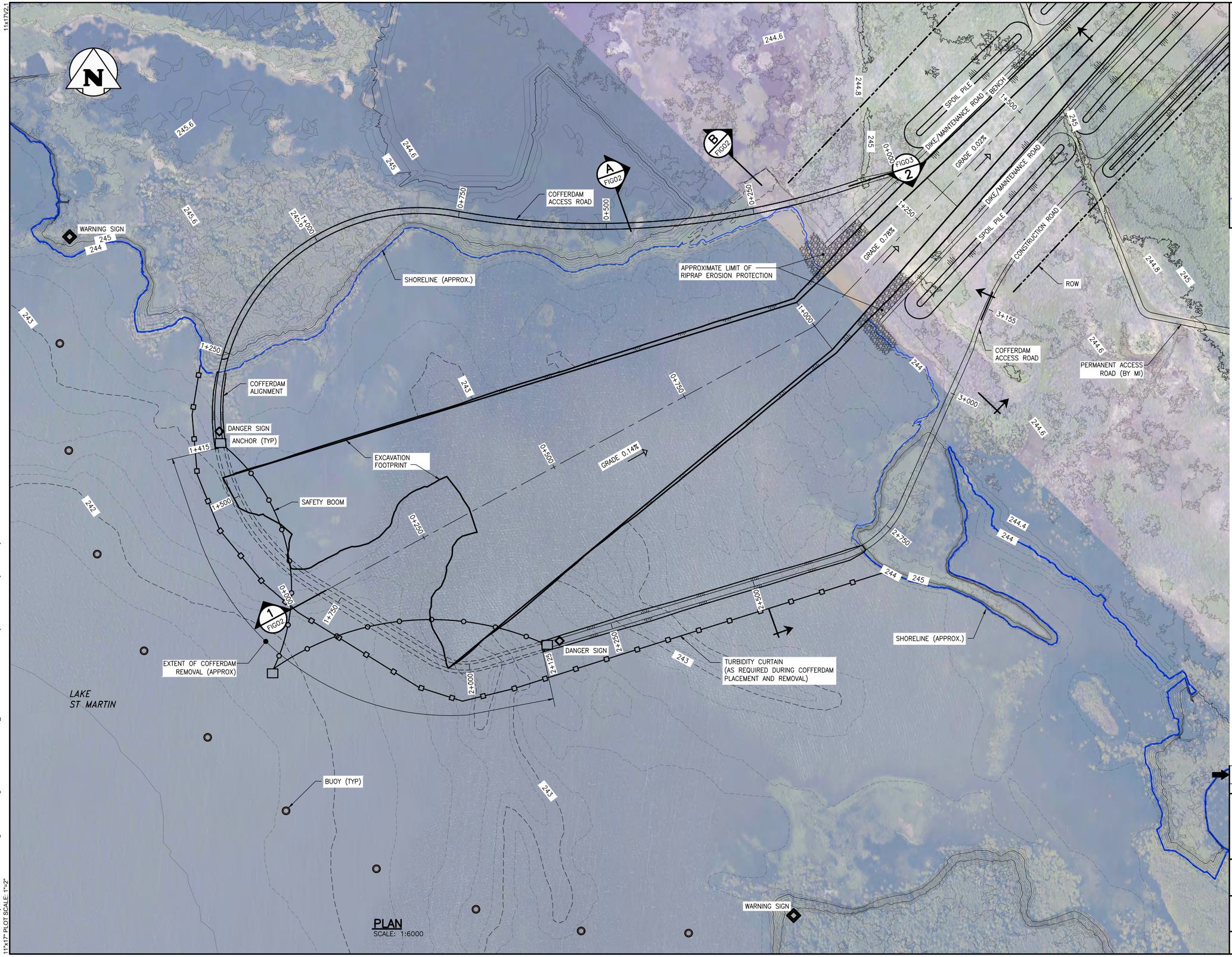
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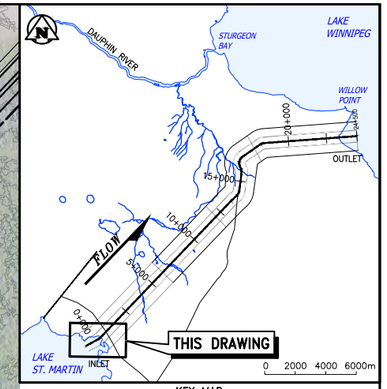
APPENDIX 3A

LSMOC Maps

11x17\V21



PLAN
SCALE: 1:6000



KEY MAP

NOTES:

1. ALL UNITS ARE METRIC AND IN METRES UNLESS OTHERWISE SPECIFIED. TRANSVERSE MERCATOR PROJECTION, AND 1983 CSRS, ZONE 14. ELEVATIONS ARE IN METRES ABOVE SEA LEVEL (MSL) AND ARE REFERENCING CANADIAN GEODETIC VERTICAL DATUM 1928 (CGVD28).
2. COFFERDAM IMPERVIOUS FILL MATERIAL TO BE SOURCED FROM CHANNEL EXCAVATION.
3. REMOVED COFFERDAM FILL TO BE PLACED IN CHANNEL SPOIL PILE

100 0 100 200m
SCALE: 1:6000 (11"x17")

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
A	22/04/29	ISSUED FOR INFORMATION	SGB	CMS

KGS GROUP

Manitoba Transportation and Infrastructure

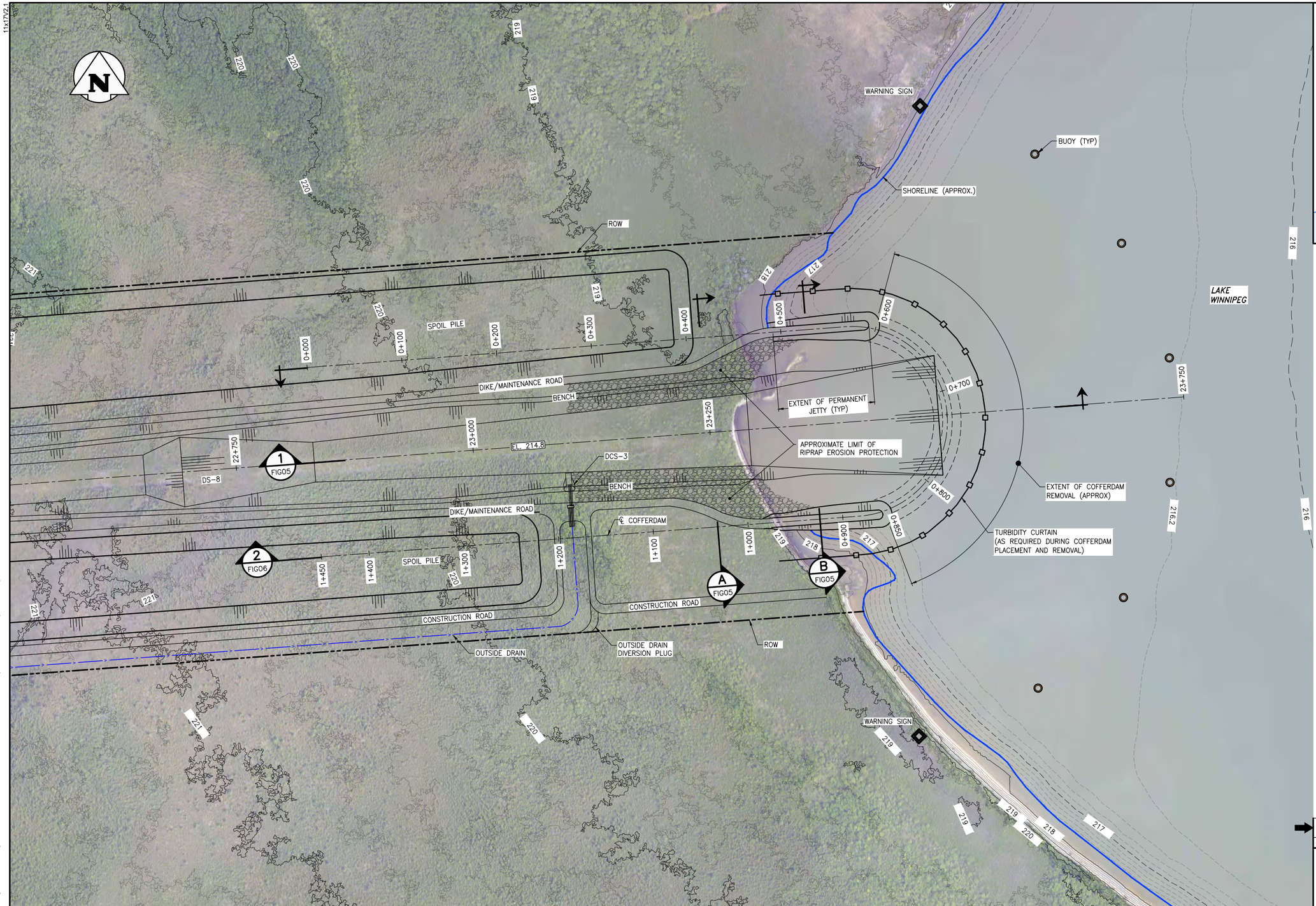
LAKE ST. MARTIN OUTLET CHANNEL PROJECT

INLET AREA GENERAL ARRANGEMENT

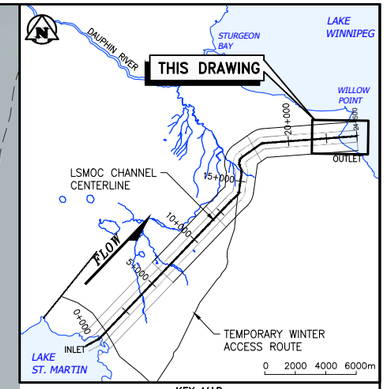
APRIL 2022 | PIR-FIG01 | REV: A

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11"x17" PLOT SCALE: 1=2"

11x17V21



PLAN
SCALE: 1:4000



KEY MAP

LEGEND:

DCS–3 DRAINAGE CONTROL STRUCTURE

NOTES:

1. ALL UNITS ARE METRIC AND IN METRES UNLESS OTHERWISE SPECIFIED. TRANSVERSE MERCATOR PROJECTION, AND 1983 CSRS, ZONE 14. ELEVATIONS ARE IN METRES ABOVE SEA LEVEL (MSL) AND ARE REFERENCING CANADIAN GEODETIC VERTICAL DATUM 1928 (CGVD28).
2. COFFERDAM IMPERVIOUS FILL MATERIAL TO BE SOURCED FROM CHANNEL EXCAVATION.
3. REMOVED COFFERDAM FILL TO BE PLACED IN CHANNEL SPOIL PILE

50 0 50 100 150m
SCALE: 1:4000 (11"x17")

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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A	22/04/29	ISSUED FOR INFORMATION	SGB	CMS

KGS GROUP

Manitoba Transportation and Infrastructure

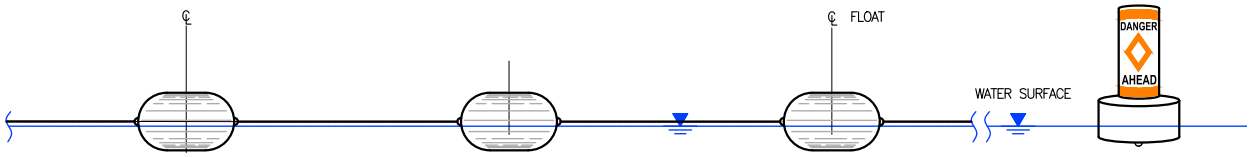
LAKE ST. MARTIN OUTLET CHANNEL PROJECT

OUTLET AREA GENERAL ARRANGEMENT

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KGS8x11P-V2.1

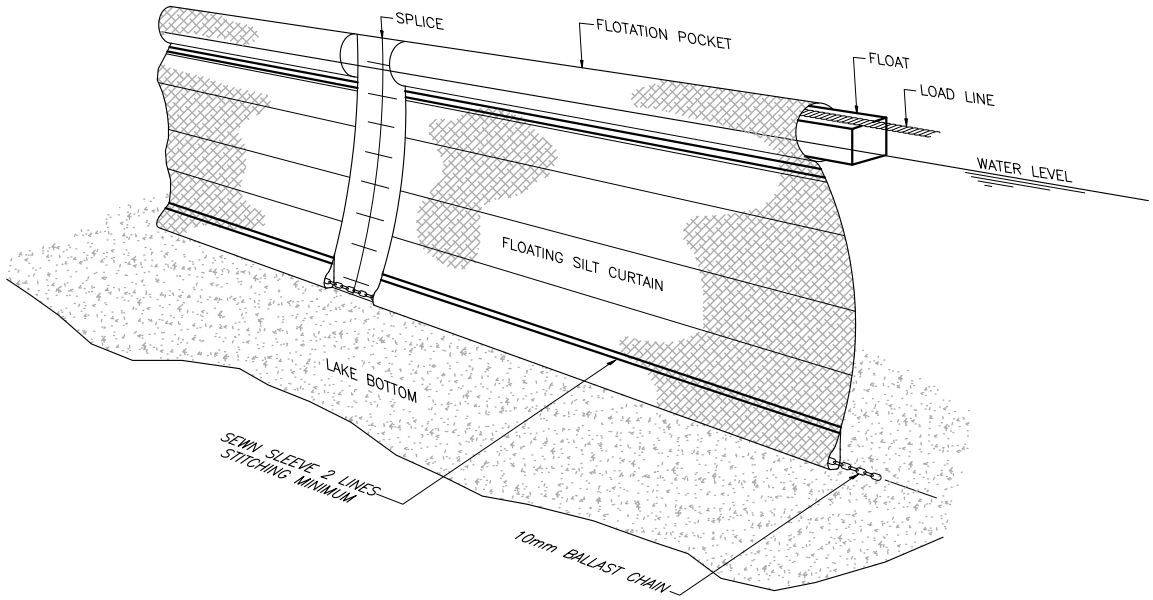


NOTE:

SAFETY BOOM FLOTATION UNIT:
COLOUR: INTERNATIONAL YELLOW

SAFETY BOOM LINE WITH FLOAT COLLAR CAN BUOYS

SCALE: N.T.S.



TYPICAL CONSTRUCTION OF A TURBIDITY CURTAIN

SCALE: N.T.S.

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
A	22/04/29	ISSUED FOR INFORMATION	SGB	CMS

KGS GROUP

Manitoba Transportation and Infrastructure

LAKE ST. MARTIN OUTLET CHANNEL PROJECT

TYPICAL DETAILS

APRIL 2022 | PIR-FIG07 | REV: A

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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8.5"x11" PLOT SCALE: 1"=2"

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Quarry Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Applicable Legislation and Reference Documents 1

2.0 COMMUNICATION 3

2.1 Contact Persons 3

3.0 CONSTRUCTION 5

3.1 Quarry Identification and Selection Criteria 5

3.1.1 General 5

3.1.2 Site Selection 5

3.2 Quarry Development Plan 6

3.3 Quarry Operation 7

3.4 Record Keeping and Reporting 8

3.5 Quarry Decommissioning Plan 9

4.0 OPERATION 11

APPENDIX 1 12

List of Tables

Table 1: Key Legislation and Documents Associated with the QMP

List of Figures

Figure A: EMP Process

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Quarry Management Plan (QMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *The Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

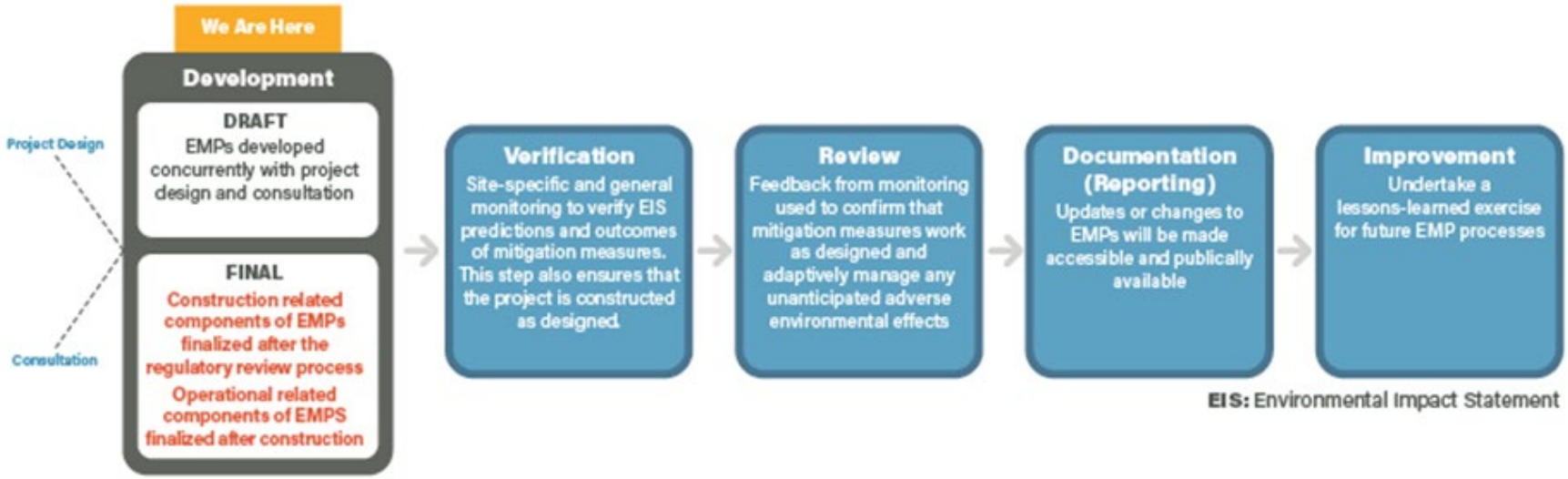


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EPP	Environmental Protection Plan
ESS	Environmentally Sensitive Sites
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
OEMP	Operation Environmental Management Program
PERs	Project Environmental Requirements
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
QDP	Quarry Development Plans

Glossary of Terms

Aggregate: A broad category of fine to coarse-grained particulate material used in construction including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates.

Bedrock: The solid rock that lies beneath the soil and/or other loose material on the Earth's surface.

Casual quarry permit: An annual permit issued for the production of a specified quantity of Crown quarry mineral (Quarry Minerals Regulation 1992).

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Contract Administrator: Refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendations for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.
Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or built structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Environmentally Sensitive Site: locations, features, areas, activities, or facilities that were identified during the environmental assessment process to be ecologically, socially, economically, culturally, or spiritually important or sensitive to disturbance and require protection during construction of the Project.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Private quarry permit: Refers to a permit for private aggregate or quarry operations in Manitoba.

The Owner: Refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Quarry: An open excavation or pit from which sand, gravel, clay, shale, gypsum, peat, salt, rock, or stone, is obtained by digging, cutting or blasting.

Quarry lease: Refers to a 10-year lease granted by the Crown with exclusive rights to excavate quarry minerals (e.g., sand, gravel, clay, shale, gypsum, peat, salt, rock or stone.)

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Riprap: A stone covering used to protect soil or surface bedrock from erosion by water or other elements.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Shale: A clastic sedimentary rock that is made up of clay-size weathering debris. It typically breaks into thin flat pieces.

1.0 INTRODUCTION

This Quarry Management Plan (QMP) is one component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the "Project"). The purpose of this plan is to outline criteria for site selection and development of quarries with the objective to avoid (to the extent possible), and mitigate potential adverse environmental effects associated with quarry development and aggregate production activities. The QMP provides the overall guidance for addressing this Project activity. Each specific quarry will require its own development plan and decommissioning plan, as described in this document.

Various construction materials are required for the Project including rockfill riprap, road building aggregates, concrete aggregates, and other granular or fine-grained materials. Estimated quantities, volumes, and identification of potential sources of construction materials are under development as the Project design progresses. Several potential bedrock and granular (i.e., sand and gravel) quarry sources exist in the general Project region, which may be used by Project Contractors. These include some existing permitted and licensed sources, which will be preferentially used, with new sites established only if required.

In addition to the requirements described within this plan, all Project activities, including quarry site selection, development, and management, will adhere to Project Environmental Requirements ([PER]; Table 1], as well as applicable components of the Construction Environmental Management Program (CEMP), the Operation Environmental Management Program (OEMP), and commitments made in the Project's Environmental Impact Statement (EIS) throughout the life of the Project.

1.1 Applicable Legislation and Reference Documents

The selection, development and operation of quarries shall comply with all applicable legislation, licenses, authorizations and permits. Key legislation and supporting documents associated with the QMP are outlined in Table 1.

Table 1: Key Legislation and Documents Associated with the QMP

Federal Legislation	
Species At Risk Act (S.C. 2002, c. 29)	*Explosives Act* (R.S.C., 1985, c. E-17)
Migratory Birds Convention Act (S.C. 1994, c. 2)	
Provincial Legislation	
Endangered Species and Ecosystems Act (C.C.S.M. c. E111)	*The Dangerous Goods Handling and Transportation Act* (C.C.S.M. c. D12)

Provincial Legislation (cont'd)	
Workplace Safety and Health Act (C.C.S.M. c. W210)	*The Fires Prevention and Emergency Response Act* (C.C.S.M. c. F80)
Mines and Minerals Act (C.C.S.M. c. M162)	Quarry Minerals Regulation, 1992 (Regulation 65/92)
Forest Act (C.C.S.M. c. F150)	*The Wildfires Act* (C.C.S.M. c. W128)
Crown Lands Act (C.C.S.M. c.C340)	
Other	
Manitoba Transportation and Infrastructure Contracts and Associated Documents	Project Licences and Authorizations
Applicable Manitoba Mines and Minerals Casual Quarry Permits or Quarry Leases	Applicable Manitoba Conservation and Climate Work Permits
Environmental Protection Guidelines	
Relevant Project Environmental Requirements	
2.1 Designated Areas and Access	2.2 Clearing and Grubbing
2.3 Erosion and Sediment Control	2.6 Machinery, Fuel Storage, Materials Handling and Storage, Spill Response and Remediation
2.7 Dust Suppression	2.9 Noise and Emissions
2.11 Wildlife and Species of Conservation Concern	2.12 Wildfires
2.13 Heritage Resources	2.14 Quarries and Borrow
2.15 Site Decommissioning	2.16 Revegetation and Vegetation Maintenance
2.17 Planned and Unplanned Shutdowns	

2.0 COMMUNICATION

Effective public education and communication about the Project is important to achieve success of the Project. The education and communication strategy for the construction and operation phases of the Project is intended to promote safety for all and to maintain an understanding among all identified rights-holders and stakeholders, and the public-at-large regarding all aspects of the Project, including quarry site selection, development, and operation.

Ongoing communications pertinent to quarry management will include information such as:

- Changes to access control points, timing of certain Project items, changes to exclusion areas due to blasting, etc.
- Specific to new quarries that may be developed for the Project, Manitoba Transportation and Infrastructure commits to working with stakeholders, the public and rights-holders to mitigate disruptions in areas for specific land and resource use and providing timely communication about Project activities, site selection for temporary works (camps and quarries), and about restrictions to activities that will be applied. Regular construction and construction activity updates will be provided to the EAC at regular frequency.

Locations of potential quarries have been identified on Figure 9.2A-15 in the Project EIS; a copy has been included in Appendix 1. This figure will be updated, as required, as design and construction progresses, and new information becomes available. Potential blasting areas will be included on the construction maps; however, more detailed blasting exclusion zones will be shown on a separate map, which will be distributed closer to the start of the construction period, should blasting be required. During the pre-construction period Manitoba Transportation and Infrastructure will maintain communication with rights-holders and local residents.

Information will be distributed through established public communication platforms, including but not limited to, Manitoba Transportation and Infrastructure's Project Website, monthly newsletters and other media used to enable effective and timely delivery to affected parties. Additionally, Manitoba Transportation and Infrastructure has developed a draft Complaint Resolution Process (CRP) intended to collect, respond to, and resolve any Project-related complaints. Specific inquiries and concerns about quarry operation and management also can be sought from Contact Persons identified the following section.

2.1 Contact Persons

Manitoba Transportation and Infrastructure, as the Project Owner, is responsible for managing the implementation, monitoring and amendments to the environmental aspects of the Project. The overall Project organization structure is outlined in Section 2.0 of both the CEMP and OEMP. The Owner will coordinate with the Contract Administrator, Inspector and Environmental Monitors, or designated alternates, who will monitor daily construction activities. These individuals will be supported by advice from a Manitoba Transportation and Infrastructure technical support team comprised of off-site environmental and design

personnel. The Owner will coordinate information sharing among on-site activities and off-site support teams.

Throughout the construction phase, Manitoba Transportation and Infrastructure, as the Project Owner, will be the main contact for communications between the Contractor and rights-holders and local residents. It will be responsible for maintaining regular communications. It will facilitate communication among the construction site staff and the local communities, including keeping leadership apprised of Project activities.

The Contractor is responsible for regular communication with the Manitoba Transportation and Infrastructure Inspector on construction activities, including overall construction schedule, identification of proposed quarries, and submission of Quarry Development Plans (QDP) and Quarry Decommissioning Plans. Prior to quarry development, and as required, Manitoba Transportation and Infrastructure, as the Project Owner, will provide rights-holders and members of the local communities with information about any Project activities and restrictions that will be put in place. Manitoba Transportation and Infrastructure, as the Owner, will work collaboratively on measures to address community concerns.

3.0 CONSTRUCTION

3.1 Quarry Identification and Selection Criteria

3.1.1 General

As indicated, efforts will be made to use existing permitted and licensed sources for materials, but the Contractor will comply with all applicable legislation, licenses, authorizations and permits with respect to aggregate exploration, quarry development and operations, should a new site need to be developed (Table 1). Quarry site selection, development and operation procedures outlined in this plan are to be read in conjunction with the PER (Table 1), as well as the CEMP, OEMP, and the Project EIS.

3.1.2 Site Selection

As indicated, aggregate for use in Project construction or maintenance shall, to the greatest extent possible, be sourced from existing sites, or from within the Project development area (PDA) and not be acquired from below the groundwater level. Existing sites that have been inactive and become active during the migratory bird breeding season (April 1- August 31) will be investigated for the presence of migratory bird nests (e.g., swallow colonies, common nighthawk nests) prior to quarry reactivation. Should existing aggregate sources be of insufficient quantities or inadequate material quality, development of additional sites shall, to the greatest extent possible, be limited to sites identified in the Project EIS and shown on Figure 9.2A-15 (Appendix 1).

Proposed quarries that are not currently active or identified in the Project EIS are subject to a site selection analysis to be approved by Manitoba Transportation and Infrastructure. The analysis will include a review of the Environmental Protection Plan (EPP) mapbooks and/or a separate biophysical review so that proposed quarry sites will not interfere with sensitive features such as:

- heritage resources and known cultural sites
- sensitive vegetation and wildlife habitat including for species at risk (e.g., red-headed woodpecker, eastern whip-poor-will)
- surface water, fish or fish habitat
- groundwater
- other sensitive sites (e.g., large stick nests, large mammal dens, mineral licks or other materials placed in the field that may attract wildlife)

Environmentally Sensitive Sites (ESSs), including those listed above, will be identified to the extent practicable prior to quarry development. If any additional ESSs are identified during the construction period they will be brought to the attention of the Monitor, Inspector, or Contract Administrator, to take appropriate mitigative action.

With respect to site selection, the following requirements shall apply:

1. No operator of a quarry may establish or mine a quarry closer than 400 metres (m) from a residence, unless the operator has established a vegetated berm or tree screen sufficient to shield the quarry from view from the residence.
2. Mining operations shall not encroach within 15 m of any property boundary adjoining private, municipal or crown-leased land.
3. With the exception of quarries that are contiguous with the road right-of- way, all quarry operations shall maintain a 50 m buffer from the proposed or actual road right-of-way. If no vegetated buffer or screen exists this distance shall be at least 150 m.
4. No quarry shall be established closer than 150 m from a Provincial Trunk Highway or Provincial Road unless the operator has established a vegetated berm or tree screen sufficient to shield the quarry from view from the road.
5. Habitat occupied by protected species shall be avoided as required, recognizing different species require different mitigative actions.
6. Quarry site selection shall consider the proximity of sensitive sites including, but not limited to, waterbodies, wildlife, heritage resources and culturally important sites. While setbacks vary depending on site conditions, selected quarry development sites are to be a minimum of:
    a. 100 m from a water course or water body
    b. 100 m from any large stick nest, eagle nest, heron rookery, or any other sensitive wildlife area
    c. 30 m from heritage resources or identified cultural sites
    d. other setbacks as required
7. Prior to development of a quarry site, it shall be assessed for the potential of acid rock generation. Sites found to contain acid generating rock shall not be developed.

3.2 Quarry Development Plan

Once a proposed quarry location has been approved for use or development, a QDP shall be produced by the selected Contractor. The QDP shall be submitted by the Contractor to the Contract Administrator for review and approval. The QDP may form part of the relevant permit or lease applications. The QDP shall describe the mobilization and demobilization of equipment, tools, materials, facilities and all things necessary for the work, including but not limited to site access, site work roads, site drainage, snow removal, clearing and grubbing, blasting, crushing and stockpiling of aggregate, environmental protection and mitigation measures, explosives storage and handling (including explosives residuals management plan), and general site cleanup and restoration.

The QDP shall include drawings diagrams or maps showing proposed site use or development limits, including the location of the initial extraction area, the progression of the extraction area, the location of sheds, offices, toilets and other temporary structures (including the explosives storage magazine), surface drainage areas and surface drainage control, stockpile areas, equipment maintenance areas, and other designated sites. The relationship between the planned quarry development, and site surface water and groundwater conditions shall also be addressed in the QDP, including items such as:

- Plans for the control of surface water inflow and runoff from the quarry site.
- The relationship between the planned quarry excavation geometry and the groundwater conditions at the site (i.e., the relationship between the invert of the quarry excavation and the groundwater conditions at the site).
- Surface water and groundwater management plans for unwatering/dewatering and associated discharge (if necessary).

The QDP is subject to approval by Manitoba Transportation and Infrastructure and may require revision(s) to meet relevant licenses, permit or lease conditions, specifications, or site-specific requirements.

3.3 Quarry Operation

Quarries shall be operated in accordance with all applicable licenses, approvals, permits and/or leases, the PER, and as per approved QDPs. The Contractor will not be permitted to commence any site work including mobilization, drilling activities or material extraction until the QDP is approved and the required permits are issued including but not limited to the following (as applicable):

- casual quarry permit or quarry lease (Manitoba Mines Branch)
- work permit (Manitoba Agriculture and Resource Development (MARD))

The Contractor will be responsible to acquire and maintain all relevant utility clearances prior to excavating in the proposed quarry development area.

The Contractor is to provide the Contract Administrator and the Owner at least eleven (11) working days (or as otherwise directed) advance notice of the location of the quarry operation. The notice is to include the QDP, and associated drawings of the working area including the location of the initial extraction area, the progression of the extraction area and the location of sheds, offices, toilets and other temporary structures, drainage and stockpile areas, equipment maintenance areas, and other designated sites. The suitability of the working area and commencement of works is to be subject to approval of the Owner.

The Contractor is to provide the Contract Administrator with at least six (6) working days (or as otherwise directed) advance notice of the intention to commence production of aggregates. The notice shall include: a preliminary schedule for work activities including establishment of access, clearing, relocation of equipment, establishment of water and wastewater services, appropriate systems to prevent accidental release of environmentally sensitive materials (e.g., fuels, oils, etc.), provisions for disposal of wastes, explosives management plan (including explosives residuals management plan), blasting plan(s), and commencement of crushing operation.

Where blasting is required, the Contractor is required to submit a blast plan (or series of blasting plans) to the Contract Administrator prior to preparatory work for each blast including such information as:

- The location, depth and area of the sinking cut.
- The blast sequencing, including location, depth, and area of each blast.
- Diameter, depth, pattern and inclination of blast holes for each blast.
- The type, strength, amount, column load, and distribution of explosives to be used per hole, per delay and per blast.
- The sequence and pattern of delays for each blast and the description and purposes of any special methods to be adopted.

Storage, transportation, and on-site handling of explosives (where required) will be in accordance with the *Explosives Act*. Storage of explosives (including magazine design and location) must be in a dry location away from flammable substances and sources of ignition and in a secure location to ensure that restricted access is limited to authorized personnel. During transport, explosives shall be appropriately labelled, packaged and an appropriate vehicle shall be used. Additional precautions pertaining to the transport, handling, and storage of explosives are detailed in the *Explosives Act.*

The quarry areas shall be maintained and left in a clean and orderly condition satisfactory to the Mines Inspector and/or Environment Officer. The explosives residuals management plan developed by the Contractor shall be adhered to throughout quarry development and operations.

The Contractor will amend the QDP to account for unexpected conditions or re-positioning of material and equipment, if required, but must do so with approval from the Contract Administrator and Owner.

3.4 Record Keeping and Reporting

In accordance with Section 25 of the *Manitoba Provincial Quarry Minerals Regulation*, 1992 (65/92) under *The Mine and Minerals Act* (C.C.S.M. c.M162), the holder of a quarry shall provide the Mining Recorder with the following (as applicable):

- An annual statement of the total quantity of quarry mineral produced from the quarry.
- A royalty payment.
- A rehabilitation levy payment.
- The annual rent, no later than the 30th day following the anniversary date of the lease.

Only quarry minerals that are produced and removed from the quarry shall be included within the annual statement. Quarry mineral removed by the Contractor for a public purpose is exempt from payment of royalties where the public agency certifies in an exemption certificate prepared on a form furnished by the recorder that the quarry mineral has been used for a public purpose.

Pursuant to Schedule C of the Quarry Minerals Regulations, 1992 of *The Mines and Minerals Act,* a rehabilitation levy of 12¢ per tonne is required for production of aggregate quarry mineral (Note: Every operator of an aggregate quarry shall remit to the recorder a rehabilitation levy equal to the product of the number of tonnes of aggregate quarry mineral produced multiplied by 0.12). This only applies to quarry

minerals that are produced and removed from the quarry (the holder does not pay this fee as long as the quarry mineral remains stockpiled on the quarry).

Prior to the commencement of mining, a work permit shall be obtained from the local Natural Resource Officer and notice of the commencement date shall be given to the Mines Inspector. The Contractor shall maintain an accurate daily record of the quantity of material removed from the site and shall make this information available to the Owner, Contract Administrator, Inspector or designated alternate, and/or the Mines Inspector upon request. If the permit was applied for on the basis of a contract for Manitoba Transportation and Infrastructure, material can only be used for the purposes of that Project.

3.5 Quarry Decommissioning Plan

Quarries that are exhausted of material or are no longer required, as determined by Manitoba Transportation and Infrastructure, shall be decommissioned and remediated of any contamination, as required, and in accordance with applicable regulations prior to Contractor demobilization. The Contractor shall develop and submit a Quarry Decommissioning Plan to Manitoba Transportation and Infrastructure no less than 90 days prior to demobilization (or as otherwise directed).

The Quarry Decommissioning Plan shall adhere to applicable regulations and incorporate measures listed in the PERs, the CEMP, the OEMP, and commitments made in the Project EIS. The Quarry Decommissioning Plan shall at minimum describe all remedial measures to address:

- **Access removal** – Access roads, approaches, and temporary culverts will be removed or appropriately blocked as part of site restoration. If the public will be affected during the decommissioning of any temporary construction roads the Contractor will establish signage or flag persons to ensure the health and safety of workers and residents in the area. Any existing or constructed roads that are required as part of the Project that will be used during the operation and maintenance phases are not required to be decommissioned.
- **Sloping considerations** – Quarry sites are to be regraded, as necessary, to establish safe side slopes and restore natural drainage to the area.
- **Re-vegetation including spreading of organic material** - Closure of temporary construction work areas, including quarry areas, will typically consist of redistributing topsoil and other organic materials to encourage natural vegetation and regeneration. Re-seeding will occur, as required, following the Revegetation Management Plan developed for the Project. Should re-seeding be required, and when conditions permit, re-seeding should be completed following grading, capping and trimming operations. If conditions do not permit re-seeding immediately, the Contractor is responsible to re-seed the next growing season. Seeding operations should not be carried out during high wind events, snow cover, ice conditions or in standing water.
- **Remediation of contamination** - Areas with fuel storage or refueling, hazardous substance and/or explosives handling, or vehicle and/or heavy equipment parking will require environmental soil testing. Should soil concentrations result in exceedances above applicable criteria the area will be remediated in accordance with applicable regulations (i.e., below Canadian Council of Ministers of the Environment guidelines) prior to Contractor demobilization.

- **Excess material** – Surplus material may be left in stockpiles that are re-graded to establish safe slope angles. Alternatively, surplus material may be moved to alternate site locations for future use during operation and maintenance phases or spread evenly over disturbed areas prior to closure. Excess material shall be left in a manner that does not impede drainage.
- **Waste** – Waste management shall be conducted in accordance with requirements set out in the CEMP and OEMP. For example, non-hazardous debris, construction waste and solid waste is to be removed and disposed of at existing permitted waste disposal sites. Hazardous materials will be removed and handled by licensed contractors and in accordance with specific legislation.
- **Removal of temporary structures and equipment** - Buildings, outbuildings, above-ground storage tanks and associated infrastructure will be removed. Dismantling of buildings will include disconnecting services such as potable water, septic holding tanks, and removal of associated infrastructure. Dismantling electrical and telephone services including removal of overhead lines, poles and transformers.
- **Safety requirements** – Access restrictions to the quarry cut edge are to be included as required. Decommissioning activities will be in compliance with applicable safety and health regulations. Signage and flag persons at the site will be required as part of the decommissioning and reclamation activities if the activities pose a risk to the safety of local residents.
- Other requirements as listed in relevant legislation, regulations, licences, authorization, approvals permits and/or leases.

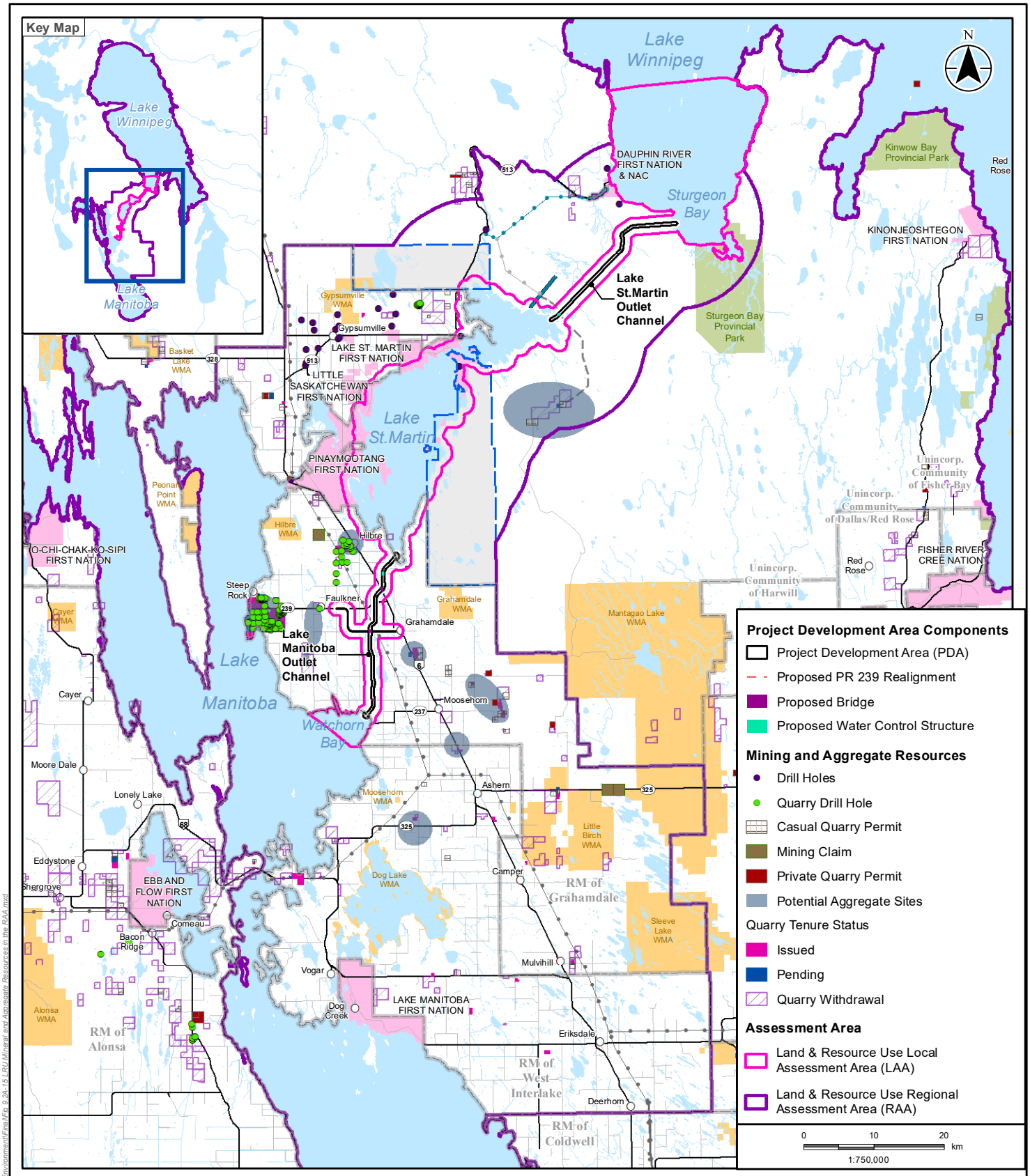
Rehabilitation of any quarry used during the operation phase of the Project will be required during or prior to decommissioning. Affected communities would be advised, and all applicable regulatory requirements would be met. The specific methodology would include and, where possible, build on the decommissioning procedures for temporary construction sites.

4.0 OPERATION

Some of the quarry areas developed during the construction phase (if any) may be retained by Manitoba Transportation and Infrastructure to support ongoing operation and maintenance of the Project. These quarries will be managed following the procedures outlined in Section 3.0. Likewise, if any new quarry sites are required in the future for any major maintenance or repair, these similarly would be sited, developed and managed in accordance with measures in Section 3.0.

APPENDIX 1

Project EIS Figure 9.2A-15 (March 2020)



Legend

- Fairford Water Control Structure
- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Existing Transmission Line
- Existing Distribution Line
- Planned Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Lake St. Martin Area Unorganized Territory
- Rural Municipality
- Northern Affairs Community (NAC)
- First Nation
- Wildlife Management Area
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure
3. Last Update: 8/23/2019 3:51:15 PM

Manitoba

MANITOBA TRANSPORTATION AND INFRASTRUCTURE
Lake Manitoba & Lake St.Martin Outlet Channels Project
Environmental Impact Statement

Mineral and Aggregate Resources in the RAA

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LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Sediment Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

Part 1: Introduction 1

1.0 PURPOSE AND SCOPE 1

2.0 OBJECTIVES 3

3.0 MANAGEMENT CRITERIA 4

3.1 General Considerations 4

3.2 Water Quality Criteria 4

3.3 Design Criteria 5

Part 2: Lake Manitoba Outlet Channel 6

4.0 CONSTRUCTION PHASE (TEMPORARY MEASURES) 6

4.1 Main Channel Excavation 7

4.1.1 Intermediate Controls 7

4.2 Other Project Components 8

4.2.1 Outside Drain 8

4.2.2 Water Control Structure and Bridges 9

4.2.3 Inlet and Outlet Works 9

4.3 Commissioning 10

5.0 OPERATION PHASE (PERMANENT MEASURES) 11

5.1 Perimeter Controls 11

5.2 Constructed Channel 12
5.3 Other Project Components 14
6.0 MONITORING 15
6.1 Construction Phase 15
6.2 Operation Phase 15
7.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP 16
7.1 General 16
7.2 Follow Up Response 17
7.2.1 Construction 17
7.2.2 Commissioning 19
7.2.3 Operation 20
7.3 Contingency Measures and Emergency Response 20
8.0 REFERENCES 22
Part 3: Lake St. Martin Outlet Channel 23
9.0 CONSTRUCTION PHASE (TEMPORARY MEASURES) 23
9.1 Main Channel Excavation 24
9.1.1 Perimeter Controls 24
9.1.2 Intermediate Controls 25
9.2 Other Project Components 26
9.2.1 Outside Drain 27
9.2.2 Structures 27
9.2.3 Inlet and Outlet Works 28
9.3 Commissioning 29
10.0 OPERATION PHASE (PERMANENT MEASURES) 30
10.1 Constructed Channel 30
10.2 Other Project Components 32

11.0 MONITORING 33
11.1 Construction Phase 33
11.2 Operation Phase 33
12.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP 34
12.1 General 34
12.2 Follow Up Response 35
12.2.1 Construction 35
12.2.2 Commissioning 37
12.2.3 Operation 38
12.3 Contingency Measures and Emergency Response 38
13.0 REFERENCES 39
APPENDIX 2A 40
APPENDIX 2B 54

List of Figures

Figure A: EMP Process
Figure 1: Typical Silt Fencing Detail
Figure 2: Typical Straw Roll Detail
Figure 3: Typical Erosion Control Blanket Details
Figure 4: Typical Silt Fencing Detail
Figure 5: Typical Straw Roll Detail
Figure 6: Typical Erosion Control Blanket Details

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Sediment Management Plan (SMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

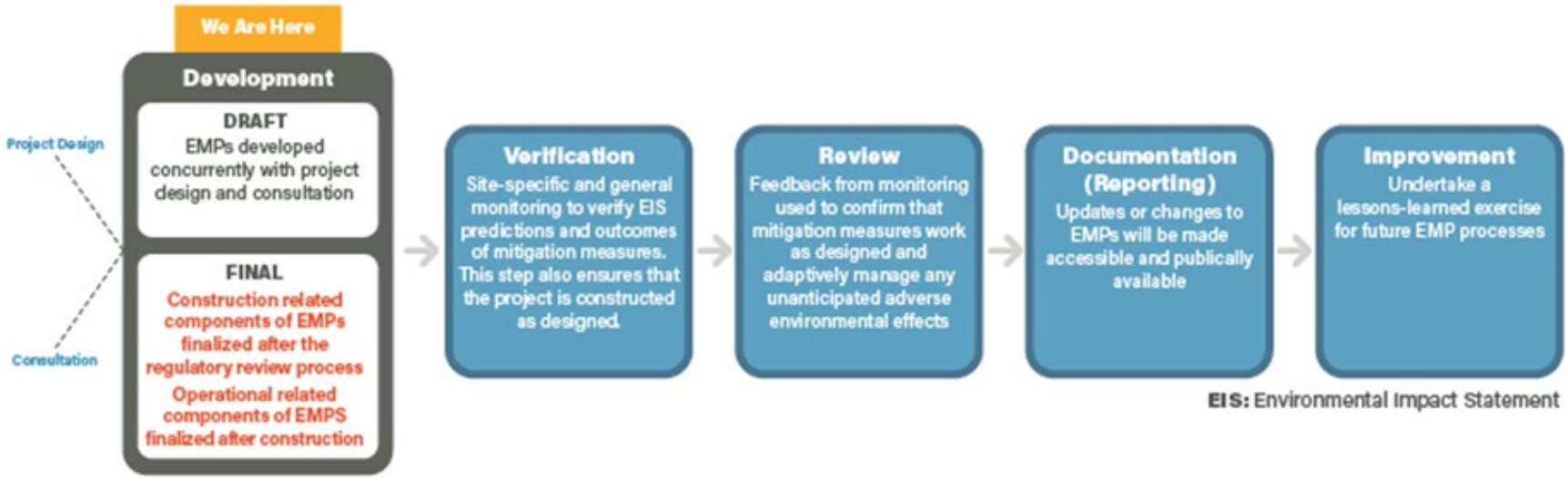


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AEMP	Aquatic Effects Monitoring Plan
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Program
DFO	Department of Fisheries and Oceans Canada
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ft	feet
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
mg/L	milligrams per litre
MWQSOG	Manitoba Water Quality Standards, Objectives and Guidelines
OEMP	Operation Environmental Management Program
O&M	Operations and Maintenance
PER	Project Environmental Requirements
PR	Provincial Road
PTH	Provincial Trunk Highway
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SMP	Sediment Management Plan
SWMP	Surface Water Management Plan
TSS	Total Suspended Solids
WCS	Water Control Structure

Glossary of Terms

Aquatic life: Organisms temporarily or permanently living or found in water.

Aquatic vegetation: Submerged, floating-leaved and floating plants that only grow on or beneath the water surface. Submerged plants may be rooted in soils or free-floating.

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Aquitard: A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

Artesian: A body of rock or sediment containing groundwater that is under greater than hydrostatic pressure: that is a confined aquifer. When an artesian aquifer is penetrated by a well, the water level will rise above the top of the aquifer; a flowing artesian well is when the water level will rise above ground surface.

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Cofferdam: An enclosure, usually only partially obstructing a river, from which water is pumped to expose the bottom to permit construction.

Confined aquifer: An aquifer that is bounded above and below by formations of distinctly lower permeability than that of the aquifer itself. An aquifer containing confined ground water. See artesian.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of Contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pump, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Hydraulic profile: The graphical representation of the water level through the channel based on the water level of the receiving water, control points, and the head loss.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Invert (channel): The stream bed or floor within a structure or channel.

Piezometric pressure: A measurement at a discrete location expressing the potentiometric surface which is an imaginary surface representing the pressure of groundwater in an aquifer that is defined by the level to which water will rise in a well.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Riprap: A lightweight stone covering used to protect soil or surface bedrock from erosion by water or the elements.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Suspended sediment: Particulate matter that is held in the water column due to movement of the water.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Turbidity: A measure of the relative clarity of water.

Waterbody: Standing and flowing surface waters (such as a creeks, rivers, lakes, and wetlands with open water), including seasonally and ephemerally occurring surface waters.

Part 1: Introduction

1.0 PURPOSE AND SCOPE

The Sediment Management Plan (SMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project (the Project). The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP). The purpose of the SMP is to describe measures to minimize or mitigate impacts of erosion and sedimentation in or near water from construction and operation activities of the Lake Manitoba Outlet Channel (LMOC) and the Lake St. Martin Outlet Channel (LSMOC).

The SMP supports the requirements described in Sections 2.3 and 2.5 of the Project Environmental Requirements (PERs) regarding Erosion and Sediment Control and Working Near Water, respectively. Section 2.3 defines erosion and sediment control measures as including the long-term, temporary, or emergency stabilization of any and all soil types to prevent undesirable soil movement or soil releases and discharges to a waterbody, as well as efforts to minimize substrate disturbance and sediment uplift or suspension during in-water work. Section 2.5 defines work near water as any and all activities occurring within the ordinary high-water mark of a waterbody, and that apply to work in or near fish-bearing and non-fish bearing waterbodies, dewatering, temporary diversions, temporary crossings and access pads, stream crossings (bridges and culverts), blasting near a waterbody, debris and sedimentation removal, and water quality monitoring.

In consideration of the PERs, measures described in the SMP include temporary construction management practices, as well as permanent mitigation measures built into the channel design, to minimize the potential for erosion and to minimize and mitigate the transport and deposition of sediment beyond construction areas or into off-site receiving water bodies. The SMP is closely coordinated with the Surface Water Management Plan (SWMP), which describes the monitoring requirements that support the implementation of SMP measures.

The SMP is intended to be a living document that will be refined over the life of the Project and will be updated as detailed design advances and various aspects are implemented, incorporating lessons learned and applicable engagement feedback provided via regulators, stakeholders and/or rights-holders. In particular, additional information will be added to the SMP during detailed design that will include general arrangement layout drawings for the PDA and the locations where the sediment management measures will be implemented.

Different sediment management strategies are required for the LMOC and the LSMOC as these distinct components of the Project are located in substantially different environmental settings with different hydraulic profiles. The LMOC, for example, is located in a well-developed agricultural area with less available area for vegetated buffers and other more naturalized mitigation measures, whereas the LSMOC is located in an undeveloped wetland and forested area. Furthermore, the strategies for handling local surface water drainage during construction differ between the two channels, as their specific designs impact on how surface water can be managed, which in turn impact the sediment management practices planned. Given these overarching site-specific differences, the SMP is organized into three parts:

- Part 1 contains general information that is common to both the LMOC and LSMOC.
- Part 2 contains information that is specific to the LMOC.
- Part 3 contains information that is specific to the LSMOC.

A number of other environmental management and monitoring plans are being developed for the Project that interrelate with sediment management, including an Aquatic Effects Monitoring Plan (AEMP), a SWMP and a Revegetation Management Plan (RVMP).

Monitoring to confirm effectiveness of sediment management measures and the identification of when adaptive management may be required is summarized in this document, with the details presented in the AEMP and SWMP. Regional and operational monitoring is included in the AEMP.

2.0 OBJECTIVES

The SMP has been developed to address the following objectives:

- Define guidelines and procedures for construction to minimize the potential for erosion and sedimentation.
- Identify erosion and sediment control measures to minimize adverse, sediment related, effects to receiving waterbodies.
- Identify emergency response practices to mitigate extreme design conditions, respond to unforeseen events and accidents, and minimize potential environmental impacts.

3.0 MANAGEMENT CRITERIA

3.1 General Considerations

Erosion and sedimentation are natural processes that occur during precipitation events and in waterbodies, particularly during spring or flood events. However, Project-related erosion and sedimentation that could increase conditions beyond these natural events must be managed. The erosion and sediment control measures described in this plan and other related plans are designed to mitigate the potential environmental effects during construction and operation activities for the proposed LMOC and LSMOC. Erosion and sediment control measures will be developed in consideration of these guidelines, environmental needs, and Project cost. The range of baseline total suspended solids (TSS) concentrations in potential receiving waters will also be considered. Sediment transport to downstream receiving bodies is viewed as detrimental to the potential habitats in the receiving bodies. Suspended sediment can cover fish spawning, feeding and rearing areas, as well as transport other pollutants into the receiving environment, and therefore must be mitigated.

A number of physical and hydrologic (weather) related items are considered in the development of erosion and sediment control measures, including:

- The range of potential rainstorm events that could occur during construction of the LMOC and LSMOC.
- The background sediment concentrations in downstream receiving bodies.
- The rate at which revegetation will occur due to various weather influences occurring during construction.
- The potential for erosion relative to the time of year in which construction will take place.
- The potential for runoff into the construction sites and the control of water during construction.
- The integration of the temporary and permanent vegetation.
- Issues related to site dewatering and acceptable dewatering practices.
- The use of temporary diversion ditches and treatments.
- The responsibility expectations for construction site management.
- The regular inspection criteria and frequency of these inspections.

3.2 Water Quality Criteria

The SWMP describes the surface water quality parameters that will be monitored, and the thresholds upon which decisions to implement or modify mitigation measures will be made, including those described in the SMP. The SWMP should therefore be used in conjunction with the SMP to effectively manage erosion and sedimentation issues.

Water quality management controls during Project construction will be designed by the Contractor, following guidance from the SWMP, in accordance with contract requirements and as approved by Manitoba Transportation and Infrastructure, to allow discharge into waterbodies using various methods of containment, treatment and discharge. The actions will be guided by a combination of the results of visual

inspections and testing, where appropriate as determined by the Inspector, and meeting appropriate Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) objectives and Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life in waterbodies. In addition to observable changes in potential erosion sources and surface water quality issues (e.g., exposed soil areas, sediment plumes), these guidelines form the basis of the adaptive management and follow-up measures described in Section 7.0 and 12.0, as well as the relevant adaptive management sections of the other EMPs.

3.3 Design Criteria

The storm event to be used for the design of sediment control measures during construction will be selected with consideration of the final design of temporary surface water management features, as discussed in the SWMP. This will be completed at detailed design once the duration and size of contracts are finalized. A storm event will be selected to manage and mitigate environmental risks that is commensurate with overall Project costs. For the operation phase, the LMOC and LSMOC and associated outside drains are being designed according to criteria adopted for the Project to minimize the potential for bed erosion, including the channel armouring designs to address uncertainties.

Part 2: Lake Manitoba Outlet Channel

4.0 CONSTRUCTION PHASE (TEMPORARY MEASURES)

The following general construction management practices are key components of the temporary erosion and sediment control measures for the LMOC.

- Coordinating construction staging and sequencing to maximize excavation in each work area while minimizing the time of exposure for newly excavated slopes. This will be accomplished by restricting excavation to within manageable units.
- Implementation of erosion and sediment control measures such as silt fences, slope roughening techniques, slope terracing, runoff management, and straw mulching. These will be specified on construction drawings and will be implemented in accordance with Project Environmental Requirements (PERs) for Erosion and Sediment Control and Working Within or Near Water.
- Maintaining a natural vegetated buffer zone on the east side of the right of way (ROW), where possible, to reduce erosion and sediment transport between the construction site and existing receiving water bodies and streams.
- Revegetating exposed areas directly after finished grade is established. Planting will, if practicable, commence immediately upon completion of a section of LMOC to maximize the potential for growth and establishment of a vegetative cover. The revegetation is considered to be part of the permanent erosion and sediment control measures discussed in Section 5.0.
- Minimizing disturbance to adjacent vegetated areas to accommodate buffering of suspended sediment.

It should be noted that channel design features such as armouring and shallow side slopes will help minimize the erosion and sediment generated during construction.

The sections that follow provide further detail on erosion and sediment control measures that will be completed at detailed design once the duration and size of contracts are finalized and applied during the construction of the various components of the LMOC. As identified in Section 6.0, monitoring will be undertaken to assess the effectiveness of proposed erosion and sedimentation control measures. A preliminary monitoring and response protocol related to LMOC in-lake construction is provided in Appendix 2A.

4.1 Main Channel Excavation

The temporary erosion and sediment control measures for excavation of the main channel are based on accepted construction industry practice to minimize erosion and sediment transport to receiving water bodies. These measures are broken down into perimeter measures, intermediate measures, and potential adaptive management and contingency measures, as defined below:

- Perimeter erosion and sediment control measures are implemented at the onset of each construction contract to enclose the designated construction area.
- Intermediate erosion and sediment control measures are the measures implemented within each construction area.
- Adaptive management measures are the erosion and sediment control measures that would be implemented in the event that one or more of the intermediate measures do not to achieve the desired performance. These are described in Section 7.2.
- Contingency measures would be implemented in the event of an emergency condition that would overwhelm the "base" erosion and sediment control measures, for example, due to a storm event that exceeds the selected design event. These are described in Section 7.3.

Specifications and drawings for LMOC construction will be prepared during detailed design and customized for each individual contract as required. Section 4.1.1 describes the base measures that will be implemented as a minimum for the LMOC.

4.1.1 Intermediate Controls

Intermediate controls will be developed as the channel excavation proceeds with a full set of controls in-place upon completion of excavation and before revegetation begins. As the excavation progresses downward to the final grade, slope roughening techniques on exposed side slopes will be implemented.

Re-establishing the vegetation cover in the LMOC is fundamental to minimizing the erosion potential during both the construction and operation phases of the LMOC. Within the planting season, and after final grade is established within a reasonably sized work area of a channel segment, the grade will be prepared and revegetated according to the appropriate revegetation prescription(s) as outlined in the RVMP. A component of the main revegetation prescription includes a cover species that will establish quickly to protect the bare soil from erosion as the remainder of the species germinates.

If stockpiles are to be left in place for more than one growing season, temporary topsoil stockpiles will be contoured and seeded during construction to reduce erosion and control weed establishment. If sandy soils are encountered during excavation to the degree and extent which sandy soils are the dominant soil texture in a soil stockpile in a given area, due to higher risk of wind erosion losses in these exposed soils, the surfaces of temporary stockpiles should be contoured and seeded, and stabilized using straw mulch treatments (mechanically anchored/crimped or treated with tackifier) or topical spray on mulches, as soon as practically feasible.

Additional intermediate controls will also be considered in the completed excavation area, or in locations with a higher risk of erosion (e.g., if sandy soils are encountered) and will be developed during detailed design based on an assessment of potential sediment that could be generated and the final construction contracting strategy. These intermediate controls may include:

- Slope interrupters constructed at regular intervals (10 m) cross-slope on the channel and spoil embankment slopes. These can be effectively constructed with a grader or dozer with an adjustable blade to create a deep furrow into the side slope. Slope interrupters are not intended to trap or filter sediment, but they will serve to minimize further slope erosion protecting against deep rills or gullies by interrupting flow of runoff down the slope.
- Straw mulch treatment outside of the channel after the surface has been seeded with vegetation. The straw mulch would be anchored/crimped into the surface of the soil. The straw mulch helps protect the slope against erosion, but also provides an enhanced environment to promote quick growth of the grass seed. Other environmentally friendly types of topical spray on mulches may also be considered, where appropriate.

The temporary erosion and sediment control measures discussed above will be left in place until the permanent vegetation is re-established. Other erosion and sediment control methods will be considered as alternatives for use as adaptive management and/or contingency measures if the base approach measures do not perform as expected. Further discussion of these adaptive management and contingency measures is provided in Section 7.0.

4.2 Other Project Components

Temporary erosion and sediment control measures will be required for the other Project components that are part of the LMOC, which include:

- Outside Drain
- Water Control Structure and Bridges
- Inlet and Outlet works

An overview description of the temporary erosion and sediment control measures for each component listed above is provided in the following subsections. Monitoring of the Project area will be conducted to assess the effectiveness of proposed erosion and sedimentation control measures as outlined in Section 6.0. Adaptive management and/or contingency and emergency response measures for these components will include similar measures described in Section 7.0.

4.2.1 Outside Drain

As part of the site preparation Project works, an outside drain will be constructed on the west side of the LMOC to collect surface water runoff. The design discharge for the outside drain will be based on the 1 in 10-year runoff event from the contributing area west of the channel alignment, which is in line with current provincial drainage standards typically applied in rural settings. To reduce the potential for erosion in this

drain, maximum average velocities will be kept below 1.0 m/s during the design event. Permeable in-stream geosynthetic sediment barriers (check dams) may be placed, as required, to control the flow velocity and help to intercept and settle out any sediment that is mobilized.

Should a runoff event or series of runoff events that is greater than the design condition be experienced prior to the re-establishment of permanent vegetation, then contingency and emergency response measures will be implemented to mitigate the risk of excess erosion as described in Section 7.3.

A vegetated buffer will be maintained between the outside drain and the channel excavation spoil pile, where practical. Silt fences will be used where vegetated buffer zones cannot be maintained effectively. Combined, these measures are expected to substantially reduce the potential for sediment transport along the drain.

Flows intercepted by the outside drain will be discharged into Lake Manitoba and Lake St. Martin.

4.2.2 Water Control Structure and Bridges

Construction work areas for the bridges and water control structures (WCS) will be isolated from channel construction activities to prevent surface water runoff from entering and to reduce the amount of groundwater depressurization pumping required.

Surface water within these work areas that must be discharged offsite will be monitored and controlled, as required, to comply with the water quality criteria outlined in Section 3.2. It is likely that the Contractor will manage surface runoff within excavation areas by directing it to low areas of the excavation to allow sediment to settle prior to being pumped to offsite receiving areas. Pump discharge points will be lined with clean rock or other acceptable flow dissipating applications, as required, to prevent erosion and the release of suspended sediments. Settling ponds will be constructed adjacent to the work areas, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction. Additional discussion on surface water management is provided in the SWMP.

4.2.3 Inlet and Outlet Works

The inlet works will consist of excavating the lake bottom within an approximately 140 m long by 215 m wide area of Lake Manitoba (Watchorn Bay). This excavation is expected to take place in the wet with the construction area isolated by a double turbidity curtain (i.e., two separate turbidity curtains) to prevent or minimize the migration of disturbed sediments into the lake during construction. Turbidity monitoring will be used to confirm the effectiveness of the measures and allow for adaptive management to be implemented if required. A preliminary monitoring and response protocol related to this is provided in Appendix 2A. A fish salvage program will be required within the isolated area which will be developed and conducted in accordance with the PERs. Methods are described in the AEMP.

Installation and removal of the double turbidity curtain, as well as the excavation work itself, will comply with the Department of Fisheries and Oceans Canada (DFO) Restricted Activity Timing Windows (DFO, 2013), and will be completed in accordance with the conditions outlined in the DFO authorization. Removal of the

curtain would occur once monitored water quality parameters on both sides of the curtain are similar and meet the criteria outlined in Section 3.2.

Specific methods of construction within the area will be determined by the Contractor, in accordance with contract requirements and as approved by Manitoba Transportation and Infrastructure. Alternate construction methods may be proposed, such as isolating the area with a cofferdam that would be constructed behind a turbidity curtain. The outlet works will consist of excavating the lake bottom within an approximately 140 m long by 115 m wide area of Lake St. Martin (Birch Bay). Construction activities and measures to manage surface water during construction will be similar to the inlet works and will comply with regulatory conditions.

4.3 Commissioning

The till base and lower sides slopes of the LMOC will be covered with an armour layer comprised of small stones to guard against its potential erosion by hydraulic forces when the channel is in operation. The armouring will be crushed limestone rock, which will be overlain on geotextile that will isolate the channel from the underlying till substrates. On the channel base and lower side slopes, the median stone size will be 35 to 40 mm diameter and the overall gradation will range in size from 25 to 100 mm. The thickness of the armouring in these areas will be 225 mm thick. On portions of the side slopes that could interact with the ice cover in the channel, the same rock sizes will be used but the thickness will be increased to 400 mm. While the size of the stones that comprise the armour layer will be designed to resist the hydraulic forces, it is also expected that some fine material will remain both on the surface and within the armour layer at the end of construction, which is anticipated to be mobilized and transported out of the LMOC when it is first operated during commissioning. Other sources of fine material may also be mobilized during commission (i.e., loose material remaining within the channel from earth plug removal, erosion of fine sands in the vicinity of the outlet, resuspended sediment near the inlet, etc.). Mobilization and transport of these materials is expected to result in a short-term temporary increase in the concentration of suspended sediment at the outlet in Birch Bay.

To limit the potential increase in suspended sediment concentrations, a controlled gate opening procedure and response protocol is being developed and will be implemented which will be informed with TSS monitoring data that will be collected during the commissioning operation from real-time turbidity loggers to be installed in Watchorn Bay and Birch Bay. Commissioning will be planned to be undertaken between July 1 and September 14, so as to comply with the DFO Restricted Activity Timing Windows (DFO, 2013). A preliminary monitoring and response protocol for this aspect of the work is provided in Appendix 2A, which will be further developed and finalized prior to commissioning taking place.

The mitigation and response measures used during commissioning, along with any adjustments made and lessons learned, will be reviewed and used to inform an updated procedure that can be followed during the initiation of future operation events, should it be found to be required.

5.0 OPERATION PHASE (PERMANENT MEASURES)

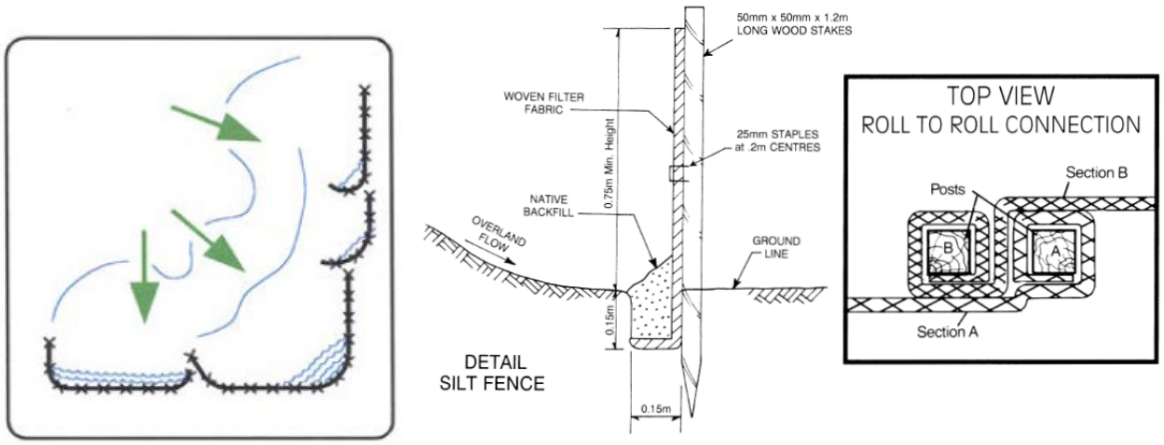
The permanent erosion and sediment control measures are those that are implemented for long-term, post construction erosion control. Permanent erosion and sediment control will consist primarily of the establishment of a permanent vegetative cover, as described in the RVMP, as well as armouring of the base and lower side slopes of the channel with stone. The channel inlet and outlet, WCS and bridges will have additional methods of permanent erosion protection as described in Section 5.2.

The temporary erosion and sediment control measures described in Section 4.0 will be maintained post construction until vegetation has fully established. As discussed in Section 6.0, monitoring will be undertaken over a 2 year post-commissioning period to confirm the effectiveness of the permanent erosion and sedimentation control measures and to identify if any supplementary measures are required as part of adaptive management. Some temporary measures may need to be re-implemented post construction following an extended operation period with the WCS gates open, or other conditions, that may result in the permanent vegetation not providing effective permanent erosion and sediment protection.

5.1 Perimeter Controls

The best method for establishing and maintaining a perimeter around exposed areas, such as staging areas and material stockpiles, is with a vegetated buffer zone. However, as vegetated buffer zones will be limited for the LMOC, it is likely that silt fencing will also be installed along the full length of the LMOC, in areas of active construction and until adequate vegetation cover becomes established. Location and placement of the silt fences will be selected to prevent additional erosion due to undercutting or end-cutting of the fence. Installation of the silt fences would adhere to typical industry specifications, with a typical detail as shown on Figure 1.

Silt fences will be of particular importance to control sediment movement in areas where staged excavation and spoil placement takes place prior to final grades being established, which are required to allow revegetation to proceed. For example, as discussed in Section 3.1.2 of the CEMP, excavation of the upper portion of the channel within a channel segment could be performed in the winter months (when no depressurization pumping is required to address the risk of basal heave), with the remaining lower portion excavation then completed in the summer months so as to limit the duration of depressurization pumping required and avoid the complications of having to pump and manage water in sub-freezing temperatures.



Note: Details may vary.

Figure 1: Typical Silt Fencing Detail

In addition to silt fences, surface water from within the construction area that must be discharged offsite will be monitored and controlled, as required, to comply with the water quality criteria outlined in Section 3.2. details are provided in the SWMP. It is likely that the Contractor will manage surface runoff within excavation areas by directing it to low areas of the excavation to allow sediment to settle prior to being pumped to offsite receiving areas. Pump discharge points will be lined with clean rock or other acceptable flow dissipating applications, as required, to prevent erosion and the release of suspended sediments. If required, any water that must be pumped outside of the work area will be discharged into dense vegetation or settling ponds. Settling ponds will be constructed adjacent to work areas, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction.

Turbidity curtains will be used to prevent or minimize the migration of disturbed sediments during removal of earth plugs that separate one channel excavation segment from another, if flooding of those segments is required.

5.2 Constructed Channel

The LMOC is being designed to minimize the potential for bed erosion during operation at the design discharge. It is designed to pass, at a minimum, the flows that would occur during the passage of the 1:300 year flood event through the Lake Manitoba/Lake St. Martin system, without exceeding the erosion thresholds. This event reflects a repeat of the 2011 Flood of Record. As indicated, the portion of the channel bed permanently under water will be covered with a stone armour layer. Remaining disturbed areas throughout the entire length of the LMOC will be revegetated, except for roads and structures.

Establishing and maintaining a vegetation cover is a key component to minimizing the long-term erosion potential. The revegetation will be designed to provide a competent initial cover that will establish quickly to protect the bare soil from erosion as the remainder of the permanent non-invasive perennial vegetation cover establishes, as described in the RVMP. It is based on the following:

- A seed mix consisting of permanent perennial native species and a quicker growing cover crop species (cereal crop) suited for the growing conditions.
- Seeding would occur in the spring months for optimal growth. Seeding would continue in the summer months with an adjusted seed mix to improve seed propagation. Seeding would not occur in the late summer/early fall as it would not likely yield enough growth to provide soil protection during fall, winter and early spring.
- Seeding with a fall prescription mix would take place after frost conditions are established and before snow hinders placement to allow early germination in the spring.
- Re-seeding would be required to compensate for the lack of vegetation cover success, if necessary.

Where possible, the Contractor's construction activities will be staged to keep the amount of un-vegetated surfaces during the excavation process to a manageable size.

The mode of operation of the LMOC is such that some revegetated portions of the channel side slopes will experience alternating periods of submergence (wet) and exposure (dry). This could lead to zones where vegetation may not survive or grow well, thus making these portions of the slopes potentially susceptible to erosion. Where submergence for extended periods of time causes substantial die off of planted vegetation, it is reasonable to expect that residual root systems that have been established will offer an interim temporary mode of erosion control while volunteer seedlings (or surviving plants) establish or recover and provide ground cover.

Plant species used in areas that will be inundated during channel operation will be selected based on their inherent capability to withstand flooding as well as seasonal drought. The channel and outside drain need erosion control in both dry and wet conditions using dry and wet condition tolerant plants and seed mixes with appropriate successional rates and processes. Measures such as monitoring and adjustment of seed mixes if required, as discussed in the RVMP, will be implemented to address the risk of poor vegetation growth on portions of the channel side slopes above the channel armouring in areas that will experience alternating periods of submergence and exposure as a result of long-term operation of the LMOC.

Over time, areas along the channel that are regularly flooded may favour the growth of annual weedy species and potentially the establishment of taller woody species including willow that may be able to access oxygen during periods of prolonged flooding. Routine inspection and maintenance of vegetation (mowing/cutting) will be undertaken so that the channel maintains hydraulic capacity in the long-term as discussed in the RVMP.

5.3 Other Project Components

The permanent erosion and sediment control measures required for the other Project components that are part of the LMOC will also generally consist of revegetation consistent with that identified in Section 5.1. If there are specific areas in which vegetation is not appropriate or adequate for permanent erosion and sediment protection, other measures such as the placement of riprap, turf reinforcement mats, etc. may be utilized. Specific areas in which vegetation will not provide the required level of protection, and therefore require other methods for permanent erosion and sediment control, include:

- Channel Base and Lower Side Slopes – The portion of the channel cross-section below the top of the normal operating range of Lake Manitoba and Lake St. Martin will be covered with an armour layer comprised of small stones to mitigate the potential risk of erosion by hydraulic forces when the channel is in operation.
- Gradient Control Structures – Gradient control structures may be necessary with the outside drain in areas where high erosive forces may be present to prevent erosion in the drain. The gradient control structures will be constructed of rockfill.
- Channel Inlet – Riprap protection will be provided along channel banks and shoreline near the channel inlet where the Project is vulnerable to wave action.
- Channel Outlet – Riprap protection will be provided along the channel banks and shoreline near the channel outlet where the Project is vulnerable to wave action.
- Outside Drain Inlets – Riprap protection will be provided at the locations where existing drainage ways will discharge into the outside drain to prevent erosion.
- Water Control Structure – The channel bottom and side slopes upstream and downstream of the WCS will have permanent riprap erosion protection installed to address the higher velocities that will be present. The WCS also includes a concrete stilling basin to dissipate energy downstream of the structure.
- Bridges – The channel bottom and side slopes in the vicinity of each bridge will have permanent riprap erosion protection installed to address the higher velocities that will be present.

6.0 MONITORING

6.1 Construction Phase

Surface water quality monitoring during construction of the LMOC is described in Section 6.2 of the SWMP. This monitoring will be undertaken to identify any changes that may result from construction activities and to assess the effectiveness of proposed erosion and sedimentation control measures. Sediment monitoring will include visual observations of signs of erosion and/or sedimentation during routine construction inspection activities (i.e., erosion of exposed slopes, presence of sediment plumes, etc.) and measurements made using sampling devices. If the water quality criteria identified in Section 3.2 are exceeded and attributed to the Project, or signs of erosion and/or sedimentation are observed, then additional mitigation measures would be considered as described in Section 7.0. A preliminary monitoring plan to identify potential sediment effects during in-lake excavation work is provided in Appendix 2A, which will be further developed and finalized during detailed design.

During the initial channel commissioning, a short-term temporary increase in suspended sediment concentration in the outlet area may occur due to the mobilization of several sources of material (i.e., fine material remaining within the armour layer, loose material remaining within the channel from earth plug removal, erosion of fine sands in Lake St. Martin downstream of the outlet, re-suspended sediment near the inlet, etc.). As discussed in Section 4.3, a controlled gate opening procedure and response protocol will be implemented to manage the potential increase in suspended sediment concentrations entering Birch Bay. Real-time turbidity monitoring in Watchorn Bay and Birch Bay will be conducted during this period which will be used to inform the gate opening procedure and make adjustments as needed. An overview of this monitoring plan is provided in Appendix 2A, which will be further developed and finalized prior to commissioning taking place.

6.2 Operation Phase

Surface water quality monitoring within the local waterways outside of the LMOC will initially be carried out during the first two years post-commissioning, as discussed in the SWMP, the intent of which is to confirm the effectiveness of construction mitigations and site restoration measures.

Longer-term regional water quality monitoring, which will include monitoring in the LMOC, will be conducted as part of an operational monitoring program that is discussed in the AEMP. In addition, visual observations of signs of erosion and/or sedimentation will also be undertaken as part of routine operation and maintenance inspection activities.

7.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP

7.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. *The Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the environmental assessment
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future environmental assessments including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

As discussed in Section 12.4.1.2 of the Project EIS, construction activities and the changes in flows and water levels caused by the Project may have minor effects on fluvial geomorphology, sediment and debris transport, in the surface water Local Assessment Area (LAA), but primarily during and immediately after construction. Suspended sediment levels may temporarily increase at work sites during construction activities, and at outlet areas during initial operation (gates open) of the outlet channels after a period of non-operation (gates closed). As such, the purpose and objectives of follow-up activities will be to monitor and further understand the residual effects due to the Project.

Although the methods and recommendations outlined in the SMP were developed based on site-specific expectations and conditions, it is accepted that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the design decisions during Project construction and long-term operation. Results from ongoing data collection and monitoring programs will inform and facilitate any necessary adjustments to this plan, to the extent feasible. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the Project designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback

during construction, temporary mitigation measures described in this SMP, as well as those included in the SWMP and RVMP, should be revisited and updated, as required. For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate vegetating methods may be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

7.2 Follow Up Response

As described in the SWMP, monitoring will include visual inspections and water quality monitoring. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental regulatory approvals requirements. If conditions recorded appear to be exceeding criteria or management thresholds, relative to baseline conditions, then follow-up responses will be implemented as described in the sub-sections below, as well as those identified in the CEMP, PERs, SMP, RVMP and any other applicable plans under the EMP.

7.2.1 Construction

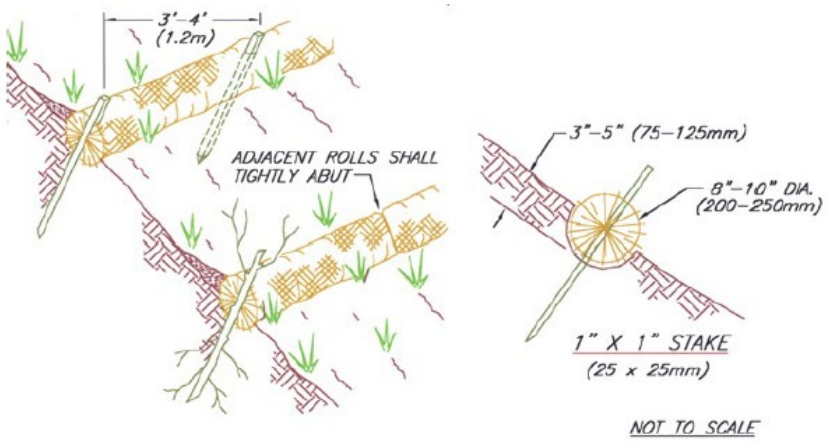
The requirements for erosion and sediment control are discussed in Section 2.3 of the PERs. As noted in Section 6.0 of this SMP, monitoring during construction will include visual inspections and water quality monitoring. Section 7.2 of the SWMP describes the protocols to identify sediment issues and trigger management responses.

In general, for any issue of potential non-compliance, an Environmental Monitor or Inspector will report the issue immediately so that Manitoba Transportation and Infrastructure or the Contract Administrator can direct the Contractor to stop work and/or implement mitigation activities if/as required. Management responses to address non-compliance related to erosion and sediment control could include (but not be limited to): temporary suspension of work activity; modifying the rate of water discharges and/or location; installing additional erosion and sediment control measures.

Some measures/activities that could be implemented in the context of erosion control and sediment management during construction include:

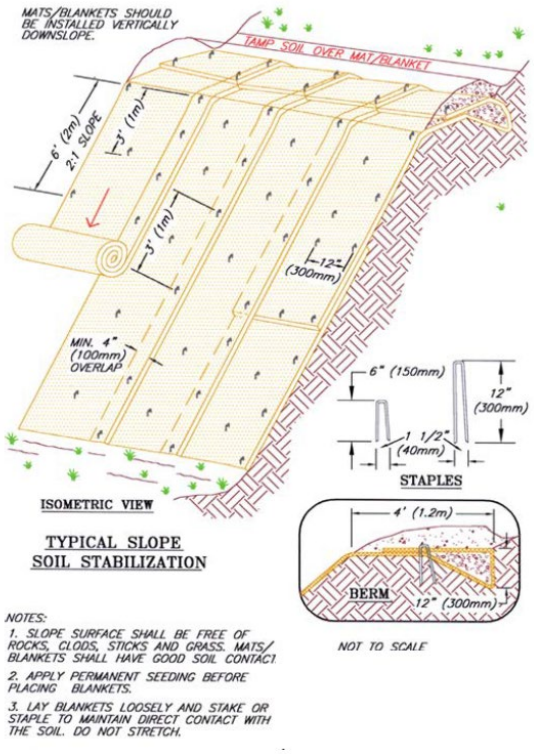
- Straw rolls/wattles could be considered as alternate measure or in addition to slope interrupters. Typical details are shown in Figure 2.
- Erosion control blankets could be used in critical areas where erosion potential is concentrated. Lining exposed areas with erosion control blankets was not considered for widespread application, as it would be very costly given the amount of area to cover. Typical details are shown in Figure 3.
- Spray mulches and bonded matrix could be substituted for straw mulch areas that require special treatment or where access for straw mulch is limited. Concerns associated with the high cost and poor success rates when the products are applied during periods of the year when temperatures are near or below freezing would need to be overcome.

- Turbidity curtains or filter systems could be installed in locations where there is water with flow velocities slow enough to facilitate effective filtration of suspended sediment.
- Rapid stabilization techniques that could include the placement of riprap and tackifiers (i.e., soil bonding agents).
- Dewatering techniques and/or pumping to decanting areas.
- Additional slope interrupters if the specified number does not meet requirements to control runoff.
- Additional sediment controls such as silt fencing or filter/check dams.
- Supplementary seeding or additional agronomic measures, such as irrigation, to promote the temporary and permanent re-vegetation on finished sections of the completed channel.
- Modification of the excavation schedule to adapt to weather conditions or limit overall exposed excavation areas.
- Implement dredging in accordance with the DFO Interim Code of Practice for Routine Maintenance Dredging (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/dredge-drageur-eng.html) to remove material that may deposit in the inlet or outlet from natural shoreline morphology processes, or upstream of drop structures, to reduce sediment that could be mobilized at start of channel operation, in the unlikely event that it is needed .
- Monitoring and management measures to address potential sediment effects during in-lake excavation work are described in Appendix 2B of this SMP.



Note: Details may vary.

Figure 2: Typical Straw Roll Detail



Note: Details may vary.

Figure 3: Typical Erosion Control Blanket Details

7.2.2 Commissioning

As indicated previously, Appendix 2A, establishes monitoring and management measures to address potential sediment effects during commissioning of the LMOC. This will involve implementation of a real-time sediment monitoring plan to monitor the magnitude, spatial, and temporal changes in TSS during these activities. The plan is based on an upstream and downstream approach to capture effects in the initial mixing zone, as well as the effects downstream in the fully mixed area. Turbidity will be monitored in the field, and measurements will be converted to TSS levels for comparison against the criteria, as described in Appendix 2A, through deployment of *in situ* turbidity loggers at multiple transect locations.

During commissioning, a controlled gate opening procedure will be implemented to manage the potential increase in suspended sediment concentrations entering Birch Bay. Input from the monitoring network during this period will be used to inform the gate opening procedure, and to make adjustments as needed to manage the TSS levels.

7.2.3 Operation

Several of the erosion and sediment control measures identified in Section 7.2.1 of this SMP can be implemented during the operation phase, depending on the specific situation that must be addressed in the event that operation phase monitoring identifies issues of potential non-compliance.

The procedures to be followed to initially open the WCS at the start of future operating events will be a part of the Operation & Maintenance Manual. Short-term increases in suspended sediment concentration entering Birch Bay that exceed the water quality criteria identified in Section 3.2 are not anticipated. Monitoring will be carried out during the first two operations to confirm this prediction, as described in Section 6.2. Should such increases be found to occur, then a controlled gate opening procedure that is similar to the mitigation and response measures used during commissioning would be implemented to manage the suspended sediment concentrations, as required.

Dredging to remove material that may be deposited in the inlet or outlet from natural shoreline morphology processes could be undertaken to reduce sediment that could be mobilized at start of channel operation, in the unlikely event that any such deposits are found to be problematic. Any such dredging would be implemented in accordance with the DFO Interim Code of Practice for Routine Maintenance Dredging (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/dredge-drageur-eng.html).

7.3 Contingency Measures and Emergency Response

Adaptive management and follow-up plans discussed above are implemented based on initial monitoring of the effectiveness of the "base" erosion and sediment control measures with adjustments made as needed. The "base" erosion and sediment control measures will be designed and maintained in good working order to manage conditions arising from the design event, as described in Section 3.3.

Contingency measures and emergency response plans will be developed for use in the event that the "base" erosion and sediment control measures are overwhelmed during a severe runoff event. Contingency planning will also be incorporated for unexpected events such as, but not limited to, an uncontrolled breach of a settling pond or failure of a turbidity curtain. Many of the contingency measures will be similar to those identified as part of follow up response in Section 7.2. These will be developed by the Contractor in accordance with Section 1.3 of the PERs and submitted to Manitoba Transportation and Infrastructure for approval prior to start of construction.

In the event of an emergency during construction, the Contractor, Manitoba Transportation and Infrastructure, and the Contract Administrator will determine which contingency and emergency control measures will be implemented. These measures would be carried out within a predetermined time period depending on the site conditions and nature of the emergency. It should be noted that in the event of an excessive precipitation event during construction, runoff would generally be contained to the area within the excavation.

During the operation phase, the channel will be resistant to large precipitation events through vegetation and armoring. Nevertheless, contingency and emergency control measures will be implemented by Manitoba Transportation and Infrastructure, depending on the site conditions and nature of the emergency, with consideration given to the Operations & Maintenance (O&M) manual that will be developed for the Project prior to the operation phase.

8.0 REFERENCES

Department of Fisheries and Oceans (DFO). December 27, 2013. Manitoba Activity Timing Windows for the Protection of Fish and Fish Habitat [online]. Available from https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html [accessed October 29, 2020].

Part 3: Lake St. Martin Outlet Channel

9.0 CONSTRUCTION PHASE (TEMPORARY MEASURES)

The following general construction management practices are key components of the temporary erosion and sediment control measures for the LSMOC.

- Construction staging and sequencing will be coordinated to maximize excavation in each work area, while minimizing the time of exposure for newly excavated slopes. This will be accomplished by restricting excavation to within manageable units.
- Implementation of erosion and sediment control measures such as silt fences, slope roughening techniques, slope terracing, runoff management, and straw mulching. These will be specified on construction drawings and will be implemented in accordance with PERs for Erosion and Sediment Control and Working Within or Near Water.
- A vegetated buffer zone will be maintained, where possible, to reduce erosion and sediment transport between the construction site and existing receiving waterbodies. Along the LSMOC, existing vegetation on either side of the ROW will act as a natural vegetated buffer zone between the construction site and existing receiving water bodies and streams, such as Lake St. Martin and Lake Winnipeg, or any tributary of Buffalo Creek.
- Exposed areas will be revegetated directly after the finished grade is established. Planting will, if practicable, commence immediately upon completion of a section of LSMOC to maximize the potential for growth and establishment of a vegetative cover. The revegetation is considered to be part of the permanent erosion and sediment control measures, discussed in Section 10.0.
- Disturbance to adjacent vegetated areas will be minimized to accommodate buffering of suspended sediment.

It should be noted that the channel design features, such as shallow side slopes, will help minimize the erosion and sediment generated during construction.

The sections which follow, provide further detail on erosion and sediment control measures that will be applied during the construction of the various components of the LSMOC. As discussed in Section 11.0, monitoring will be undertaken to assess the effectiveness of proposed erosion and sedimentation control measures. A preliminary monitoring and response protocol related to in-water construction is provided in Appendix 2B.

9.1 Main Channel Excavation

The temporary erosion and sediment control measures are based on accepted construction industry practice to minimize erosion and sediment transport to receiving water bodies. The temporary erosion and sediment control measures are broken down into perimeter measures, intermediate measures, and potential adaptive management and contingency measures. A definition of each of these terms is given below:

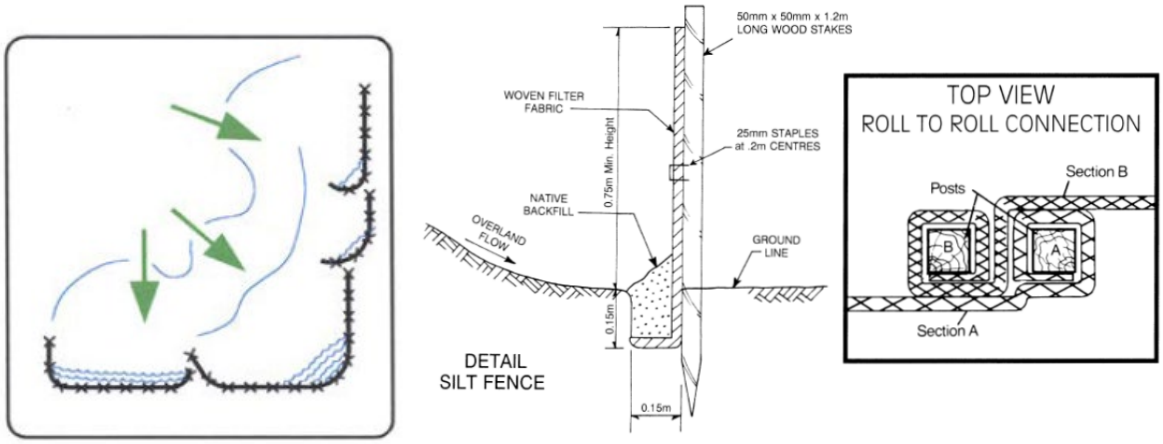
- Perimeter erosion and sediment control measures are implemented at the onset of each construction contract to enclose the designated construction area.
- Intermediate erosion and sediment control measures are implemented within each construction area.
- Adaptive management measures are the erosion and sediment control measures that would be implemented in the event that one or more of the intermediate measures do not achieve the desired performance. These are described in Section 12.0.
- Contingency measures would be implemented in the event of an emergency condition that would overwhelm the "base" erosion and sediment control measures, for example, due to a storm event that exceeds the selected design event. These are described in Section 12.3.

Specifications and drawings for LSMOC construction will be prepared during detailed design and customized for each individual contract as required. Sections 9.1.1 and 9.1.2, describe the base measures that will be implemented as a minimum for the LSMOC.

9.1.1 Perimeter Controls

The best method for establishing and maintaining a perimeter around exposed areas, such as staging areas and material stockpiles, is with a vegetated buffer zone. For the LSMOC, where vegetated buffer zones or intermediate controls are implemented, described in Section 9.1.2 cannot be maintained effectively, installation of silt fencing will likely be considered. Location and placement of the silt fences will be selected to prevent additional erosion due to undercutting or end-cutting of the fence. Installation of the silt fences would adhere to typical industry specifications, with a typical detail as shown on Figure 4.

Silt fences will be of particular importance to control sediment movement in areas where staged excavation and spoil placement takes place prior to final grades being established, which are required to allow revegetation to proceed. For example, as discussed in Section 3.1.2 of the CEMP, excavation of the upper portion of the channel within a channel segment could be performed in the winter months (when no depressurization pumping is required to address the risk of basal heave), with the remaining lower portion excavation then completed in the summer months so as to limit the duration of depressurization pumping required and avoid the complications of having to pump and manage water in sub-freezing temperatures.



Note: Details may vary.

Figure 4: Typical Silt Fencing Detail

In addition to silt fences, surface water quality from within the construction area that must be discharged offsite will be monitored and controlled, as required, to comply with the water quality criteria outlined in Section 3.2. details are provided in the SWMP. It is likely that the Contractor will manage surface runoff within excavation areas by will be directing it ed to low areas of the excavation to allow any sediment to settle prior to being pumped to offsite receiving areas. Pump discharge points will be lined with clean rock or other acceptable flow dissipating applications, as required, to prevent erosion and the release of suspended sediments. If required, any water that must be pumped outside of the work area will be discharged into dense vegetation or settling ponds. Settling ponds will be constructed adjacent to work areas, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction.

Turbidity curtains will be used to prevent or minimize the migration of disturbed sediments during removal of earth plugs that separate one channel excavation segment from another, if flooding of those segments is required.

9.1.2 Intermediate Controls

Intermediate controls will be developed as the channel excavation proceeds with a full set of controls in-place upon completion of excavation and before revegetation begins. As the excavation progresses downward to the final grade, slope roughening techniques on exposed side slopes will be implemented.

Re-establishing the vegetation cover in the LSMOC is fundamental to minimizing the erosion potential during both the construction and operation phases of the LSMOC. Within the planting season, and after final grade is established within a reasonably sized work area of a channel segment, the grade will be prepared and revegetated according to the appropriate revegetation prescription(s) as outlined in the RVMP. A component

of the main revegetation prescription includes a temporary cover species that will establish quickly to protect the bare soil from erosion as the remainder of the species germinates.

Due to the presence of areas of sandy soils in the LMOC, some additional measures will be considered. If, after August 15th, sandy soils are encountered during excavation to the degree and extent which sandy soils are the dominant soil texture in a soil stockpile, within a given area due to higher risk of wind erosion losses in these exposed soils, final grade will be prepared and revegetated, and stabilized using straw mulch treatments (mechanically anchored/crimped or treated with tackifier) or topical spray on mulches, as soon as practically feasible. August 15 is the fall seeding deadline for fall establishment of forage crops (alfalfa, grasses, etc.) provided by the Manitoba Agricultural Services Corporation, and therefore provides a reasonable guideline as to timing after which forage type crops may not establish well.

Additional intermediate controls will also be considered in the completed excavation area or in locations with a higher risk of erosion (e.g., if sandy soils are encountered) and will be developed during detailed design based on an assessment of potential sediment that could be generated and the final construction contracting strategy. These intermediate controls may include:

- Slope interrupters constructed at regular intervals (10 m) cross-slope on the channel and spoil embankment slopes. These can be effectively constructed with a grader or dozer with an adjustable blade to create a deep furrow into the side slope. Slope interrupters are not intended to trap or filter sediment, but they will serve to minimize further slope erosion protecting against deep rills or gullies by interrupting flow of runoff down the slope.
- Straw mulch treatment outside of the channel after the surface has been seeded with vegetation. The straw mulch would be anchored/crimped into the surface of the soil. The straw mulch helps protect the slope against erosion, but also provides an enhanced environment to promote quick growth of the grass seed. Other environmentally friendly types of topical spray on mulches may also be considered, where appropriate.

The temporary erosion and sediment control measures discussed above will be left in place until the temporary cover species vegetation and the permanent vegetation are re-established. Other erosion and sediment control methods will be considered as alternatives for use as adaptive management and/or contingency measures if the base approach measures do not perform as expected. Further discussion of these adaptive management and contingency measures is provided in Section 12.0.

9.2 Other Project Components

Temporary erosion and sediment control measures will be required for the other Project components that are part of the LSMOC, which include:

- Outside Drain
- Various types of structures
- Inlet and Outlet works

An overview description of the temporary erosion and sediment control measures for each component listed above is provided in the following subsections. Monitoring of the Project area will be conducted to assess the effectiveness of proposed erosion and sedimentation control measures as outlined in Section 11.0. Adaptive management and/or contingency and emergency response measures for these components are described in Section 12.0.

9.2.1 Outside Drain

As part of the site preparation Project works, an outside drain will be constructed on the east side of the LSMOC to collect surface water runoff. The design discharge for the outside drain will be based on the 1 in 10-year runoff event from the contributing area east of the channel alignment, which is in line with current provincial drainage standards typically applied in rural settings. To reduce the potential for erosion in this drain, allowable shear stress will not exceed the threshold value of 6 Pascals for clay and clay till, as described in the SWMP. Numerous gradient control structures will be constructed along the outside drain to reduce the velocities and shear stress in the channel, to meet this criteria. Rockfill check dams will also be installed, as required, to control the flow velocity and promote deposition of sediments that may be transported along the drain. After the outside drain has been excavated, it will also be revegetated in accordance with the RVMP.

Should a runoff event or series of runoff events, that are greater than the design condition has experienced prior to the re-establishment of permanent vegetation, then contingency and emergency response measures will be implemented to mitigate the risk of excess erosion as described in Section 12.3.

A vegetated buffer will be maintained between the outside drain and the channel excavation spoil pile, where practicable. In addition, silt fences will be used where vegetated buffer zones cannot be maintained effectively. Combined, these measures are expected to substantially reduce the potential for sediment transport along the drain.

The drain outlet will temporarily discharge into Lake Winnipeg. riprap will be placed as required to prevent erosion of the shoreline from water flowing from the drain. The temporary drain outlet will be constructed during winter with portions extending into Lake Winnipeg, completed where the lake typically freezes to bottom. This will help improve constructability and mitigate the potential for erosion and sedimentation. Construction activities and measures to manage surface water, erosion and sedimentation during construction will comply with regulatory requirements.

9.2.2 Structures

Various types of structures will be constructed as part of the Project, including a WCS, multiple drop structures, and an outlet structure for the outside drain. Construction of structures will be isolated from channel construction activities to prevent surface water runoff from entering the work area, and therefore, reduce the potential for erosion and sedimentation. For all structures, dewatering activities will be required during construction to collect surface water runoff within the work area. At the WCS, dewatering is also

required to address groundwater depressurization requirements, as described in the Groundwater Management Plan.

Surface water quality within the work areas will be monitored and controlled, as required, to comply with the criteria outlined in Section 3.2. Any water that must be pumped outside of the work area will be discharged into dense vegetation or settling ponds and managed as per the SWMP. Settling ponds will be constructed adjacent to the work area, as deemed necessary, prior to discharge at locations to be approved by Manitoba Transportation and Infrastructure during construction. Pump discharge points will be lined with clean rock or other acceptable flow dissipating applications, as required, to prevent erosion and the release of suspended sediments.

9.2.3 Inlet and Outlet Works

Inlet works will consist of excavating the lake bottom within an approximately 1,200 m long by 600 m wide area of Lake St. Martin. The construction area will be surrounded with a temporary rock plug or cofferdam to allow work activities to be isolated from the lake, preventing the release of any deleterious substances. Riprap protection will be incorporated into the design to protect the plug/cofferdam against wave action. A turbidity curtain will be temporarily installed in Lake St. Martin, outside of the rock plug/cofferdam, as required, to prevent or minimize the migration of disturbed sediments into the lake during installation/removal of the rock plug/cofferdam. A fish salvage program will be required within the isolated area, which will be developed and conducted in accordance with the PERs. Once construction of the LSMOC is complete, the rock plug/cofferdam will be removed in part or in whole, as required and in accordance with environmental requirements.

Installation and removal of the turbidity curtain, as well as the construction and removal of the cofferdam, will comply with the DFO Restricted Activity Timing Windows (DFO, 2013), and will be completed in accordance with the conditions outlined in the DFO authorization. Once the construction area has been isolated by a cofferdam, construction works within it, may proceed year-round. Removal of the curtain would occur once monitored water quality parameters on both sides of the curtain are similar and meet the criteria outlined in Section 3.2.

Installation of a double turbidity curtain, in lieu of a rock plug/cofferdam, will also be considered depending on the preferred construction methods to be determined during detailed design. Winter construction may also be considered in areas where the lake typically freezes to bottom to help improve constructability. With winter construction, the potential for erosion and sedimentation is significantly reduced.

Outlet works will consist of excavating the lake bottom within an approximately 200 m long by 200 m wide area of Lake Winnipeg (Sturgeon Bay). Construction activities and measures to manage surface water, erosion and sedimentation during construction will be similar to the inlet works and will comply with regulatory conditions. In addition to the excavation, groins extending into Lake Winnipeg will be constructed to control the longer-term migration of sediment. Similar erosion control methods will be used to manage sediment during the construction of these structures.

Turbidity monitoring will be used at both the inlet and outlet locations to confirm the effectiveness of the measures and allow for adaptive management to be implemented if required. A preliminary monitoring and response protocol related to this is provided in Appendix 2B.

9.3 Commissioning

The till base and lower sides slopes of the LSMOC will be covered with an armour layer comprised of small stones, to guard against the potential erosion by hydraulic forces, when the channel is in operation. The armouring will be crushed limestone rock, which will be overlain on geotextile that will isolate the channel from the underlying till substrates. On the channel base and lower side slopes, the median stone size will be 35 to 40 mm diameter and the overall gradation will range in size from 25 to 100 mm. The thickness of the armouring in these areas will be 225 mm thick. On portions of the side slopes that could interact with the ice cover in the channel, the same rock sizes will be used but the thickness will be increased to 400 mm. While the size of the stones that comprise the armour layer will be designed to resist the hydraulic forces, it is also expected that some fine material will remain both on the surface and within the armour layer at the end of construction, which is anticipated to be mobilized and transported out of the LSMOC when it is first operated during commissioning. Other sources of fine material may also be mobilized during commission (i.e., loose material remaining within the channel from cofferdam removal, erosion of fine sands in the vicinity of the outlet, resuspended sediment near the inlet, etc.). Mobilization and transport of these materials is expected to result in a short-term temporary increase in the concentration of suspended sediment at the outlet in Sturgeon Bay.

To limit the potential increase in suspended sediment concentrations, a controlled gate opening procedure and response protocol is being developed and will be implemented, which will be informed with TSS monitoring data that will be collected during the operation from real-time turbidity loggers to be installed in the North Basin of Lake St. Martin and in Lake Winnipeg (Sturgeon Bay). The commission will be planned to be undertaken between July 1 and September 14, to comply with the DFO Restricted Activity Timing Windows (DFO, 2013).

A preliminary monitoring and response protocol for this aspect of the work is provided in Appendix 2A, which will be further developed and finalized prior to commissioning taking place.

The mitigation and response measures used during commissioning, along with any adjustments made and lessons learned, will be reviewed, and used to inform an updated procedure that can be followed during the initiation of future operation events, should it be found to be required.

10.0 OPERATION PHASE (PERMANENT MEASURES)

The permanent erosion and sediment control measures are those that are implemented for long-term post construction erosion control. Permanent erosion and sediment control will consist primarily of the establishment of a permanent vegetative cover, as described in the RVMP, as well as armouring of the base and lower side slopes of the channel with stone. The channel inlet and outlet, WCS and drainage control structure inlets and outlets will have additional methods of permanent erosion protection as described in Section 10.2.

The temporary erosion and sediment control measures, described in Section 9.0, will be maintained post construction, until vegetation has fully established. As discussed in Section 11.0, monitoring will be undertaken over a 2-year post-commissioning period to confirm the effectiveness of the permanent erosion and sedimentation control measures, and to identify if any supplementary measures are required as part of adaptive management. Some temporary measures may need to be implemented post construction, following an extended operation period with the WCS gates open, or other conditions that may result in the permanent vegetation not providing effective permanent erosion and sediment protection.

10.1 Constructed Channel

The LSMOC is being designed to minimize the potential for bed erosion during operation at the design discharge. It is designed to pass, at a minimum, the flows that would occur during the passage of the 1:300 year flood event through the Lake Manitoba/Lake St. Martin system, without exceeding the erosion thresholds. This event reflects a repeat of the 2011 Flood of Record. The portion of the channel bed permanently under water will be covered with a stone armour layer. Remaining disturbed areas throughout the entire length of the LSMOC will be revegetated, except for roads and structures.

Establishing and maintaining a vegetation cover is a key component to minimizing the long-term erosion potential. The revegetation will be designed to provide a competent initial coverage that will establish quickly to protect the bare soil from erosion, as the remainder of the permanent non-invasive perennial vegetation coverage establishes, as described in the RVMP. It is based on the following:

- A seed mix consisting of permanent perennial native species and a quicker growing cover crop species (cereal crop), suited for the growing conditions.
- The planting season would be in the spring months for optimal growth of the native species and continue in the summer months to late August, with an adjusted seed mix to improve propagation of the cover crops. Seeding would not occur in the late summer/early fall as it would not likely yield enough growth to provide soil protection during fall, winter, and early spring.

- Areas that are excavated following the end of the typical growing season in a year will be seeded with a fall prescription mix after October 15th of that year, during the dormant seeding window until frost or snow inhibits seed placement. This will facilitate early germination and vegetation growth in the spring even in the event that conditions are not suitable to allow for seeding during the spring period.
- Re-seeding would be required to compensate for the lack of vegetation cover success, if necessary.

Where possible, the Contractor's construction activities will be staged in such a manner that manageable areas of un-vegetated surface may be specified and maintained during the excavation process.

The revegetation plan for the LSMOC consists of two zones, an upper berm and lower berm zones, to reflect the different environmental conditions that will be present during the operation phase. The zones are defined largely by an anticipated gradient in moisture availability from the uplands to the side slopes, as follows:

- The upper berm zone includes sites that will regularly be subjected to drought conditions during dry summer months, however, in extreme wet conditions, these sites may also experience flooding for short periods (three to four days). Species planted in this zone will include drought tolerant native grasses well-suited to upland sites and local climatic conditions. Several species in this mix will also have a degree of flood tolerance to account for flooding potential.
- The lower berm zone includes channel and drain side-slopes that will be periodically flooded during heavy rainfall periods and channel operation. In times of water deficit, this zone may also be subjected to extended periods of drought. To account for these moisture variations, the seed mix will be designed using species capable of tolerating inundation as well as those adapted to drought conditions.

The final RVMP will include plant species suited to the anticipated site conditions with some overlap in species selected for each zone to accommodate seasonal moisture variations.

Disturbed areas including those areas along the side slopes, ditch bottoms, and back slopes throughout the entire length of the Project will be revegetated. To make the most efficient use of seeding opportunities and to minimize exposure of prepared sites to further erosion, seeding will commence immediately upon completion of final grading operations. Areas to be seeded will be prepared by de-compacting the subsoil, placement of stockpiled organics, and integration of the organics into the subsoil by harrowing. Following preparation, the permanent native grasses and/or cover crop will be seeded in accordance with the planting windows. Seed bed preparation and seeding operations will be carried out parallel to the centerline of the channel to discourage erosion. Further details are provided in the RVMP.

The mode of operation of the LSMOC is such that some portions of the channel side slopes will experience alternating periods of submergence (wet) and exposure (dry). This could lead to zones where vegetation may not survive or grow well, thus making these portions of the slopes potentially susceptible to erosion. Where flooding due to opening of the WCS gates causes substantial die-off of planted vegetation, it is reasonable to expect that residual root systems that have been established will offer an interim temporary mode of erosion control while volunteer seedlings (or surviving plants) establish or recover and provide ground cover.

Plant species used in areas that will be inundated during channel operation will be selected based on their inherent capability to withstand flooding as well as seasonal drought. The channel and outside drain need erosion control in both dry and wet conditions, using dry and wet condition tolerant plants and seed mixes

with appropriate successional rates and processes. Mitigation measures such as monitoring and adjustment of seed mixes, as discussed in the RVMP, may be required to address the risk of poor vegetation growth on the portions of the channel side slopes that will experience alternating periods of submergence and exposure as a result of long-term operation of the Project.

Over time, areas along the channel that are regularly flooded may favour the growth of annual weedy species and potentially the establishment of taller woody species including willow, that may be able to access oxygen during prolonged flooding. Routine inspection and maintenance of vegetation (mowing/cutting) will be undertaken in such a manner that the channel maintains hydraulic capacity in the long-term as discussed in the RVMP.

10.2 Other Project Components

The permanent erosion and sediment control measures required for the other Project components that are part of the LSMOC will also generally consist of revegetation consistent with that discussed in Section 10.1. If there are specific areas in which vegetation is not appropriate or adequate for permanent erosion and sediment protection, other measures such as the placement of riprap, turf reinforcement mats, etc. may be utilized. Some specific areas in which vegetation will not provide the required level of protection and therefore will require other methods for permanent erosion and sediment control include:

- Channel Base and Lower Side Slopes – The portion of the channel cross-section below the top of the non-operating water level in the channel will be covered with an armour layer comprised of small stones to mitigate the potential risk of erosion by hydraulic forces when the channel is in operation.
- Rock Fill Drop Structures – The LSMOC will require eight drop structures to minimize channel flow velocity and erosion in areas of steep sloping terrain. The drop structures will be constructed of rockfill, with a sheet pile cutoff at the upstream crest.
- Gradient Control Structures – multiple gradient control structures will be constructed along the outside drain to minimize flow velocities and erosion in areas of steep sloping terrain. The gradient control structures will be constructed of rockfill.
- Channel Inlet – Riprap protection will be constructed along channel banks and shoreline near the channel inlet where the Project is vulnerable to wave action.
- Channel Outlet – Rock jetties and riprap protection will be constructed along the channel banks and shoreline near the channel outlet where the Project is vulnerable to wave action. The jetties will also limit sedimentation from natural shoreline morphology processes within the deepest portion of the outlet.
- Outside Drain Outlet Structure – Specific areas near the inlet and outlet of this structure will require the placement of riprap protection.
- Water Control Structure – The channel bottom and side slopes upstream and downstream of the WCS will include riprap to provide permanent erosion protection. The WCS also includes a concrete stilling basin to dissipate energy downstream of the structure.

11.0 MONITORING

11.1 Construction Phase

Surface water quality monitoring during construction of the LSMOC is described in Section 11.2 of the SWMP. This monitoring will be undertaken to identify any changes that may result from construction activities and to assess the effectiveness of proposed erosion and sedimentation control measures. Sediment monitoring will include visual observations of signs of erosion and/or sedimentation during routine construction inspection activities (i.e., erosion of exposed slopes, presence of sediment plumes, etc.) and measurements made using sampling devices. If the water quality criteria identified in Section 3.2 are exceeded and attributed to the Project, or signs of erosion and/or sedimentation are observed, then additional mitigation measures would be considered as described in Section 12.0. A preliminary monitoring plan to identify potential sediment effects during in-lake excavation work is provided in Appendix 2B, which will be further developed and finalized during detailed design.

During the initial channel commissioning, a short-term temporary increase in suspended sediment concentration in the outlet area may occur due to the mobilization of several sources of material (e.g., fine material remaining within the armour layer, loose material remaining within the channel after construction, erosion of fine sands in Lake Winnipeg downstream of the outlet, etc.). As discussed in Section 9.3, a controlled gate opening procedure and response protocol will be implemented to manage the potential increase in suspended sediment concentrations entering Lake Winnipeg. Real-time turbidity monitoring in the North Basin of Lake St. Martin and in Lake Winnipeg (Sturgeon Bay) will be conducted during this period, which will be used to inform the gate opening procedure and to make adjustments as needed. An overview of this monitoring plan is provided in Appendix 2B, which will be further developed and finalized prior to commissioning taking place.

11.2 Operation Phase

Surface water quality monitoring within the local waterways outside of the LSMOC will initially be carried out during the first two years post-commissioning, as discussed in the SWMP, the intent of which is to confirm the effectiveness of construction mitigations and site restoration measures. Longer-term regional water quality monitoring, which will include monitoring in the LSMOC, will be conducted as part of an operational monitoring program that is discussed in the AEMP. In addition, visual observations of signs of erosion and/or sedimentation will also be undertaken as part of routine operation and maintenance inspection activities.

12.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP

12.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. *The Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the environmental assessment
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future environmental assessments including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects.

As discussed in Section 12.4.1.2 of the Project EIS, construction activities and the changes in flows and water levels caused by the Project may have minor effects on fluvial geomorphology, sediment and debris transport, in the surface water LAA, but primarily during and immediately after construction. Suspended sediment levels may temporarily increase at work sites during construction activities, and at outlet areas during initial operation (gates open) of the outlet channels after a period of non-operation (gates closed). As such, the purpose and objectives of follow-up activities will be to monitor and further understand the residual effects due to the Project.

Although the methods and recommendations outlined in the SMP were developed based on site-specific expectations and conditions, it is accepted that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the design decisions during implementation and long-term operation. Results from ongoing data collection and monitoring programs will inform and facilitate and necessary adjustments to this plan, to the extent feasible. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the initial designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback

during construction, temporary mitigation measures described in this SMP, as well as those included in the SWMP and RVMP, should be revisited and updated, as required. For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate vegetating methods may be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

12.2 Follow Up Response

As described in the SWMP, monitoring will include visual inspections and water quality monitoring. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental regulatory approvals requirements. If conditions recorded appear to be exceeding criteria or management thresholds, relative to baseline conditions, then follow-up responses will be implemented as described in the sub-sections below, as well as those identified in the CEMP, PERs, SMP, RVMP and any other applicable plans under the EMP.

12.2.1 Construction

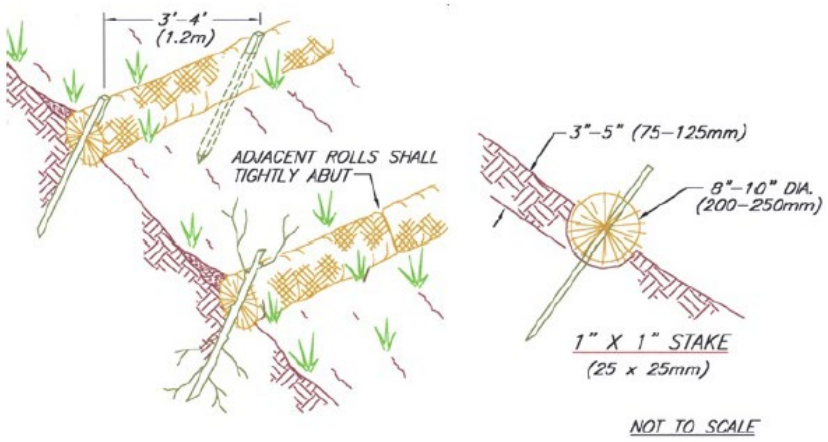
The requirements for erosion and sediment control are discussed in Section 2.3 of the PERs. As described in Section 11.0 of this SMP, monitoring will include visual inspections and water quality monitoring as part of the SWMP and AEMP. Section 12.2 of the SWMP describes the protocols to identify sediment issues and trigger management responses.

In general, for any issue of potential non-compliance, the Environmental Monitor or Inspector will report the issue immediately so that Manitoba Transportation and Infrastructure or the Contract Administrator can direct the Contractor to stop work and/or implement mitigation activities if/as required. Management responses to address non-compliance related to erosion and sediment control could include temporary suspension of work activity, modifying the rate of water discharges, and/or installing additional erosion and sediment control measures.

Some measures/activities that could be implemented in the context of erosion control and sediment management during construction include:

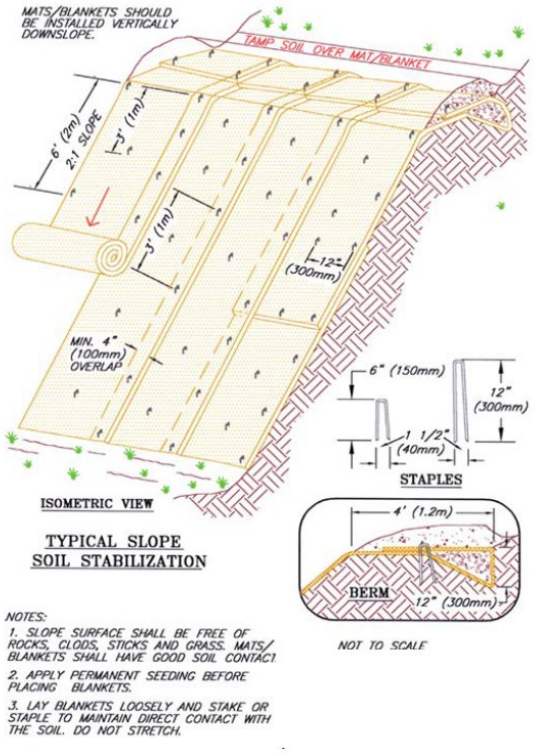
- Straw rolls/wattles could be considered as alternate measure or in addition to the slope interrupters. Typical details are shown in Figure 5.
- Erosion control blankets could be used in critical areas where erosion potential is concentrated. Lining exposed areas with erosion control blankets was not considered for widespread application, as it would be very costly given the amount of area to cover. Typical details are shown in Figure 6.
- Spray mulches and bonded matrix could be substituted for straw mulch areas that require special treatment or access for straw mulch is limited. Concerns associated with the high cost and poor success rates when the products are applied during periods of the year when temperatures are near or below freezing would need to be overcome.

- Turbidity curtains or in-channel filter systems could be installed in locations where there is water with flow velocities slow enough to facilitate effective filtration of suspended sediment.
- Rapid stabilization techniques that could include the placement of rip rap and tackifiers (i.e., soil bonding agents).
- Dewatering techniques and/or pumping to decanting areas.
- Additional slope interrupters if the specified number does not meet requirements to control runoff.
- Additional sediment controls such as silt fencing or filter/check dams.
- Supplementary seeding or additional agronomic measures, such as irrigation, to promote the temporary and permanent revegetation on finished sections of the completed channel.
- Modification of the excavation schedule to adapt to weather conditions or limit overall exposed excavation areas.
- Implement dredging in accordance with the DFO Interim Code of Practice for Routine Maintenance Dredging (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/dredge-drageur-eng.html) to remove material that may deposit in the inlet or outlet from natural shoreline morphology processes, or upstream of drop structures, to reduce sediment that could be mobilized at start of channel operation, in the unlikely event that it is needed.
- Monitoring and management measures to address potential sediment effects during in-lake excavation work are described in Appendix 2B of this SMP.



Note: Details may vary.

Figure 5: Typical Straw Roll Detail



Note: Details may vary.

Figure 6: Typical Erosion Control Blanket Details

12.2.2 Commissioning

As indicated previously, Appendix 2B establishes monitoring and management measures to address potential sediment effects during commissioning of the LSMOC. This will involve implementation of a real-time sediment monitoring plan to monitor the magnitude of spatial and temporal changes in TSS during these activities. The plan is based on an upstream and downstream approach to capture effects in the initial mixing zone, as well as the effects downstream in the fully mixed area. Turbidity will be monitored in the field and measurements converted to TSS levels for comparison against the criteria, as described in Appendix 2A, through deployment of in *situ* turbidity loggers at multiple transect locations. During commissioning, a controlled gate opening procedure will be implemented to manage the potential increase in suspended sediment concentrations entering Sturgeon Bay. Input from the monitoring network during this period, will be used to inform the gate opening procedure and to make adjustments as needed to manage the TSS levels.

12.2.3 Operation

Several of the erosion and sediment control measures identified in Section 12.2.1 of this SMP can be implemented during the operation phase, depending on the specific situation that must be addressed in the event that operation phase monitoring identifies issues of potential non-compliance.

The procedures to be followed to initially open the WCS at the start of future operating events will be a part of the Operation & Maintenance Manual. Short-term increases in suspended sediment concentration entering Sturgeon Bay that exceed the water quality criteria identified in Section 3.2 are not anticipated. Monitoring will be carried out during the first two operations to confirm this prediction, as described in Section 11.2. Should such increases be found to occur, then a controlled gate opening procedure that is similar to the mitigation and response measures used during commissioning would be implemented to manage the suspended sediment concentrations, as required.

12.3 Contingency Measures and Emergency Response

Adaptive management plans discussed in the previous section are implemented based on initial monitoring of the effectiveness of the "base" erosion and sediment control measures with adjustments made as needed. The "base" erosion and sediment control measures will be designed and maintained in good working order to manage conditions arising from the design event, as described in Section 3.3.

These will be developed by the Contractor in accordance with Section 1.3 of the PERs and submitted to Manitoba Transportation and Infrastructure for approval prior to start of construction.

In the event of an emergency during construction, the Contractor, Manitoba Transportation and Infrastructure, and the Contract Administrator will determine which of the contingency and emergency control measures will be implemented. Emergencies which need to be reported to regulators will be reported as soon as possible. These measures would be carried out within a predetermined time period depending on the site conditions and nature of the emergency.

During the operation phase, the channel will be resistant to large precipitation events through vegetation and armoring. Nevertheless, contingency and emergency control measures will be implemented by Manitoba Transportation and Infrastructure, depending on the site conditions and nature of the emergency, with consideration given to the O&M manual that will be developed for the Project prior to the operation phase.

13.0 REFERENCES

Department of Fisheries and Oceans (DFO). December 27, 2013. Manitoba Activity Timing Windows for the Protection of Fish and Fish Habitat [online]. Available from https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html [accessed October 29, 2020].

APPENDIX 2A

Preliminary Sediment Monitoring Plan and Response Protocol for LMOC In-Lake Excavation and Commissioning Activities

Preliminary Sediment Monitoring Plan and Response Protocol for LMOC In-Lake Excavation and Commissioning Activities

1.0 REAL-TIME SEDIMENT MONITORING PLAN

A detailed in-lake real-time total suspended sediment (TSS) monitoring program will be implemented during the course of construction to monitor the magnitude and spatial and temporal changes in TSS within the proximity of the Project during in-lake construction and commissioning activities. The monitoring program design is based on the expected construction effects on the sedimentation regime in Watchorn Bay and Birch Bay, and recent experience on other construction projects in the Province of Manitoba. Overall, the design is based on an upstream and downstream approach to capture effects in the initial mixing zone as well as the effects downstream in the fully mixed area. Changes to this plan, if required, will be shared with Indigenous communities, stakeholders and IAAC will be informed of prior to implementation of changes.

1.1 OBJECTIVES

The sediment monitoring program is intended to document the spatial and temporal variations of TSS concentrations and the magnitude of any increases in Watchorn Bay and in Birch Bay during in-lake construction activities, as well as any increases in Birch Bay during the commissioning stage. The program has been designed to facilitate responses to pre-determined action levels described in Section 2.0.

1.2 MONITORING PARAMETERS

The main parameter being monitored is TSS; however, TSS cannot be measured in real time but must be determined in a laboratory using a water sample. Turbidity (Tu) will be measured as a surrogate using automated in-situ Tu loggers that can measure and report Tu on a real time basis. This is an industry standard approach and has been used in several projects in the Province of Manitoba, including Manitoba Hydro's Wuskwatim and Keeyask Generating Station projects and the Pointe du Bois Spillway Replacement project. The Coordinated Aquatic Monitoring Program (CAMP) also adopted a similar approach in Manitoba. Typically, the relationship would be expressed in the form of:

$$TSS(\mathrm{mg/L}) = X * Tu(\mathrm{NTU}) + Y,$$

where *X* and *Y* would be calculated using regression analysis.

Relationships between Tu and TSS will be developed prior to construction in order to facilitate the use of Tu as a surrogate of TSS. Typically, development of the relationships will be based on TSS and Tu data that have been collected in Lake Manitoba and Lake St. Martin in the past, as well as any additional data that will be collected prior to the in-lake construction activities. The development of relationships will consider ranges of TSS and Tu that typically occur in the existing environment, their natural variabilities, and correlation between the two parameters. In addition, laboratory analysis will be carried out to develop relationships between TSS and Tu using sediment particles that are predominant in the till mix. The relationships will be used to determine if in-lake construction and commissioning activities are causing TSS increases that exceed specific action thresholds so that the corrective actions discussed in Section 2.0 can be implemented in a timely manner. During in-lake work, samples of water at the monitoring stations will be periodically collected and analyzed for TSS to confirm or adjust the Tu-TSS relationship, as required.

The assessment of potential effects on the TSS concentration in the water will be based on an upstream and downstream approach to capture changes in the downstream area. Given that the monitoring locations are located in two different lakes, a relationship will be developed between TSS concentrations in Watchorn Bay and Birch Bay using existing environment data.

1.3 MONITORING LOCATIONS

TSS and turbidity will be monitored through deployment of in-situ turbidity loggers at multiple transect locations approximately as shown in Figure 1 and Figure 2. Multiple loggers will be installed at each transect to monitor average conditions across the initial mixing zone as well as in the fully mixed area. The logger locations and purpose will vary depending on whether in-lake excavation work or commissioning activities are underway, as described below. There will be common logger locations (sediment monitoring point [SMP]-1 and SMP-5) for both the in-lake excavation and commissioning stages to measure background TSS in the lakes. For the purpose of the in-lake excavation stage, there will be loggers at SMP-2 and at SMP-3 immediately outside of turbidity curtains to make sure that additional TSS that may be generated from the excavation work can be tracked and measured. The commissioning stage will include a logger location at SMP-4 that will be within the mixing zone of additional TSS that could result from the initial gate operation. The logger locations may be modified during the program as more data becomes available to improve and optimize the monitoring plan and response protocol.

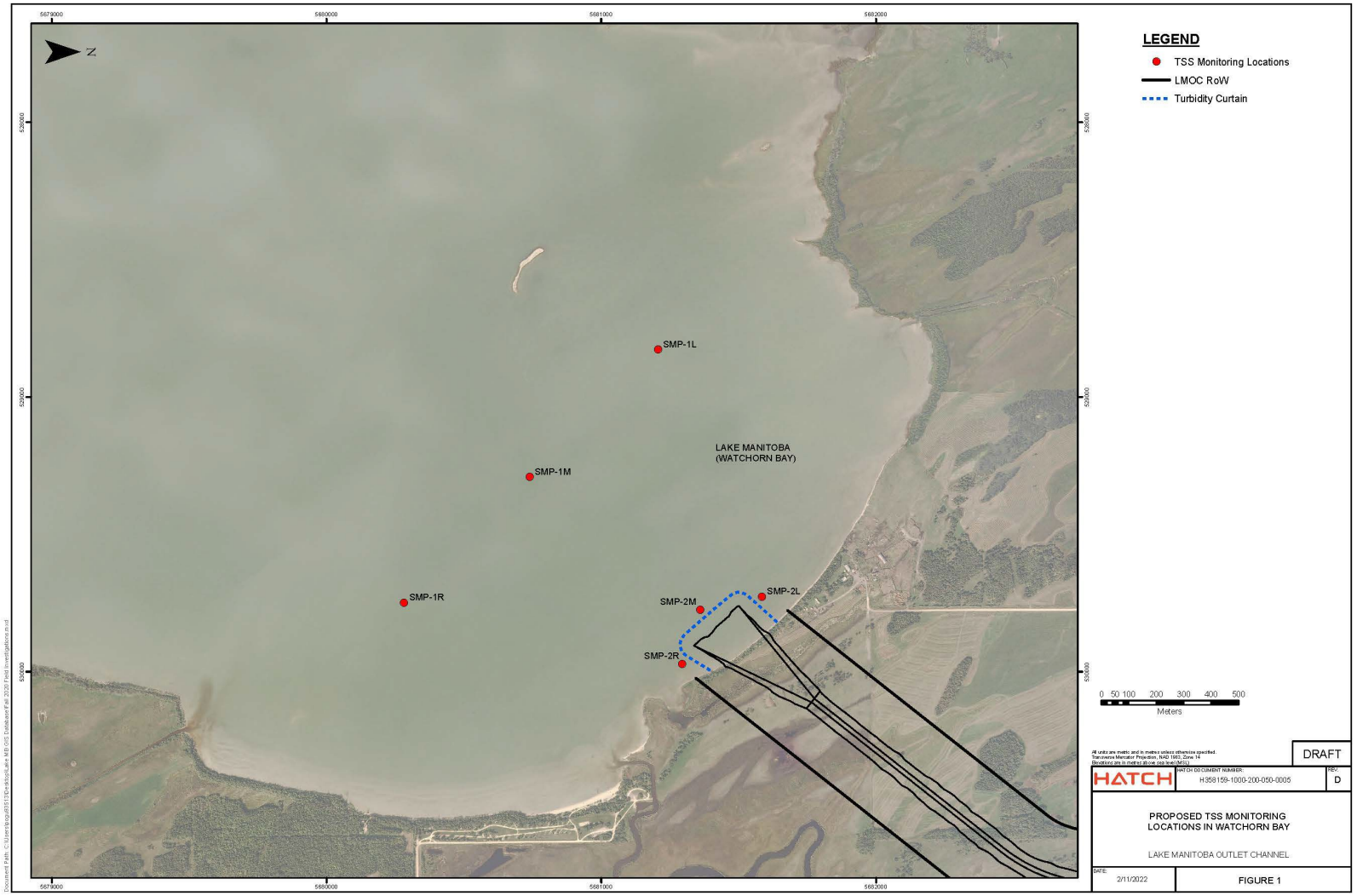


Figure 1: Proposed TSS Monitoring Locations in Watchorn Bay

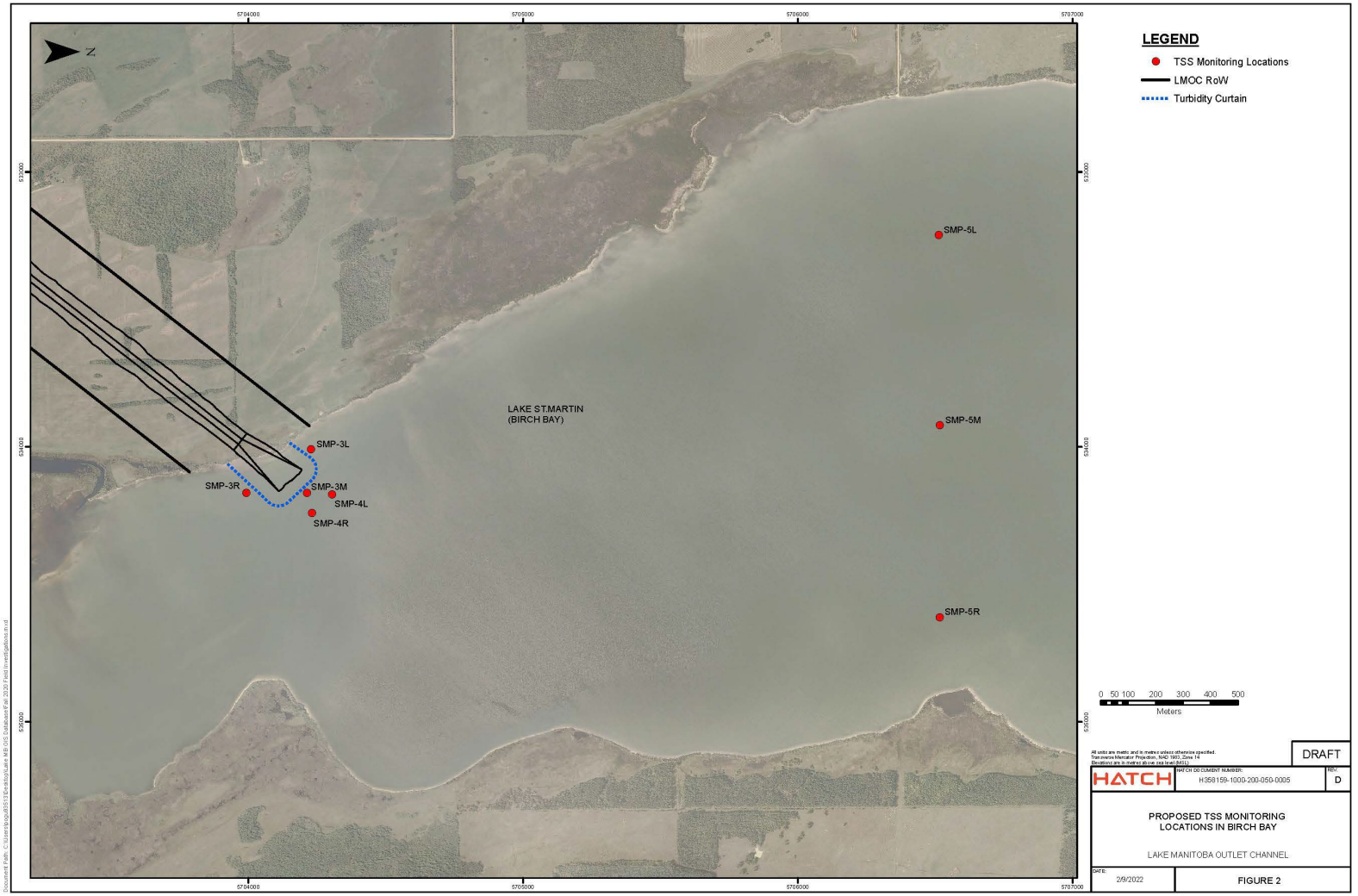


Figure 2: Proposed TSS Monitoring Locations in Birch Bay

1.3.1 In-Lake Excavation

- SMP-1 will be located in Watchorn Bay approximately 1 kilometre (km) upstream of the shoreline at the entrance to the Lake Manitoba Outlet Channel (LMOC) to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-1L, SMP-1M and SMP-1R) located across the width of the bay.
- SMP-2 will be located just outside of the inlet excavation double turbidity curtain, approximately 200 metre (m) from the shoreline. Loggers will be installed at three sites (SMP-2L, SMP-2M and SMP-2R) located across the length of the curtain (transect). In addition, multiple measurements along the length of the turbidity curtain will frequently be made using handheld loggers to augment the permanent loggers and detect if any transport of sediment through the curtain is occurring. The frequency and locations of monitoring will be further developed with input from the Contractor based on the construction sequence and methodology. Given the close proximity of the transect to the construction area, handheld logger measurements that will be made at least once a day will provide flexibility to track potential sediment plumes that may not be otherwise detected at the permanent loggers.
- SMP-3 will be located just outside of the outlet excavation double turbidity curtain, approximately 150 m from the shoreline. Loggers will be installed at three sites (SMP-3L, SMP-3M and SMP-3R) located across the length of the curtain (transect). In addition, multiple measurements along the length of the turbidity curtain will frequently be made using handheld loggers to augment the permanent loggers and detect if any potential transport of sediment through the curtain is occurring. The frequency and locations of monitoring will be further developed with input from the Contractor based on the construction sequence and methodology. Given the close proximity of the transect to the construction area, handheld logger measurements that will be made at least once a day will provide flexibility to track potential sediment plumes that may not be otherwise detected at the permanent loggers.
- SMP-5 will be located approximately 2.5 km downstream of the shoreline at the LMOC outlet into Birch Bay to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-5L, SMP-5M and SMP-5R) located across the width of the bay.

Aerial image capture with drones may be considered to augment the permanent turbidity monitoring locations and allow identification of potential sediment plumes during construction that could then inform the deployment of a monitoring crew to a specific area of concern to obtain handheld logger readings.

1.3.2 Commissioning

- SMP-1 will be located in Watchorn Bay approximately 1 km upstream of the shoreline at the entrance to the LMOC to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-1L, SMP-1M and SMP-1R) located across the width of the bay. These will be the same locations selected for monitoring of background conditions during in-lake construction activities at the inlet.

- SMP-4 will be located approximately 250 to 300 m downstream of the shoreline at the LMOC outlet into Birch Bay outside the excavation area and beyond the area of in-lake activities during construction. This is a near-field location within the mixing zone prior to fully mixed conditions. Loggers will be installed at two sites (SMP-4L and SMP-4R) located across the channel width to monitor for sediment plumes.
- SMP-5 will be located approximately 2.5 km downstream of the shoreline at the LMOC outlet into Birch Bay in the fully mixed zone of the flow. Loggers will be installed at three sites (SMP-5L, SMP-5M and SMP-5R) located across the width of the bay. The locations of the loggers at the three sites were selected based on the expected sediment plume's shape and extent, as estimated through sediment transport modeling for selected commissioning scenarios. These will be the same locations selected for monitoring of background conditions during in-lake construction activities at the outlet.

Aerial image capture with drones may be considered to augment the permanent turbidity monitoring locations.

1.4 Monitoring Methodology

Both permanent and handheld loggers will be used to collect Tu at the sites described in Section 1.3. The purpose of the permanent loggers would be to monitor Tu on a longer-term basis at pre-determined locations to monitor average conditions across the transect. This will help identify changes in sediment concentrations that may occur during in-lake construction and commissioning activities. The purpose of the handheld loggers would be to track and measure sediment plumes, as well as help identify potential sediment sources and thus assist in formulating mitigation measures. Periodically, Tu measurement will also be conducted using handheld loggers at the permanent logger sites for quality control purposes.

Real-time Tu data from the permanent loggers installed at monitoring sites will be remotely transmitted to a central computer at the construction site at a pre-determined interval (every 15 minutes anticipated) so monitoring results can be evaluated as soon as possible.

The permanent Tu loggers will be equipped with self-cleaning optical sensors with integrated wipers to remove deposits from the sensor's glass and maintain high data accuracy. They will be visited every two weeks to maintain and clean the monitoring system (and free them of any potential algae and vegetation debris) to avoid erratic spikes in data. In addition to planned routine maintenance, the permanent Tu logger will also be inspected and maintained as soon as practicable if the real-time readings indicate a potential problem with the logger (i.e., a logger stops working; erratic readings are obtained; etc.). The details of logger maintenance will be developed depending on the selection of loggers, the supplier's specification and maintenance requirements.

During each maintenance visit, Tu will be measured using handheld loggers, and water samples will be collected for laboratory analysis of TSS to confirm or improve the Tu-TSS relationship. Manual sampling will be performed at near surface, mid-depth, and near-bottom depths to collect data across the entire water column at each site.

2.0 ADAPTIVE RESPONSE PROTOCOLS

2.1 In-Lake Construction

2.1.1 Target Levels

Management of TSS levels during in-lake construction at the inlet will incorporate the following action levels:

1. An average TSS reading of all permanent loggers deployed at the SMP-2 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 milligram per litre (mg/L) above background TSS at monitoring site SMP-1.
2. An average TSS reading of all permanent loggers deployed at the SMP-2 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above background TSS at monitoring site SMP-1. The increase will also be compared against TSS measurements at SMP-1 collected during the pre-construction period.
3. A background TSS reading at monitoring site SMP-1 that is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location.

Background TSS at monitoring site SMP-1 during construction will be determined by computing the average TSS reading of all permanent loggers deployed at the SMP-1 location, based on four consecutive 15-minute averaged measurements.

Management of TSS levels during in-lake construction at the outlet will incorporate the following action levels:

1. An average TSS reading of all permanent loggers deployed at the SMP-3 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 mg/L above background TSS at monitoring site SMP-5.
2. An average TSS reading of all permanent loggers deployed at the SMP-3 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above background TSS at monitoring site SMP-5. The increase will also be compared against the TSS measurements at SMP-5 collected during the pre-construction period.
3. A background TSS reading at monitoring site SMP-5 that is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location.

Background TSS at monitoring site SMP-5 during construction will be determined by computing the average TSS reading of all permanent loggers deployed at the SMP-5 location, based on four consecutive 15-minute averaged measurements.

Both proposed action levels (i.e., 25 mg/L and 200 mg/L above background) identified above are below acutely lethal thresholds of suspended sediment for freshwater fish, which range from the hundreds to hundreds of thousands mg/L (DFO, 2000). Exceedance of these action levels will initiate an action plan to identify the source of the TSS and secondary mitigation strategies for unanticipated events as discussed in Section 2.1.2 and/or a modification to the construction procedures. The action levels will be reviewed periodically throughout the construction period and updated if required to optimize the monitoring plan and response protocol.

2.1.2 Adaptive Action Plan for Unanticipated Events

The Adaptive Action Plan for responding to TSS levels will be implemented as soon as possible in response to these results as follows:

When the average displayed TSS output at SMP-2 or SMP-3 is less than 25 mg/L above background at SMP-1 and SMP-5, respectively, results will continue to be monitored and no action will be taken.

When the average TSS reading of all permanent loggers at SMP-2 or SMP-3 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above background at SMP-1 and SMP-5, respectively, but less than 200 mg/L, the following tasks will be carried out:

a) Confirm the results are accurate (i.e., rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Manitoba Transportation and Infrastructure;

d) Take action, which includes investigating to try to identify if a project activity is resulting in the recorded TSS increase and if it is still underway, implement effective mitigation. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):

   - Temporary suspension of work activity
   - Modifying the rate of material placement or removal
   - Modifying the sequence of material placement or removal
   - Installing additional erosion and sediment control measures
   - Verifying the quality of the material being used is appropriate
   - Temporarily moving to a new work area

e) Record the event in the daily report.

When the average TSS reading of all permanent loggers at SMP-2 or SMP-3 associated with a 15-minute average measurement is equal to or greater than 200 mg/L above background at SMP-1 and SMP-5, respectively, the following steps will be taken:

a) Confirm the results are accurate (i.e., rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Manitoba Transportation and Infrastructure;

d) Take action, which in this case should be carried out by the Manitoba Transportation and Infrastructure after they evaluate whether the construction activity that resulted in high TSS is still underway. If so, the following measures may be required of the Contractor:

   - Temporary work stoppage
   - Installation of sediment containment
   - Other modifications to construction practices

e) Notify Fisheries and Oceans Canada (DFO); and

f) Record the event in the daily report.

When the average TSS reading of all permanent loggers at SMP-1 or SMP-5 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above the computed 24-hour rolling average at these respective locations, the following steps will be taken:

a) Confirm the results are accurate (i.e., rule out logger malfunction)

b) Discuss the exceedance with the Manitoba Transportation and Infrastructure;

c) Take action, which includes investigating to try to identify if a project activity is resulting in the recorded TSS increase and if it is still underway, mitigation may need to be implemented. This may include advising the Contractor of the need to modify work activities, such as (but not limited to):

   - Temporary suspension of work activity
   - Modifying the rate of material placement or removal
   - Modifying the sequence of material placement or removal
   - Installing additional erosion and sediment control measures (i.e., turbidity curtains)
   - Verifying the quality of the material being used is appropriate
   - Temporarily moving to a new work area

d) Record the event in the daily report.

e) If the exceedance continues for 3 consecutive days, notify DFO and take further action, which in this case should be carried out by the Manitoba Transportation and Infrastructure. The following measures may be required of the Contractor:

   - Temporary work stoppage
   - Installation of sediment containment

2.2 Commissioning

2.2.1 Target Levels

Management of TSS levels during commissioning will incorporate the following action levels measured in the mixing zone at SMP-4 and the fully mixed zone at SMP-5:

1. An average TSS reading of all loggers deployed at the SMP-4 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 mg/L above the background TSS at monitoring site SMP-1. Given that SMP-4 is located in Birch Bay and the background monitoring reference site SMP-1 is in Watchorn Bay, the SMP-1 measurements will be factored using a relationship that will be developed between the existing environment TSS of the two lakes. Development of potential TSS relationships between the two lakes will consider assessments of natural ranges of TSS that typically occur in the existing environment, natural variabilities in TSS, influences from wind events, and correlation between the TSS concentrations in the two lakes.
2. An average TSS reading of all loggers deployed at the SMP-4 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above the background TSS at monitoring site SMP-1. Given that SMP-4 is located in Birch Bay and the background monitoring reference site SMP-1 is in Watchorn Bay, the SMP-1 measurements will be factored using a relationship that will be developed between the existing environment TSS of the two lakes.
3. A computed 24-hour rolling average TSS reading of all loggers deployed at the SMP-5 location that is equal to or greater than 25 mg/l above the 24-hour rolling average TSS reading of all loggers deployed at the SMP-1 location. Given that SMP-5 is located in Birch Bay and SMP-1 is in Watchorn Bay, the SMP-1 measurements will be factored using a relationship that will be developed between the existing environment TSS of the two lakes. The increase at SMP-5 will also be compared against the TSS measurements at SMP-5 collected during the pre-commissioning period

Background TSS at monitoring site SMP-1 during commissioning will be determined by computing the average TSS reading of all loggers deployed at the SMP-1 location, based on four consecutive 15-minute averaged measurements.

Both proposed action levels (i.e., 25 mg/L and 200 mg/L above background) are below acutely lethal thresholds of suspended sediment for freshwater fish, which range from the hundreds to hundreds of thousands mg/L (DFO, 2000). Exceedance of these action levels will initiate an action plan to identify the source of the TSS and secondary mitigation strategies as discussed in in Section 2.2.2 for unanticipated events and/or a modification to the channel commissioning procedures. The action levels will be reviewed periodically throughout the commissioning period and updated if required, to optimize the monitoring plan and response protocol.

2.2.2 Adaptive Action Plan for During Commissioning

The Adaptive Action Plan for responding to TSS levels will be implemented during commissioning (initial gate operation) as soon as possible in response to these results as follows:

When the average displayed TSS output at SMP-4 and SMP-5 is less than 25 mg/L above the factored background SMP-1, results will continue to be monitored and no action will be taken.

When the average TSS reading of all loggers at SMP-4 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above the factored background at SMP-1, but less than 200 mg/L, the following tasks will be carried out:

a) Confirm the results are accurate (i.e., rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Lowering the gates in a controlled manner to reduce TSS concentration flowing downstream until measurements return below the action levels ; and

d) Record the event in the daily report.

When the average TSS reading of all loggers at SMP-4 associated with a 15-minute average measurement is equal to or greater than 200 mg/L above the factored background at SMP-1, the following steps will be taken:

a) Confirm the results are accurate (i.e., rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Manitoba Transportation and Infrastructure;

d) Take action, which may include:

- Further lowering of the gates in a controlled manner to reduce outflows and TSS concentrations
- Review and adjustment of controlled gate opening sequence
- Temporary stoppage of commissioning activities

e) Notify DFO; and

f) Record the event in the daily report.

When the computed 24-hour rolling average of all loggers at SMP-5 is equal to or greater than 25 mg/L above the computed 24-hour rolling average factored TSS of all loggers at SMP-1, the following steps will be taken:

a) Confirm the results are accurate (i.e., rule out logger malfunction);

b) Take action, which includes:

- Lowering the gates in a controlled manner to reduce TSS concentration flowing downstream
- Evaluating whether the commissioning activity that resulted in high TSS is still underway. If so, the controlled gate opening sequence should be reviewed and further adjusted.

c) Record the event in the daily report.

d) If the exceedance continues for 3 consecutive days, the following steps will be taken:

- Temporarily stop commissioning activities; and
- Notify DFO.

3.0 REFERENCES

Department of Fisheries and Oceans (DFO) Canada. January 2000. Effects of Sediment on Fish and Their Habitat. DFO Pacific Region Habitat Status Report 2000/01.

APPENDIX 2B

Preliminary Sediment Monitoring Plan and Response Protocol for LSMOC In-Lake Excavation and Commissioning Activities

Preliminary Sediment Monitoring Plan and Response Protocol for LSMOC In-Lake Excavation and Commissioning Activities

1.0 REAL-TIME SEDIMENT MONITORING PLAN

A detailed in-lake real-time total suspended sediment (TSS) monitoring program will be implemented during the course of construction to monitor the magnitude and spatial and temporal changes in TSS within the project area during in-lake construction and commissioning activities. The monitoring program design is based on the expected construction effects on the sedimentation regime in the North Basin of Lake St. Martin and Sturgeon Bay (Lake Winnipeg), and recent experience on other construction projects in the Province of Manitoba. Overall, the design is based on an upstream and downstream approach to capture effects in the initial mixing zone as well as the effects downstream in the fully mixed area. Changes to this plan, if required, will be shared with Indigenous communities, stakeholders and Impact Assessment Agency of Canada (IAAC) will be informed of prior to implementation of changes.

1.1 OBJECTIVES

The sediment monitoring program is intended to document the spatial and temporal variations of TSS concentrations and the magnitude of any increases in the North Basin of Lake St. Martin and in Sturgeon Bay during in-lake construction activities, as well as any increases in Sturgeon Bay during the commissioning stage. The program has been designed to facilitate responses to pre-determined action levels described in Section 2.0.

1.2 MONITORING PARAMETERS

The main parameter being monitored is TSS; however, TSS cannot be measured in real time but must be determined in a laboratory using a water sample. Turbidity (Tu) will be measured as a surrogate using automated in-situ Tu loggers that can measure and report Tu on a real time basis. This is an industry standard approach and has been used in several projects in the Province of Manitoba, including Manitoba Hydro's Wuskwatim and Keeyask Generating Station projects and the Pointe du Bois Spillway Replacement project, as well as the Province of Manitoba Red River Floodway Expansion Project and the Lake St. Martin Emergency Outlet Channel Project. The Coordinated Aquatic Monitoring Program (CAMP) also adopted a similar approach in Manitoba. Typically, the relationship would be expressed in the form of:

$$TSS(\text{mg/L}) = X * Tu(\text{NTU}) + Y,$$

where *X* and *Y* would be calculated using regression analysis.

Relationships between Tu and TSS will be developed prior to construction to facilitate the use of Tu as a surrogate of TSS. Typically, development of the relationships will be based on TSS and Tu data that have been collected in Lake St. Martin and Lake Winnipeg in the past, as well as any additional data that will be collected prior to the in-lake construction activities. The development of relationships will consider ranges of TSS and Tu that typically occur in the existing environment, their natural variabilities, and correlation between the two parameters. In addition, laboratory analysis will be carried out to develop relationships between TSS and Tu using sediment particles that are predominant in the soils located within the project area that may be suspended during construction or commissioning. The relationships will be used to determine if in-lake construction and commissioning activities are causing TSS increases that exceed specific action thresholds so that the corrective actions discussed in Section 2.0 can be implemented in a timely manner. During in-lake work, samples of water at the monitoring stations will be periodically collected and analyzed for TSS to confirm or adjust the Tu-TSS relationship, as required.

The assessment of potential effects on the TSS concentration in the water will be based on an upstream and downstream approach to capture changes in the downstream area.

1.3 MONITORING LOCATIONS

TSS and turbidity will be monitored through deployment of in-situ turbidity loggers at multiple transect locations approximately as shown in Figure 1, Figure 2 and Figure 3. Multiple loggers will be installed at each transect to monitor average conditions across the initial mixing zone as well as in the fully mixed area. The logger locations and purpose will vary depending on whether in-lake excavation work or commissioning activities are underway, as described below. There will be common logger locations (sediment sampling point [SMP]-1, SMP-5, and SMP-6) for both the in-lake excavation and commissioning stages to measure background TSS in the lakes. For the purpose of the in-lake excavation stage, there will be loggers at SMP-2 and at SMP-3 immediately outside of turbidity curtains to make sure that additional TSS that may be generated from the excavation work can be tracked and measured. The commissioning stage will include a logger location at SMP-4 that will be within the mixing zone of additional TSS that could result from the initial gate operation. The logger locations may be modified during the program as more data becomes available to improve and optimize the monitoring plan and response protocol.

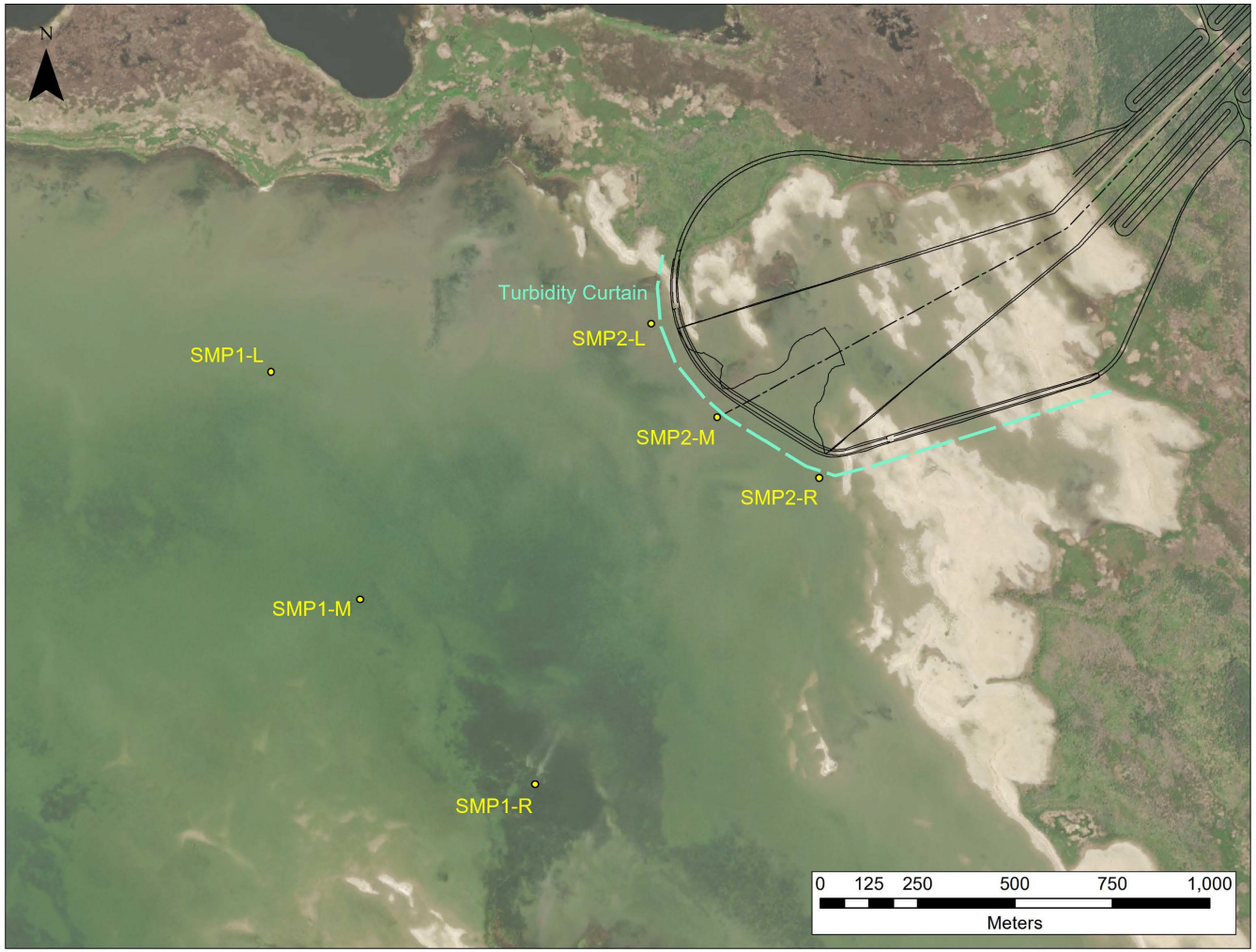


Figure 1: Proposed TSS Monitoring Locations in the North Basin of Lake St. Martin during Inlet Construction

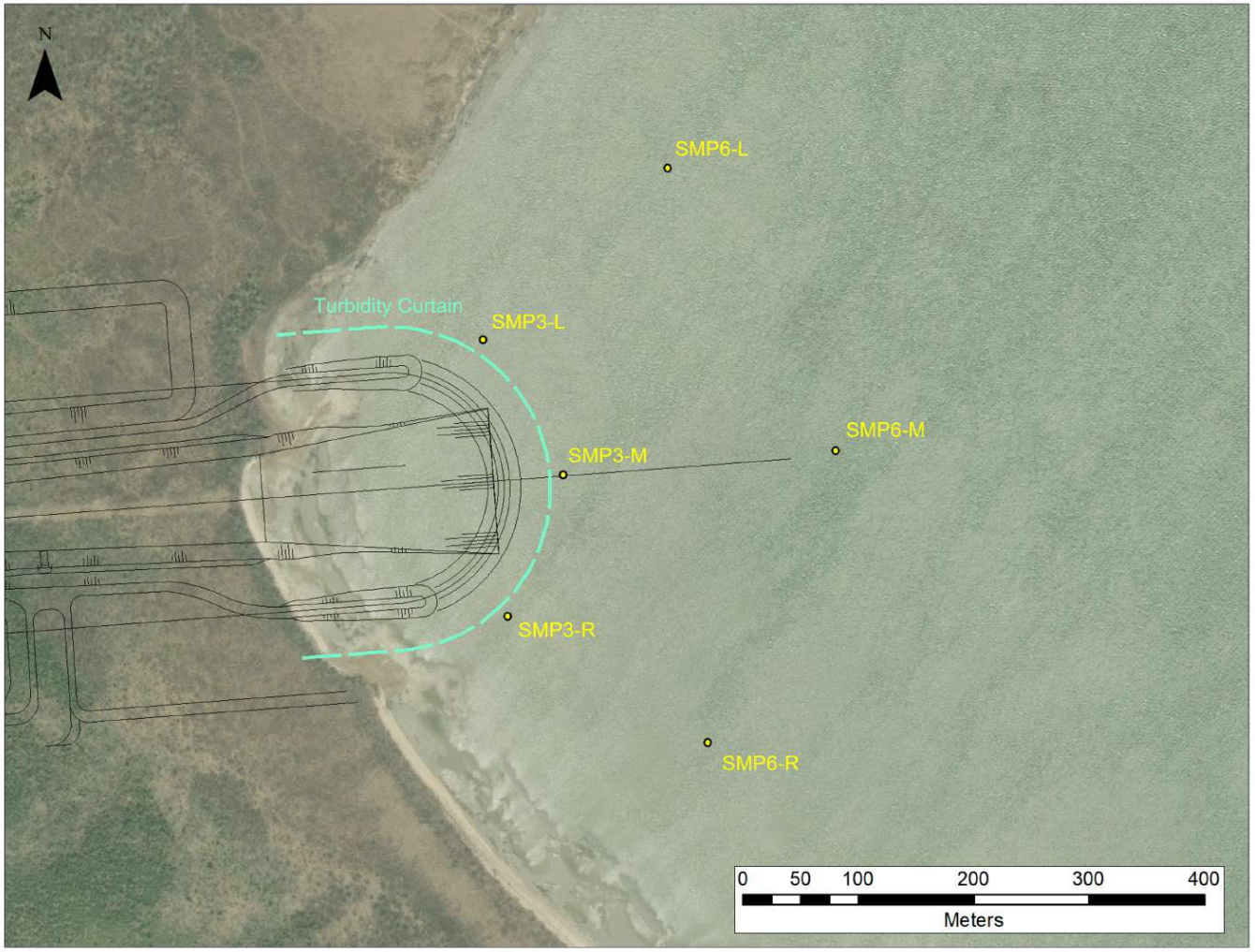


Figure 2: Proposed TSS Monitoring Locations in Sturgeon Bay during Outlet Construction

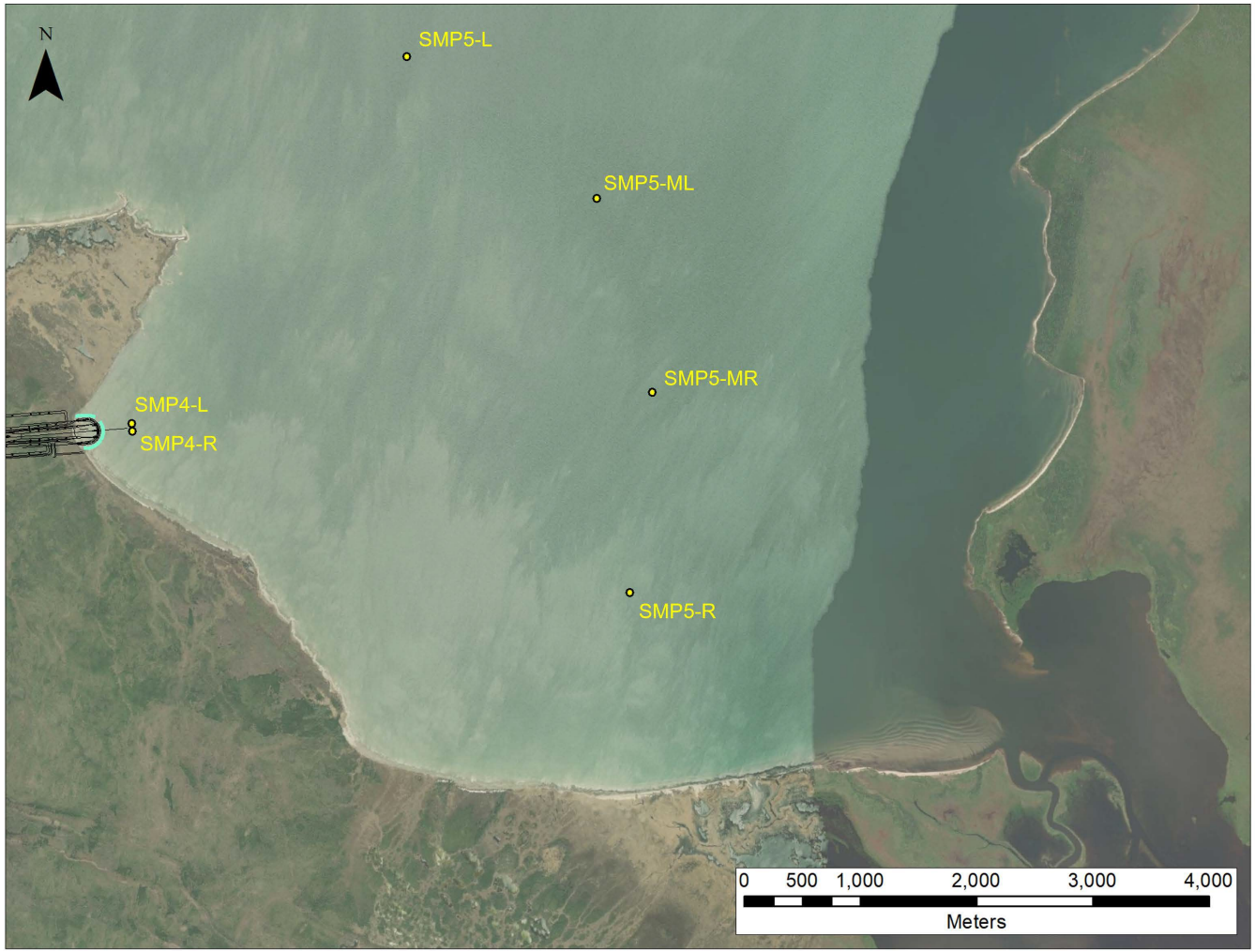


Figure 3: Proposed TSS Monitoring Locations in Sturgeon Bay during Outlet Commissioning

1.3.1 In-Lake Excavation

- SMP-1 will be located in The North Basin of Lake St. Martin approximately 2 kilometre (km) upstream of the shoreline at the entrance to the LSMOC to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-1L, SMP-1M and SMP-1R) located across the width of the bay.
- SMP-2 will be located just outside of the inlet cofferdam double turbidity curtains. Loggers will be installed at three sites (SMP-2L, SMP-2M and SMP-2R) located across the length of the curtain (transect). In addition, multiple measurements along the length of the turbidity curtain will frequently be made using handheld loggers to augment the permanent loggers and detect if any transport of sediment through the curtain is occurring. The frequency and locations of monitoring will be further developed with input from the Contractor based on the construction sequence and methodology. Given the close proximity of the transect to the construction area, handheld logger measurements that will be made at least once a day will provide flexibility to track potential sediment plumes that may not be otherwise detected at the permanent loggers.
- SMP-3 will be located just outside of the cofferdam double turbidity curtain, approximately 200 metres (m) from the shoreline. Loggers will be installed at three sites (SMP-3L, SMP-3M and SMP-3R) located across the length of the curtain (transect). In addition, multiple measurements along the length of the turbidity curtain will frequently be made using handheld loggers to augment the permanent loggers and detect if any potential transport of sediment through the curtain is occurring. The frequency and locations of monitoring will be further developed with input from the Contractor based on the construction sequence and methodology. Given the close proximity of the transect to the construction area, handheld logger measurements that will be made at least once a day will provide flexibility to track potential sediment plumes that may not be otherwise detected at the permanent loggers.
- SMP-6 will be located approximately 500 m downstream of the shoreline at the LSMOC outlet into Sturgeon Bay to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-6L, SMP-6M and SMP-6R) located across the width of the bay.

Aerial image capture with drones may be considered to augment the permanent turbidity monitoring locations and allow identification of potential sediment plumes during construction that could then inform the deployment of a monitoring crew to a specific area of concern to obtain handheld logger readings.

1.3.2 Commissioning

- SMP-1 will be located in The North Basin of Lake St. Martin approximately 2 km upstream of the shoreline at the entrance to the LSMOC to monitor ongoing background conditions. Loggers will be installed at three sites (SMP-1L, SMP-1M and SMP-1R) located across the width of the bay. These will be the same locations selected for monitoring of background conditions during in-lake construction activities at the inlet.

- SMP-4 will be located approximately 500 m downstream of the shoreline at the LSMOC outlet into Sturgeon Bay outside the excavation area and beyond the area of in-lake activities during construction. This is a near-field location within the mixing zone prior to fully mixed conditions. Loggers will be installed at two sites (SMP-4L and SMP-4R) located across the channel width to monitor for sediment plumes.
- SMP-5 will be located approximately 5 km downstream of the shoreline at the LSMOC outlet into Sturgeon Bay in the fully mixed zone of the flow. Loggers will be installed at four sites (SMP-5L, SMP-5ML, SMP-5MR and SMP-5R) located across the width of the bay. The locations of the loggers at the four sites were selected based on the expected sediment plume's shape and extent, as estimated through sediment transport modeling for selected commissioning scenarios.

Aerial image capture with drones may be considered to augment the permanent turbidity monitoring locations.

1.4 Monitoring Methodology

Both permanent and handheld loggers will be used to collect Tu at the sites described in Section 1.3. The purpose of the permanent loggers would be to monitor Tu on a longer-term basis at pre-determined locations to monitor average conditions across the transect. This will help identify changes in sediment concentrations that may occur during in-lake construction and commissioning activities. The purpose of the handheld loggers would be to track and measure sediment plumes, as well as help identify potential sediment sources and thus assist in formulating mitigation measures. Periodically, Tu measurement will also be conducted using handheld loggers at the permanent logger sites for quality control purposes.

Real-time Tu data from the permanent loggers installed at monitoring sites will be remotely transmitted to a central computer at the construction site at a pre-determined interval (every 15 minutes anticipated) so monitoring results can be evaluated as soon as possible.

The permanent Tu loggers will be equipped with self-cleaning optical sensors with integrated wipers to remove deposits from the sensor's glass and maintain high data accuracy. They will be visited every two weeks to maintain and clean the monitoring system (and free them of any potential algae and vegetation debris) to avoid erratic spikes in data. In addition to planned routine maintenance, the permanent Tu logger will also be inspected and maintained as soon as practicable if the real-time readings indicate a potential problem with the logger (i.e., a logger stops working; erratic readings are obtained; etc.). The details of logger maintenance will be developed depending on the selection of loggers, the supplier's specification and maintenance requirements.

During each maintenance visit, Tu will be measured using handheld loggers, and water samples will be collected for laboratory analysis of TSS to confirm or improve the Tu-TSS relationship. Manual sampling will be performed at near surface, mid-depth, and near-bottom depths to collect data across the entire water column at each site.

2.0 ADAPTIVE RESPONSE PROTOCOLS

2.1 In-Lake Construction

2.1.1 TARGET LEVELS

Management of TSS levels during in-lake construction at the inlet will incorporate the following action levels:

1. An average TSS reading of all permanent loggers deployed at the SMP-2 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 milligram per litre (mg/L) above background TSS at monitoring site SMP-1.
2. An average TSS reading of all permanent loggers deployed at the SMP-2 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above background TSS at monitoring site SMP-1. The increase will also be compared against TSS measurements at SMP-1 collected during the pre-construction period.
3. A background TSS reading at monitoring site SMP-1 that is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location.

Background TSS at monitoring site SMP-1 during construction will be determined by computing the average TSS reading of all permanent loggers deployed at the SMP-1 location, based on four consecutive 15-minute averaged measurements.

Management of TSS levels during in-lake construction at the outlet will incorporate the following action levels:

1. An average TSS reading of all permanent loggers deployed at the SMP-3 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 mg/L above background TSS at monitoring site SMP-6.
2. An average TSS reading of all permanent loggers deployed at the SMP-3 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above background TSS at monitoring site SMP-6. The increase will also be compared against the TSS measurements at SMP-6 collected during the pre-construction period.
3. A background TSS reading at monitoring site SMP-6 that is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location.

Background TSS at monitoring site SMP-6 during construction will be determined by computing the average TSS reading of all permanent loggers deployed at the SMP-6 location, based on four consecutive 15-minute averaged measurements.

Both proposed action levels (i.e., 25 mg/L and 200 mg/L above background) identified above are below acutely lethal thresholds of suspended sediment for freshwater fish, which range from the hundreds to hundreds of thousands mg/L (DFO, 2000). Exceedance of these action levels will initiate an action plan to identify the source of the TSS and secondary mitigation strategies for unanticipated events as discussed in

Section 2.1.2 and/or a modification to the construction procedures. The action levels will be reviewed periodically throughout the construction period and updated if required to optimize the monitoring plan and response protocol.

2.1.2 ADAPTIVE ACTION PLAN FOR UNANTICIPATED EVENTS

The Adaptive Action Plan for responding to TSS levels will be implemented as soon as possible in response to these results as follows:

When the average displayed TSS output at SMP-2 or SMP-3 is less than 25 mg/L above background at SMP-1 and SMP-6, respectively, results will continue to be monitored and no action will be taken.

When the average TSS reading of all permanent loggers at SMP-2 or SMP-3 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above background at SMP-1 and SMP-6, respectively, but less than 200 mg/L, the following tasks will be carried out:

a) Confirm the results are accurate (i.e. rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Owner, Manitoba Transportation and Infrastructure ;

d) Take action, which includes investigating to try to identify if a project activity is resulting in the recorded TSS increase and if it is still underway, implement effective mitigation. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):

   - Temporary suspension of work activity
   - Modifying the rate of material placement or removal
   - Modifying the sequence of material placement or removal
   - Installing additional erosion and sediment control measures
   - Verifying the quality of the material being used is appropriate
   - Temporarily moving to a new work area

e) Record the event in the daily report.

When the average TSS reading of all permanent loggers at SMP-2 or SMP-3 associated with a 15-minute average measurement is equal to or greater than 200 mg/L above background at SMP-1 and SMP-6, respectively, the following steps will be taken:

a) Confirm the results are accurate (i.e. rule out logger malfunction);

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Manitoba Transportation and Infrastructure ;

d) Take action, which in this case should be carried out by the Manitoba Transportation and Infrastructure after they evaluate whether the construction activity that resulted in high TSS is still underway. If so, the following measures may be required of the Contractor:

   - Temporary work stoppage

- Installation of sediment containment
- Other modifications to construction practices

e) Notify Fisheries and Oceans Canada (DFO); and

f) Record the event in the daily report.

When the average TSS reading of all permanent loggers at SMP-1 or SMP-6 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above the computed 24-hour rolling average at these respective locations, the following steps will be taken:

a) Confirm the results are accurate (i.e. rule out logger malfunction)

b) Discuss the exceedance with the Manitoba Transportation and Infrastructure ;

c) Take action, which includes investigating to try to identify if a project activity is resulting in the recorded TSS increase and if it is still underway, mitigation may need to be implemented. This may include advising the Contractor of the need to modify work activities, such as (but not limited to):

- Temporary suspension of work activity
- Modifying the rate of material placement or removal
- Modifying the sequence of material placement or removal
- Installing additional erosion and sediment control measures (i.e., turbidity curtains)
- Verifying the quality of the material being used is appropriate
- Temporarily moving to a new work area

d) Record the event in the daily report.

e) If the exceedance continues for 3 consecutive days, notify DFO and take further action, which in this case should be carried out by the Manitoba Transportation and Infrastructure. The following measures may be required of the Contractor:

- Temporary work stoppage
- Installation of sediment containment

2.2 Commissioning

2.2.1 TARGET LEVELS

Management of TSS levels during commissioning will incorporate the following action levels measured in the mixing zone at SMP-4 and the fully mixed zone at SMP-5:

1. An average TSS reading of all loggers deployed at the SMP-4 location, based on four consecutive 15-minute averaged measurements, that is equal to or greater than 25 mg/L above the background TSS at monitoring site SMP-5. The increase at SMP-4 will also be compared against the background TSS measurements at SMP-1.

2. An average TSS reading of all loggers deployed at the SMP-4 location, based on a 15-minute averaged measurement, that is equal to or greater than 200 mg/L above the background TSS at monitoring site SMP-5. The increase at SMP-4 will also be compared against the background TSS measurements at SMP-1.
3. A background TSS reading at monitoring site SMP-5 that is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location. The increase at SMP-5 will also be compared against the TSS measurements at SMP-5 collected during the pre-commissioning period

Background TSS at monitoring sites SMP-1 and SMP-5 during commissioning will be determined by computing the average TSS reading of all loggers deployed at these locations, based on four consecutive 15-minute averaged measurements.

Both proposed action levels (i.e., 25 mg/L and 200 mg/L above background) are below acutely lethal thresholds of suspended sediment for freshwater fish, which range from the hundreds to hundreds of thousands mg/L (DFO, 2000). Exceedance of these action levels will initiate an action plan to identify the source of the TSS and secondary mitigation strategies as discussed in in Section 2.2.2 for unanticipated events and/or a modification to the channel commissioning procedures. The action levels will be reviewed periodically throughout the commissioning period and updated if required, to optimize the monitoring plan and response protocol.

2.2.2 ADAPTIVE ACTION PLAN FOR DURING COMMISSIONING

The Adaptive Action Plan for responding to TSS levels will be implemented during commissioning (initial gate operation) as soon as possible in response to these results as follows:

When the average displayed TSS output at SMP-4 is less than 25 mg/L above the background at SMP-5, results will continue to be monitored and no action will be taken.

When the average TSS reading of all loggers at SMP-4 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above the background at SMP-5, but less than 200 mg/L, the following tasks will be carried out:

a) Confirm the results are accurate (i.e. rule out logger malfunction) and occurring from commissioning activity;
b) If possible, take a handheld turbidity reading to confirm the result;
c) Lowering the gates in a controlled manner to reduce TSS concentration flowing downstream until measurements return below the action levels ; and
d) Record the event in the daily report.

When the average TSS reading of all loggers at SMP-4 associated with a 15-minute average measurement is equal to or greater than 200 mg/L above the background at SMP-5, the following steps will be taken:

a) Confirm the results are accurate (i.e. rule out logger malfunction) and occurring from commissioning activity;

b) If possible, take a handheld turbidity reading to confirm the result;

c) Discuss the exceedance with the Manitoba Transportation and Infrastructure ;

d) Take action, which may include:

    - Further lowering of the gates in a controlled manner to reduce outflows and TSS concentrations
    - Review and adjustment of controlled gate opening sequence
    - Temporary stoppage of commissioning activities

e) Notify DFO; and

f) Record the event in the daily report.

When the average TSS reading of all loggers at SMP-5 associated with four consecutive 15-minute averaged measurements is equal to or greater than 25 mg/L above the computed 24-hour rolling average at this location, the following steps will be taken:

a) Confirm the results are accurate (i.e. rule out logger malfunction) and occurring from commissioning activity;

b) Take action, which includes:

    - Lowering the gates in a controlled manner to reduce TSS concentration flowing downstream
    - Evaluating whether the commissioning activity that resulted in high TSS is still underway. If so, the controlled gate opening sequence should be reviewed and further adjusted.

c) Record the event in the daily report.

d) If the exceedance continues for 3 consecutive days, the following steps will be taken:

    - Temporarily stop commissioning activities; and
    - Notify DFO.

3.0 REFERENCES

Department of Fisheries and Oceans (DFO) Canada. January 2000. Effects of Sediment on Fish and Their Habitat. DFO Pacific Region Habitat Status Report 2000/01.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Surface Water Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vii

Part 1: Introduction 1

1.0 PURPOSE AND SCOPE 1

2.0 OBJECTIVES 3

3.0 MANAGEMENT CRITERIA 4

3.1 General Considerations 4

3.2 Water Quality Criteria 4

3.3 Design Criteria 4

3.3.1 Lake Manitoba Outlet Channel 4

3.3.2 Lake St. Martin Outlet Channel 5

Part 2: Lake Manitoba Outlet Channel 6

4.0 SOURCES OF WATER 6

4.1 Surface Water 6

4.2 Groundwater 8

4.3 Processed Water 8

5.0 SURFACE WATER MANAGEMENT 9

5.1 Construction Phase (Temporary Measures) 9

5.1.1 Channel Works 9

5.1.2 Inlet Works 11

5.1.3 Outlet Works 11

5.1.4 Water Control Structure 11
5.1.5 Road Bridges 12
5.1.6 PR 239 Realignment 12
5.1.7 Sediment Management 12
5.2 Operation Phase (Permanent Measures) 12
5.2.1 Outside Drain 13
5.2.2 Augmentation of Birch Creek Flows 16
5.2.3 Conditions in the LMOC 16
5.2.4 Revegetation Plan 17
6.0 MONITORING 18
6.1 Baseline Monitoring 18
6.2 Construction Phase Monitoring 19
6.2.1 Overview 19
6.2.2 Discharge from Construction Areas 19
6.2.3 Surface Water in Local Waterbodies 20
6.2.4 Sediment Monitoring for In-Lake Excavation and Commissioning Activities 22
6.3 Operation Phase Monitoring 22
6.4 Cattle Operation Runoff 22
6.5 Reporting 23
7.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP 24
7.2.1 Construction 25
7.2.2 Commissioning 26
7.2.3 Operation Phase 27
7.3 Contingency Measures and Emergency Response 27
Part 3: Lake St. Martin Outlet Channel 28
8.0 SOURCES OF WATER 28
8.1 Surface Water 28
8.2 Groundwater and Seepage Water 29

8.3 Processed Water 30

9.0 SURFACE WATER MANAGEMENT 31

9.1 Construction Phase (Temporary Measures) 31

9.1.1 Channel Works 31

9.1.2 Inlet Works 33

9.1.3 Outlet Works 33

9.1.4 Water Control Structure 33

9.1.5 Sediment Management 34

9.2 Operation Phase (Permanent Measures) 34

9.2.1 Outside Drain 34

9.2.2 Augmentation of Buffalo Creek Watershed Flows 37

9.2.3 Conditions in the LSMOC 37

9.2.4 Revegetation Plan 38

10.0 MONITORING 39

10.1 Baseline Monitoring 39

10.2 Construction Phase Monitoring 40

10.2.1 Overview 40

10.2.2 Discharge from Construction Areas 40

10.2.3 Surface Water in Local Waterbodies 41

10.2.4 Sediment Monitoring for In-Lake Excavation and Commissioning Activities 43

10.3 Operation Phase Monitoring 43

10.4 Reporting 43

11.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP 44

11.2.1 Construction 45

11.2.2 Commissioning 46

11.2.3 Operation Phase 46

11.3 Contingency Measures and Emergency Response 47

List of Tables

Table 1: Characteristics of Sub-Basins Blocked by the LMOC

Table 2: Proposed Surface Water Quality Monitoring Parameters

Table 3: Characteristics of Sub-Basins Intercepted by the LSMOC

Table 4: Proposed Surface Water Quality Monitoring Parameters

List of Figures

Figure A: EMP Process

Figure 1: Surface Water Catchment Areas in Vicinity of the LMOC

Figure 2: LMOC Outside Drain Arrangement

Figure 3: LMOC Outside Drain Profile – South Reach

Figure 4: LMOC Outside Drain Profile – North Reach

Figure 5: LMOC Baseline Surface Water Quality Monitoring Locations

Figure 6: Surface Water Catchment Areas Intercepted by the LSMOC

Figure 7: Temporary Drainage Plan

Figure 8: Permanent Surface Water Drainage Plan

Figure 9: Profile of the Outside Drain

Figure 10: LSMOC Baseline Surface Water Quality Monitoring Locations

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Surface Water Management Plan (SWMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

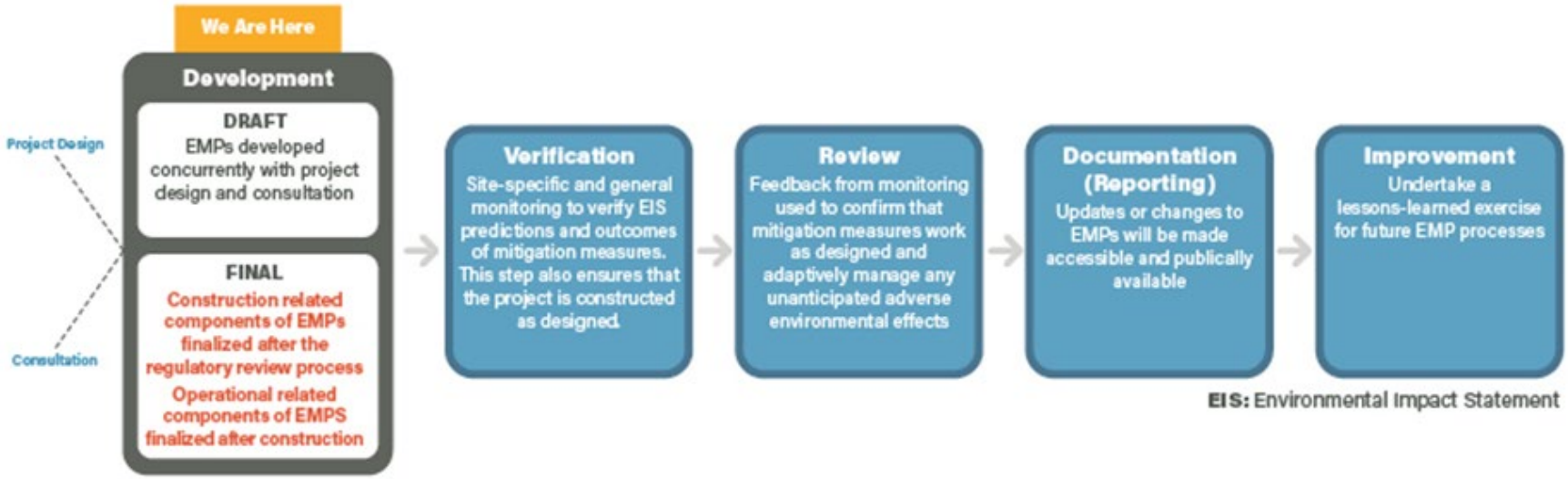


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AEMP	Aquatic Effects Monitoring Plan
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Program
CSP	corrugated steel pipes
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ft	feet
EOC	Emergency Outlet Channel
GCS	Gradient Control Structure
GWMP	Groundwater Management Plan
IMP	Ice Management Plan
km	kilometre
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
mm	millimetre
m/s	metres per second
m^3/s	cubic metres per second
mg/L	milligrams per litre
MWQSOG	Manitoba Water Quality Standards, Objectives and Guidelines
NTU	Nephelometric Turbidity Unit
OEMP	Operation Environmental Management Program

O&M	Operation and Maintenance
PAL	Protection of Freshwater Aquatic Life
PDA	Project Development Area
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
PTH	Provincial Trunk Highway
QA	quality assurance
QC	quality control
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SMP	Sediment Management Plan
SWMP	Surface Water Management Plan
TSS	Total Suspended Sediment
WetMP	Wetland Monitoring Plan
WCS	Water Control Structure

Glossary of Terms

Aquatic life: Organisms temporarily or permanently living or found in water.

Aquatic vegetation: Submerged, floating-leaved and floating plants that only grow on or beneath the water surface. Submerged plants may be rooted in soils or free-floating.

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Aquitard: A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

Artesian: A body of rock or sediment containing groundwater that is under greater than hydrostatic pressure: that is a confined aquifer. When an artesian aquifer is penetrated by a well, the water level will rise above the top of the aquifer; a flowing artesian well is when the water level will rise above ground surface.

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Carbonate aquifer: See Aquifer; see Carbonates. Refers to an aquifer comprised of a carbonate bedrock.

Carbonates: A rock made up primarily of carbonate minerals (minerals containing the CO3 anionic structure). Examples: limestone, dolostone, and marble (metamorphosed limestone or dolomite) are the most commonly encountered carbonate rocks.

Cofferdam: An enclosure, usually only partially obstructing a river, from which water is pumped to expose the bottom to permit construction.

Confined aquifer: An aquifer that is bounded above and below by formations of distinctly lower permeability than that of the aquifer itself. An aquifer containing confined ground water. See artesian.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pump, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with Drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the project to support the structural design of the bridge or structure.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dissolved oxygen: Oxygen molecules (O_2) dissolved in water.

Electrical Conductivity: A measure of the ability of a solution to conduct electrical flow; units are microSiemens per centimetre.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Hydraulic profile: The graphical representation of the water level through the channel based on the water level of the receiving water, control points, and the head loss.

Hydrocarbon: A group of chemicals made up of carbon, hydrogen, and oxygen, including gasoline and oil.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Invert (channel): The stream bed or floor within a structure or channel.

Piezometric pressure: A measurement at a discrete location expressing the potentiometric surface which is an imaginary surface representing the pressure of groundwater in an aquifer that is defined by the level to which water will rise in a well.

Pool: A deep, slow-moving area of a stream; an artificially confined body of water above a dam or weir.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of

alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase in the design process typically supports the pre-construction engagement and consultation process with the public and Indigenous groups, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Recharge: Water added to an aquifer or the process of adding water to an aquifer.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Rip-rap: A lightweight stone covering used to protect soil or surface bedrock from erosion by water or the elements.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Shoreline morphology: The outward appearance (shape, structure, color, pattern, size) of the narrow strip of land in immediate contact with the sea, lake or river.

Suspended sediment: Particulate matter that is held in the water column due to movement of the water.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Turbidity: A measure of the relative clarity of water.

Water table: The upper surface of the zone of saturation in an unconfined aquifer.

Waterbody: Standing and flowing surface waters (such as a creeks, rivers, lakes, and wetlands with open water), including seasonally and ephemerally occurring surface waters.

Part 1: Introduction

1.0 PURPOSE AND SCOPE

The Surface Water Management Plan (SWMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project (the Project). The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, water control structures (WCS) with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

The purpose of the SWMP is to describe the measures to be used to mitigate or avoid impacts to local surface water during construction and operation of the LMOC and the LSMOC. These include methods to manage local runoff (both inside and outside of construction areas), and the associated potential transport and deposition of sediments beyond construction areas and into off-site receiving water bodies. The SWMP also identifies preliminary monitoring requirements to confirm mitigations are effective and the process for identifying and implementing adaptive measures if measures are not effective. This document does not cover methods used by the province for managing surface water at a larger regional / drainage basin level, nor how operation of the LMOC and LSMOC will function within the provincial flood management system. Operation of the project will occur in accordance with the Project Operating Guidelines.

The SWMP supports the requirements described in Section 2.5 of the Project Environmental Requirements (PERs) regarding Working Near Water. Section 2.5 defines this as any and all activities occurring below the ordinary high-water mark of a waterbody, and that apply to work in or near fish-bearing and non-fish bearing waterbodies, dewatering, temporary diversions, temporary crossings and access pads, stream crossings (bridges and culverts), blasting near a waterbody, debris and sedimentation removal, and water quality monitoring.

The SWMP is intended to be a living document that will be refined over the life of the Project and will be updated as detailed design advances and various aspects are implemented, incorporating lessons learned and applicable engagement feedback provided via regulators, stakeholders and/or rights-holders.

Different surface water management strategies are required for the LMOC and the LSMOC as these distinct components of the Project are located in substantially different hydrologic settings. The LMOC, for example, is located in a well-developed agricultural area with an established drainage network, whereas the LSMOC is located in an undeveloped wetland and forested area. Furthermore, the strategies for handling local surface water drainage differ between the two channels as their specific designs impact on how surface water can be managed. Given these overarching site-specific differences, the SWMP is organized into three parts:

- Part 1 contains general information that is common to both the LMOC and LSMOC.

- Part 2 contains information that is specific to the LMOC.
- Part 3 contains information that is specific to the LSMOC.

A number of other environmental management and monitoring plans are being developed for the Project that deal with aspects of water management, including a Groundwater Management Plan (GWMP), Aquatic Effects Monitoring Plan (AEMP), a Sediment Management Plan (SMP), an Ice Management Plan (IMP) and a Wetland Monitoring Plan (WetMP). The SWMP and other related environmental management and monitoring plans may be updated during/following detailed design based on input from engagement processes and environmental approvals, permits and licenses. Regional and operational surface water monitoring is included in the AEMP.

2.0 OBJECTIVES

The SWMP has been developed to address the following objectives:

- Describe measures to manage local surface water during and after construction of the LMOC and LSMOC, and the associated potential for erosion, transport and deposition of sediments and pollutants beyond construction areas and into off-site receiving water bodies.
- Summarize monitoring plans for surface water quality and quantity in the vicinity of the LMOC and LSMOC to verify that the measures implemented meet requirements and identify additional contingency measures to be considered for implementation in the event of emergency conditions or undesirable circumstances.

3.0 MANAGEMENT CRITERIA

3.1 General Considerations

The management criteria used for the development of the SWMP are based on experience with other similar large-scale projects and will be updated, as required, considering Project risks, costs, and input from on going engagement and consultation and the environmental regulatory review processes. As indicated, Section 2.5 of the PERs discusses requirements for Working Near Water. Managing activities near water requires adherence to criteria that dictate what is acceptable and when actions are required. This includes a combination of design measures, monitoring, and water quality criteria.

3.2 Water Quality Criteria

Water quality management controls during Project construction will be designed by the Contractor, in accordance with contract requirements and with approval from Manitoba Transportation and Infrastructure or the Contract Administrator, to allow discharge into waterbodies using various methods of containment, treatment and discharge. The actions will be guided by a combination of the results of visual inspections and testing, where appropriate as determined by the Inspector, and meeting appropriate Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) objectives and Canadian Council of Ministers of the Environment (CCME) and Federal Environmental Quality Guidelines for the protection of aquatic life in waterbodies. In combination with observable changes in surface water (e.g., oil sheens, sediment plumes), these guidelines form the basis of the adaptive management and follow-up measures described in Sections 7.0 and 11.0 of this document and the relevant adaptive management sections of the other EMPs.

3.3 Design Criteria

3.3.1 Lake Manitoba Outlet Channel

For the construction phase, the water management controls related to the SWMP for the LMOC will be designed, constructed, and maintained to manage precipitation and surface run-off. Additionally, to prevent soil erosion and discharge of sediment-bearing water runoff, erosion and sediment control measures will be designed, installed and maintained until construction is completed and/or vegetation has been established on disturbed areas. These measures are further described in the SMP.

For the operation phase, the permanent works related to the management of local surface water runoff for the LMOC will be designed as follows:

- The design discharge for the outside drain will be based on the 1 in 10-year runoff event from the contributing area west of the channel alignment. This event was selected to be in line with current provincial drainage standards typically applied in rural settings.

- Average velocities within the outside drain to be less than 1.0 metres per second (m/s) during the design runoff event, with appropriate erosion protection measures used in areas where hydraulic conditions exceed this criterion.
- The design of drainage crossing structures (i.e., culverts) will comply with Manitoba Transportation and Infrastructure Water Control & Structures' Structures Design Manual.

Since surface water in the vicinity of the LMOC is not being used for drinking, drinking water quality standards do not apply. Should a runoff event or series of runoff events be experienced that exceeds the design criteria, then the impacts will be evaluated, and contingency measures as described in Section 7.3 implemented, if required.

3.3.2 Lake St. Martin Outlet Channel

For the construction phase, the water management controls related to the SWMP for the LSMOC will be designed, constructed and maintained to manage precipitation, surface run-off. Additionally, to prevent soil erosion and discharge of sediment-bearing water runoff, erosion and sediment control measures will be designed, installed and maintained until construction is completed and/or vegetation has been established on disturbed areas. These measures are further described in the SMP.

For the operation phase, the permanent works related to the management of local surface water runoff for the LSMOC will be designed as follows:

- The outside drain will be designed to maintain shear stress in the channel below the adopted erosion threshold value of 6 Pascals for clay and clay till during the 1 in 10-year runoff event. It will also convey flows up to the 1 in 10-year runoff event without causing inundation of adjacent land. Select portions of the outside drain that are incised in mineral soil through high topographic areas will be maintained in a similar manner as other provincial drains across Manitoba. Other portions of the drain that cut through peat will have minimal maintenance. The hydraulic roughness of the drain will change over time from growth of vegetation in the unmaintained areas. At those locations, this will result in higher water levels in the drain. Under this condition, the design allows for some inundation of adjacent land during the 1:10 year runoff event without damaging LSMOC infrastructure.
- Rockfill Gradient Control Structures within the outside drain are designed to incur minimal damage at the 1 in 25-year event and accommodate the 1 in 200-year event without significant risk of complete failure (i.e., washout of structure).
- Flow from the outside drain will either discharge directly into Lake Winnipeg, or into the LSMOC through a drainage control structure (i.e., culverts) at the downstream end.

Since surface and ground water in vicinity of the LSMOC is not being used for drinking, drinking water quality standards do not apply. Should a runoff event or series of runoff events be experienced that exceeds the design criteria, then the impacts will be evaluated, and contingency measures as described in Section 11.3 implemented, if required.

Part 2: Lake Manitoba Outlet Channel

4.0 SOURCES OF WATER

4.1 Surface Water

Surface water includes the runoff contribution from snowmelt and rainfall within the LMOC area (i.e., the excavated area) as well as any additional runoff from outside of the LMOC area that naturally or artificially drains towards the LMOC.

Existing drainage in the region around the LMOC generally flows towards the lower lying area between Watchorn Bay on Lake Manitoba and Birch Bay on Lake St. Martin. This low-lying area includes Watchorn Creek, draining south to Lake Manitoba, with Reed Lake, Clear Lake, Water Lake, Goodison Lake and Birch Creek draining north to Lake St. Martin. The proposed LMOC will be located immediately to the west of this low-lying area and will block existing drainage paths originating from the west.

Figure 1 shows the overall catchment area for the watershed, along with the delineation of the nine western sub-basins that will be blocked by the LMOC. The drainage areas for these sub-basins are listed in Table 1. The total existing drainage area for Birch Creek is approximately 295 square kilometres (km^2) and for Watchorn Creek is approximately 93 km^2.

Table 1: Characteristics of Sub-Basins Blocked by the LMOC

Sub Basin Name	Drainage Area (km^2)
W150 - West	2.7
W840 - West	20.8
W840A - West	5.1
W610-West	17.8
W550 - West	3.5
W530-West	19.5
W510 - West	1.1
W490 - West	10.6
W490A - West	0.4

The blockage of surface water runoff by the LMOC will reduce the drainage area of Birch Creek and Watchorn Creek by approximately 27% and 3%, respectively.

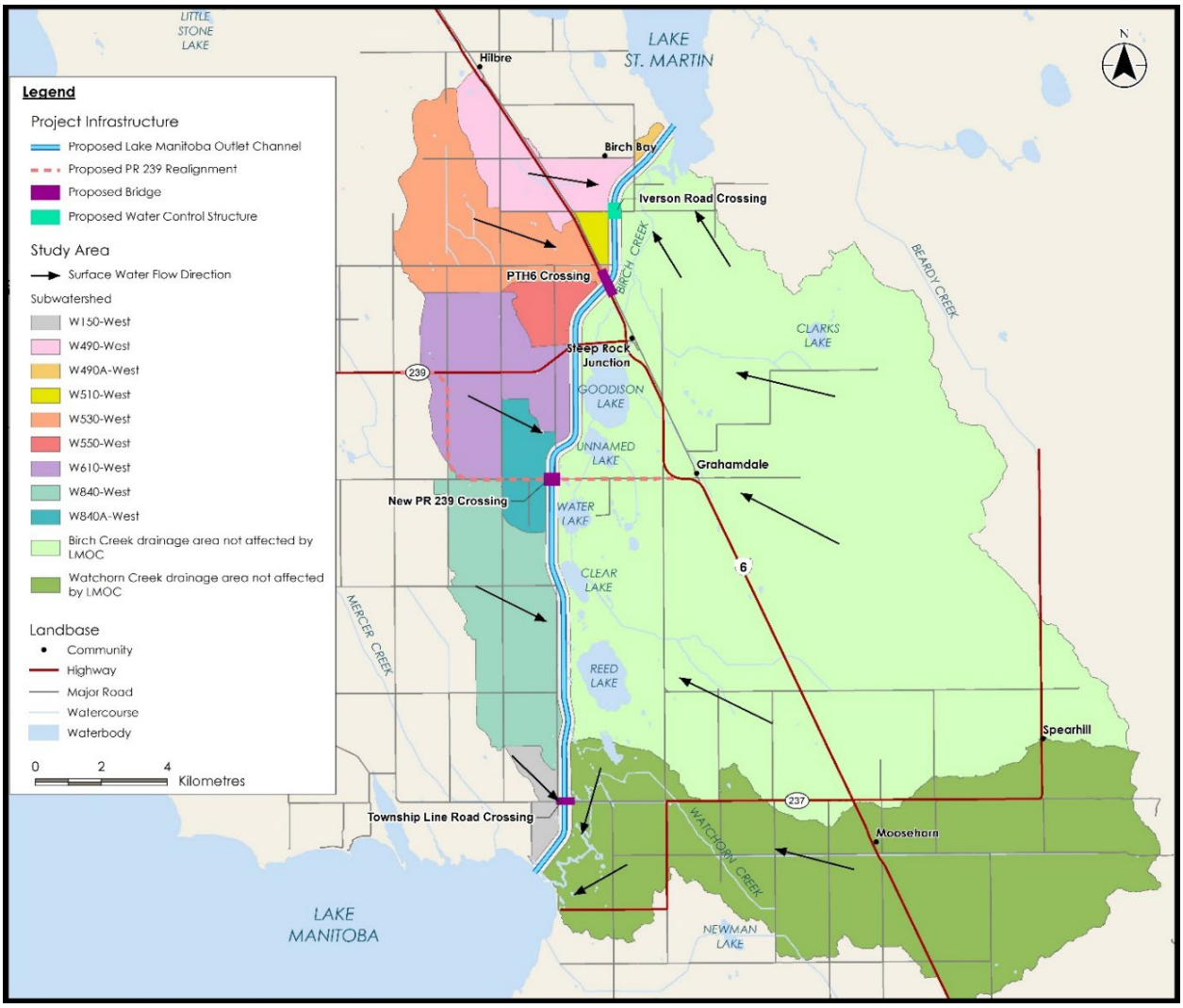


Figure 1: Surface Water Catchment Areas in Vicinity of the LMOC

4.2 Groundwater

The bedrock aquifers in the study area are composed of the Paleozoic rock sequence commonly referred to in Manitoba as the "Carbonate Aquifer System" and is considered to be the principal aquifer in the region. The primarily used aquifer in the LMOC region (referred to as the Upper Carbonate Aquifer) resides approximately in the highly fractured upper 30 metres (m) of bedrock. In areas where the bedrock aquifer pressures are elevated relative to the thickness of the confining till aquitard units, particularly during channel excavation and unloading of the confining aquitard units, there is a risk of basal heave/hydraulic fracturing of the till.

During construction, active depressurization (pumping from wells) will be undertaken to lower the pressure head in the bedrock aquifer in the vicinity of the channel alignment. Depressurization wells will be placed at select locations along the LMOC construction perimeter with each well releasing groundwater from the confined aquifer to the surface, thereby reducing aquifer pressure.

During operation, passive depressurization along the channel will take place via depressurization wells and reverse drains. Depressurization wells will passively release groundwater into the LMOC, while reverse drains will involve excavating to the bedrock and infilling with coarse material. The coarse material will act as a cover and provide the higher hydraulic conductivity required to allow water to flow upward from the bedrock aquifer into the LMOC. More information on groundwater and groundwater management is available in the GWMP.

4.3 Processed Water

Processed water consists of any water considered to be a direct product of the construction activities only and, as such, may require the implementation of mitigation measures, such as settling ponds and/or chemical remedies to meet regulatory requirements. Potential sources of processed water for the LMOC will be defined during detailed design and may include, but are not limited to:

- Dewatering of excavation areas.
- Accidental spills and releases.
- Leachate from rock stockpiles and structures containing rock exposed to surface waters and/or drainage.
- Control and treatment of sewage water from any construction camps that may be established.
- Blasting (if required).

5.0 SURFACE WATER MANAGEMENT

The management measures to control and mitigate environmental effects are described in the following sections, and as indicated, are developed to support the requirements in the PERs.

5.1 Construction Phase (Temporary Measures)

Temporary measures will be required during construction to manage surface water to improve constructability, control the potential for erosion and manage sediments. The specific measures will depend on construction staging and sequencing until the permanent works are completed. Construction methods for temporary drainage works will consider the erosion and sediment control measures described in the SMP.

No untreated wastewaters will be released to the environment from Project construction sites, including construction camps and staging areas. Wastewater will be treated by acceptable industry methods before being released.

5.1.1 Channel Works

Channel works include construction activities related to the LMOC, excluding the inlet and outlet works, WCS and road bridges. The primary method of managing surface water during construction of the channel works will be via a permanent outside drain, which will be constructed in advance of the channel excavation. The outside drain will be located along the west side of the LMOC to intercept the watershed runoff originating from the west (which will include drainage from a portion of the realigned and upgraded section of PR 239) and prevent it from flowing into the construction zone. The outside drain will also be used to convey water from local construction dewatering and groundwater depressurization works along the LMOC. The drain will be sloped from a highpoint to be established where realigned PR 239 will cross the drain. Water in the outside drain north of this location will drain to Lake St. Martin, while water south of this location will drain to Lake Manitoba, as shown on Figure 2. Permanent culvert crossings will be constructed where the outside drain crosses Township Line Road, Provincial Trunk Highway (PTH) 6 and Iverson Road, while temporary culverts will be installed where it crosses existing PR 239, as well as other construction detours as required. The design of the permanent outside drain is described further in Section 5.2.1.

Surface water naturally flows away from the east side of the LMOC toward the existing wetlands and creeks. Accordingly, no outside drain will be required on that side of the channel. Management of surface water flows and groundwater seepage within the channel excavation will be the responsibility of the Contractor. Pumping will be required for construction of the channel works to manage surface water runoff within the excavation and to facilitate aquifer depressurization requirements.

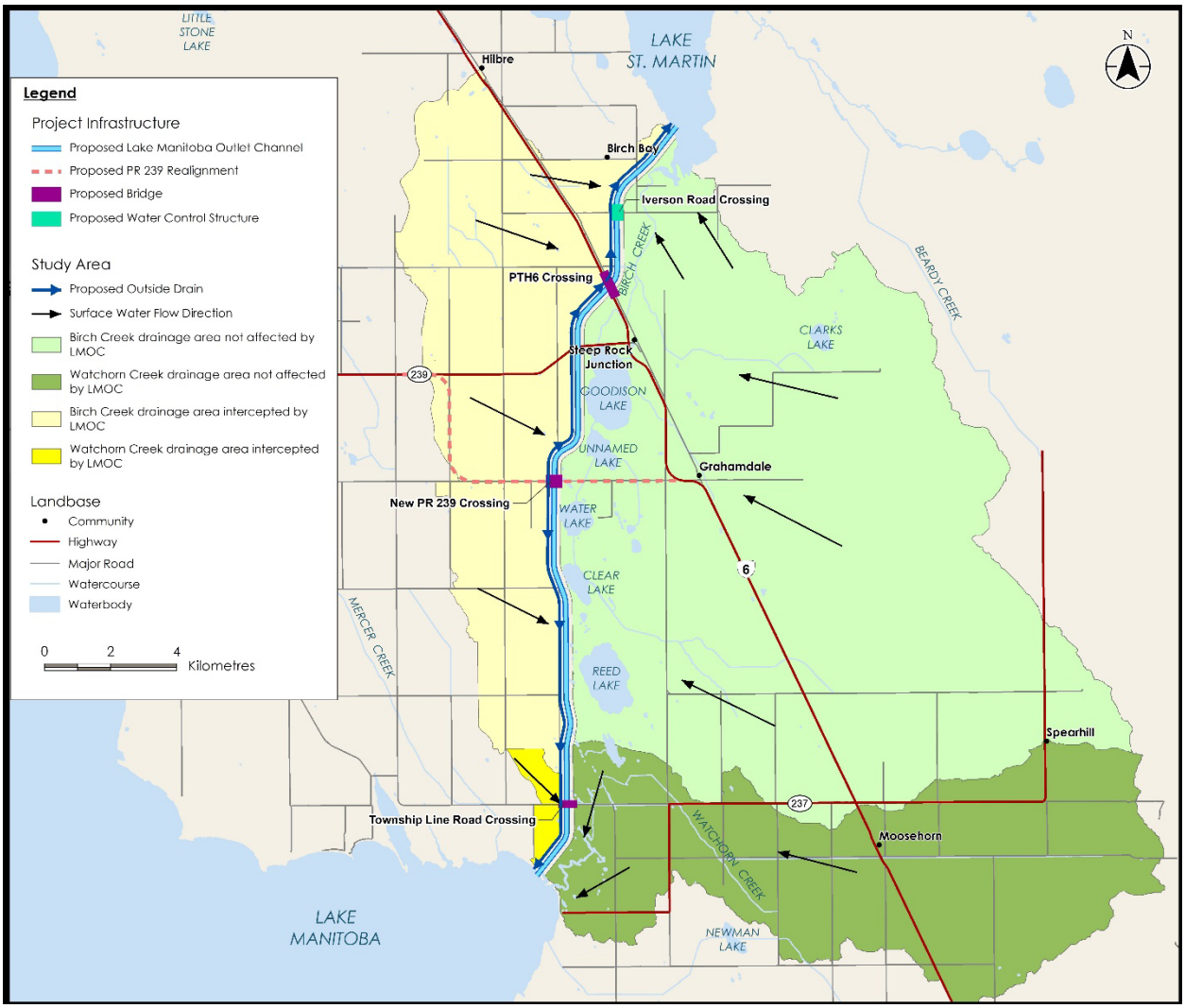


Figure 2: LMOC Outside Drain Arrangement

Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in Section 3.1. Settling ponds will be constructed, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction. As described in Section 5.2, the primary method to prevent or minimize the potential for erosion will be through the establishment of permanent vegetation. Until vegetation is established, temporary erosion and sediment control measures will be employed during construction, as described in the SMP.

5.1.2 Inlet Works

The inlet works, will consist of excavating the lake bottom within an approximately 140 m long by 215 m wide area of Lake Manitoba (Watchorn Bay). This excavation is expected to take place "in-the-wet" with the construction area isolated by a double turbidity curtain (i.e., two separate turbidity curtains) to prevent or minimize the migration of disturbed sediments into the lake during construction. A fish salvage program will be required within the isolated area which will be developed and conducted in accordance with Section 2.5.5 of the PERs.

Installation and removal of the double turbidity curtain, as well as the excavation work itself, will comply with Fisheries and Oceans Canada (DFO)'s Restricted Activity Timing Windows (https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html), and will be completed in accordance with the conditions outlined in the DFO Authorization. Removal of the curtain would occur once monitored water quality parameters on both sides of the curtain are similar and meet the criteria outlined in Section 3.1.

Specific methods of construction within the area will be determined by the Contractor, in accordance with contract document and with approval from Manitoba Transportation and Infrastructure or the Contract Administrator. Alternate construction methods may be proposed, such as isolating the area with a cofferdam that would be constructed behind a turbidity curtain. In this case, any water that must be pumped outside of the work area would be discharged into settling ponds, if necessary, prior to release into Lake Manitoba.

5.1.3 Outlet Works

The outlet works will consist of excavating the lake bottom within an approximately 140 m long by 115 m wide area of Lake St. Martin (Birch Bay). Construction activities and measures to manage surface water during construction will be similar to the inlet works, as described in Section 5.1.2.

5.1.4 Water Control Structure

As is also the case for the channel works, pumping will be required for construction of the water control structure (WCS) to manage surface water runoff within the excavation and to facilitate aquifer depressurization requirements. The WCS work area will be isolated from the rest of the channel construction work areas to reduce the amount of pumping required and to prevent additional surface water runoff from entering the construction area. Other potential sources of water include various types of processed water, as described in Section 4.3. Management of surface water flows and groundwater seepage within the excavation will be the responsibility of the Contractor.

Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in Section 3.1. Settling ponds will be constructed adjacent to the work area, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction.

5.1.5 Road Bridges

As is also the case for the channel works, pumping will be required for construction of the bridges to manage surface water runoff within the excavation and to facilitate aquifer depressurization requirements. The bridge work areas will be isolated from rest of the channel construction work areas to reduce the amount of pumping required and to prevent additional surface water runoff from entering the construction area. Other potential sources of water include various types of processed water, as described in Section 4.3. Management of surface water flows and groundwater seepage within the excavation will be the responsibility of the Contractor.

Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in Section 3.1. Settling ponds will be constructed adjacent to the work area, as deemed necessary, prior to discharge into the outside drain and/or the waterbodies east of the LMOC, or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction.

5.1.6 PR 239 Realignment

Management of surface water flows associated with the PR 239 realignment will be the responsibility of the Contractor. It is anticipated that existing ditches along the PR 239 realignment route will be used for the conveyance of surface water runoff during its construction with appropriate erosion and sediment control measures in place.

5.1.7 Sediment Management

A separate SMP for the control of erosion and sediment has been prepared for the Project. The SMP identifies temporary and permanent measures that will be incorporated during construction until vegetation has been established on disturbed areas to prevent or minimize the potential for erosion and to mitigate the transport and deposition of sediments beyond construction areas and into off-site receiving water bodies. These measures will be developed to meet requirements outlined in the provincial environmental license and federal decision statement conditions.

5.2 Operation Phase (Permanent Measures)

Once construction is complete, surface water from outside of the Project area (i.e., west of the channel) will continue to be managed with the permanent outside drain used to facilitate management of runoff during construction, as described in Section 5.2.1. Surface water runoff within the right-of-way (ROW) of the LMOC will either discharge into the LMOC or away from the channel.

Temporary erosion and sediment control measures will be maintained until vegetation has fully established, and it is confirmed that the water quality criteria outlined in Section 3.1 can be maintained in the long term. Refer to the SMP and Revegetation Management Plan (RVMP) for further details.

Construction of the LMOC will result in a reduction to the catchment area of Birch Creek and Watchorn Creek, as described in Section 4.1. Plans to address the potential effects to these waterbodies are discussed in the Aquatic Offsetting Plan. Construction of a small, gated control structure through the east dike of the LMOC at Rafkillsen Road is under consideration that could be used to augment flows in the lower Birch Creek with water from the channel, and thus reduce the flow reduction in this portion of Birch Creek due to the reduction in the drainage area caused by presence of the LMOC. Additional details on this proposed structure are described in Section 5.2.2.

5.2.1 Outside Drain

The outside drain that will be initially constructed to facilitate management of runoff during construction, as described in Section 5.1.1, will be utilized as part of the permanent drainage works for the LMOC to collect surface water runoff arriving from the west and convey it into Lake Manitoba and Lake St. Martin, as shown previously on Figure 2. On the east side, surface water naturally flows away from the LMOC toward the existing wetlands and creeks. Accordingly, no outside drain will be required on that side of the channel.

The preliminary hydraulic design of the outside drain was based on a trapezoidal channel shape with 4H:1V side slopes and sized for the 1 in 10-year runoff event. The drain base width varies between 4 m and 25 m. The outside drain invert and longitudinal slopes were set to follow the existing ground elevation profile to reduce excavation depths, while also keeping the design water surface profile at or below the existing prairie level, as well as the inverts of the existing lateral drains that will discharge into it, so as to not result in backwater effects during the 1 in 10-year runoff event with Lake Manitoba and the south basin of Lake St. Martin at the upper end of their normal operating ranges (i.e., el. 247.65 m [812.5 feet (ft)] and el. 243.84 m [800.0 ft], respectively). No diking is required along the west side of the outside drain to accommodate the passage of the 1 in 10-year runoff event.

Figure 3 and Figure 4 show the hydraulic profile for the south and north reach of the outside drain for the 1 in 10-year runoff event, respectively.

The outside drain is designed to be non-eroding during passage of the 1 in 10-year runoff event by keeping average velocities below 1.0 m/s. Higher velocities are expected in the steeper portions of the north reach near Iverson Road and where the outside drain connects to Lake St. Martin. Permanent gradient control structures are anticipated to be required in these areas to accommodate the higher velocities and control erosion. The configuration of these gradient control structures will be determined during detailed design.

Permanent culvert crossings will be required under Township Line Road, PTH 6 and Iverson Road, which will be designed to Manitoba Transportation and Infrastructure Water Control & Structures design requirements. It is presently anticipated that 3–1800-millimetre (mm) diameter corrugated steel pipes (CSP) (i.e. culverts) with be required at Township Line Road, while 2-1500 mm diameter CSPs will be required at Iverson Road. The crossing at PTH 6 is anticipated to consist of a single 2400 mm x 2400 mm cast-in-place concrete box culvert. All culverts will be embedded into the bed of the outside drain by 300 mm.

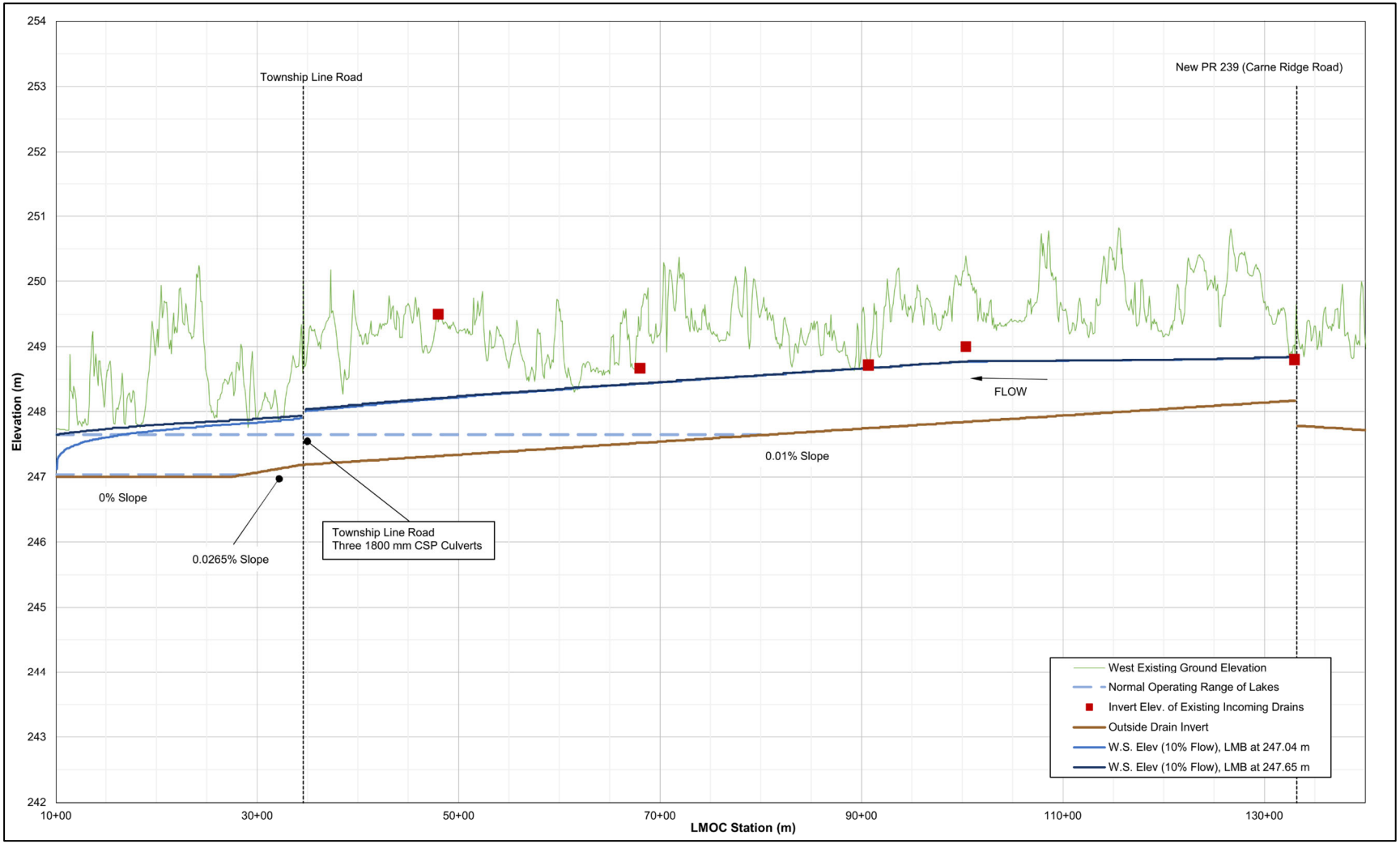


Figure 3: LMOC Outside Drain Profile – South Reach

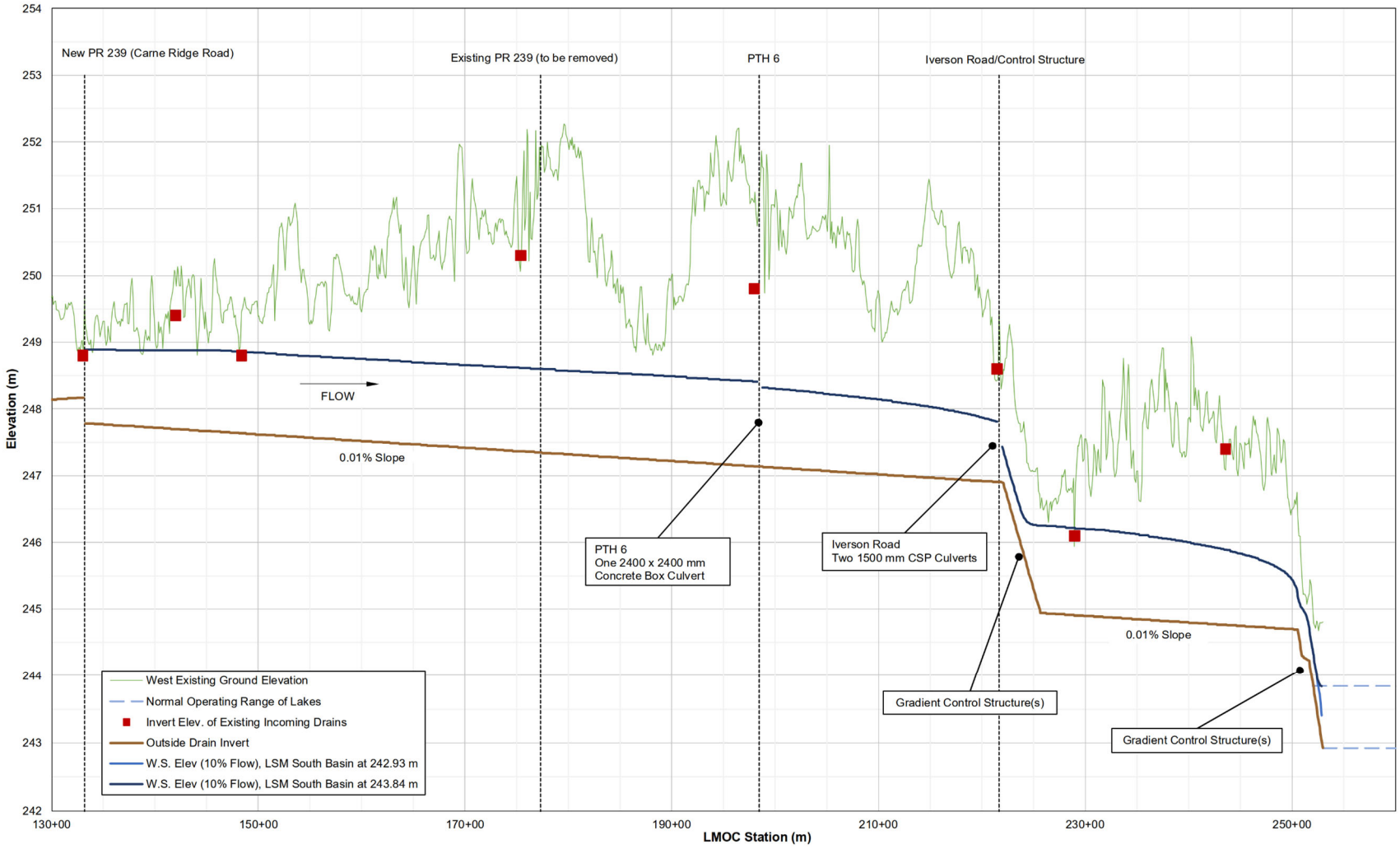


Figure 4: LMOC Outside Drain Profile – North Reach

Consideration is being given to incorporating passive wetland treatment in order to mitigate potential effects of agricultural runoff that may enter the outside drain. Such wetlands could be located immediately downstream of agricultural operations in order to facilitate filtering of runoff prior to it leaving those sites. In addition, natural vegetation will grow in the shallow water depths within a portion of the outside drain near where it discharges into Lake Manitoba which will provide some additional filtering of runoff. Water quality monitoring, in the outside drain and near the discharge point to the lake will be undertaken to assess if additional measures are needed.

5.2.2 Augmentation of Birch Creek Flows

Consideration is being given to constructing a small, gated control structure where the undeveloped Rafkillsen Road Government Road Allowance intersects the LMOC, which is located between PTH 6 and the proposed WCS at Iverson Road. The purpose of the proposed structure (which is referred to as the Birch Creek Flow Augmentation Structure) would be to allow for the controlled release of LMOC water into the lower Birch Creek in order to restore flow that will be lost due to the reduction in the drainage area caused by the construction of the LMOC.

The proposed structure would be comprised of a gated conduit with concrete headwalls built through the east channel bank. The conduit would be approximately 1 m in diameter and would accommodate conveyance of a flow rate of up to 0.5 cubic metres per second (m^3/s) by gravity into an approximately 490 m long discharge channel that would be constructed along the undeveloped Rafkillsen Road Government Road Allowance and tied-into Birch Creek. Riprap protection would be installed at the downstream end of the conduit to control erosion and assist in dissipating the energy of the released flow.

The Birch Creek Flow Augmentation Structure would only be operated during open-water periods when the LMOC WCS gates are closed, and thus would be designed to accommodate water levels in the LMOC that reflect the normal operation range of Lake Manitoba (i.e., el. 247.04 m to 247.65 m [810.5 ft to 812.5 ft]). The structure's gate would be utilized to control the amount of flow released and the timing of the releases to coincide with critical fish spawning periods in Birch Creek.

5.2.3 Conditions in the LMOC

Expected flow sources into the LMOC include discharge from Lake Manitoba (when the WCS gates are open) and runoff originating from within the LMOC ROW. Water will be present throughout the LMOC when the WCS gates are closed. Under this condition, the water level in the channel upstream of the WCS will be equal to the water level on Lake Manitoba, and on the downstream side of the WCS it will be equal to the water level on Lake St. Martin.

When the WCS gates are initially opened, the water level in the LMOC will drop approximately 2.8 m immediately upstream of the WCS and will increase in the upstream direction such that it is equal to the level of Lake Manitoba at the inlet. Immediately downstream of the WCS, the water level in the LMOC will rise by approximately 0.6 m and will decrease in the downstream direction such that it is equal to the level of the south basin of Lake St. Martin at the outlet. Water levels along the channel will then rise and fall in response to the levels of Lake Manitoba and Lake St. Martin.

The mode of operation of the LMOC is such that some revegetated portions of the channel side slopes (above the channel armouring) will experience alternating periods of submergence (wet) and exposure (dry). This could lead to zones where vegetation may not survive or grow well, thus making these portions of the slopes potentially susceptible to erosion. Measures to mitigate this risk are discussed in the RVMP and the SMP.

5.2.4 Revegetation Plan

Maintaining and establishing a vegetation cover along the LMOC is fundamental to minimizing the erosion potential, during both its construction and operation. The revegetation approach will be dynamic and flexible in terms of its implementation under potentially challenging hydrological conditions and is described further in the RVMP.

6.0 MONITORING

6.1 Baseline Monitoring

Figure 5 identifies baseline surface water quality monitoring locations. Baseline water quality data have been collected between 2016 and 2021 for waterbodies in the vicinity of the LMOC. Baseline data will form the basis of comparison to monitor for changes in surface water quality in waterbodies in the vicinity of the LMOC during construction and for two years post-construction. Additional data collected since 2021 will be added to the data compilation prior to construction. Sites for baseline monitoring in the vicinity of the LMOC were selected to represent the variety of waterbodies that may be impacted by construction of the LMOC. In addition, as described in the WetMP, baseline wetland surface water quality monitoring is planned in the vicinity of LMOC prior to construction.



Figure 5: LMOC Baseline Surface Water Quality Monitoring Locations

6.2 Construction Phase Monitoring

6.2.1 Overview

Surface water will be monitored during construction to identify changes that may result from construction activities along the LMOC and to assess the effectiveness of proposed mitigations and the SMP. If the water quality criteria identified in Section 3.1 are exceeded and attributed to the Project, then additional mitigation measures would be considered, as described in Section 7.0. Where monitoring results show impacts that are not attributed to the Project, information will be provided to Manitoba Environment, Climate, and Parks.

LMOC construction-phase surface water monitoring will be conducted for the duration of the construction phase. The frequency and location of sample stations included in the program will change as the construction staging advances. Determination of frequency and location of samples will also be based on:

- environmental considerations described in the Project EIS
- proximity and potential for change to local fish-bearing receiving waters as a result of the works
- monitoring plans being developed for the Project as part of other management plans (such as the AEMP, the GWMP and Wetland Management Plan)
- input from engagement processes and regulatory input.

Monitoring plans are provided in the sub-sections that follow related to:

- discharges from construction areas
- surface water quantity and quality in lakes and streams in the vicinity of the LMOC
- sediment monitoring for in-lake excavation and commissioning activities
- cattle operation runoff.

6.2.2 Discharge from Construction Areas

Effects on surface water quality from the construction of the Project were predicted in the environmental assessment (EA) process. The Project may affect surface water quality via introduction of sediment to waterbodies, discharge of groundwater to surface water, and accidental spills and leaks during Project construction.

Water quality criteria outlined in Section 3.2 for the protection of aquatic life will be met where water is discharged from the Project construction area to waterbodies (see EPP mapbooks for delineation of such areas within the Project Development Area [PDA]). An Environmental Monitor on site will implement a monitoring program for turbidity, total suspended sediment (TSS), dissolved oxygen (DO), and other relevant parameters at discharge points at an appropriate frequency to confirm compliance.

Sediment in Discharges

Sediment monitoring of construction site discharges will include general observations during routine surveillance activities (i.e., areas of exposed soil and/or sediment plumes) and monitoring of turbidity using hand-held sampling devices. The objective of monitoring TSS and turbidity during construction activities is to confirm that sediment mitigation measures and erosion and sediment controls are effective and that

discharges from the Project construction area are managed appropriately before release to waterbodies. The monitoring results will be used to inform adaptive management of construction activities to reduce construction related increases in suspended sediment concentrations. This monitoring plan will be modified as needed in the field to complement the construction activities as they are developing; however, general guidelines for sediment monitoring of construction site discharge are as follows:

- Consider site-specific waterbody characteristics, including receiving waterbody size and width, water depth, water velocity and flow (i.e., laminar flow vs. turbulent flow). Monitoring transects may be established where background and downstream water samples may be collected in a manner that captures changes in suspended sediment concentrations near the construction site. Where a visual plume is observed, a sample will be taken from the middle of the plume and as close to the source as safely possible. Water samples will be at 50% water depth where water is less than 1 m deep. Where waterbodies are greater than 1 m deep, samples will be taken at 20% and 80% of water depth at each transect sample point and results averaged.
- When sediment introduction to the waterbodies is likely, turbidity sampling will be completed at appropriate intervals. If turbidity levels remain constant and low, the sample frequency may be reduced, or halted altogether, as directed by the Inspector.
- Daily turbidity monitoring records will be kept and maintained during construction and will be available on site. Upon completion of construction activities, a final construction monitoring report with all sampling and testing data will be produced.

Other Parameters in Discharges

Where water discharged from the Project construction area may exceed CCME-Protection of Freshwater Aquatic Life (PAL) guidelines and MWQSOG-PAL objectives as outlined in Section 3.1, an Inspector or Environmental Monitor will sample such water prior to discharge to a waterbody for appropriate parameters (DO, temperature, conductivity, and pH) which may be altered by groundwater discharge.

Spills and Leaks

An Inspector or Environmental Monitor will visually inspect discharges from the Project construction area for indications of spills and leaks, such as sheen and foam. In the event of a release during Project construction, contractors will follow their own spill response plans, which will have been reviewed and approved by Manitoba Transportation and Infrastructure as part of their contract submittals. The PERs describe measures to address accidents and spills, including reporting, cleanup, compliance training, inspection, and enforcement.

6.2.3 Surface Water in Local Waterbodies

Surface water monitoring during construction will include collection of surface water quality samples and water level measurements within the vicinity of the LMOC. Water levels are anticipated to be monitored at selected locations in small lakes along Birch Creek using staff gauges and/or continuous level recorders, to be determined during the detailed design phase. This monitoring will be incorporated in the SWMP at detailed design, as required, in consideration of other EMP requirements.

Proposed surface water quality monitoring sites will include previously established baseline sites in the vicinity of the LMOC (see Section 6.1). Monitoring locations may be adjusted as designs are advanced and additional engagement input is received from regulators, rights-holders, and public stakeholders. They will also be positioned to address any relevant regulatory approvals conditions. Proposed water quality parameters to be monitored for are listed in Table 2 including routine chemistry, total and dissolved nutrients, carbon, total and dissolved metals (including mercury), bacteria, hydrocarbons, and pesticides. Monthly open-water sampling at these monitoring sites is planned during active construction in the vicinity of the monitoring sites. Methylmercury in fish tissue and chlorophyll *a* monitoring are included in the AEMP during Project commissioning.

All surface water quality samples will be collected following standard procedures, will be submitted to an accredited laboratory for analysis, and subject to standard quality assurance (QA)/quality control (QC) processes.

Table 2: Proposed Surface Water Quality Monitoring Parameters

Water Quality Parameters	
Field Parameters	DO; Electrical Conductivity; Oxidation Reduction Potential; pH; Temperature; Turbidity
General Chemistry	Alkalinity, Bicarbonate (as CaCO3); Alkalinity, Carbonate (as CaCO3); Alkalinity, Hydroxide (as CaCO3); Alkalinity, Total; Hardness (as CaCO3); Total Dissolved Solids; Major ions (Sulfate; Chloride; Fluoride; Sodium; Potassium)
Sediment	TSS
Microbiological Parameters	*Escherichia coli (E.Coli);* Fecal Coliforms
Nutrients/Carbon	Ammonia (as N); Nitrate (as N); Nitrite (as N); Total Kjeldahl Nitrogen; Nitrogen (Total); Phosphorus, Total; Phosphorus, Total (Dissolved); Phosphorus, Total (Particulate); Phosphate (PO4), dissolved and reactive; Dissolved Organic Carbon (DOC); Dissolved Inorganic Carbon (DIC); Total Organic Carbon (TOC); Total Inorganic Carbon (TIC)
Petroleum Hydrocarbons	Benzene; Toluene; Ethylbenzene, Xylene (BTEX); Hydrocarbons
Metals	Standard Total/Dissolved Metals Scan (including Mercury)
Pesticides	Glyphosate; Organochlorinated

6.2.4 Sediment Monitoring for In-Lake Excavation and Commissioning Activities

A detailed in-lake real-time TSS monitoring program will be implemented during construction to monitor the magnitude of spatial, and temporal changes in TSS concentrations within the vicinity of the PDA during in-lake construction (inlet and outlet works) and commissioning activities. The monitoring program design is based on the expected construction effects on the sedimentation regime in Watchorn Bay and Birch Bay, and recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2A of the SMP.

6.3 Operation Phase Monitoring

Collection of surface water quality samples and water level measurements at previously established baseline sites will continue following construction of the LMOC. This monitoring will initially be carried out during the first two years post-commissioning, the intent of which is to confirm the effectiveness of construction mitigations and site restoration measures. This duration may be extended depending on the monitoring results, environmental conditions present and success of revegetation.

The frequency and locations of the water quality monitoring conducted during the 2 year post-commissioning period will be based on specific environmental conditions present, success of revegetation, and adjusted, as required, based on the monitoring results. Water quality monitoring parameters are expected to be consistent with those monitored during the construction phase, as summarized in Section 6.2.

Longer-term operation monitoring (which includes consideration of the frequency of use of the LMOC) will take place beyond the 2-year post-commissioning period as outlined in the AEMP and the Operation and Maintenance (O&M) Manual.

6.4 Cattle Operation Runoff

Cattle feedlots are present in the watershed catchment area surrounding the LMOC. Runoff from these feedlot areas, which currently flows toward the waterbodies on Watchorn Creek and Birch Creek during overland flooding events, can contain nutrients such as phosphorus and nitrogen as well as bacteria indicated by fecal coliforms.

Sampling and testing of runoff will be conducted in the vicinity of cattle operations. Samples will be analysed for typical lagoon effluent and compared to water quality guidelines referenced in Section 3.1. Proposed parameters are as follows:

- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD_5)
- Total Phosphorus (TP)
- Total Kjeldahl Nitrogen (TKN)
- Total Ammonia (NH_3-N)
- Total Nitrogen (TN)
- Nitrate/Nitrite

- Fecal coliforms
- Alkalinity
- TSS
- pH – field and lab
- DO - field
- Oxidation-Reduction Potential (ORP) – field
- Electrical Conductivity (EC) – field
- Turbidity.

Pre-construction monitoring will focus on monitoring the water quality of the runoff in the vicinity of cattle operations at discharge locations near where the point sources connect to the existing municipal drainage network. This information will be used to identify the need for specific mitigation requirements associated with each cattle operation. Management triggers and actions will be developed as the plan for management of cattle operation runoff is developed further.

Focused surface water quality monitoring in the vicinity of cattle operations will be continued during construction and post-construction phases, as needed, to confirm the effectiveness of mitigation. This may include some monitoring locations where the municipal drainage network connects to the outside drain, as well as a location within the outside drain where it discharges into Watchorn Bay.

6.5 Reporting

Annual surface water monitoring reports will be prepared throughout the construction phase and for the duration of monitoring ultimately conducted during the operation phase. The results of the cattle operation runoff water quality monitoring will be reported annually, or as needed.

7.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP

7.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The *Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

As discussed in Section 12.4.1.2 of the Project EIS, construction activities and the changes in flows and water levels caused by the Project may have minor effects on fluvial geomorphology, sediment and debris transport in the surface water local assessment area (LAA), but primarily during and immediately after construction. Suspended sediment levels may temporarily increase at work sites during construction activities, and at outlet areas during initial operation (gates open) of the outlet channels after a period of non-operation (gates closed). As such, the purpose and objectives of follow-up activities will be to monitor and further understand the residual effects due to the Project.

As indicated, the SWMP has been developed to address the requirements of Section 2.5 of the PERs regarding Working Near Water. Although the methods and recommendations outlined in the SWMP were developed based on site-specific expectations and conditions, it is accepted that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the design decisions during Project construction and long-term operation. Results from ongoing data collection and monitoring programs will inform and facilitate any necessary adjustments to this plan, to the extent feasible. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the Project designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback

during construction, temporary mitigation measures described in this SWMP, as well as those included in the SMP and RVMP, will be revisited and updated, as required. For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate revegetation methods may be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

7.2 Follow Up Response

As described in Section 6.0, monitoring will include visual inspections and water quality monitoring. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental regulatory approvals requirements. If conditions recorded appear to be exceeding criteria or management thresholds, relative to baseline conditions, then follow-up responses will be implemented as described in the sub-sections below, as well as those identified in the CEMP, PERs, SMP, RVMP and any other applicable plans under the EMP.

7.2.1 Construction

Discharges from Construction Areas

Should monitoring results indicate that the water to be discharged from construction areas do not meet the water quality objectives outlined in Section 3.2, the following tasks will be carried out:

- Environmental Monitor shall confirm the results are accurate (e.g., rule out measurement equipment malfunction).
- Environmental Monitor will discuss the exceedance with Manitoba Transportation and Infrastructure.
- Manitoba Transportation and Infrastructure shall consider undertaking additional monitoring further downstream of the discharge point (near the receiving local lakes and streams) to determine if the exceedance persists closer to those receiving waterbodies.
- Manitoba Transportation and Infrastructure or Contract Administrator will take action, which includes investigating the activity that is resulting in the exceedance and if it is still underway, implement mitigation, if necessary/possible. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):
    - temporary suspension of work activity
    - modifying the rate of discharge and/or location
    - apply mitigation measures as per the relevant plans under the EMP (such as installing additional erosion and sediment control measures as per the SMP, further aerating the discharge as per the GWMP, implementing spill/leak response as per the CEMP, etc.)
- Environmental Monitor shall record the event in the daily report.

Surface Water in Local Waterbodies

Surface water quality monitoring data in local lakes and streams in the vicinity of the LMOC will be reviewed as it is received. Should guideline exceedances attributable to Project construction activities be detected, adaptive management strategies will be implemented. Should monitoring results not meet the water quality objectives outlines in Section 3.1, then the following tasks will be carried out:

- Environmental Monitor shall confirm the results are accurate (e.g., rule out measurement equipment malfunction) and attributed to Project construction activities.
- Environmental Monitor will discuss the exceedance with Manitoba Transportation and Infrastructure.
- Manitoba Transportation and Infrastructure or Contract Administrator will take action, which includes investigating the activity that is resulting in the exceedance and if it is still underway, implement mitigation, if possible. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):
    - modifying the rate of discharge and/or location
    - apply mitigation measures as per the relevant plans under the EMP (such as installing additional erosion and sediment control measures as per the SMP, further aerating the discharge as per the GWMP, etc.)
    - temporary suspension of work activity
- Environmental Monitor shall record the event in the daily report.

Sediment Management for In-lake Excavation

Detailed adaptive response protocols will be implemented to address potential sediment effects during in-lake excavation work. The protocols are based on recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2A of the SMP.

Cattle Operation Runoff

Pre-construction cattle operation runoff water quality monitoring will be used to identify specific mitigation requirements associated with each cattle operation. Management triggers and actions will be developed as the plan for management of cattle operation runoff is developed further.

Focused surface water quality monitoring in the vicinity of cattle operations will be continued during construction and post-construction phases, as needed, to confirm the effectiveness of mitigation. This may include some monitoring locations where the municipal drainage network connects to the outside drain, as well as a location within the outside drain where it discharges into Watchorn Bay.

7.2.2 Commissioning

As with in-lake excavation, detailed adaptive response protocols will be implemented to address potential sediment effects during in-lake excavation work and commissioning activities. The protocols are based on recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2A of the SMP.

7.2.3 Operation Phase

Management triggers and adaptive management actions will be developed as per the operation phase monitoring program based on the results of the SWMP monitoring during construction.

7.3 Contingency Measures and Emergency Response

Contingency measures and emergency response will be developed for deployment in the event that aspects of this SWMP do not meet the water quality objectives or if the prescribed measures are overwhelmed during a severe runoff event greater than the design condition (or multiple successive large runoff events). Contingency planning will also be incorporated for unexpected events such as, but not limited to, an uncontrolled breach of a settling pond, or the failure of a pumping system for depressurization or dewatering. These will be developed by the Contractor in accordance with Section 1.3 of the PERs and submitted to Manitoba Transportation and Infrastructure for approval prior to start of construction.

Mitigation measures will be identified in the "base" plan that may include, for example, choosing locations of construction phase settling ponds to reduce direct surface runoff to aquatic environments. Contingency measures that would be implemented in the event of an emergency will also be identified that may include the deployment of straw rolls/wattles, erosion control blankets, rapid stabilization techniques, supplementary seeding, temporary settling ponds, etc. These will be developed as per the CEMP, PERs, SMP, RVMP and any other applicable EMPs.

In the event of an emergency, the Contractor, Manitoba Transportation and Infrastructure, and the Contract Administrator will determine which contingency and emergency control measures will be implemented. These contingency and emergency control measures would be carried out within a predetermined time period depending on the site conditions and nature of the emergency. Contingency measures will include monitoring at immediate downstream locations in the event of emergency conditions or undesirable circumstances.

During the operation phase, the channel will be resistant to large precipitation events through vegetation and armoring. Nevertheless, contingency and emergency control measures will be implemented by Manitoba Transportation and Infrastructure, depending on the site conditions and nature of the emergency, with due consideration given to the O&M manual that will be developed for the Project prior to the operation phase.

Part 3: Lake St. Martin Outlet Channel

8.0 SOURCES OF WATER

8.1 Surface Water

Surface water includes the runoff contribution from snowmelt and rainfall within the LSMOC area (i.e., excavated area) as well as any additional runoff from outside of the LSMOC area which naturally or artificially drains towards the LSMOC.

Along the LSMOC, most of the surface water flows naturally towards Buffalo Creek. Flows in Buffalo Creek were monitored between 2011 and 2015 to support aquatic monitoring of the Lake St. Martin Emergency Outlet Channel (EOC). Base flows in the creek, when the EOC was not in operation, were measured between approximately 1 m^3/s and 10 m^3/s and was estimated to range up to approximately 25 m^3/s in response to significant rainfall events.

Figure 6 shows the surface water catchment areas intercepted by the LSMOC alignment. The drainage areas for these sub-basins are summarized in Table 3.

The sub-basins listed in Table 3 drain to Buffalo Creek, with the exception of A3 which discharges directly to Lake Winnipeg. The LSMOC will reduce the total drainage area upstream of the Buffalo Creek confluence with the Dauphin River by approximately 51.5% (reduction from 31.5 km^2 to 15.3 km^2). The total sub-basin area contributing flows to the LSMOC outside drain will be 18.9 km^2 (A1, A2, and A3).

Table 3: Characteristics of Sub-Basins Intercepted by the LSMOC

Sub-Basin Name	Drainage Area (km^2)	Location Relative to LSMOC
A1	11.5	East
A2	4.7	East
A3	2.7	East
A4	6.5	West
A5	2.9	West
A6	0.9	West
A7	5.0	West

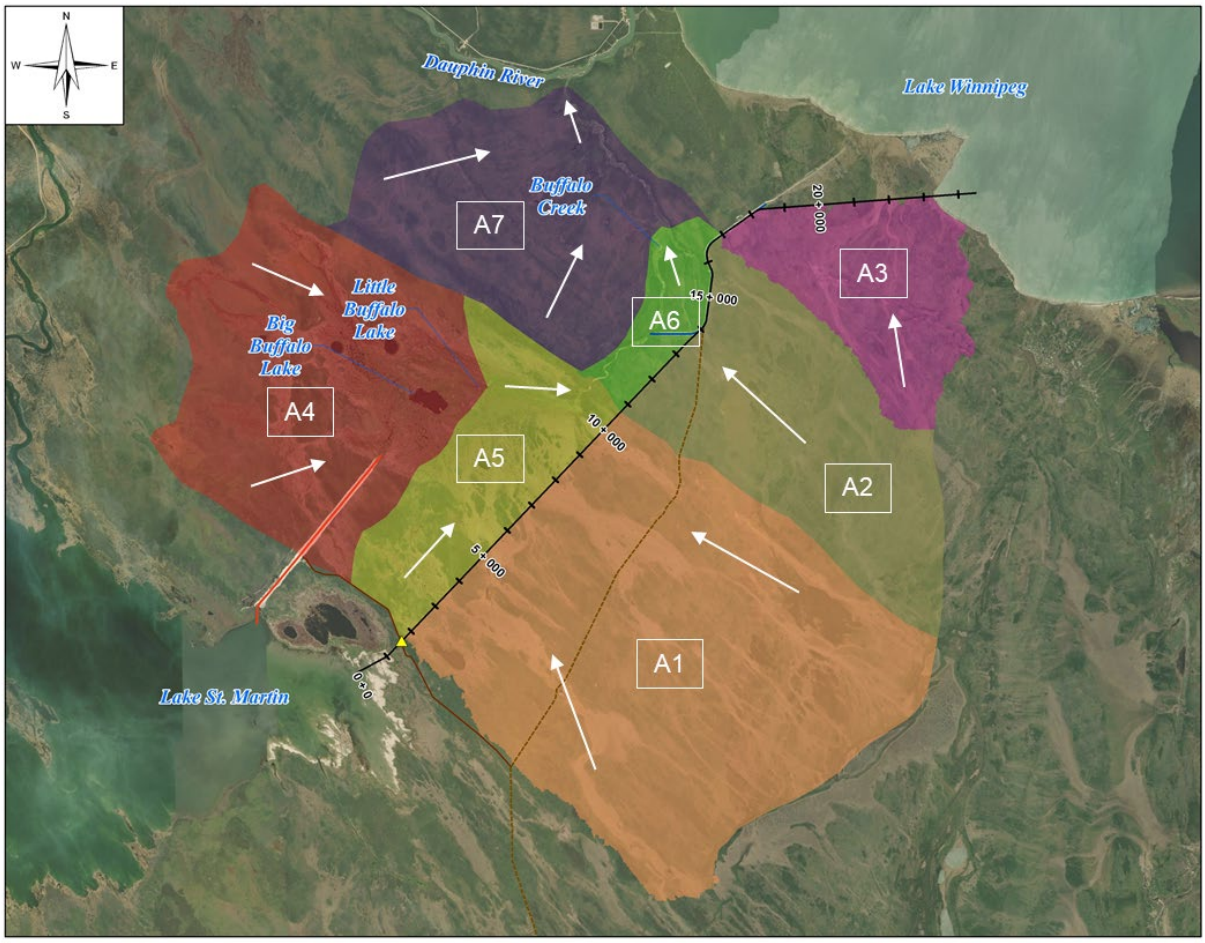


Figure 6: Surface Water Catchment Areas Intercepted by the LSMOC

8.2 Groundwater and Seepage Water

Two distinct groundwater systems are known to be present within the region of the LSMOC: within the upper saturated peat and the lower confined carbonate bedrock aquifer.

The upper, saturated peat unit is perched above the clays (where present) and underlying till units. The peat is recharged directly from surface rainfall and snowmelt. Small-scale flow systems develop from raised bog/peat mound areas, flowing radially outward toward relatively lower-lying depressions and other associated open water areas. Construction of the LSMOC will result in temporarily localized discharge from this system into excavated areas until channel dikes are constructed. Localized discharge will also occur into the outside drain and will vary seasonally depending on the water table and surface conditions.

The lower, confined bedrock aquifer is comprised of a Paleozoic rock sequence commonly referred to in Manitoba as the "Carbonate Aquifer System". This aquifer system is isolated from the peat unit by the upper clay zone and underlying tills. In areas where the pressures are high relative to the confining till units, there is a risk of upward pressure fracturing the till, and producing some uncontrolled groundwater discharge, which is anticipated to be limited by the low permeable nature of the tightly fractured bedrock. Because these conditions cannot be avoided in the region, it was estimated for the Project that there will be a degree of groundwater discharge. In general, consideration of groundwater piezometric pressures and any associated aquifer depressurization requirements will apply to the channel excavation, the channel inlet/outlet excavations, and channel WCS foundations, including long-term WCS uplift pressure mitigation.

Seepage water may also be attributed to minor leakage downstream of a cofferdam. Quantification of groundwater and seepage volumes will be defined, as required. More information on groundwater and seepage water are available in the GWMP.

8.3 Processed Water

Processed water consists of any water considered to be a direct product of the construction activities only and, as such, may require the implementation of mitigation measures, such as settling ponds and/or chemical remedies to meet natural discharge criteria. Potential sources of processed water for the LSMOC Project will be defined during detailed design and may include, but are not limited to:

- Blasting (if required).
- Leachate from rock stockpiles and structures containing rock exposed to surface waters and/or drainage.
- Discharge of wastewaters from processing of aggregate materials and concrete batch plant, and water treatment plant filter backwash.
- Dewatering of excavation areas.
- Accidental spills and releases.
- Control and treatment of sewage water from any construction camps that may be established.

9.0 SURFACE WATER MANAGEMENT

The management measures to control and mitigate environmental effects are described in the following sections, and as indicated, are designed to support the requirements in the PERs.

9.1 Construction Phase (Temporary Measures)

Temporary measures will be required during construction to manage surface water to improve constructability, control the potential for erosion and manage sediments. The specific measures will depend on construction staging and sequencing until the permanent works are completed. Construction methods for temporary drainage works will consider the erosion and sediment control measures described in the SMP.

No untreated wastewaters will be released to the environment from Project construction sites, including construction camps and staging areas. Wastewater will be treated by acceptable industry methods before being released.

9.1.1 Channel Works

Channel works include all construction activities related to the LSMOC, excluding the inlet and outlet works and the WCS.

The primary method of managing surface water for channel works will be via a permanent outside drain, which will be constructed as part of the initial contracts. The purpose of the outside drain is to intercept surface water runoff from the east side of the Project upstream of the construction areas to minimize inflow of surface water into the construction zone. During construction, intercepted surface water will be conveyed along the drain and discharged directly into Lake Winnipeg with a temporary outlet protected with riprap.

Within the excavated channel, a pilot ditch will be constructed as part of the initial contracts to promote downstream drainage of the excavated area. Earth plugs will be maintained between contracts to prevent discharge of water from one contract to the next. As contracts are completed, the earth plugs will be removed to allow for gravity drainage away from the construction site. The existing Reach 3 plug that currently conveys water from the Reach 3 Emergency Channel towards Buffalo Creek will also be removed. Temporary outlets for the pilot ditch and the outside drain are shown on Figure 7.

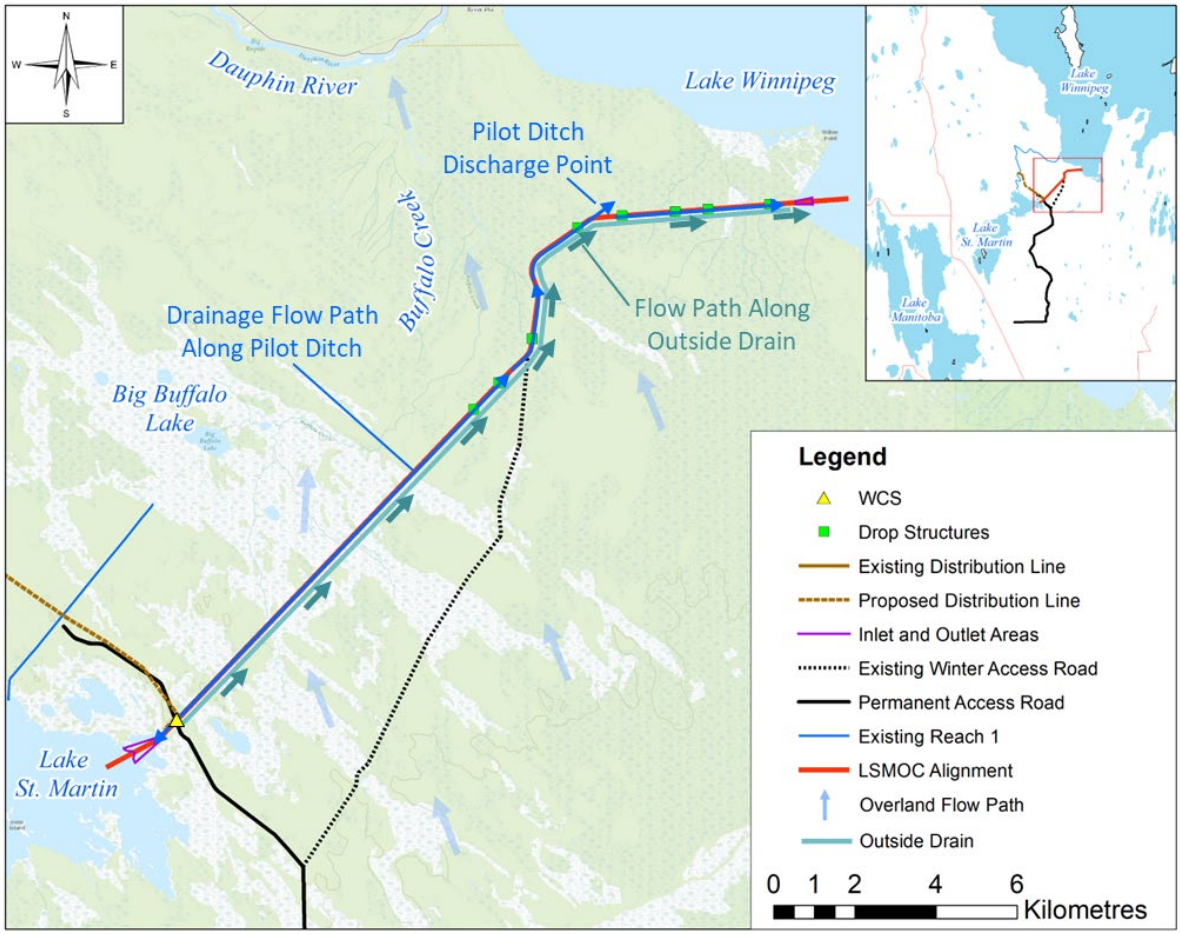


Figure 7: Temporary Drainage Plan

Surface water management within the excavated area of each individual contract will be the responsibility of the Contractor. This is anticipated to involve a combination of temporary pumping in low lying areas and gravity drainage away from the construction site. Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in Section 3.1, prior to discharge into the outside drain, or towards Lake St. Martin, Lake Winnipeg or Buffalo Creek, and as approved by Manitoba Transportation and Infrastructure during construction. Water discharged offsite will be released to settling ponds, filtering systems or through dense terrestrial vegetation of sufficient distance from waterbodies or streams to reduce the potential of sediment release downstream of the construction areas. As described in Section 10.2, the primary method to prevent or minimize the potential for erosion within the LSMOC will be through the establishment of permanent vegetation. Until vegetation is established, temporary erosion and sediment control measures will be employed during construction, as described in the SMP.

Figure 7 shows the preliminary temporary drainage plan for LSMOC channel works.

9.1.2 Inlet Works

The inlet works will consist of excavating the lake bottom within an approximately 1,200 m long by 600 m wide area of Lake St. Martin. It is expected that the construction area will be surrounded with a temporary rock plug or cofferdam to allow work activities to be isolated from the lake. Riprap protection will be incorporated into the design to protect the plug/cofferdam against wave action from a wind event consistent with the criteria defined in Section 3.3. A turbidity curtain will be temporarily installed in Lake St. Martin prior to construction of the rock plug/cofferdam, or as required, to prevent or minimize the migration of disturbed sediments into the lake during construction. A fish salvage program will be required within the isolated area which will be developed and conducted in accordance with Section 2.5.5 of the PERs, and following the methods described in the AEMP.

Once construction of the LSMOC is complete, the rock plug/cofferdam will be removed in part or in whole, as required and in accordance with environmental requirements. Installation and removal of the rock plug or cofferdam will also comply with DFO's Restricted Activity Timing Windows (https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html) and will be completed in accordance with the conditions outlined in the DFO Authorization. Removal of the turbidity curtain would occur once monitored water quality parameters on both sides of the curtain are similar and meet the criteria outlined in Section 3.1.

Specific methods of construction within the isolated area will be determined by the Contractor, in accordance with contract requirements and as approved by Manitoba Transportation and Infrastructure. Excavation works may occur "in-the-wet" or within one or multiple areas that have been dewatered for construction. Any water that must be pumped outside of the work area will be discharged into dense terrestrial vegetation, settling ponds, or filtering systems, if necessary, prior to release into Lake St. Martin. Alternate construction methods will also be considered, such as isolating the area with a double turbidity curtain instead of a rock plug/cofferdam, or allowing excavation works to occur in the winter in shallow areas where the lake ice freezes all the way through to the bottom elevation. These options will be reviewed at detailed design with input from the environmental approval process.

9.1.3 Outlet Works

The outlet works will consist of excavating the lake bottom within an approximately 200 m long by 200 m wide area of Lake Winnipeg (Sturgeon Bay). Construction activities and measures to manage surface water during construction will be similar to the inlet works, as described in Section 9.1.2.

9.1.4 Water Control Structure

Dewatering activities will be required for construction of the WCS to collect surface water runoff and to address groundwater depressurization requirements, as described in the GWMP. The WCS work area will be isolated from channel construction activities to reduce the amount of pumping required and to prevent additional surface water runoff from entering the work area. Other potential sources of water include various types of processed water, as described in Section 8.3. Management of surface water flows and groundwater seepage within the excavation will be the responsibility of the Contractor.

Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in Section 3.1, and discharged into dense vegetation or settling ponds, as deemed necessary, towards the outside drain or at alternate locations that may be approved by Manitoba Transportation and Infrastructure during construction.

9.1.5 Sediment Management

A separate SMP for the control of erosion and sediment has been prepared for the Project. The SMP identifies temporary and permanent measures that will be incorporated during construction until vegetation has been established on disturbed areas to prevent or minimize the potential for erosion and to mitigate the transport and deposition of sediments beyond construction areas and into off-site receiving water bodies. These measures will be developed to comply with requirements outlined in the Environmental license and federal decision statement conditions.

9.2 Operation Phase (Permanent Measures)

Once LSMOC construction is complete, surface water from outside of the Project area to the east of the channel will continue to be managed with the permanent outside drain, as described in Section 9.2.1. Surface water runoff within the ROW of the LSMOC will either discharge into the LSMOC or away from the channel, as described in Section 10.2.2.

Permanent erosion control measures, such as the drop structures, will help minimize erosion in the LSMOC. In addition, temporary erosion and sediment control measures will be maintained until vegetation has fully established on the side slopes and it is confirmed that the criteria identified in Section 3.1 can be maintained in the long term. Refer to the SMP and RVMP for further details.

Construction of the LSMOC will result in a reduction to the catchment size of the Buffalo Creek basin, as described in Section 9.1. As described in Section 9.2.2, methods to re-introduce water to the Buffalo Creek wetlands are under consideration.

9.2.1 Outside Drain

The outside drain that will be constructed to facilitate management of surface water runoff during construction, as described in Section 9.1.1, will be utilized as part of the permanent drainage works for the LSMOC. The permanent outside drain will function in the same way as it did during construction, collecting surface water runoff from the east side of the Project area and conveying it towards Lake Winnipeg. The only difference will be that the permanent outlet will be directed into the LSMOC channel through conduits under the channel dikes and spoil pile rather than discharging directly into Lake Winnipeg. On the west side of the LSMOC, surface water naturally flows away from the channel toward Buffalo Creek or Lake Winnipeg. Therefore, no outside drain is required on that side of the LSMOC.

The outside drain comprises a trapezoidal excavated channel. The drain invert was selected to minimize excavation volumes while also minimizing inundated areas at the 1:10 year design runoff event. The drain invert intersects both peat and mineral soil along its length. In areas where the drain runs through peat, the

cross section will have side slopes of 3H:1V. In areas where the drain runs through mineral soil, the side slopes will be 4H:1V. The base width of the drain varies from 4 m at the upstream end to 14 m at the downstream end, to account for the accumulation of flow in the downstream direction. The invert slope of the drain is 0.06% with the exception of two reaches that have slopes of 0.02% and 0.04% to better fit the natural topography.

Gradient Control Structures (GCS) will be constructed along the drain to limit water velocities and shear stresses to permissible levels to mitigate potential for erosion of the drain. The GCSs will be rockfill structures with raised crests and steep chutes. The chutes will be protected with riprap to prevent erosion from the high velocities in the region where the water surface elevation is lowered over a short distance. The GCSs are designed to withstand flows up to the 1:25 year event with minimal damage and flows up to the 1:200 year event without complete failure (washout of structures).

The permanent surface water drainage plan is presented in Figure 8.

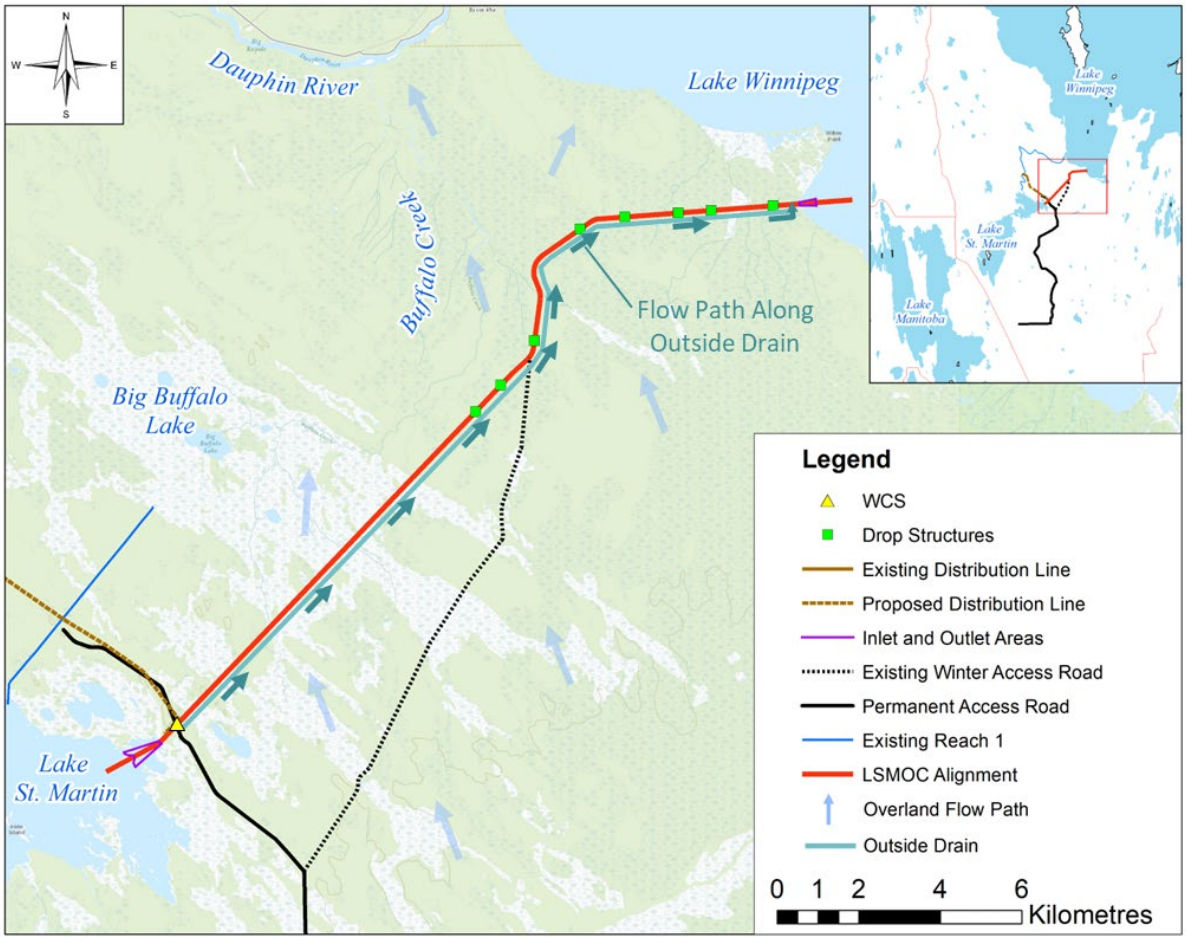


Figure 8: Permanent Surface Water Drainage Plan

Figure 9 shows the hydraulic profile for the outside drain for the 1:10 year design event. The preliminary design of the outside drain includes 15 GCSs with crest heights ranging from approximately 0.4-0.7 m.

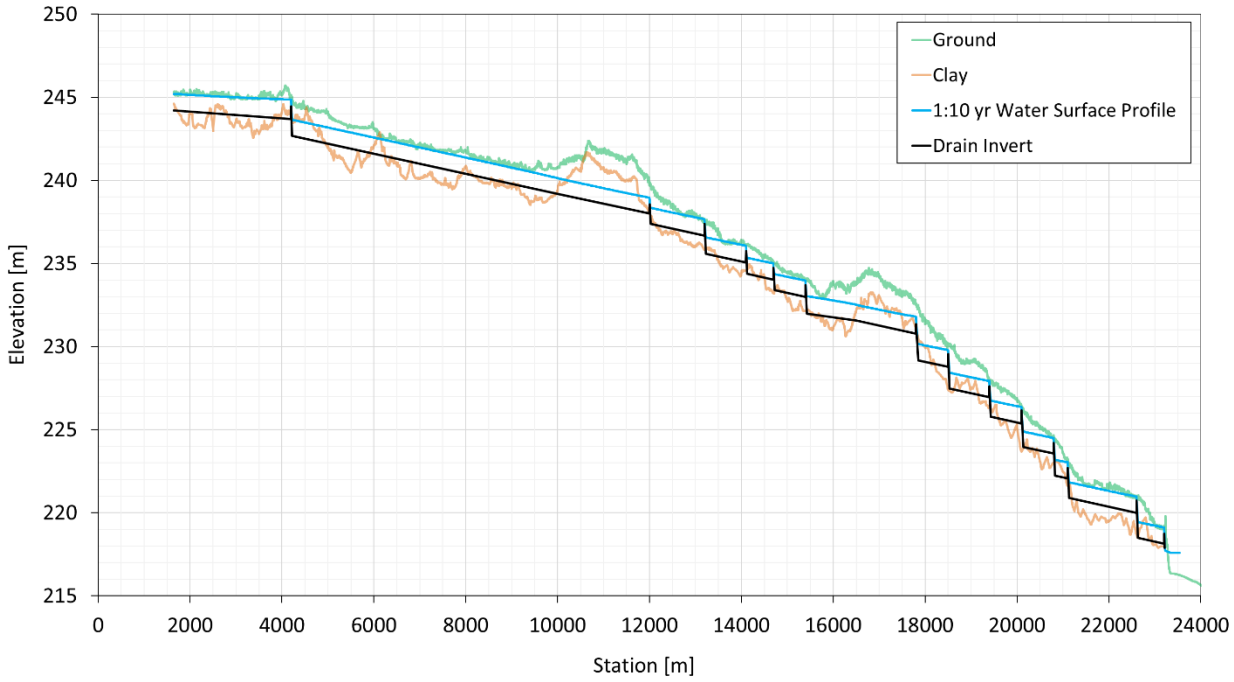


Figure 9: Profile of the Outside Drain

The hydraulic roughness of the drain will change over time, affecting its capacity and the extent of inundated areas expected during runoff events. Soon after construction, the hydraulic roughness of the drain will be relatively low. Over time, growth of vegetation will gradually increase the roughness. Specific portions of the drain that cut through high points in the topography and have inverts incised in mineral soil are expected to be maintained in a similar manner as other provincial drains across Manitoba. Minimal maintenance activities are expected in other portions of the drain that cut through peat. In those areas, it is expected that long after construction of the outside drain (i.e., when the drain has grown in with vegetation), the 1:10 year runoff event will cause some temporary ponding of low-lying areas outside of the Project ROW. The extent and duration of ponding of adjacent land increases for more extreme events. Ponded water could flow overland towards Lake Winnipeg outside of the drain. Rockfill overflow sections will be included with the design, if required, on the banks of the LSMOC to control overflow from the drain into LSMOC during these more extreme events.

9.2.2 Augmentation of Buffalo Creek Watershed Flows

Manitoba Transportation and Infrastructure has considered four options to offset for the water intercepted by the LSMOC during operation and reduce potential effects to wetland function. While discussions are ongoing with communities and regulators as a part of the engagement and consultation process, the tentatively preferred option is a controlled flow release from one or more ditches located along the west channel ROW. The ditch would collect local rainfall and snowmelt within the ROW and additional water would be added from Lake St. Martin, as required to provide required water quantities.

Water would flow via gravity through the structure or with a pump into a ditch running parallel to the LSMOC channel. Water from the ditch would be released at one or more points to distribute flow to the area of wetlands downgradient of the outlet channel. The goal is to mimic natural flows that would diffuse across the wetland landscape. The release of water will be actively managed and will be limited to occur within the spring, summer, and fall months. The flow of water to be released would be dependent on the diameter of conduit used to transport the water. For example, conduit diameters ranging between 0.5 m and 2 m would convey flows between approximately 0.1 m^3/s and 1 m^3/s when within typical Lake St. Martin north basin water levels (i.e., between 242.9 and 243.8 m).

This is Manitoba Transportation and Infrastructure's tentatively preferred option as it provides a reliable source of water with flexibility during operation to control the frequency, flow rate, timing, and volume of water released. The appropriate flow rates, infrastructure design, and confirmation of the proposed option to best compensate flow to this sub watershed will occur during detailed design.

9.2.3 Conditions in the LSMOC

When the LSMOC WCS gates are closed, sheet pile cut-off walls at the crests of the drop structures will maintain a minimum water depth of 1 m above the channel invert in the pools between the drop structures. A base flow will be provided through the WCS to maintain appropriate water quality conditions (DO levels). Other sources of water into the LSMOC will include groundwater discharge and runoff within the channel banks and along the slopes of the channel dikes.

Maintaining and establishing a vegetation cover in the LSMOC is a key component to minimizing the erosion potential during construction and over the long-term. A summary of the revegetation plan is provided in Section 10.2.3. Temporary erosion and sediment control measures will be maintained along the channel banks until vegetation has fully established.

When the LSMOC is in operation, water levels in the channel will typically increase by two to three meters for extended periods. As a result, portions of the channel side slopes will experience alternating periods of submergence (wet) and exposure (dry). Under these conditions, there will be a zone (above the channel armouring) where vegetation may not survive or grow well, thus making the slopes susceptible to erosion. Adaptive management measures to mitigate this risk have been included in the RVMP and in the SMP and involve implementing a long-term monitoring and management approach as well as installing permanent erosion control measures if deemed necessary.

9.2.4 Revegetation Plan

Maintaining and establishing a vegetation cover in the LSMOC is fundamental to minimizing the erosion potential during construction and over the long-term. The revegetation approach will be dynamic and flexible in terms of its implementation under potentially challenging hydrological conditions and is described in the RVMP.

10.0 MONITORING

10.1 Baseline Monitoring

Figure 10 identifies baseline surface water quality monitoring locations. Baseline water quality data have been collected between 2020 and 2021 for waterbodies in the vicinity of the LSMOC. In addition, data collected for the EOC in 2011-2015 have been incorporated in the baseline dataset. Baseline data will form the basis of comparison to monitor for changes in surface water quality in waterbodies in the vicinity of the LSMOC during construction and for two years post-construction. Additional data collected since 2021 will be added to the data compilation prior to construction. Sites for baseline monitoring in the vicinity of the LSMOC were selected to represent the variety of waterbodies that may be impacted by construction of the LSMOC. In addition, as described in the WetMP, baseline wetland surface water quality monitoring is planned in the vicinity of LSMOC prior to construction.

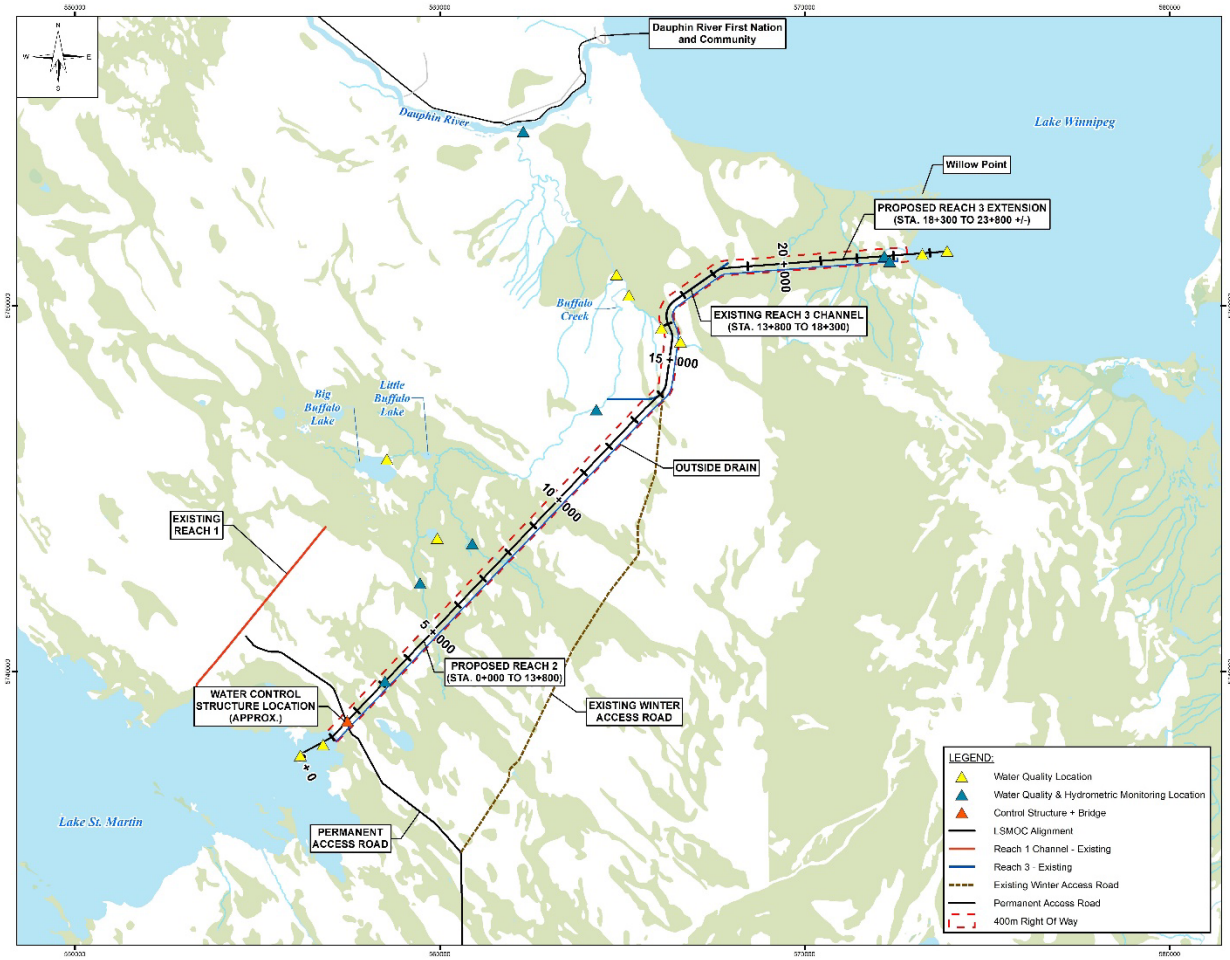


Figure 10: LSMOC Baseline Surface Water Quality Monitoring Locations

10.2 Construction Phase Monitoring

10.2.1 Overview

Surface water will be monitored during construction to identify changes that may result from construction activities along the LSMOC and to assess the effectiveness of proposed mitigations and the SMP. If the water quality criteria identified in Section 3.1 are exceeded and attributed to the Project, then additional mitigation measures would be considered. Where monitoring results show impacts that are not attributed by the Project, information will be provided to Manitoba Conservation and Climate.

LSMOC construction-phase surface water monitoring will be conducted for the duration of the construction phase. The frequency and location of sample stations included in the program will change as the construction staging advances. Determination of frequency and location of samples will also be based on:

- environmental considerations described in the Project EIS;
- proximity and potential for change to local fish bearing receiving waters as a result of the works;
- monitoring plans being developed for the Project as part of other management plans (such as the AEMP, the GWMP and Wetland Management Plan);
- input from engagement processes and regulatory input.

Monitoring plans are provided in the sub-sections that follow related to:

- discharges from construction areas
- surface water quantity and quality in lakes and streams in vicinity of the LSMOC
- sediment monitoring for in-lake excavation and commissioning activities

10.2.2 Discharge from Construction Areas

Effects on surface water quality from the construction of the Project were predicted in the EA process. The Project may affect surface water quality via introduction of sediment to waterbodies, discharge of groundwater to surface water, and accidental spills and leaks during Project construction.

Water quality criteria outlined in Section 3.2 for the protection of aquatic life will be used to manage discharges from the Project construction area to an aquatic environment (i.e., waterbodies). See the EPP mapbooks for delineation of such areas within the PDA. An Environmental Monitor on site will implement a monitoring program for turbidity, TSS, DO, and other relevant parameters at discharge points at an appropriate frequency to confirm compliance.

Sediment in Discharges

Sediment monitoring in construction site discharges will include general observations during routine surveillance activities (i.e., areas of exposed soil and/or sediment plumes) and monitoring using hand-held sampling devices.

The objective of monitoring TSS and turbidity during construction activities is to confirm that sediment mitigation measures and erosion and sediment controls are effective and that discharges from the Project

construction area are managed appropriately before release to aquatic environment (i.e., waterbodies). The monitoring results will be used to inform adaptive management of construction activities to reduce construction related increases in suspended sediment concentrations. This monitoring plan will be modified as needed in the field to complement the construction activities as they are developing; however, the general guideline for discharge monitoring is as follows:

- Consider site-specific waterbody characteristics including receiving waterbody size and width, water depth, water velocity and flow (i.e., laminar flow vs turbulent flow). Monitoring transects may be established where background and downstream water samples may be collected in a manner that captures changes in suspended sediment concentrations near the construction site. Where a visual plume is observed, a sample will be taken from the middle of the plume and as close to the source as safely possible. Water samples will be at 50% water depth where water is less than 1 m deep. Where waterbodies are greater than 1 m deep, samples will be taken at 20% and 80% of water depth at each transect sample point and results averaged.
- When sediment introduction to the aquatic environment (i.e., waterbodies) is likely, turbidity sampling will be completed at appropriate intervals. If turbidity levels remain constant and low the sample frequency may be reduced, or halted altogether, as directed by the Environmental Monitor.
- Daily turbidity monitoring records will be kept and maintained during construction and will be available on site. Upon completion of construction activities, a final construction monitoring report with all sampling and testing data will be produced by the Environmental Monitor.

Other Parameters in Discharges

Where water discharged from the Project construction area may exceed CCME-PAL guidelines and MWQSOG-PAL objectives as outlined in Section 3.1, an Inspector or Environmental Monitor will monitor such water prior to discharge for appropriate parameters (DO, temperature, conductivity, and pH), which may be altered by groundwater discharge.

Spills and Leaks

An Inspector or Environmental Monitor will visually inspect discharges from the Project construction area for indications of spills and leaks, such as sheen and foam. In the event of a release during Project construction, contractors will follow their own spill response plans, which will have been reviewed and approved by Manitoba Transportation and Infrastructure as part of their contracts. PERs have been developed that describe measures to address accidents and spills, including reporting, cleanup, compliance training, inspection, and enforcement.

10.2.3 Surface Water in Local Waterbodies

Surface water monitoring will include collection of surface water quality samples and water level measurement in the vicinity of the LSMOC. Monitoring of flows and water levels have been included to support monitoring of water quantity at select locations in the LSMOC Channel and outside drain, and in Buffalo Creek. The frequency and location of the monitoring stations included in the program will be updated as required, based on monitoring results, input from regulatory approvals and as the construction staging advances to reflect Project needs and requirements.

Proposed surface water quality monitoring sites will include previously established baseline sites in the vicinity of the LSMOC (see Section 10.2). These sites were selected to represent the variety of creeks and lakes in vicinity of the channels. Monitoring locations may be adjusted as designs are advanced and additional engagement input is received from regulators, rights-holders, and public stakeholders. They will also be positioned to address any relevant regulatory approvals conditions. Proposed water quality parameters are listed in Table 4. This comprehensive list of parameters includes routine chemistry, total and dissolved nutrients, carbon, total and dissolved metals (including mercury), bacteria, hydrocarbons, and pesticides. Presently, a monthly open-water sampling at these monitoring sites is planned during active construction in the vicinity of the monitoring sites. Results would be reviewed monthly for guideline exceedances and results would be reported quarterly. Should the guideline exceedances attributable to Project construction activities be detected, adaptive management measures will be immediately implemented. Refer to Section 11.0 for relevant adaptive management sections of the other EMPs for more details. Methylmercury in fish tissue and chlorophyll *a* are included in the AEMP.

All surface water quality samples will be collected following standard procedures, will be submitted to an accredited laboratory for analysis and subject to standard QA/ QC processes.

Table 4: Proposed Surface Water Quality Monitoring Parameters

Water Quality Parameters	
Field Parameters	DO; Electrical Conductivity; Oxidation Reduction Potential; pH; Temperature; Turbidity
General Chemistry	Alkalinity, Bicarbonate (as CaCO3); Alkalinity, Carbonate (as CaCO3); Alkalinity, Hydroxide (as CaCO3); Alkalinity, Total; Hardness (as CaCO3); Total Dissolved Solids; Major ions (Sulfate; Chloride; Fluoride; Sodium; Potassium)
Sediment	TSS
Microbiological Parameters	*Escherichia coli (E.Coli);* Fecal Coliforms
Nutrients/Carbon	Ammonia (as N); Nitrate (as N); Nitrite (as N); Total Kjeldahl Nitrogen; Nitrogen (Total); Phosphorus, Total; Phosphorus, Total (Dissolved); Phosphorus, Total (Particulate); Phosphate (PO4), dissolved and reactive; Dissolved Organic Carbon (DOC); Dissolved Inorganic Carbon (DIC); Total Organic Carbon (TOC); Total Inorganic Carbon (TIC)
Petroleum Hydrocarbons	BTEX; Hydrocarbons
Metals	Standard Total/Dissolved Metals Scan (including Mercury)
Pesticides	Glyphosate; Organochlorinated

10.2.4 Sediment Monitoring for In-Lake Excavation and Commissioning Activities

A detailed in-lake real-time TSS monitoring program will be implemented during construction to monitor the magnitude of spatial and temporal changes in TSS concentrations in the vicinity of the PDA during in-lake construction and commissioning activities. The monitoring program design is based on the expected construction effects on the sedimentation regime in the North Basin of Lake St. Martin and in Lake Winnipeg (Sturgeon Bay), and recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2B of the SMP.

10.3 Operation Phase Monitoring

Collection of surface water quality samples and water level measurements at previously established baseline sites will continue following construction of the Project. This monitoring will initially be carried during the first two years post-commissioning, the intent of which is to confirm the effectiveness of construction mitigations and site restoration measures. This duration may be extended depending on the monitoring results, environmental conditions present, and success of revegetation.

The frequency and locations of the water quality monitoring conducted during the 2-year post-commissioning period will be based on specific environmental conditions present, success of revegetation, and adjusted, as required, based on monitoring results. Flow and water level monitoring will also be included to support assessment of surface water quality parameters at select surface water sampling stations in the LSMOC Channel and outside drain, and in the Buffalo Creek watershed. Water quality monitoring parameters are expected to be consistent with those monitored during the construction phase, as summarized in Section 10.2.

Longer-term operation monitoring (which includes consideration of the frequency of use of the LSMOC) will take place beyond the 2-year post-commissioning period as outlined in the AEMP and the O&M Manual.

10.4 Reporting

Annual surface water monitoring reports will be prepared throughout the construction phase and for the duration of monitoring ultimately conducted during the post-commissioning phase.

11.0 ADAPTIVE MANAGEMENT AND FOLLOW-UP

11.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The *Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

As discussed in Section 12.4.1.2 of the Project EIS, construction activities and the changes in flows and water levels caused by the Project may have minor effects on fluvial geomorphology, sediment and debris transport in the surface water LAA, but primarily during and immediately after construction. Suspended sediment levels may temporarily increase at work sites during construction activities, and at outlet areas during initial operation (gates open) of the outlet channels after a period of non-operation (gates closed). As such, the purpose and objectives of follow-up activities will be to monitor and further understand the residual effects due to the Project.

As indicated, the SWMP has been developed to address the requirements of Section 2.5 of the PERs regarding Working Near Water. Although the methods and recommendations outlined in the SWMP were developed based on site-specific expectations and conditions, it is accepted that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the design decisions during implementation and long-term operation. Results from ongoing data collection and monitoring programs will inform and facilitate any necessary adjustments to this plan to the extent feasible. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the Project designs while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback

during construction, temporary mitigation measures described in this SWMP, as well as those included in the SMP and RVMP, should be revisited and updated, as required.

For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate revegetating methods may be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

11.2 Follow Up Response

As described in Section 10.0, monitoring will include visual inspections and water quality monitoring. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental licensing requirements. If conditions recorded appear to be exceeding criteria or management thresholds, relative to baseline conditions, then follow-up responses will be implemented as described in the sub-sections below, as well as those identified in the CEMP, PERs, SMP, RVMP and any other applicable plans under the EMP.

11.2.1 Construction

Discharges from Construction Areas

Should monitoring results indicate that the water to be discharged from construction areas do not meet the water quality objectives outlined in Section 3.1, the following tasks will be carried out:

- Environmental Monitor shall confirm the results are accurate (e.g., rule out turbidity measurement equipment malfunction).
- Environmental Monitor will discuss the exceedance with Manitoba Transportation and Infrastructure.
- Manitoba Transportation and Infrastructure shall consider undertaking additional monitoring further downstream of the discharge point (near the receiving local lakes and streams) to determine if the exceedance persists closer to those receiving waterbodies.
- Manitoba Transportation and Infrastructure or Contract Administrator will take action, which includes investigating the activity that is resulting in the exceedance and if it is still underway, implement mitigation, if necessary/possible. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):
    - temporary suspension of work activity,
    - modifying the rate of discharge and/or location
    - apply mitigation measures as per the relevant plans under the EMP (such as installing additional erosion and sediment control measures as per the SMP, further aerating the discharge as per the GWMP, implementing spill/leak response as per the CEMP, etc.)
- Environmental Monitor shall record the event in the daily report.

Surface Water in Local Waterbodies

Surface water quality monitoring data in local lakes and streams in the vicinity of the LMOC will be reviewed, as it is received. Should guideline exceedances attributable to Project construction activities be detected, adaptive management strategies will be implemented. Should monitoring results not meet the water quality objectives outlines in Section 3.1, then the following tasks will be carried out:

- Environmental Monitor shall confirm the results are accurate (e.g., rule out measurement equipment malfunction) and attributed to Project construction activities.
- Environmental Monitor will discuss the exceedance with Manitoba Transportation and Infrastructure.
- Manitoba Transportation and Infrastructure or Contract Administrator will take action, which includes investigating the activity that is resulting in this exceedance and if it is still underway, implement mitigation, if possible. Mitigation may include directing the Contractor to modify work activities, such as (but not limited to):
  - modifying the rate of discharge and/or location
  - apply mitigation measures as per the relevant plans under the EMP (such as installing additional erosion and sediment control measures as per the SMP, further aerating the discharge as per the GWMP, etc.)
  - temporary suspension of work activity
- Environmental Monitor shall record the event in the daily report.

Sediment Management for In-lake Excavation

Detailed adaptive response protocols will be implemented to address potential sediment effects during in-lake excavation work. The protocols are based on recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2B of the SMP.

11.2.2 Commissioning

As with in-lake excavation, detailed adaptive response protocols will be implemented to address potential sediment effects during in-lake excavation work and commissioning activities. The protocols are based on recent experience on other construction projects in the Province of Manitoba. Details can be found in Appendix 2B of the SMP.

11.2.3 Operation Phase

Management triggers and adaptive management actions will be developed as for the post-commissioning monitoring program based on the results of the SWMP monitoring during construction.

11.3 Contingency Measures and Emergency Response

Contingency measures and emergency response will be developed for deployment in the event that aspects of this SWMP do not meet the water quality objectives or if the prescribed measures are overwhelmed during a severe runoff event greater than the design condition (or multiple successive large runoff events). Contingency planning will also be incorporated for unexpected events such as, but not limited to, an uncontrolled breach of a settling pond, or the failure of a pumping system for dewatering. These will be developed by the Contractor in accordance with Section 1.3 of the PERs and submitted to Manitoba Transportation and Infrastructure for approval prior to start of construction.

Mitigation measures will be identified in the "base" plan and may include, for example, choosing final locations of settling ponds to reduce direct surface runoff to aquatic environments, or incorporating secondary containment cells at each of the main settling ponds. Contingency measures that would be implemented in the event of an emergency will also be identified and may include, for example, the deployment of straw rolls/wattles, erosion control blankets, rapid stabilization techniques, supplementary seeding, temporary settling ponds etc. These will be developed as per the CEMP, PERs, SMP, RVMP and any other applicable EMPs.

In the event of an emergency, the Contractor, the Owner, and the Contract Administrator will determine which contingency and emergency control measures will be implemented. These contingency and emergency control measures would be carried out within a predetermined time period depending on the site conditions and nature of the emergency. Contingency measures will include monitoring at immediate downstream locations in the event of emergency conditions or undesirable circumstances.

During the operation phase, the channel will be resistant to large precipitation events through vegetation and armoring. Nevertheless, contingency and emergency control measures will be implemented by Manitoba Transportation and Infrastructure, depending on the site conditions and nature of the emergency, with due consideration given to the O&M manual that will be developed for the Project prior to the operation phase.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Groundwater Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vii

Part 1: Introduction 1

1.0 PURPOSE AND SCOPE 1

1.1 Related Documents 2

2.0 OBJECTIVES 3

3.0 REGIONAL SETTING 4

3.1 Geological Setting 4

3.2 Hydrogeology 4

4.0 MANAGEMENT CRITERIA 7

4.1 Piezometric Head 7

4.2 Water Quality 8

4.3 Groundwater-Surface Water Interactions 8

Part 2: Lake Manitoba Outlet Channel 9

5.0 LMOC EXISTING CONDITIONS 9

5.1 Overview 9

5.2 Groundwater Piezometric Head 10

5.3 Groundwater Quality 16

5.4 Groundwater-Surface Water Interactions 16

6.0 LMOC SUMMARY OF EFFECTS 17
6.1 Overview 17
6.2 Groundwater Piezometric Head 18
6.3 Groundwater Quality 20
6.4 Groundwater-Surface Water Interactions 20
7.0 LMOC MITIGATION MEASURES 21
7.1 Overview 21
7.2 Aquifer Depressurization During Construction 22
7.2.1 LMOC Groundwater Depressurization 22
7.2.2 Groundwater Piezometric Head 23
7.2.3 Groundwater Quality 23
7.2.4 Groundwater-Surface Water Interactions 23
7.3 Aquifer Depressurization During Operations. 24
7.3.1 Design of Operation Depressurization Plan 24
7.3.2 Groundwater Piezometric Heads 25
7.3.3 Groundwater Quality 25
7.3.4 Groundwater-Surface Water Interaction 26
8.0 LMOC MONITORING 27
8.1 Objectives 27
8.2 Baseline Monitoring 27
8.2.1 Groundwater Piezometric Head 27
8.2.2 Groundwater Quality 28
8.2.3 Groundwater-Surface Water Interactions 29
8.3 Pre-Construction Monitoring 29
8.3.1 Network Expansion 29
8.3.2 Groundwater Piezometric Head 31
8.3.3 Groundwater Quality 31
8.3.4 Groundwater-Surface Water Interactions 32

8.4 Construction Monitoring 32
8.4.1 Groundwater Piezometric Head 32
8.4.2 Groundwater Quality 33
8.4.3 Groundwater-Surface Water Interactions 34
8.5 Operations Monitoring 34
8.5.1 Groundwater Piezometric Head 34
8.5.2 Groundwater Quality 35
8.5.3 Groundwater-Surface Water Interactions 35
9.0 LMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP 36
9.1 General 36
9.2 Follow-up 39
9.2.1 Stakeholder Complaint Resolution Process 39
9.2.2 Groundwater Piezometric Head 40
9.2.3 Groundwater Quality 42
9.2.4 Groundwater-Surface Water Interactions 45
9.2.5 Operations and Maintenance Plan 45
9.3 Contingency Measures and Emergency Response 45
10.0 LMOC REFERENCES 46
Part 3: Lake St. Martin Outlet Channel 48
11.0 LSMOC EXISTING CONDITIONS 48
11.1 Overview 48
11.2 Groundwater Piezometric Head 51
11.3 Groundwater Quality 53
11.4 Groundwater-Surface Water Interactions 54
12.0 LSMOC SUMMARY OF EFFECTS 57
12.1 Overview 57
12.2 Groundwater Piezometric Head 59

12.3 Groundwater Quality 59
12.4 Groundwater-Surface Water Interactions 59
13.0 LSMOC MITIGATION MEASURES 61
13.1 Overview 61
13.2 Aquifer Depressurization During Construction 63
13.2.1 LSMOC Depressurization 63
13.2.2 Groundwater Piezometric Head 64
13.2.3 Groundwater Quality 67
13.2.4 Groundwater-Surface Water Interaction 67
13.3 Aquifer Depressurization During Operations 68
13.3.1 Design of Operation Depressurization Plan 68
13.3.2 Operations and Maintenance Plan 68
13.3.3 Groundwater Piezometric Head 68
13.3.4 Groundwater Quality 69
13.3.5 Groundwater-Surface Water Interaction 70
14.0 LSMOC MONITORING 71
14.1 Objectives 71
14.2 Baseline Monitoring 71
14.2.1 Groundwater Piezometric Head 72
14.2.2 Groundwater Quality 73
14.2.3 Groundwater-Surface Water Interactions 74
14.3 Pre-Construction Monitoring 74
14.3.1 Network Expansion 74
14.3.2 Groundwater Piezometric Head 76
14.3.3 Groundwater Quality 76
14.3.4 Groundwater-Surface Water Interactions 76
14.4 Construction Monitoring 77
14.4.1 Groundwater Piezometric Head 77
14.4.2 Groundwater Quality 77

14.4.3 Groundwater–Surface Water Interactions 78
14.5 Operation Monitoring 78
14.5.1 Groundwater Piezometric Head 78
14.5.2 Groundwater Quality 79
14.5.3 Groundwater–Surface Water Interactions 79
15.0 LSMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP 80
15.1 General 80
15.2 Follow-up 82
15.2.1 Stakeholder Complaint Resolution Process 82
15.2.2 Groundwater Piezometric Head 83
15.2.3 Groundwater Quality 85
15.2.4 Groundwater-Surface Water Interactions 86
15.3 Contingency Measures and Emergency Response 87
16.0 LSMOC REFERENCES 88
APPENDIX 1A 89
APPENDIX 1B 98

List of Tables

Table 1: Summary of Groundwater Wells in the LMOC LAA

Table 2: Groundwater Parameters Measured in LMOC Pre-Construction Monitoring Program

Table 3: Thresholds, Actions and Possible Mitigations for Anticipated Project-Related Private Water Supply Effects

Table 4: Thresholds, Actions and Possible Mitigations for Unanticipated Project-Related Private Water Quality Effects

Table 5:Groundwater Parameters Measured in Pre-Construction Monitoring Program

Table 6: Proposed Locations of Monitoring Wells and Instrumentation to be Installed for Construction Phase and Post-Construction Monitoring

Table 7: Thresholds, Actions and Possible Mitigations for Unanticipated Project-Related Water Quality Effects

Table A-1: Sources of Borehole Data used in Geological Model

List of Figures

Figure A: EMP Process

Figure 1: Regional Groundwater Flow in Carbonate-Evaporite Unit (Betcher et al., 1995)

Figure 2: LMOC Baseline Groundwater Monitoring and Sampling Locations

Figure 3: Groundwater Piezometric Head along LMOC profile

Figure 4: Existing Groundwater Piezometric Pressure Head Contours in the LMOC LAA

Figure 5: Piezometric Pressure Above Ground Surface near the LMOC Alignment

Figure 6: Area of Effect of Depressurization

Figure 7: Adaptive Management Process

Figure 8: Incident Resolution Process

Figure 9: Monitored Well and Test Hole Locations

Figure 10: Schematic of Regional Artesian Spring Sites and Contoured Bedrock Aquifer Piezometric Pressures

Figure 11: Adaptive Management Process

Figure 12: Incident Resolution Process

Figure A-1: Surficial Geology Within the LMOC Region

Figure A-2: Regional Groundwater Flow and Piezometric Head Conditions

Figure A-3: Piezometric Water Elevations in the Carbonate Aquifer (2005-2021)

Figure B-1: Surficial Geology Within the Region of the LSMOC

Figure B-2: Stratigraphic Profile of Proposed LSMOC as Interpreted from Borehole Logs

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Groundwater Management Plan (GWMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

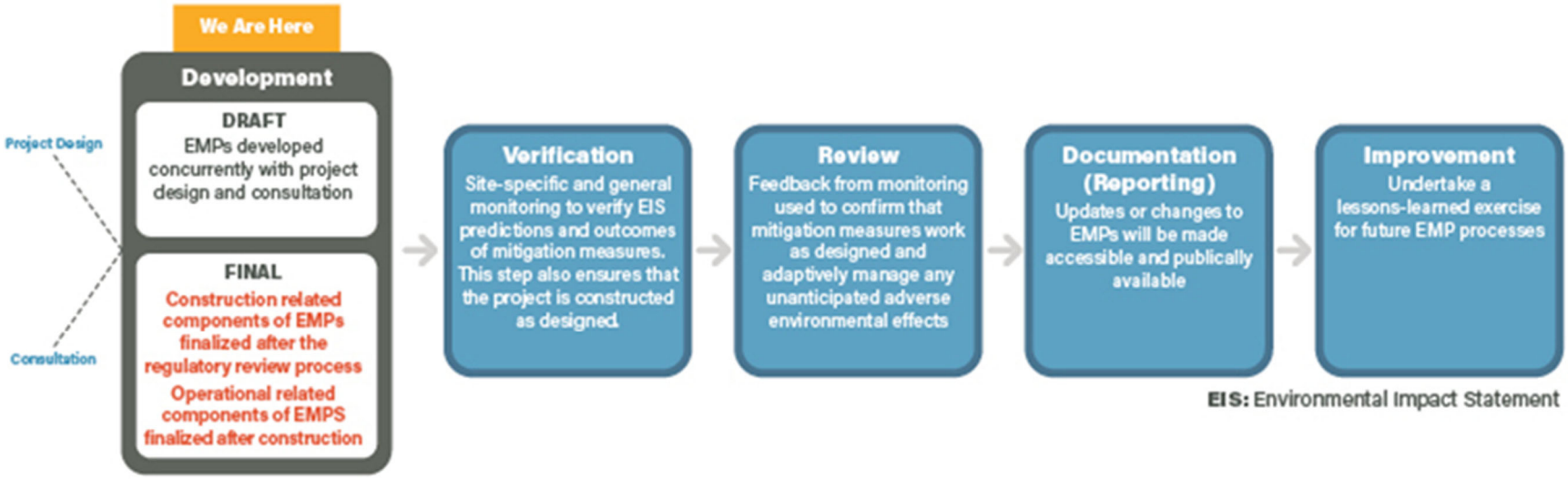


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	percent
cfs	cubic feet per second
CCME	Canadian Council of Ministers of the Environment
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
DO	Dissolved Oxygen
EA	environmental assessment
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EPP	Environmental Protection Plan
GWMP	Groundwater Management Plan
HC-CDWQ	Health Canada – Canadian Drinking Water Quality Guidelines
km	kilometre
LAA	local assessment area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
m^2/d	square metres per day
m^3/s	Cubic metres per second
masl	metres above sea level
MECP	Manitoba Environment, Climate and Parks
mg/L	milligrams per Litre
MWQSOG	Manitoba Water Quality Standards, Objectives and Guidelines Regulation
N	nitrogen

OEMP	Operation Environmental Management Program
ORP	oxygen reducing potential
PDA	Project development area
PER	Project Environmental Requirements
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
SP	standpipe piezometer
Sta.	Station
SWMP	Surface Water Management Plan
TDS	Total Dissolved Solids
VW	Vibrating Wire Piezometer
WCS	water control structure
WCSB	Western Canada Sedimentary Basin
WetMP	Wetland Monitoring Plan

Glossary of Terms

Alkalinity: A pH value of greater than 7.0 (pH is a way to measure the acidity or alkalinity of a solution).

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Aquitard: A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

Artesian Well: When the pressure is the well in above the top of the aquifer

Baseflow: The portion of the streamflow that is sustained between precipitation events, fed to streams by delayed pathways.

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Carbonates: A rock made up primarily of carbonate minerals (minerals containing the CO3 anionic structure). Examples include limestone, dolostone, and marble (metamorphosed limestone or dolomite) are the most commonly encountered carbonate rocks.

Carbonate aquifer: See Aquifer; see Carbonates. Refers to an aquifer comprised of a carbonate bedrock.

Cofferdam: An enclosure, usually only partially obstructing a river, from which water is pumped to expose the bottom to permit construction.

Conductivity: A measure of the ability of a solution to conduct electrical flow; units are micro Siemens per centimeter.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pump, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with Drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the project to support the structural design of the bridge or structure.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dissolved oxygen: Oxygen molecules (O2) dissolved in water.

Dolomite: A sedimentary rock composed mostly of dolomite (CaMg (CO3)2) which often forms from limestone as the calcium is partly replaced by magnesium, usually as water solutions move through the limestone.

Domestic well: A water well used to supply water for the domestic needs of an individual residence or systems of four or fewer service connections.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Flowing Wells: When the pressure in the well in above ground it is a flowing well.

Glaciolacustrine: Pertaining to, derived from, or deposited in glacial lakes; especially said of the deposits and landforms composed of suspended material brought by meltwater streams flowing into lakes bordering the glacier, such as deltas, kame deltas, and varved sediments.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Groundwater quality: Refers to the chemical composition of groundwater and its suitability for various uses and also varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current land use practices that may contribute anthropogenic effects.

Groundwater quantity: Refers to the availability of groundwater at a given rate for production and use, and it varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current groundwater use.

Hydraulic Conductivity: Symbolized as K, is a property of vascular plants, soils and rocks that describes the ease with which a fluid (usually water) can move through pore spaces or fractures. It depends on the intrinsic permeability of the material, the degree of saturation, and on the density and viscosity of the fluid.

Hydrogeology: The study of the interrelationships of geologic materials and processes with water, especially groundwater.

Invert (channel-): The stream bed or floor within a structure or channel.

Lacustrine: Of, or pertaining to, lakes; used in reference to soils deposited as sediments in a lake.

Management Threshold: A monitoring result that exceeds a pre-established value (e.g., guideline, deviation from historic variability) that triggers a response/action – in terms of closer examination and possibly additional mitigation measures.

Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Piezometer: A piezometer is a device used to measure the pressure (more precisely, the piezometric head) of groundwater at a specific point.

Pool: A deep, slow-moving area of a stream; an artificially confined body of water above a dam or weir.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase of the design process typically supports the pre-construction engagement and consultation process with the public and Indigenous rights-holders, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Recharge: Water added to an aquifer or the process of adding water to an aquifer.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Shale: A clastic sedimentary rock that is made up of clay-size weathering debris. It typically breaks into thin flat pieces.

Stratigraphy: The science of rocks: it is concerned with the original succession and age relations of rock strata and their form, distribution, lithologic composition, fossil content, geophysical and geochemical properties-all characters and attributes of rocks as strata-and their interpretation in terms of environment and mode of origin and geologic history. Generic term referring to the sequential stacking of sediments / rocks in a region.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Transmissivity: The rate of flow under a unit hydraulic gradient through a unit width of aquifer of thickness.

Turbidity: A measure of the relative clarity of water.

Water table: The upper surface of the zone of saturation in an unconfined aquifer.

Wetland: Refers to:

(a) a marsh, bog, fen, swamp or ponded shallow water, and

(b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

Part 1: Introduction

1.0 Purpose and Scope

The Groundwater Management Plan (GWMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project). The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

This GWMP has been prepared for Manitoba Transportation and Infrastructure to describe the groundwater management measures that will be implemented to mitigate or protect against impacts to groundwater or from groundwater during the construction and operation of the LMOC and LSMOC. These may include water level changes in aquifers, water quality changes, and changes in the relationship of the groundwater aquifer discharge to the surface water system. Monitoring will be carried out to verify effect predictions, effectiveness of mitigation, and capture any unanticipated Project effects where adaptive measures need to be applied. Adaptive measures are also identified for implementation if monitoring indicates the need for additional mitigation.

The GWMP is intended to be a living document that will be reviewed over the life of the Project and will be updated during detailed design, incorporating applicable engagement feedback provided by landowners, rights-holders and regulators.

While the regional topography, geology and hydrogeology provides an overall context for the entire Project, there are local differences in land use and hydrogeology that require different management approaches. The LMOC and LSMOC components of the Project are located in two distinct areas. The LMOC is located near and through developed private farmland with drinking water and irrigation supply wells in proximity to the LMOC alignment. The LSMOC is located in isolated, undeveloped Crown land used predominantly for hunting and fishing, including traditional use activities, with no agricultural activity or supply wells in the area. Given the unique site characteristics of each of the channels, this GWMP is organized into three parts:

- Part 1 includes information that is common to both the LMOC and LSMOC
- Part 2 includes information that is specific to the LMOC
- Part 3 includes information that is specific to the LSMOC

1.1 Related Documents

The following Project documents will also contain groundwater-related topics and details, not necessarily included in this GWMP:

- The CEMP addresses contingency and emergency response measures, including items related to groundwater
- The Project Environmental Requirements include measures relating to drill holes and dewatering
- Detailed Design Documents will specify details of groundwater depressurization programs
- A Groundwater Depressurization Plan will be developed
- An Application for Temporary authorization for Groundwater Construction Depressurization will be developed by the Contract Administrator and submitted to Manitoba Environment, Climate and Parks (MECP) Water Licensing, which will contain Project specifics and an assessment of projected drawdown
- General/specific conditions addressing groundwater issues from the *Canadian Environmental Assessment Act (CEAA) 2012* Decision Statement and the provincial license under *The Environment Act* for the Project will also be incorporated into the management plan

2.0 Objectives

The main objectives of the GWMP are as follows:

- presenting an understanding of the hydrogeological conditions in the LMOC and LSMOC areas
- presenting descriptions of groundwater depressurization plans for construction and operation scenarios
- identifying potential impacts on groundwater supply wells and required mitigation measures
- describing the planned monitoring to confirm effectiveness of mitigation measures and to verify the Project Environmental Impact Statement (EIS) predictions
- describing the measures and protocols to address any unanticipated effects or areas of non-compliance (adaptive management).

3.0 Regional Setting

Manitoba is divided into four physiographic regions: the Precambrian shield, the Hudson Bay Lowland, the Manitoba Lowland, and the Manitoba Upland. The LMOC and LSMOC are located within the Manitoba Lowland region, which is an area of gentle relief located east of the Manitoba escarpment and extending to the eastern edge of Lake Winnipeg (Betcher et al., 1995). The major lakes (Lake Manitoba, Lake Winnipegosis, and Lake Winnipeg) occupy portions of the lowland area and act as collectors for surface drainage within the southern part of the province. The study area lies within the Lake Manitoba and Lake Winnipeg drainage basins in the Interlake. The lakes within the Manitoba Lowland collect drainage from the southern portion of the Province, which is directed through Lake Winnipeg into the Nelson River system, and ultimately discharges into Hudson Bay.

3.1 Geological Setting

The Manitoba Lowlands are underlain by Paleozoic and Mesozoic carbonate rocks with some clastic (granular) and argillaceous (clay-rich) units (Betcher et al., 1995). The bedrock units gently dip southwestward and form the eastern edge of the Western Canada Sedimentary Basin (WCSB), located along the eastern edge of Lake Winnipeg. In southcentral Manitoba, Paleozoic rocks are primarily carbonates with minor clastics and evaporites that dip gently at 2 to 10 metres (m)/kilometre (km) with the dip increasing to the southwest. Bedrock is overlain by glacial tills and proglacial lacustrine sediments.

Drift (surficial sediment) thickness in the Lowland area is quite variable, ranging between less than 10 m through large parts of the western and northern areas of the Lowland to more than 100 m thick southwest of Lake Manitoba and near the Manitoba-US border (Betcher et al., 1995). The surficial sediments comprise primarily glacial till, proglacial lacustrine and shallow marine sediments. In the Manitoba Lowlands, drift thickness is quite variable, ranging between 100 m southwest of Lake Manitoba and near the Manitoba-US border and less than 10 m in the Interlake. Inter- and intra-till sand and gravel deposits are found extensively in the tills of southern Manitoba. Sand and gravel deposits tend to be less common in the thinner tills of the Interlake region and, where found, are typically located at the bedrock-till interface and generally of limited areal extent.

3.2 Hydrogeology

The most extensive bedrock aquifer system in the province is the carbonate-evaporite unit which consists of a gently dipping layered sequence of dolostones and limestones with minor shales, sandstones and evaporites of Ordovician through Mississippian age (Betcher et al, 1995). The carbonate-evaporite unit is present throughout the Manitoba portion of the WCSB and where it is overlain by a clastic unit comprising Mesozoic and Cenozoic shales, sandstones and evaporites, the groundwater is saline and non-potable. The eastern extent of the clastic unit generally lies west of the western edge of Lakes Manitoba and Winnipegosis

and associated saline springs are present along the western edge of Lake Winnipegosis. Neither the clastic unit nor the associated saline groundwater are present within the Interlake area where the proposed developments are planned.

Primary hydraulic conductivity is quite low in the carbonate aquifer and groundwater movement occurs largely through an interconnected network of secondary and dissolution-enhanced features such as fractures, joints, bedding planes, etc. (Betcher et al, 1995). In the Interlake area, where the carbonate rock aquifer forms the uppermost bedrock unit, the upper 10 m is frequently heavily fractured and highly permeable. Below this, fractures are commonly present and will typically be intersected at similar depths in nearby wells suggesting the presence of areally extensive features of increased permeability. This is commonly referred to as the upper carbonate aquifer.

Regional recharge to the upper carbonate aquifer occurs in the central portion (See Figure 2) of the Interlake where the overlying till layer is thin or bedrocks outcrops at surface. This has created a local groundwater mound or divide, east of which groundwater flows towards Lake Winnipeg and west of which, groundwater flows toward Lake Manitoba and Lake Winnipegosis. Groundwater discharge occurs as seeps and springs and may also discharge into streams, marshes and lakes where the overlying till is thin. The confined aquifer is under positive pressure and typically exhibits artesian conditions which may or may not result in flowing springs and wells at surface, depending on local conditions.

Groundwater from the upper carbonate aquifer is typically calcium-magnesium-bicarbonate type with total dissolved solids (TDS) values between 400 milligrams per Litre (mg/L) and 800 mg/L. The aquifer is a major source of groundwater for municipal, industrial, rural residential and agricultural uses.

There are a few scattered and minor sand and gravel aquifers in the Interlake region; however much of the sand and gravel that is found tends to be in isolated lenses with limited storage capacity. Where present, groundwater in these aquifers is calcium-magnesium-bicarbonate type with aTDS of less than 600 mg/L. The hydro-chemical similarity between this and the groundwater in the underlying upper carbonate aquifer reflects the influx of groundwater from the underlying aquifer into the overlying sediments due to positive pressure within the confined aquifer. Details on Hydrogeologic conditions can be found in Appendix 1A (LMOC) and 1B (LSMOC).

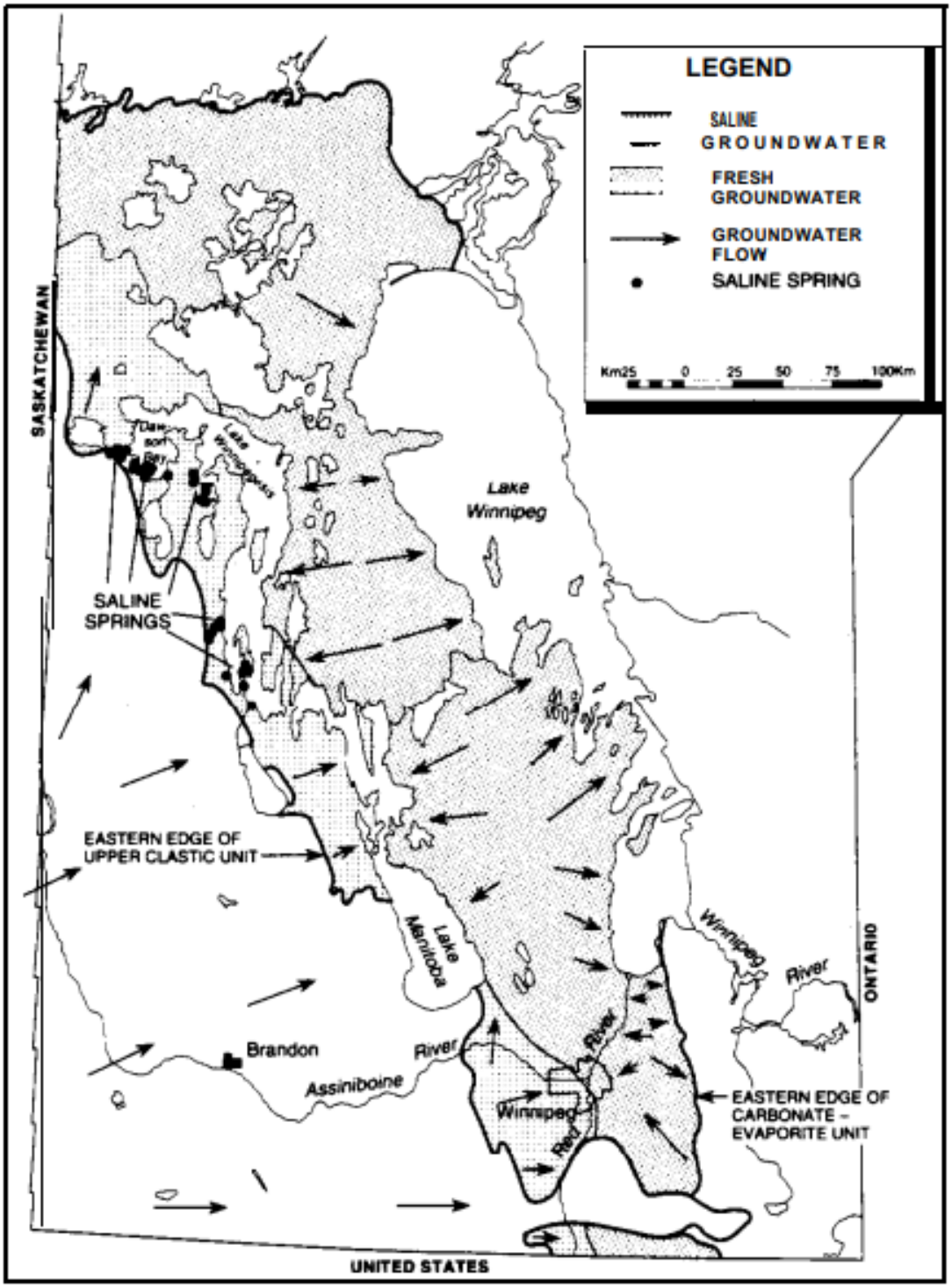


Figure 1: Regional Groundwater Flow in Carbonate-Evaporite Unit (Betcher et al., 1995)

4.0 MANAGEMENT CRITERIA

Groundwater management controls for this GWMP are designed to focus on addressing the following potential Project effects:

- Changes to groundwater piezometric pressure head
- Changes to groundwater quality
- Changes to groundwater surface water interactions

As indicated, adjustments may be made to the GWMP so that the Project is constructed and maintained in accordance with the terms and conditions of *The Environment Act* provincial license, and conditions of the CEAA 2012 Decision Statement as effects may impact elements within federal and provincial jurisdiction, once the Project is approved. This section describes the various management criteria associated with the three listed types of effects.

4.1 Piezometric Head

The Project will require depressurization of the confined bedrock aquifer during construction to reduce the risk of basal heave. Aquifer depressurization will continue post-construction during operation. Although long term depressurization (i.e., during operation) will be focused on areas within the Project development area (PDA), the reduced piezometric pressure head may impact the operation of private water wells within the RM of Grahamdale and located up to 5 km from the Project PDA.

Some key considerations for adaptive management are:

- Reduction in piezometric pressure head at flowing (non-pumped) wells to a level that will reduce but will not stop flow.
- Reduction in piezometric pressure head at flowing (non-pumped) wells to a level that will cause flowing wells to stop flowing.
- Reduction in piezometric pressure head at non-flowing (pumped) wells to an elevation below the pump intake that will cause the pump to stop operating.
- Reduction in piezometric pressure head at either flowing or non-flowing wells to an elevation below the well bottom that would require well deepening or a new installation.
- Reduction in piezometric pressure head to an elevation which impacts groundwater – surface water interactions.

For the LMOC, Project monitoring wells will be located near private water wells. The adaptive management response in this region will primarily focus on changes (reductions) in piezometric pressure head and their impacts on private water supplies. For the LSMOC, the focus will be on the potential impacts of changes in piezometric pressure head may on groundwater interactions with surface water. For both channels, the trigger that initiates adaptive management will be a change in piezometric pressure head; however, the

thresholds will vary to address the specific Project effects for each channel. For a detailed list of thresholds and associated actions and mitigations please see Sections 9.2.2 (LMOC) and 15.2.2 (LSMOC).

4.2 Water Quality

Groundwater quality is not expected to be affected by the Project; however, water quality criteria will be used to interpret groundwater quality data where required (i.e., for detailed design or to verify compliance with regulatory approvals). The criteria used to make management decisions are developed to suit the predominant usage of groundwater in the areas surrounding each channel. The predominant groundwater uses in the LMOC area are domestic and livestock watering. Therefore, the Health Canada – Canadian Drinking Water Quality Guidelines (HC-CDWQG)(Health Canada 2019) and the applicable Canadian Council of Ministers of the Environment (CCME 2011) and Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) (Manitoba Water Stewardship 2011) pathways will be applied. Groundwater quality triggers to implement adaptive management measures for LMOC and LSMOC will be different as the potential effects from changes in water quality are different. LMOC water quality protection is focussed on drinking water and/or livestock water protection, whereas water quality protection around the LSMOC is related to groundwater surface water interactions and how quality changes may potentially affect wetlands.

The primary adaptive management trigger will be exceedances in applicable water quality guidelines. Statistical trend analysis (such as Mann Kendall) will be run on water quality data which exceed the current baseline variability and/or the applicable regulatory criteria or guideline. Mitigation responses will be initiated if the effects are verified to be Project-related. Thresholds and associated actions and mitigations specific to each channel are presented in Section 9.2. (LMOC) and 15.2.2 (LSMOC).

4.3 Groundwater-Surface Water Interactions

The Project EIS documented changes to groundwater-surface water interactions as potential Project effects, but these effects are predicted to be limited in both extent and duration. A decrease in bedrock aquifer pressure may reduce groundwater discharge to the surface and may affect adjacent wetlands in the region. Groundwater monitoring will assist with understanding the groundwater pressure variations during construction and information on groundwater piezometric head and quality will be shared with surface water and wetland teams as it is collected. This information will aid in the further refinement of the adaptive management plan led by wetlands monitoring and management team, and therefore, threshold triggers will be established for those components in the wetland monitoring plan, and not be set in the GWMP.

Part 2: Lake Manitoba Outlet Channel

5.0 LMOC EXISTING CONDITIONS

5.1 Overview

In 2019, several field programs were conducted for the Project to provide baseline ground water quality and quantity information needed for environmental assessment (EA) and Project planning. These included: test hole and well installation, instrumentation, pumping tests, groundwater monitoring and water quality sampling. Groundwater monitoring and water quality sampling was also completed in 2020 and 2021 (Stantec 2020a, Stantec 2021b) and will continue on an annual basis through construction and the first two years of operation, as described in Section 8. Installation of an expanded monitoring well network will be completed in advance of construction start and will be incorporated into the monitoring and sampling program. Details on hydrogeologic conditions can be found in Appendix 1A.

The LMOC and LSMOC portions of the Project local assessment area (LAA) each display a unique response, and overall range in observed seasonal (i.e., year-to-year) and intra-seasonal (i.e., within season) aquifer piezometric pressure variability. Piezometric pressure changes that occur within the LAA portion of each channel have a different set of implications, in terms of receptors. In terms of groundwater quality, while the existing regional conditions surrounding the LMOC and LSMOC are generally comparable, the implications of any water quality changes with respect to the receptors in the vicinity (LAA portion) of each channel are different. Importantly, the implications for piezometric pressure variability/changes and/or groundwater quality changes within the LAA portion of the LMOC are related to a large number of private domestic and agricultural well users, along with the natural environment and nearby wetlands. Within the LSMOC portion of the LAA, the key sensitivity of groundwater discharge related to aquifer piezometric pressures and/or any groundwater quality changes is connected directly to groundwater contributions to the wetlands and fens that are pervasive in the LAA of the LSMOC. Because of these unique differences between the LMOC and LSMOC, adaptive management planning and associated setting of trigger levels within the adaptive management plans are somewhat unique and are directly reflective of the key needs within each LAA portion, to facilitate timely mitigative actions that are triggered appropriately and effectively.

5.2 Groundwater Piezometric Head

Bedrock Monitoring Wells

Groundwater level monitoring was conducted in conjunction with groundwater quality sampling during the 2019, 2020 and 2021 field seasons. Groundwater monitoring was completed in the spring (May/June) summer (July/August) and fall (September/October) of each year. Groundwater piezometric pressure head monitoring was conducted at a total of six locations along the LMOC alignment. These include four 2019 pump test locations (each comprising one pump well and two observations wells for a total of 12 wells) and two long term monitoring wells developed in earlier studies (KGS, 2017a). Table 1 lists the 14 monitoring wells used for the 2019, 2020 and 2021 piezometric pressure head monitoring program and the purpose of each well. Six of these wells, as indicated, are used for long-term groundwater pressure or groundwater quality monitoring, as indicated. In addition, data for two provincial wells (WRB-116766 and WRB-122050) located in the vicinity of the LMOC was provided by the Government of Manitoba (Hydata 2020) to provide long-term data from 2005 to present. Monitoring well locations are shown on Figure 2.

Table 1: Summary of Groundwater Wells in the LMOC LAA

Well ID	UTM Easting	UTM Northing	Ground Elevation (masl)	Purpose	Comment
Project Wells installed in 2019 for Preliminary Engineering					
PW19-17	5701488	5701488	248.876	Pumping Test well Long Term Pressure Monitoring	Flowing; Data Logger # C30274
OW19-16	5701488	532344	248.785	Observation well Long Term Quality Sampling	Flowing
OW19-18	5701488	532304	248.924	Observation well	Flowing
PW19-06	5696645	531018	250.472	Pumping Test well Long Term Pressure Monitoring	Flowing; Data Logger #C30288
OW19-05	5696655	531019	250.472	Observation well Long Term Quality Sampling	Flowing
OW19-07	5696695	531010	250.743	Observation well	Flowing

Well ID	UTM Easting	UTM Northing	Ground Elevation (masl)	Purpose	Comment
PW19-22	5688122	530695	248.514	Pumping Test well Long Term Pressure Monitoring	Flowing; Data Logger# C30065
OW19-23	5688132	530695	248.701	Observation well Long Term Quality Monitoring	Flowing
OW19-24	5688174	530694	249.171	Observation well	Flowing
PW19-39	530823	5683152	247.811	Pumping Test well Long Term Pressure Monitoring	Flowing; Data Logger# C30351
OW19-40	530823	5683152	247.909	Observation well Long Term Quality Sampling	Flowing
OW19-41	530823	5683152	247.844	Observation well	Flowing
Project Wells installed in 2016 & 2017 for Conceptual Design					
TH-ED-01W (TH-ED-01P) KGS WELL	530503	5692376	249.49	Long Term Pressure Monitoring	Groundwater Hydrographs from 2016 to present
15-RD-PW1 (TH-GD-07) KGS WELL	531900	5699454	252.05	Long Term Pressure Monitoring	Groundwater Hydrographs from 2017 to present



Figure 2: LMOC Baseline Groundwater Monitoring and Sampling Locations

Long-term monitoring wells installed into the bedrock are equipped with transducers to continuously monitor and record groundwater level, electrical conductivity, and temperature data. Four wells, previously used for pump testing (PW19-17, PW-19-06, PW19-22, PW19-39) were selected for long-term groundwater level monitoring along with two wells developed in earlier studies (15-RD-PW1 (TH-GD-07) & TH-ED-01W (TH-ED-01P); KGS 2017a).

The average annual groundwater pressure along the LMOC is plotted against the ground elevation in Figure 3. The pressure head remains about 3-5 m higher than ground level on average along the LMOC. The groundwater pressure decreases along the profile moving north (towards Lake St. Martin) and south (towards Lake Manitoba), indicating groundwater flow moving in those directions.

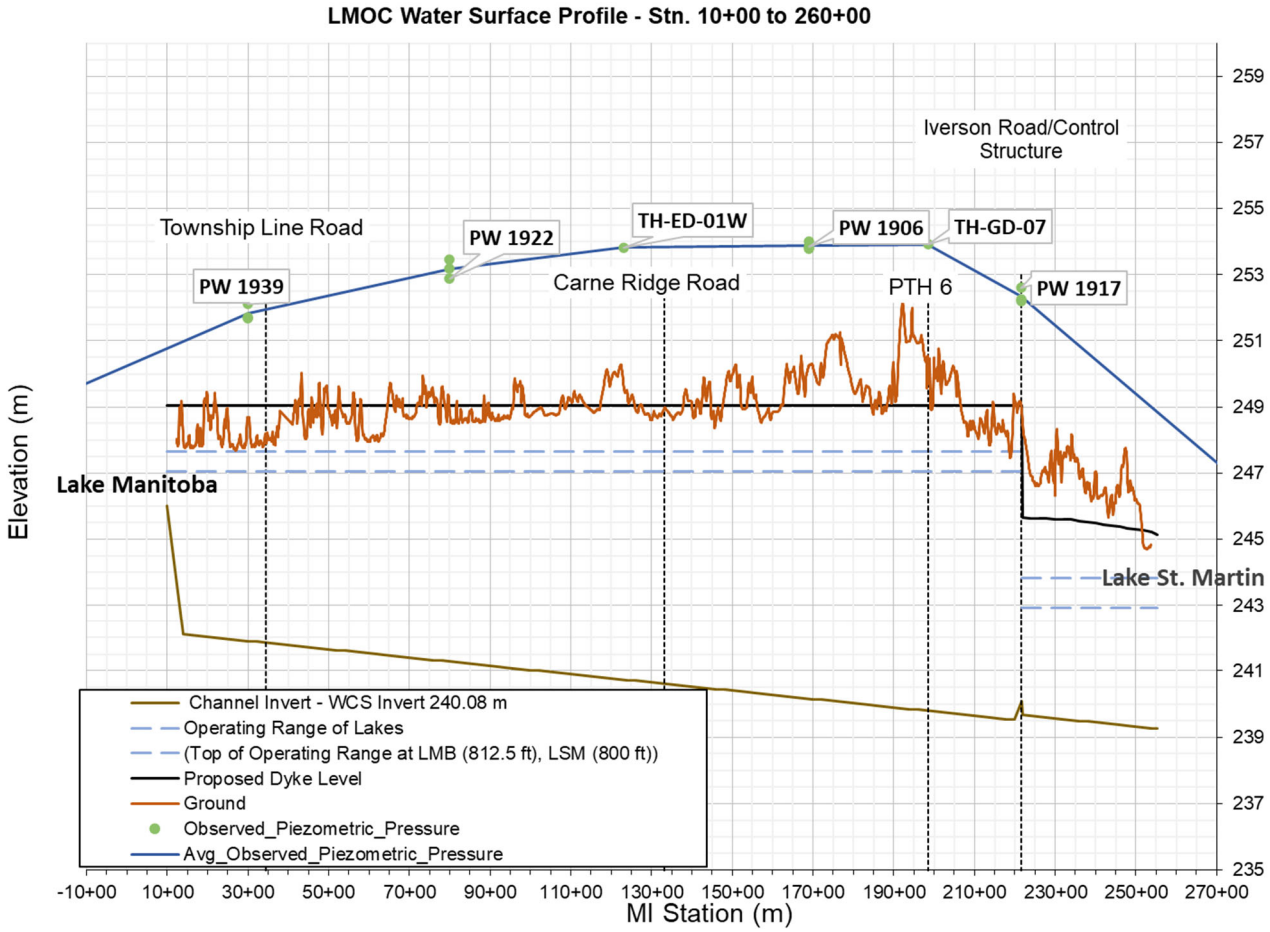


Figure 3: Groundwater Piezometric Head along LMOC profile

Based on the monitoring of piezometric pressure head along the channel alignment, the existing groundwater piezometric pressure head in the region of the LMOC was extrapolated and is shown in Figure 4. The direction of groundwater flow is controlled by the pressure head with the flow moving downgradient, perpendicular to the piezometric pressure head contour lines. Recharge occurs on both side of the channels (See Figure A-1 in Appendix 1A for location of recharge areas). The groundwater flow direction in the vicinity of the LMOC is to the north towards Lake St Martin and to the west and southwest towards Lake Manitoba.

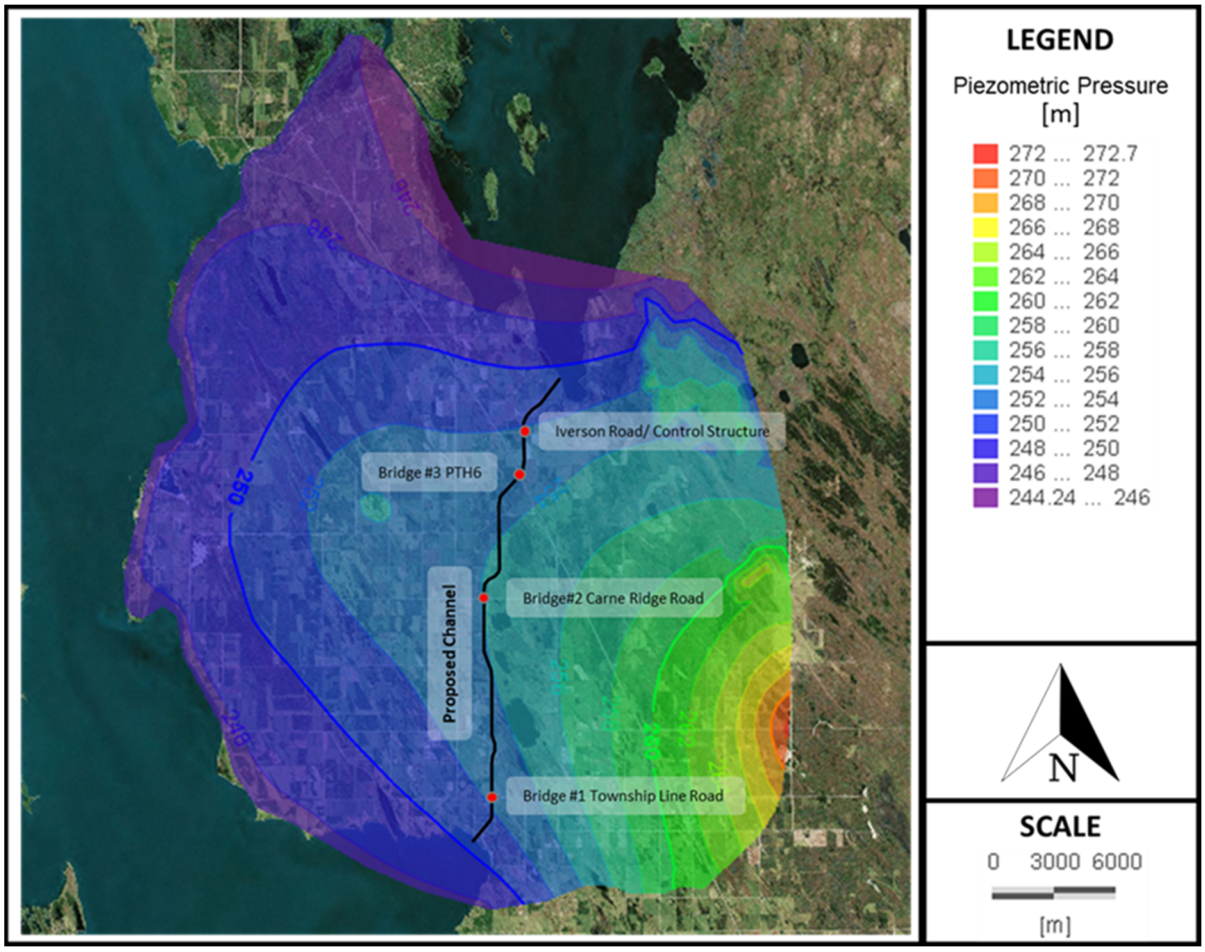


Figure 4: Existing Groundwater Piezometric Pressure Head Contours in the LMOC LAA

In much of the area the piezometric pressure in the aquifer is under artesian pressure. An estimate of the average annual piezometric pressure head above ground was calculated by subtracting the ground elevation from the pressure head elevation in Figure 4. To the east of the LMOC the piezometric head may be 5-8 m above the ground surface in some areas (Figure 5) and groundwater wells in this area would be flowing artesian wells.

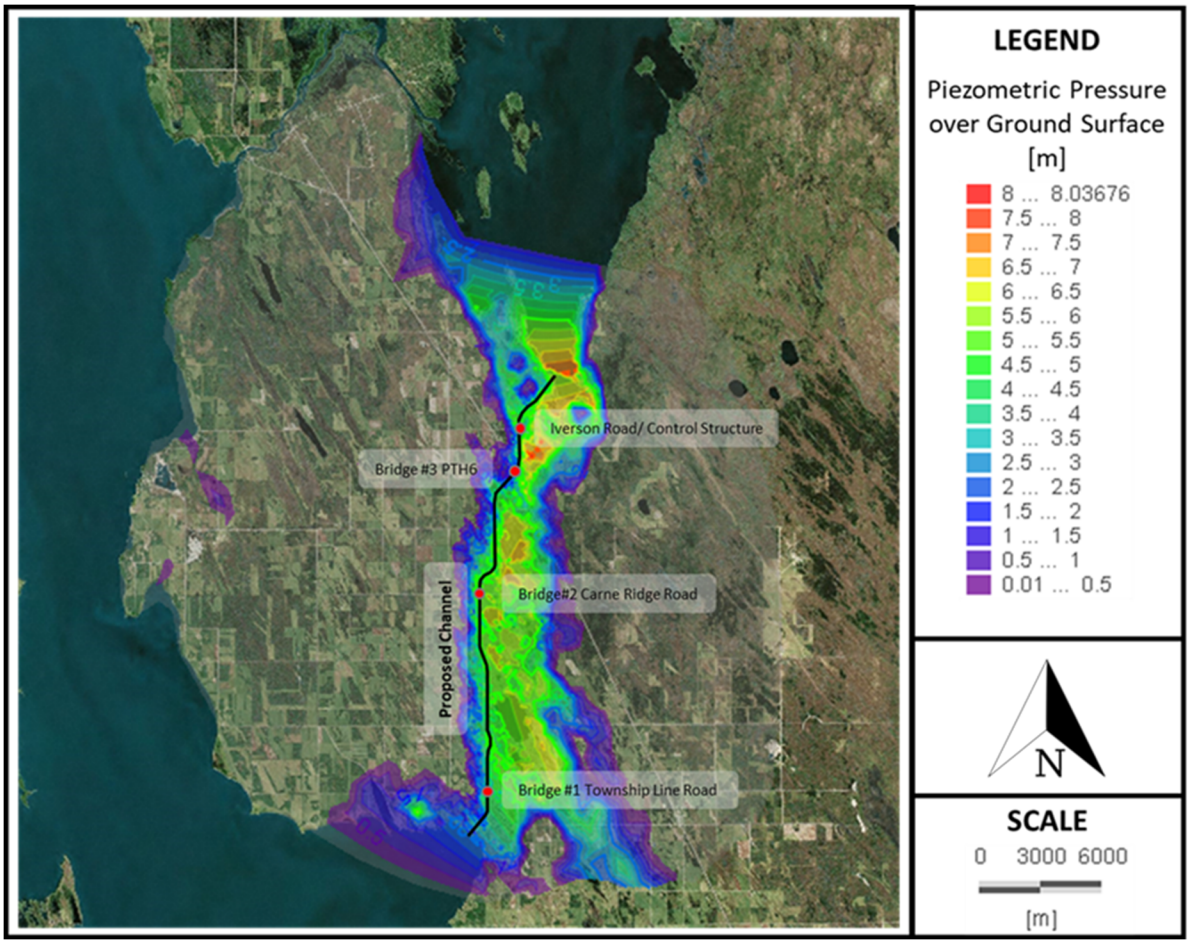


Figure 5: Piezometric Pressure Above Ground Surface near the LMOC Alignment

5.3 Groundwater Quality

Existing groundwater quality in the LMOC portion of the LAA was characterized using data collected from wells previously installed between 2016 and 2019. The purpose of collecting and characterizing the data was to:

- establish a preconstruction baseline of the groundwater quality so that changes occurring during or after construction can be identified
- assess the potential effects of groundwater being discharged to the surface during depressurization on surface water quality

In the LMOC portion of the LAA, available groundwater quality monitoring data is a compilation of data collected during field programs conducted between 2016 and 2018 (KGS 2017a, 2017b, 2018) and data collected in 2019, 2020 and 2021, as part of the ongoing pre-construction monitoring program (Stantec 2021a and Stantec 2021b). In 2019, 2020 and 2021, groundwater sampling was conducted at 13 sites (CH-19-08, OW19-18, PW19-17, OW19-16, CH19-11, BH19-12, OW19-05, PW19-06, BH19-29, OW19-23, PW19-22, CH19-37, OW19-40; Figure 2). Water quality results from these programs were compared to applicable CCME and MWQSOG criteria and guidelines. As the upper carbonate aquifer is a common source of local drinking water, the data were also compared against HC-CDWQG.

Based on reviewing existing data and the Project-specific sampling data, groundwater quality in the aquifer provides good quality drinking water. The groundwater quality generally meets the applicable CCME and MWQSOG criteria and/or guidelines.

5.4 Groundwater-Surface Water Interactions

The Birch Creek and Watchorn Creek valley is in a region of high piezometric pressure (4 to 8 m above ground) from the underlying confined bedrock aquifer. A thick impermeable till layer is present under most of the valley, limiting upward groundwater seepage flow to surface. An exception exists to the east of Reed Lake, further from the LMOC, where bedrock is present closer to the surface (See Figure A-1 in Appendix 1A). An analysis was done of groundwater and surface water quality to estimate the percentage of the surface water that could be influencing the water bodies east of the LMOC along Birch Creek (Stantec 2021c). The percentage of groundwater discharge in the upper reaches of the Birch Creek wetland lakes (from Reed Lake to Clear Lake) is in the range of 6 percent (%) to 13% of the flow to these lakes. Further downstream the percent of groundwater discharging into Birch Creek would be even less, representing less than 1% of the surface water flow.

6.0 LMOC SUMMARY OF EFFECTS

6.1 Overview

In order to safely and successfully construct, operate and maintain the LMOC, depressurization of the bedrock aquifer is required. Groundwater conditions along and in the vicinity of the LMOC are complex and driven by the regional groundwater aquifer system in the Interlake (i.e., between Lake Manitoba and Lake Winnipeg). Management of the groundwater conditions is important for the successful construction and long-term operation of the Project as discussed below. Responsible management of the groundwater conditions has been identified as important to Aboriginal treaty rights, health, social conditions and sustainability of these communities.

Stratigraphy beneath the LMOC portion of the LAA (as described in Appendix 1A) comprises a confined carbonate bedrock aquifer which is overlain by 5 m to 18 m of till. Flowing artesian wells are present along the LMOC alignment, with piezometric pressure head elevations that can be up to 5 m above the ground surface. The bedrock aquifer is recharged regionally via rainfall and snowmelt. Groundwater local to the LMOC recharges regionally in upland areas as well as from local recharge zones to the east and west of the LMOC. Groundwater flow in the carbonate aquifer is interpreted to be from the LMOC area south towards Lake Manitoba and north towards Lake St. Martin (see Figure 4).

Construction and operation of the LMOC will result in potential changes to the existing groundwater conditions within the till and confined aquifer piezometric pressure conditions along the LMOC between Lake Manitoba and Lake St. Martin. These may include water level (pressure) changes in aquifers and changes to the amount of groundwater discharge to Lake Manitoba and Lake St. Martin. However, no change to the overall water balance of either lake is expected because of construction and operation of the LMOC.

In areas where the bedrock aquifer pressures are elevated relative to the thickness of the confining till aquitard units there is a potential for basal heave/hydraulic fracturing of the till to occur, particularly during channel excavation and unloading of the confining aquitard units. This may induce some localized fracturing of the overlying till where the layer has become thinner because of construction activities, allowing groundwater from the bedrock aquifer to discharge at the base of the excavation. Areas where basal heave occurs during construction will be over-excavated and backfilled with filter material and coarse gravel, if and as they occur.

The creation of new groundwater discharge pathways into the LMOC will locally increase the direct connection of exfiltrating groundwater from the underlying bedrock aquifer to channel surface water. Groundwater currently flows towards and discharges into Lake Manitoba and Lake St. Martin under the existing pre-Project conditions.

Based on the long-term groundwater balance, the operation of the channel (with water control structure [WCS] gates open or closed) is not expected to alter the groundwater flow direction towards the lakes. The fraction of the bedrock groundwater flow that would have otherwise discharged into the lakes will be captured by the depressurization wells and reverse drain and be transported to the lakes via the LMOC. The regional groundwater flow direction will remain consistent, although local groundwater gradients and velocity may be increased by the Project depressurization. Further analyses and details will contribute to advancing the preliminary design.

6.2 Groundwater Piezometric Head

The LMOC is located on the west side of Birch Creek valley (Figure 2). The average piezometric head elevation in this area ranges between 249 metres above sea level (masl) and 255 masl and is artesian, with piezometric pressures of up to 5 m above ground level along the LMOC. The bedrock aquifer is fully saturated. The flowing artesian pressures (i.e., where the piezometric head is above ground) present in the Birch Creek valley extend approximately 5 km to the east of the LMOC (Figure 5). As the ground elevation is lower along Birch Creek, the existing piezometric pressure head above ground will be higher (5 to 8 m) in these areas.

Currently, the groundwater aquifer is recharged in the uplands between Lake Manitoba and Lake Winnipeg (and locally in recharge areas away from the channel) and discharges into Lake Manitoba and Lake St. Martin. With the construction dewatering and long-term depressurization in place, the aquifer will continue to recharge in the same areas, feed the domestic and livestock wells in the area (although at a reduced pressure), and discharge to both Lake Manitoba and Lake St Martin either directly or indirectly via the LMOC.

During and after construction, in all areas along the channel and for several kilometers to each side, the piezometric pressure head is expected to remain above the upper surface of the bedrock (i.e., will remain artesian) and the aquifer is expected to remain fully saturated. All known registered wells in the LMOC area, for domestic or livestock consumption, draw from the bedrock aquifer. While depressurization activities will lower the aquifer piezometric pressure head, it is not expected to be lower than the top of the bedrock unit and therefore the wells are anticipated to continue to be wet. However, the decreased pressures may cause the cessation of flow in some wells when the piezometric pressure drops below the local ground elevation. In these instances, pumping would be required for water supply. In some cases, the pump intake may need to be lowered in the well to improve well function. If the well capacity is insufficient and well operation is impaired, mitigation will be necessary, as described in Section 7.

The construction and long-term depressurization system planned for the LMOC will reduce the groundwater piezometric pressure head in the LMOC portion of the LAA (See Section 7.3). Throughout the Birch Creek valley area where flowing artesian wells exist (5 km east of the LMOC as shown on Figure 5 where the piezometric head is above ground), the artesian pressure will be reduced, and in most of this area flowing artesian pressure may be lost. This will have a direct effect on artesian-dependent well operation and some wells will not operate without pumping. The location of the wells used for monitoring during construction is discussed in section 8.3 and the process for identification of wells that may require mitigation are discussed in Section 9.

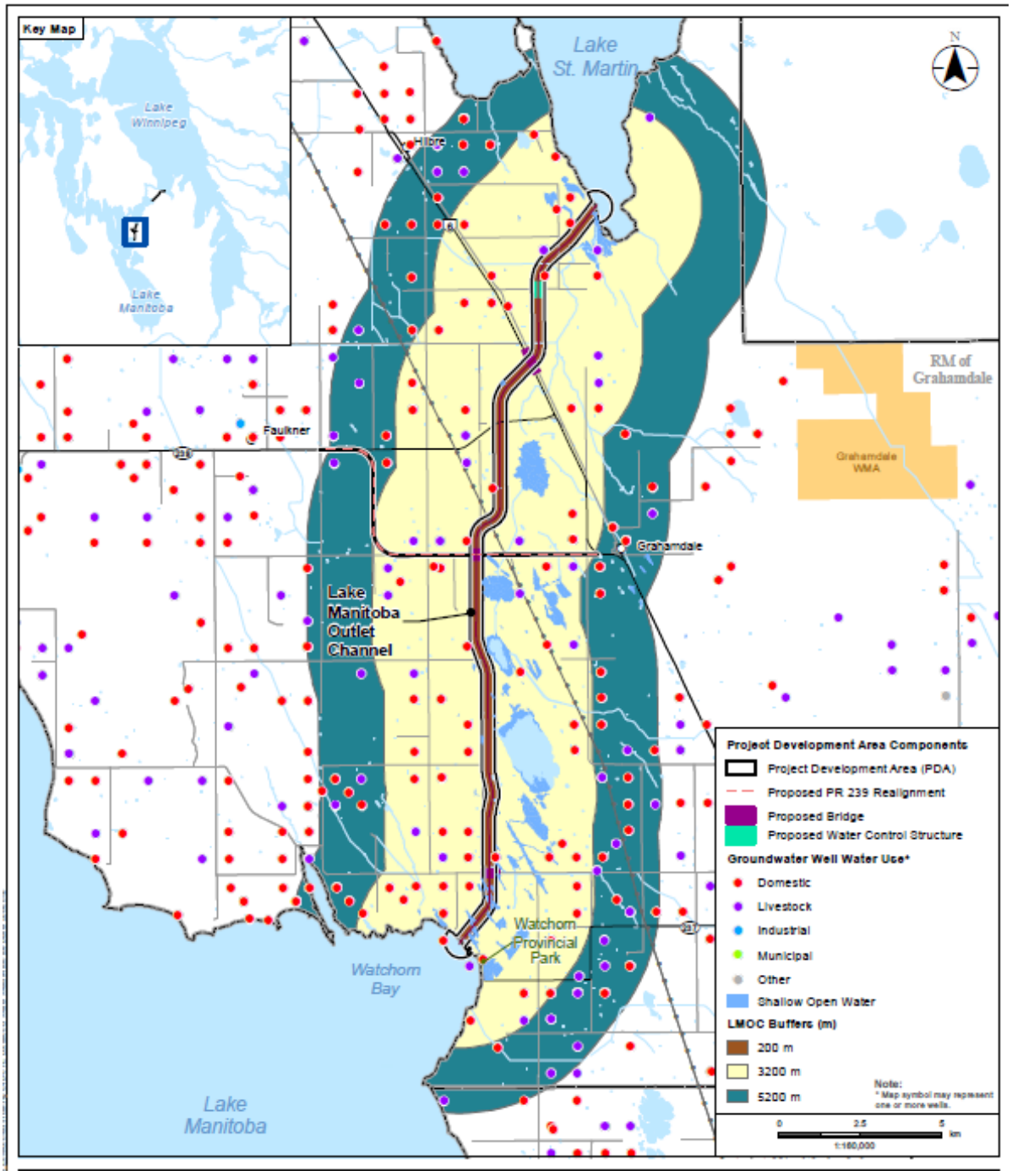


Figure 6: Area of Effect of Depressurization

6.3 Groundwater Quality

No effects to groundwater quality are expected due to the Project. The LMOC channel was located to take advantage of the natural artesian conditions which exist along the LMOC channel alignment, as discussed in Section 5.2, which will reduce the risk of surface water influences on groundwater quality. Construction and operation of the LMOC will require depressurization of the aquifer to reduce the potential for basal heave, till fracturing and slope failure. However, even with active depressurization during construction, the bedrock aquifer in the LMOC area will remain under positive pressure, although the pressure will be reduced, and the piezometric pressure head elevation may no longer exceed the local ground elevation. Recharge of the aquifer via the base of the LMOC is not expected to occur as the upward pressure of the groundwater in the upper carbonate aquifer will promote groundwater discharge at this location.

Should a change occur such that groundwater pressure decreases and the elevation of the piezometric head drops below the elevation of the ground surface (at the base of the channel), the overlying till and passive drains would act as filters for the surface water. Pressure changes are anticipated to be rare and transient events and not sufficient to cause any change to the groundwater quality. Regular monitoring of the aquifer in the region will be conducted both during and post-construction.

6.4 Groundwater-Surface Water Interactions

The percentage of groundwater discharge in the upper reaches of the Birch Creek wetland lakes (from Reed Lake to Clear Lake) in the range of 6% to 13% of the flow to these lakes; (Stantec 2021c). Further downstream the percent of groundwater discharging into Birch Creek would be even less, representing less than 1% of the surface water flow. The loss of flowing piezometric head in the region is expected to stop this flow; in addition, surface water flow from the west will be affected by the Project as the LMOC will intercept this drainage in the Birch Creek watershed.

7.0 LMOC MITIGATION MEASURES

7.1 Overview

A construction sequencing plan for the LMOC is being developed prior to construction start and will require information on temporary bedrock depressurization at construction locations specific to each construction contract. Because depressurization requirements for one contract area have the potential to influence another, the timing of a group of construction contracts needs are being considered to optimize the depressurization plan. Accordingly, active aquifer depressurization plans will be developed for each year of construction (short-term) based on construction progress and local conditions and will include the installation of temporary depressurization wells near the construction area perimeter(s) to reduce groundwater pressure to the required targets. Groundwater quality will be monitored and mitigated as required prior to discharge to the surface, with surface water issues being addressed in the Surface Water Management Plan [SWMP]. Triggers, thresholds and mitigation for local area wells is discussed in Section 9.0.

As the channel is built sequentially, the long-term depressurization measures (for use during channel operation) for each section of the channel under construction will be installed. Whereas short-term depressurization will require a combination of active pumping and passive depressurization, long-term measures will rely on passive depressurization via reverse drains or passive (non-pumped) wells. Therefore, both short-term construction-related effects and long-term operation-related effects from depressurization will need to be considered concurrently. In addition, mitigation measures for domestic or livestock wells during construction (see Section 7.3.2) may need to remain in place for the long-term.

Groundwater dewatering wells will be installed in the confined bedrock aquifer according to the depressurization requirements of the construction sequencing plan. Groundwater will be pumped out to lower the piezometric pressure head in the aquifer, to an elevation below the base of the channel and held there during construction. As indicated, aquifer depressurization will continue in the long-term during operation. An estimate of the drawdown using analytical models was developed as part of the conceptual design (KGS Group 2017a). Sensitivity analysis was performed by varying transmissivity and storativity coefficients. The depressurization will be highest at the channel site during construction, with an estimated reduction in piezometric pressure head of about 14 m to reach the invert of the channel at the WCS. The magnitude of the effect of depressurization will reduce with distance from the channel alignment. The estimated reduction in piezometric pressure head at a distance of 3 km from the segments of the channel being actively depressurized is estimated to be between 1.5 m and 3.3 m and between 0.9 m and 2.7 m at 5 km distance (Figure 6). Typical seasonal piezometric head variation in the aquifer near the LMOC is predicted to be 2.5 m to 3 m per year. In most cases (at a distance greater than 3 km) and in all cases (at a distance greater than 5 km), the decrease in pressure (piezometric head) from the Project dewatering depressurization is expected to be within the typical seasonal variation of pressure and would likely have no impact on domestic well operation. Away from the WCS, mitigation will entail to raising the depressurization target above the invert along the LMOC to reduce the magnitude of the regional groundwater effects. The

process is ongoing, and each target adjustment will be site specific and depend upon site-specific geotechnical analyses.

7.2 Aquifer Depressurization During Construction

7.2.1 LMOC Groundwater Depressurization

Design work related to the depressurization measures that are required during construction of the LMOC is ongoing. In general, these measures are expected to consist of the installation of temporary wells that will be actively pumped during construction of the LMOC and its associated structures to protect against unplanned groundwater discharge and basal heave in open excavations.

A groundwater depressurization plan to achieve the design requirements will be developed and other specifications listed in the tender will be developed. Activities to be conducted may include:

- design and location of drilling and testing programs to further define aquifer conditions, and analysis of associated pump test results
- development of pumping system configuration for required combined total pump flow rate and individual flow rates, and discharge water requirements and associated handling of discharge groundwater
- supply, installation and testing of bedrock pumping wells and associated observation wells according to types, sizes, materials, and construction specifications
- supply, installation and testing and commissioning of a bedrock groundwater depressurization pumping system at the WCS, including such items as pumps, power supply, drop piping, wellhead connections, well system header discharge piping, well caps and flow meters
- bedrock groundwater depressurization system operation including preparation of discharge area for erosion control and aeration at discharge header outlet
- on-site monitoring (groundwater flow and piezometric pressure) in the work area
- water quality testing of the WCS depressurization system pump discharge water during pump test and depressurization operations
- regional monitoring of groundwater elevations

Work will be supervised by the Contract Administrator and undertaken by the Contractor Administrator, their designate, or the contractor.

The impact of depressurization on the surrounding groundwater system will be monitored during construction, as identified in Section 8.4.1, and assessed to inform the implementation of mitigation measures and adaptive management strategies. Where predictions indicate that impact is possible, mitigation planning will be initiated prior to construction. Adaptive management measures will be applied where impacts occur that were not predicted prior to construction, and/or exceed thresholds. Follow-up measures will be implemented to drive continuous improvement.

7.2.2 Groundwater Piezometric Head

The depressurization of the aquifer at the LMOC will cause a decrease in groundwater piezometric head at wells nearby. A measurable loss of piezometric head greater than natural variation is expected within 3 km from the LMOC and is likely up to 5 km away. Beyond 5 km effects greater than natural variation are not expected.

The specific impact at each well will depend upon the amount of change in regional piezometric head, the well installation details, and well use. Mitigations will be unique to each well circumstance and will include consideration of several issues. Wells that were flowing but are no longer flowing may require pumps. Pumped wells where the piezometric pressure head has dropped below the pump intake level may need either a new pump set up or to lower the pump intake level. Piezometric head monitoring of sentinel wells will occur during construction, as discussed in section 8.4, and thresholds, actions and mitigations for water supply effects are summarized in Section 9.2.2 (LMOC Adaptive Management and Follow-up).

To mitigate the impact to the regional aquifer, reducing the amount of active pumping required at locations away from the WCS and bridges along the LMOC is being investigated. If successful, this mitigation measure may reduce regional depressurization in the southern half of the LMOC.

7.2.3 Groundwater Quality

As indicated, the key mitigation to protect groundwater quality in the LMOC portion of the LAA was siting the LMOC to take advantage of local artesian conditions and reduce the risk of surface water influences on groundwater quality. Depressurization measures involve actively pumping groundwater out of the aquifer and will not change the water quality of the aquifer. All wells that are not actively used for supply (private wells), or monitoring (Project wells), should be capped and locked or decommissioned to reduce the risk of aquifer contamination. Groundwater quality monitoring will be conducted during construction (see Section 8.4.2). Thresholds, actions, and possible mitigations for unanticipated project-related private water well quality effect are discussed in Section 9.2.3.

7.2.4 Groundwater-Surface Water Interactions

As stated in Section 6.4, the proportion of groundwater discharge to the Birch Creek wetland lakes is between 6-13% of the overall water balance and that proportion decreases downstream (i.e., into Birch Creek). Once the channel is constructed, loss of flowing piezometric head in this area is expected to eliminate groundwater discharge to these lakes and drainage in the Birch Creek watershed from the west will be intercepted by the LMOC. Monitoring of piezometric head in the bedrock and till in the vicinity of the Birch Creek lakes will be conducted both during construction and post construction. No mitigation is planned in the GWMP; however, groundwater data will be shared with surface water and wetland teams as it is collected to inform Project planning and adaptive management, with mitigation issues being addressed in other plans, such as the SWMP, and in measures to address effects to wetlands.

7.3 Aquifer Depressurization During Operations.

7.3.1 Design of Operation Depressurization Plan

Aquifer depressurization is required to reduce the potential for post-construction basal heave and slope instability within the channel. A long-term target level for piezometric pressure head has been developed that meets these requirements (see Section 9.2.2). As a mitigation, these targets may be raised to reduce impacts to regional groundwater. Areas south of the WCS and between the bridge cross may require less depressurization than originally assessed.

To depressurize the bedrock aquifer along the LMOC a hydraulic connection to the surface is required. Two passive depressurization options will be used at various locations:

- depressurization via reverse drains
- depressurization via wells

Reverse Drains

In some reaches of the LMOC the excavation of the channel will intersect the bedrock directly (i.e., at the WCS) or only a relativity thin layer of till will remain between the channel invert and the top of bedrock. In these areas pressure relief can be effectively provided by excavating to the bedrock and infilling with fine- to medium-grained clastic material. This material will provide a cover on the bedrock aquifer while increasing the hydraulic conductivity to allow water to flow upward from the bedrock aquifer into the channel base. This will provide passive depressurization along and perpendicular to the channel.

As with the depressurization wells, the reverse drains along the channel will flow year-round under positive pressure. The reverse drains would not pose a threat of contaminating the aquifer as they will be installed in aquifer discharge zone(s) and not in recharge zone(s). Should the groundwater pressure decrease, allowing surface water to recharge the aquifer, the drain will act as a filter for surface water as it enters the subsurface.

Wells

Depressurization wells will be installed outside the LMOC channel limits and each well will be pumped to reduce groundwater piezometric pressure in the confined aquifer during construction only. Passive depressurization wells/reverse drains, for long-term operation, will be located within the LMOC channel and will be designed for passive relief directly into the channel. These wells would remain under artesian pressure post construction; therefore, groundwater will flow upward year-round, and the reverse drains will act as a discharge zone for the aquifer. There will be no active pumping wells long-term. As a result, a portion of the aquifer groundwater, currently naturally discharging into Lake Manitoba or Lake St. Martin, will be artificially discharged to the LMOC through these wells. The positive pressure in the aquifer depressurization wells will protect against aquifer contamination.

As an added contingency measure to avoid unanticipated effects to groundwater, each passive depressurization location will have a layer of granular (sand and gravel) filter material installed on top. During operation, groundwater will discharge upward through the reverse drain. If the groundwater in the aquifer near the LMOC is depressurized (e.g., by unauthorized pumping that depressurizes the aquifer in an area adjacent to the LMOC to below the water level of the LMOC) the water entering from the LMOC will be filtered through the sand and gravel filter on top of the passive well. There will be no active depressurization pumping long term (i.e., post-construction).

7.3.2 Groundwater Piezometric Heads

The long-term depressurization system planned for the LMOC will reduce the groundwater piezometric pressure head elevation in the LMOC portion of the LAA. Active depressurization during construction was required to minimize the potential for basal heave and till instability in the channel walls. Once the channel is complete and operating the weight of the water in the channel will counteract some of the upward pressure effects from the confined bedrock aquifer and active depressurization will no longer be required. Passive depressurization (via reverse drains) will continue and will help the groundwater system stabilize. This will allow for some rebound in piezometric pressure head elevation; however, the overall pressure head elevations will remain lower than prior to construction.

Throughout the Birch Creek valley area, where flowing artesian wells currently exist (within 5 km of the LMOC, as shown on Figure 6), the artesian pressure will be reduced and in most of this area, flowing artesian pressure may be lost. All registered wells in the LMOC area are for either domestic or livestock consumption and draw from the bedrock aquifer. Some wells that will be impacted and mitigated during construction may need some adjustments to optimize performance once the piezometric pressure head in the bedrock aquifer stabilizes. These will be revisited on a case by case basis. While a return of flowing well conditions is not anticipated, there is no anticipated long term loss of groundwater in the LMOC portion of the LAA.

7.3.3 Groundwater Quality

As previously described, the siting of the LMOC to take advantage of local artesian conditions will reduce the risk of surface water influences on groundwater. The greatest risk for water quality impacts is through aquifer recharge at the base of the channel during operations. This is not expected to occur as the upward pressure of the groundwater in the upper carbonate aquifer will continue to promote groundwater discharge into the channel post construction. Should a change occur such that groundwater pressure decreases and the elevation of the piezometric head drops below the elevation of the surface, the overlying till and passive drains would act as filters for the surface water. Pressure changes are considered to be rare and transient events and not sufficient to cause any change to the groundwater quality. Regular monitoring of the aquifer in the region will be conducted during, and post-construction.

7.3.4 Groundwater-Surface Water Interaction

Once the channel is constructed, the loss of flowing piezometric head in the Birch Creek valley may reduce groundwater discharge. In addition, surface water flow from the west will be intercepted by the LMOC thereby reducing recharge to the Birch Creek valley. Monitoring of piezometric head in the bedrock and till in the vicinity of the Birch Creek lakes will be conducted both during construction and post construction. As indicated previously, no mitigation is planned in the GWMP; however, groundwater data will be an input to the Wetland Monitoring Plan (WetMP), and mitigation issues will be addressed in other plans, such as the SWMP, and in measures to address effects to wetlands. The additional data may help to refine the adaptive management strategies for these other plans.

To mitigate the impact to the regional aquifer, reducing long-term passive depressurization to the WCS and bridges along the LMOC is being investigated. Less depressurization may be used at and between the bridges. If successful, this mitigation measure may reduce regional depressurization in the southern half of the LMOC and may reduce impact to groundwater-surface water interactions.

8.0 LMOC MONITORING

8.1 Objectives

The objectives of the LMOC groundwater monitoring program include:

- pre-construction monitoring of groundwater quality to determine baseline conditions and support engineering design
- verify anticipated effects to groundwater quality, quantity and based on the EA completed for the Project
- determine the effectiveness of mitigation measures
- assess the need for additional mitigation measures if initial measures are not adequate
- determine the effectiveness of any additional / adapted measure(s)
- confirm compliance with regulatory requirements relevant to groundwater quality and quantity

Groundwater monitoring in the LMOC portion of the LAA has and will generally be conducted three times per year, in the spring, summer and fall - prior to, during, and for two years following construction (including a flood year and one year post-flood). Additional groundwater monitoring will be required during active depressurization (construction) to understand the migration of the depressurization front within the bedrock aquifer and monitoring / sampling programs will be adjusted to meet the requirements of the GWMP. In all Project phases, groundwater will be monitored for both quality and quantity (i.e., groundwater level [pressure head]). Standard field and laboratory quality assurance/quality control (QA/QC) protocols will be followed, including the use of trip blanks and collection of field blanks and blind duplicate samples. Monitoring results and analysis will be completed and communicated via written report on an annual basis. Multi-year/trend analysis may also be needed.

8.2 Baseline Monitoring

8.2.1 Groundwater Piezometric Head

Groundwater piezometric head data for the LMOC was collected from wells shown in Table 1 and Figure 2 during Project-specific monitoring programs between 2016 and 2021. Data for two provincial wells (WRB-116766 and WRB-122050) located in the vicinity of the LMOC was provided by the Government of Manitoba (Hydata 2020) to provide long-term data from 2005 to present. These 16 wells were used to define the piezometric groundwater head in the region.

8.2.2 Groundwater Quality

Groundwater quality samples are collected three times per year from the groundwater wells shown in Table 1. Collected samples are analyzed for the suite of parameters listed in Table 2 to characterize baseline groundwater quality conditions. The analytical suite of parameters was selected to characterize the groundwater and includes:

- field monitoring to determine aquifer conditions [temperature, pH, dissolved oxygen (DO) and oxygen reducing potential (ORP)
- potability testing to determine the quality and type of groundwater
- trace metal analyses
- petroleum hydrocarbon constituents and microbiological components due to the proximity of developed areas to the LMOC (to assess potability and risk of surface water- groundwater interactions)

The results of the groundwater sampling program are documented in annual monitoring reports (Stantec 2020a, Stantec 2021b).

Table 2: Groundwater Parameters Measured in LMOC Pre-Construction Monitoring Program

Category	Parameters
Field Monitoring	temperature, pH, electrical conductivity (EC), DO, oxygen reduction potential, TDS, turbidity, pressure, nitrate
Potable Water	electrical conductivity, hardness, pH, TDS, turbidity, alkalinity, ammonium (as nitrogen [N]), bicarbonate, carbonate, chloride, fluoride, hydroxide, nitrate and nitrite (as N), nitrate (as N), nitrite (as N), phosphorus, sulfate, TDS, total Kjeldahl nitrogen, total suspended solids
Total & Dissolved Metals	aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, cesium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, phosphorus, potassium, rubidium, selenium, silicon, silver, sodium, strontium, sulfur, tellurium, thallium, thorium, tin, titanium, tungsten, uranium, vanadium, zinc, zirconium
Petroleum Hydrocarbons	BTEX (Benzene, Toluene, Ethylbenzene, Xylenes), and Hydrocarbon Fractions F1 through F4
Microbiological	*Escherichia coli (E. coli)*, total and fecal coliforms

8.2.3 Groundwater-Surface Water Interactions

Groundwater/ Surface water interactions were estimated using information collected from the annual monitoring reports on groundwater and surface water quality (Stantec 2021a, Stantec 2022a). This information includes static water levels and piezometric pressure head (groundwater), surface water elevations, and surface water and groundwater quality.

8.3 Pre-Construction Monitoring

Baseline groundwater monitoring activities will continue during the detailed design phase of the Project to support the finalization of engineering design prior to Project tendering and construction. These activities include:

- continued monitoring of groundwater levels (static water levels and piezometric head) at existing instrumentation
- collection of groundwater samples for laboratory analysis of the parameters in Table 2 (above)

The Project monitoring well network will be expanded as described in Section 8.3.1 below. The expansion includes replacement wells for those currently installed within the LMOC right-of-way, which are expected to be decommissioned prior to construction start and monitoring wells at additional locations to support piezometric pressure head and water quality modeling during and post-construction. This section describes the planned additions to the current baseline monitoring program and how the baseline and pre-construction baseline monitoring data for the wells within the LMOC right-of-way will be integrated to that from their replacement wells.

8.3.1 Network Expansion

The groundwater monitoring network includes wells located proximal to the WCS, Birch Creek wetland lakes, a possible groundwater recharge area, near Federal lands (i.e., Pinaymootang First Nation), and landowners in the LMOC portion of the LAA. The purposes of well site selections proximal to these features or areas are described below.

Groundwater Piezometric and Groundwater Quality Data

Baseline Replacement Wells

The existing baseline monitoring well network is nearly all located within the LMOC Right of Way (ROW). These monitoring wells will be decommissioned because they are located within the areas to be excavated during the preliminary stages of construction and therefore will be lost as data points. New monitoring well locations have been selected adjacent to the LMOC ROW so that consistent data collection can continue during construction and operations. The replacement groundwater wells will retain the same function as the baseline monitoring wells (i.e., collection of groundwater quality and/or groundwater level data) and will be installed at locations proximate to the existing baseline monitoring wells to address/confirm potential construction/operation groundwater effects in comparison to the pre-construction data program. An overlap period of monitoring is ideal to allow for integration for the two data sets.

Water Control Structure

During construction, the largest drawdown is expected to occur around the WCS due to the required depth of excavation and relatively shallow depth to the top of the bedrock aquifer surface below grade. Active groundwater depressurization will occur continually at this location throughout construction and a reverse drain will be installed to allow for passive depressurization during channel operation. An array of groundwater monitoring wells, located near and radiating outward from the WCS, is proposed to facilitate monitoring of effects of the WCS dewatering on groundwater piezometric pressure and quality. Wells no longer required for monitoring (post-construction once aquifer conditions have stabilized) will be decommissioned as part of future works.

Private Wells in the LMOC Portion of the LAA

Project monitoring wells will be located in areas close to landowner wells that have a potential to be affected by depressurization. Based on the groundwater modeling analysis (see Figure 6), landowners with water wells within 3 km of the Project are likely to experience changes to their water supply as a result of the required aquifer depressurization activities during construction. Between 3 km and 5 km, some effects may be identified in some areas; however, at a distance of 5 km or more away from the Project, the induced change to water levels is anticipated to be within the range of seasonal variability and measurable changes to the water supply at these locations are not anticipated. The monitoring network will include wells within the 0-3 km zone of influence, wells within the 3-5 km zone of potential influence and wells beyond the 5 km buffer to confirm the expected limited aquifer response beyond this point. Monitoring wells installed at or greater than 5 km from the channel will be important sources of information regarding the detection of any unexpected impacts if they do occur.

Groundwater-Surface Water Interactions

Wetland Lakes

Surface water and groundwater interaction effects in the small wetland lakes to the east of the proposed LMOC (i.e., Reed Lake and Clear Lake) have been raised as a concern by various stakeholders and First Nations communities. A Wetland Monitoring Plan has been established to examine changes to wetlands. To monitor changes to groundwater discharge that could impact the potential for surface water infiltration into the subsurface, well clusters will be installed near the wetland complex. The well clusters or well pairs will comprise a deep well completed in the bedrock aquifer and a shallow well completed in the overlying unconsolidated sediments. Where appropriate, a third even shallower well location may be included if there is a peat layer present. It is anticipated that both water level and water quality data would be collected from these well installations to support the wetlands monitoring program.

Control locations

Recharge Area

One well is proposed to monitor groundwater levels between the LMOC and a model-predicted recharge area to the northeast of the LMOC. This, in addition to the long-term provincial government monitoring wells, will provide information relating to factors external to the LMOC (e.g., climate change), which could influence groundwater levels within the Project RAA. The monitoring well will also allow collection of data to confirm that impacts related to depressurization are not extending to the groundwater recharge area northeast of the LMOC.

Federal Lands

Groundwater modeling analysis predicts that the active depressurization pumping zone of measurable influence will not extend beyond 10 km from the LMOC during construction. Pinaymootang First Nation, the nearest Indigenous community to the Project, is located greater than 10 km away from the LMOC and therefore no measurable effects on wells on Indigenous lands are expected. One well, located at a distance greater than 10 km from the LMOC but outside of the First Nation Reserve land, will be installed to monitor groundwater levels and quality at this location to provide early warning if unexpected depressurization effects are detected at this distance.

Manitoba Government Well

Manitoba Government Well 116766 has provided long-term piezometric pressure head data in the region since 2004. This well (shown on Figure 2) is located 14 km from the LMOC and will not be affected by the Project and will provide an understanding of how the natural changes in recharge affect piezometric pressure head in the region. This control well data can be compared to other Project-impacted wells to determine whether identified changes in piezometric pressure head are due to natural conditions or Project effects.

8.3.2 Groundwater Piezometric Head

Continuous level monitoring gauges (transducers) will be installed and maintained at select locations (see Section 8.3.1), and new wells will be installed, as required, for construction depressurization monitoring. Monitoring will be initiated before the bedrock depressurization begins.

8.3.3 Groundwater Quality

Continued monitoring of groundwater quality at existing sites (discussed in Section 5.3.2) and new sites (discussed in Section 8.3.1) will be undertaken during spring, summer and fall, with reporting completed annually. Collected samples will be analyzed for the suite of parameters listed in Table 2 to characterize baseline groundwater quality conditions. New wells discussed in Section 8.3.1 will be monitored at least once prior to the initiation of depressurization.

8.3.4 Groundwater-Surface Water Interactions

The Birch Creek wetland lakes monitoring wells (See Section 8.3.1) will be monitored prior to depressurization to determine the preconstruction vertical groundwater gradients. Clustered well sets will comprise a well completed in the bedrock and a second well completed in the overlying unconsolidated sediments. A third well may be installed and completed in a surficial peat layer if present. The clustered well sets will be located near the wetland lakes.

8.4 Construction Monitoring

Construction start, for purposes of this GWMP, is defined as the initiation of clearing in support of construction operations. During construction, groundwater levels will be monitored, and the results will be used to adjust depressurization activities and determine mitigation measures. This will be accomplished through interactions with landowners and Contractors, as required, throughout the construction process. Continuous level monitoring gauges will be maintained, and groundwater quality monitoring will continue annually in spring, summer and fall during construction, with reporting completed annually. Groundwater quality samples may be collected at other times if a need is identified.

During the course of LMOC construction, threshold exceedances (see Section 9.2) on Project monitoring wells will prompt collection of well-specific information from well owners in each area. This information will be used to determine piezometric pressure elevations unique to each well that will require mitigation. Information of well water elevations will include groundwater surface (at the well), pump intake and bottom of the well. Identification of flowing wells and pumped wells will also be important considerations when determining well-specific mitigations.

It is likely that all private well information will not be easily obtained. Other sources of data, such as the provincial well data base (GWDrill) can be used to estimate the top of well and the screened (i.e., bottom of well) level for wells in the area. The well intake level is not readily available however could be assumed to be 2 m below the average piezometric head or the ground level, whichever is lower.

8.4.1 Groundwater Piezometric Head

As construction begins, groundwater depressurization will occur in a phased approach along segments of the LMOC. The estimated decrease in piezometric pressure head (i.e., the pressure drawdown) that may occur as a result of depressurization activities has been estimated based on groundwater modelling. Monitoring of pressures within the Project monitoring wells will be actively ongoing during depressurization activities. This will confirm that the aquifer pressures are changing as predicted and will provide information necessary to mitigate water supply changes for private well owners. For wells that are close (i.e., within 3 km) to the construction site, a loss of flow in wells is anticipated at most wells and these wells are expected to be the first impacted by the Project. However, aquifers are very complex and monitoring of actual conditions (especially as distance from the zone of active depressurization increases) will be key in identification of the need for mitigation.

From the collected information, a unique set of mitigations, as described Section 9.0 will be developed for each private well that is registered in the Project mitigation plan. The mitigations will be based on the groundwater supply effects identified at that well location.

8.4.2 Groundwater Quality

Groundwater quality will be monitored in the established Project monitoring well network and at select private wells based on location and proximity to the Project as part of the ongoing domestic well monitoring program. Regular monitoring and water quality sampling of groundwater quality at the wells will continue to occur three times per year. Special events such as a substantial change in quality or a spill in the area may warrant an increased frequency in groundwater quality monitoring at certain wells. All groundwater samples will be collected following standard procedures, will be submitted to an accredited laboratory for analysis and subject to standard laboratory quality assurance (QA)/quality control (QC) processes.

The groundwater water quality is not expected to change beyond current variation as a result of the Project and is expected to maintain a stable trend into the future. Monitoring of groundwater quality will continue throughout construction and for 2 years post-construction (including one flood event and one-year post flood). Water quality changes in private wells not included as part of the domestic well monitoring program will be identified by the landowners.

Parameters will be reviewed after each monitoring event during construction and post-construction. In some cases, groundwater concentrations of some parameters (e.g., iron, manganese, fluoride) may be present at concentrations above the HC-DWQG during the baseline period. In these instances, the threshold would be the presence of a statistically significant increasing trend. Associated actions and mitigations would be situation and well dependent.

Special events such a substantial change in water quality or a spill in the area may warrant an increased frequency in groundwater quality monitoring at certain wells to characterize the effect. All groundwater samples will be collected following standard procedures, will be submitted to an accredited laboratory for analysis, and will be subjected to standard laboratory quality assurance (QA)/quality control (QC) processes.

Groundwater removed during depressurization will be discharged to surface and /or surface water. Once discharged groundwaters are part of the surface water system, the water quality management monitoring triggers and thresholds are also addressed in the SWMP.

8.4.3 Groundwater-Surface Water Interactions

The Birch Creek wetland lakes monitoring wells (See Section 8.3.1) will be monitored prior to and during depressurization to identify any changes in vertical gradients from the preconstruction to the construction phase. Clustered well sets will comprise a deep well completed in the bedrock aquifer and a shallow well completed in the overlying unconsolidated sediments. Any identified change (i.e., reversal of vertical gradient) will be communicated to the wetlands monitoring team. Monitoring results would be used to inform mitigation planning and may include mitigations or execution of adaptive management processes identified in the SWMP, the CEMP, Operation Environmental Management Program (OEMP), Project Environmental Requirements (PER), Environmental Protection Plan (EPP) and/or others, depending on the nature of the change experienced.

8.5 Operations Monitoring

Groundwater monitoring and sampling during operations will follow the same frequency of occurrence as during pre-construction and construction. Groundwater monitoring and sampling will continue for the first two years post-commissioning and including one flood event and one-year post-flood. Groundwater conditions are expected to stabilize within two years. A plan for long-term groundwater monitoring beyond two years post- commissioning will be developed based on the previous monitoring data, an assessment of any possible LMOC effects and public engagement. The plan will include monitoring the effects of the channel on groundwater quantity (i.e., piezometric pressure head) and quality during channel operating and non-operating conditions. On-site and regional monitoring of the effects of any long-term passive aquifer depressurization will also be included in the plan.

8.5.1 Groundwater Piezometric Head

Continuous level monitoring gauges will be maintained with data downloaded at regular intervals (three times per year) for the first two years post-commissioning. Groundwater levels will also be monitored at provincial monitoring well locations, WRB122050 and WRB116766 located approximately 2 km and 14 km from the LMOC. These wells are indicated on Figure 2. Trends identified in the Project LAA will be compared against these regional monitoring locations to decouple any naturally-occurring environmental variation from potential Project-related impacts.

After commissioning, the regional groundwater piezometric head is expected to stabilize at a lower elevation than exists pre-construction but higher than during construction, as discussed in Section 6.2. There will be some natural seasonal variation in piezometric pressure head as was identified during the baseline (pre-construction) period. Monitoring will continue for 2 years post-commissioning. No well mitigations related to quantity / supply changes are expected during operation once any construction phase well mitigations are refined post-construction. It may be possible that pump intake elevations may need to be reset on some private wells after the piezometric head stabilizes to a new range of seasonal variation post-commissioning. If any unanticipated effects are identified, adaptive management processes will be triggered (see Section 9.2.1).

The Project can potentially affect the piezometric pressure head in the aquifer due to the operation of the WCS. The WCS will change the surface water level in the channel by dropping the surface water level in the channel 2 m upstream of the gate and raising it 2 m downstream of the gate. The Project monitoring wells previously installed around the WCS will provide the necessary data to determine the impact on aquifer piezometric pressure head away from the WCS. The magnitude of piezometric pressure variation is expected to be similar to current seasonal variation in piezometric head (2-3 m) caused by recharge of snowmelt and rainfall. If any unanticipated effects are identified during WCS operation, adaptive management processes will be triggered (see Section 9).

8.5.2 Groundwater Quality

Operation phase groundwater quality parameters are expected to remain consistent with those analyzed during the pre-construction and construction phases and identified in Table 3. The frequency and locations of sampling may be adjusted based on monitoring results and environmental conditions. Similarly, analytical parameters may be adjusted depending on water quality results. Groundwater quality during operations is expected to be consistent with that measured during the pre-construction phase.

Groundwater water quality is not expected to change beyond natural variation and to maintain a stable trend into the future. Monitoring of groundwater quality will continue through 2 years post-construction and reported annually. The suite of analytical parameters will be reviewed each year post-construction. If an unanticipated water quality effect is identified, adaptive management processes will be triggered (see Section 9.2.2).

8.5.3 Groundwater-Surface Water Interactions

The Birch Creek wetland lakes monitoring wells (See Section 8.3.1) will continue to be monitored post-construction. Any identified change (i.e., reversal of vertical gradient) will be shared with the wetlands monitoring team and Manitoba Transportation and Infrastructure.

9.0 LMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP

9.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The CEAA *2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

Follow-up is one step in the overall continuous improvement process which aims to evolve practices and processes based on feedback. Continuous improvement is generally a four-stage process: Plan, Do, Check and Act. This loop allows work to be planned, executed, reported on, and then corrected as required.

In the context of groundwater management for the Project, the design will be implemented while managing risks with monitoring, as generally described in Section 7.0 and 8.0. As described in Section 12.4.1.1 of the Project EIS, the objective of the groundwater follow-up and monitoring program is to determine whether there are changes to the volume and accessibility or quality of the groundwater in the groundwater LAA as a result of construction or operations and update and implement mitigation measures and responses accordingly. The predicted residual effects during construction and operation of the Project include:

- a change in local groundwater piezometric pressure head due to depressurization operations,
- a change in local groundwater quality due to depressurization operations; and
- a change in groundwater–surface water interaction due to bedrock aquifer depressurization.

The monitoring and analysis program described in Section 8 will provide information to better predict and quantify potential effects and confirm which locations of the groundwater LAA should be further monitored during aquifer depressurization. Existing data collection or monitoring programs will be applicable to inform development of new monitoring plans, where identified, to the extent feasible. Baseline groundwater quantity and quality will be established during the pre-construction monitoring program (in progress) which

will form the basis for comparison to determine what, if any, effects are occurring. A few select domestic water wells may be monitored for their quality if the Project monitoring wells indicate a potential issue in the region. Knowledge obtained from field performance will be used to modify programs as necessary as construction progresses.

Mitigations will be well-specific and determined based on the predicted effects to groundwater quality and quantity from construction depressurization activities. Management thresholds will establish actions to be undertaken once a threshold level has been exceeded at a specific location and are based on the logical next steps. Early threshold exceedances typically initiate additional information gathering to collect the required information to determine the appropriate next steps or to prepare for future mitigations, if required. Follow-up responses will evaluate the effectiveness of the overall program, including the thresholds, planned actions and proposed mitigations.

Monitoring programs implemented for the Project will produce data that will be assessed to evaluate environmental impact. Based on the results, changes in the monitoring program locations, analytical parameters or frequency of monitoring may be warranted. The monitoring program will be designed with this flexibility in mind and consideration of all factors which could influence changes in well performance. Regional (i.e., external to the Project area) provincial monitoring wells are incorporated into the monitoring program to decouple regional environmental effects due to climate variability from Project-related effects.

Groundwater water quality effects are not expected; therefore, any effect would be considered an unanticipated event and would trigger the adaptive management process shown in Figure 7. Unanticipated Project-related effects to groundwater could include changes to water supply and/or water quality, which may or may not be related to surface water-groundwater interactions. To design appropriate mitigations for unanticipated Project-related effects, the cause of the effect will need to be understood. This process will often be triggered by receiving information regarding unanticipated effects from stakeholders (i.e., well owners – through the Complaint Resolution Process) in the area, or could be triggered through analysis of data from monitoring wells. This will then trigger the adaptive management process shown in Figure 7. The threshold would be any change in water quality from the baseline beyond the historic range or exceeding drinking water guidelines.

Changes to groundwater surface water interactions could occur due to the Project; however, are not expected to have any material impact on local groundwater quality. As indicated, data will be provided to the wetland monitoring program and addressed as part of the wetland management activities.

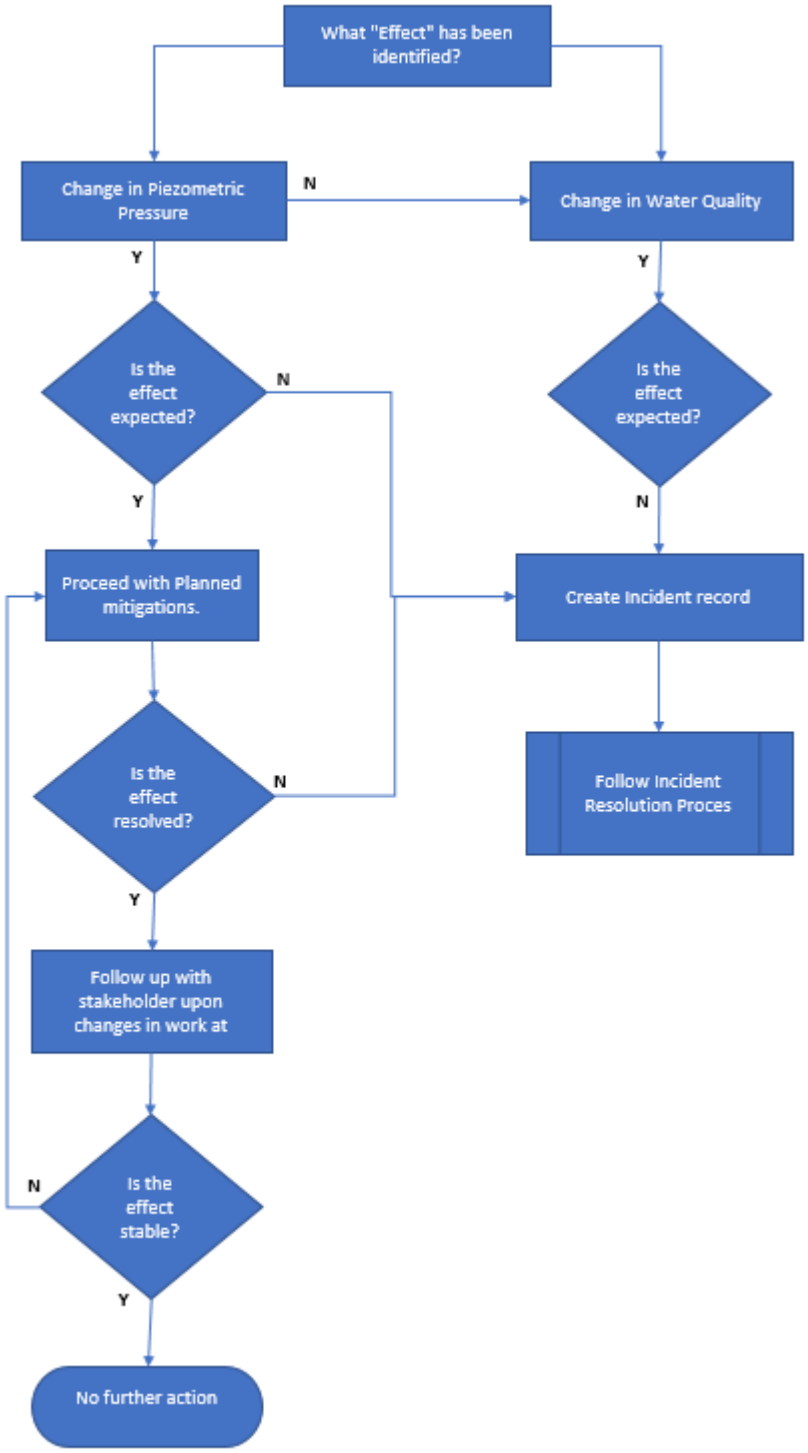


Figure 7: Adaptive Management Process

9.2 Follow-up

9.2.1 Stakeholder Complaint Resolution Process

The Complaint Resolution Process will be implemented to allow private well owners to record any issues that they encounter with respect to their well performance or water quality. Complaints will be investigated, and mitigations determined on a case-by-case basis.

Changes in groundwater piezometric pressures (level) are expected in areas within 5 km of the channel. The greatest changes will be seen at the wells most proximal to the channel alignment with an expected decrease reduction in the effect with distance from the channel. As previously stated, wells located > 5 km from the channel alignment, are expected to report variations in piezometric pressure within normal seasonal variation. These variations are not anticipated to impact well users. If a change is identified that is not anticipated, an incident will be created and investigated as shown in Figure 8. This investigation will determine whether the change is Project-related, the cause for the change and the parameters required to determine any required mitigations. In the short-term, the effects can be mitigated by supplying a fresh water source, a pump and/or by lowering the pump intake (where applicable) until the circumstances and required actions are understood. Possible mitigation will be developed on a case-by-case basis, as required. Once the incident is resolved and stakeholder signoff is obtained, the report will be closed.

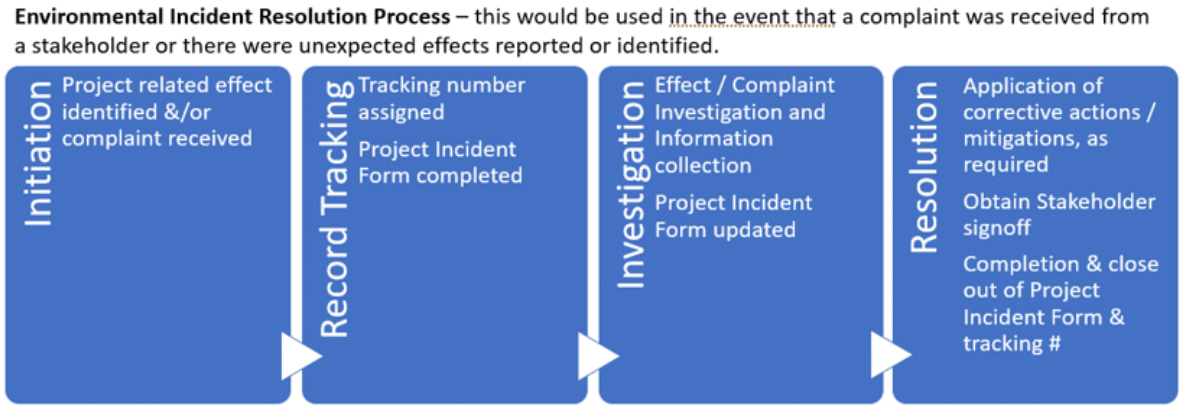


Figure 8: Incident Resolution Process

9.2.2 Groundwater Piezometric Head

The main trigger related to water supply is a change (typically a reduction) in aquifer piezometric pressure. A reduction in piezometric pressure will potentially change the well performance which would impact private water supplies and may require system modifications (i.e., addition of a pump) for some (flowing) wells. Project monitoring wells will be actively monitored during the start of depressurization and following any change to depressurization activities. When piezometric pressure reductions are identified in the Project monitoring wells, it is expected that similar changes are occurring in the nearby / surrounding private wells.

Thresholds, actions and mitigations for water supply effects are summarized in Table 3. Thresholds have been set to be conservative. Threshold one (10-15% change) has been set as an initial detectable change in piezometric pressure head which will permit Manitoba Transportation and Infrastructure to collect the necessary data from surrounding private wells and establish unique well action levels based on the piezometric pressure head at that location. A 10-15% change (decrease) in the piezometric pressure head has been set at an initial threshold that indicates the arrival of the depressurization front at that well. There are no mitigations required at this time; however, the threshold exceedance will trigger collection of information that is key to determining well specific mitigations to private wells through collection and verification of well specific information. Threshold two (45% change in piezometric pressure head) was selected as a mid-point value that would trigger more frequent monitoring at individual private wells to facilitate timely well mitigations. Localized heterogeneities (i.e., variation in geology or primary/secondary porosity) can impact the rate of depressurization at individual wells; therefore, once the piezometric pressure head drops by 45% more frequent monitoring at individual wells is warranted to support mitigation planning and execution. This threshold was set to be conservative to allow time for mitigation preparation and execution.

Once an initial threshold of a 10-15% change in groundwater piezometric pressure is identified in a sentinel well, Manitoba Transportation and Infrastructure will contact the surrounding landowners to confirm available well system data or collect well system data if it is not already known. This information will include:

- well records, including the age of the well, completion interval, total depth, pump intake depth (if pumped)
- ground and top of casing elevation
- type of pump / water supply system the landowner currently has in place
- collection of current data (groundwater pressure) where possible
- water supply observations from the landowner

The timing for implementation of individual water supply well mitigations will be based on a combination of regional observations through the overall Project monitoring well network as well as local changes in groundwater pressure at both the closest Project monitoring well and the individual private wells.

Table 3: Thresholds, Actions and Possible Mitigations for Anticipated Project-Related Private Water Supply Effects

Threshold	Action	Possible mitigations
10-15% change in piezometric pressure at Project monitoring wells	Meet with surrounding landowners and collect well specific information. Well-specific data will be entered into Project database and unique well action levels will be established.	No required mitigations are expected at this time.
45% change in piezometric pressure at Project monitoring wells	Previously gathered information, including unique well action levels, will be checked against local/regional piezometric pressure trends. Individual well monitoring frequency will increase as required to support mitigation planning and execution.	Mitigations will be unique to each well circumstance and will include consideration of the following. Flowing wells which are no longer flowing may require pumps. Pumped wells where the piezometric pressure head has dropped below the pump intake level may need either a new pump set up or to lower the pump intake level. Where water supply has been temporarily lost (i.e., water supply system requires adjustment) provide clean water for consumption and other domestic/livestock uses.
Unanticipated rate of change in piezometric pressure	Discuss rate of change with construction crews and pumping crews to determine if the pumping rates can be adjusted	Adjust pumping rates at the LMOC to lower rate of change.
Landowner initiated incident	Log and investigate incident.	Mitigations may be required if the incident is determined to be Project related. Where water supply has been temporarily lost (i.e., water supply system requires adjustment) provide clean water for consumption and other domestic/livestock uses.

Once a 45% change in groundwater pressure is observed at the Project monitoring well, mitigations may be required at the nearby private wells. The previously collected information (elevations of top of well, depth to pump and depth to well bottom) can be checked against the piezometric pressure of the nearby Project monitoring wells. There may be need to interpolate between two Project monitoring wells to estimate the elevation of the piezometric pressure head (masl) at some private wells. A spreadsheet database will be developed and used to manage the water supply well information, including the relationship between individual water supply wells and the local piezometric pressure head. Monitoring frequency at individual wells may be increased, as required, to check against expected pressure changes and potentially adapt programs. Ideally, mitigations will be implemented ahead of water supply impairment; however, circumstances may impact the rate of piezometric pressure head decrease at individual wells. Therefore, the rate of drop of the piezometric pressure head and the seasonal nature of groundwater head variation will need to be considered in mitigation timing.

During depressurization programs, nearby Project monitoring wells will be actively monitored to confirm that required drawdown is achieved in the work area. If monitoring programs indicate groundwater quantity effects in excess of the management thresholds (i.e., the rate of decline in aquifer piezometric pressure is greater than expected) then pumping rates will be adjusted or additional wells will be installed at the construction site to maintain the required drawdown in the immediate work area while limiting the amount of off-site drawdown which could affect local residents. Continued monitoring will determine the need for additional adaptive management measures. Other mitigation measures will be developed, as required, based on further investigation and monitoring data collected during the Project construction.

9.2.3 Groundwater Quality

Groundwater quality monitoring will continue during construction and operations phases, although there are no anticipated effects to groundwater quality resulting from the Project construction or operation activities. Data collected from private water wells as a result of a landowner-initiated incident will be compared against provincial and federal livestock watering or drinking water quality guidelines (see Section 4.2) and notifications will be made if any results which indicate adverse effects and risk to human or livestock health will be communicated to local private well owners. Regional changes to water quality identified through the regular Project monitoring and sampling program will be managed as shown in Table 4. Groundwater quality thresholds have been set to trigger additional monitoring/sampling as a result of a statistically significant change (i.e., 20% increase over baseline) and to determine well specific mitigations if a parameter of concern increases to 75% of the regulatory criteria, guideline or objective and represent industry standard threshold levels. The response to the initial threshold exceedance identified in a Project monitoring well could include additional sampling of private water wells to confirm the quality of the water supply. If concentrations continued to increase and exceeded the second threshold (75% of the applicable guideline), well specific mitigations would need to be investigated and implemented, as required.

Table 4: Thresholds, Actions and Possible Mitigations for Unanticipated Project-Related Private Water Quality Effects

Threshold	Action	Possible mitigations
Unanticipated changes in water quality reported by private well owner.	Log and investigate incident. Complete groundwater monitoring and sampling activities at private well location. Determine if there are any threshold exceedances and action accordingly Investigate if the change is Project related.	Mitigations will be unique to each well and well system and are dependent upon confirming that the perceived and identified change is a result of Project activities, the parameter and the individual water supply system. Where water quality has been temporarily impacted (i.e., a change in water quality has been detected in the well) provide clean water for consumption and other domestic/livestock uses during the initial investigation. If the change is due to the Project, water supply should continue until the issue is mitigated.
Concentration of parameter increases to a concentration that is 20% higher than the baseline geometric mean concentration	Assess whether the maximum parameter concentration exceeded this threshold during baseline period. Complete statistical trend analysis (requires minimum 4 data points) if possible, to determine if there is a trend in the data.	If the maximum parameter concentration during the baseline did not exceed the threshold and there is not sufficient data to complete a statistical trend analysis, complete weekly groundwater monitoring and sampling at this location for a minimum of four weeks. If the maximum parameter concentration exceeded this threshold during the baseline period, no further actions are required at this time. If an increasing trend is identified in the data set, an increased frequency of sampling should be implemented until the parameter reaches the next threshold or the increasing trend resolves over four consecutive sample dates. If the parameter threshold exceedance could present a risk to a receptor (i.e., exceeds a regulatory criteria, objective or guideline), initiate a groundwater testing program in nearby landowner wells.

Threshold	Action	Possible mitigations
Concentration of parameter increases to 75% of the applicable guideline (HC-DWQG, CCME, MWQGOS)	Assess whether parameter concentrations exceeded the threshold or the guideline during baseline. Complete statistical trend analysis (requires a minimum of four data points) if possible, to determine if there is a trend in the data. Complete an investigation to determine the cause of the change in water quality and whether the change is Project related.	If the data set is not sufficiently large, complete additional sampling weekly until enough data are collected to permit statistical trend analysis. If the parameter concentration exceeded the guideline or criteria during the baseline period, and there is no increasing trend, no further action is required. If the parameter concentration exceeded the guideline or criteria during the baseline period, an increasing trend is identified and an investigation into the cause has determined that the change is related to the Project, mitigation options will be investigated. Mitigations will be well-specific and based on the specific effect (e.g., water supply trucks, new deeper wells, reverse osmosis, decommissioning a nearby well that is causing problem). Potable water will be supplied, if required (i.e., groundwater parameter concentrations are reported at concentrations that exceed the applicable regulatory criteria, objective or guideline).

9.2.4 Groundwater-Surface Water Interactions

As discussed in Section 8.4.3, data collected during monitoring of these well clusters will be provided at regular intervals (i.e., following each monitoring and sampling event) to the wetlands monitoring team for incorporation into their assessment and decision making. Any identified change (i.e., reversal of vertical gradient) will be cause for immediate notification to the wetlands monitoring team and Manitoba Infrastructure and Transportation. Monitoring identified in wetland monitoring plan would be used to inform mitigation planning and may include mitigations or execution of adaptive management processes identified in the SWMP, the CEMP, OEMP, PERs, EPP and or others depending on the nature of the change experienced.

9.2.5 Operations and Maintenance Plan

Based on experience gained through construction, an operations and maintenance plan will be developed for groundwater management components such as monitoring wells and depressurization works as part of long-term operations and maintenance activities.

9.3 Contingency Measures and Emergency Response

Contingency measures and emergency response will be included for unforeseen events or circumstances related to groundwater in various planning documents for the program. These will be developed and finalized prior to construction, and include the following:

- Groundwater Depressurization Plan – The Groundwater depressurization plan will include contingency measures for loss of power during depressurization and will include provisions to increase pumping rates if possible or longer-term measures such as additional wells to provide additional depressurization if needed.
- Safety and Health Plan – The health and safety plan for the Project and individual contractors must address hazards associated with channel and deeper excavations where unplanned discharge of groundwater may occur in an emergency situation..
- Construction Environmental Management Program – The CEMP provides specific measures to address the potential contamination of groundwater from hazardous materials and waste, including materials and waste management and emergency spill response and reporting procedures
- Complaint Resolution Process – The complaint resolution plan describes the processes and procedures for receiving and responding to private well owner complaints related to groundwater quantity and/or quality issues identified within private water wells. The process describes the complaint response and investigation process. Mitigations will be determined on a case-by-case basis and determined by the outcome of the investigation.

10.0 LMOC REFERENCES

Betcher, R.N, Grove, G., Pupp, C. 1995: Groundwater in Manitoba: Hydrogeology, Quality concerns, management, NHRI Contribution No. CS-93017, Environmental Sciences Division, National Hydrology Research Institute, environment Canada, Saskatoon, Saskatchewan.

Betcher, R.N. 1997. Rural Groundwater Quality Surveys: Southern and Central Manitoba. In: Proceedings of Rural Water Quality Symposium, March 25 to 26, 1997, Winnipeg, pp. 19- 38.

Canadian Council of Ministers of the Environment (CCME). 2011. Protocols Manual for Water Quality Sampling in Canada. CCME. Retrieved from: https://www.ccme.ca/files/Resources/water/water_quality/protocols_document_e_final_101.pdf. Accessed July 14, 2020.

Health Canada. 2019. Guidelines for Canadian Drinking Water Quality, June 2019.

HYDAT (2020), Province of Manitoba, Groundwater Management.

KGS Group. 2017a. Investigations and preliminary engineer for LMB Outlet Channels Options C and D. Final – Rev 0. KGS Group 16-0300 006. May 2017.

KGS Group. 2017b. Investigations and Preliminary Engineering for LMB Channels Options C and D Deliverable D2, Annual Monitoring Report to July 1, 2017. Final Rev 0, Prepared by KGS Group.

KGS Group. 2018. Investigations and Preliminary Engineering for Lake Manitoba Outlet Channels Options C and D Deliverable D3, Annual Monitoring Report to July 01, 2018. KGS Group Project 16-0300-006. Final - Rev 0. August 2018.

Manitoba Water Stewardship. 2011. Manitoba Water Quality Standards, Objectives and Guidelines.

Matile, G.L.D. and Keller, G.R. (2004): Surficial geology of the Dauphin Lake map sheet (NTS 62O), Manitoba; Surficial Geology Compilation Map Series, SG-62O, scale 1:250 000.

Render, F.W. (1988): Water Supply Capacity of the Assiniboine Delta Aquifer. Canadian Water Resources Journal, Volume 13, Number 4, pages 35-51.

Rutulis, M. (1987): Groundwater resources in the western Interlake planning district, Hydrotechnical Services, Hydrology Section, Winnipeg, Manitoba.

Simpson, F., H.R. McCabe and D. Barchyn (1987): Subsurface Disposal of Wastes in Manitoba - Part I: Current Status and Potential of Subsurface Disposal of Fluid Industrial Wastes in Manitoba. Manitoba Energy and Mines, Geological Services, Geological Paper GP83-1.

Stantec (2021a): Lake Manitoba Outlet Channel 2019 Surface Water and Groundwater Monitoring Report. Hatch Document Number: E358159-1000-220-230-0004, Rev. 0, June 2021.

Stantec (2021b): Lake Manitoba Outlet Channel 2020 Surface Water and Groundwater Monitoring Report. Hatch Document Number: E358159-1000-220-230-0005, Rev. 0. June 2021

Stantec (2021c): Surface Water and Groundwater Interactions in the Region of the Lake Manitoba Outlet Channel. Stantec File: 111475107-1200.1206 Hatch Document Number: E358159-1000-220-030-0003 Rev. A. June 2021.

Stantec (2021 d): Groundwater Balance in Region of Lake Manitoba/Lake St. Martin Outlet Channels. Hatch Document Number: E358159-1000-220-030-0002-Rev 0. August 2021

Tetra Tech EBA (2016): Ice Engineering Services for Drilling on Ice Covers on Lake Manitoba and Lake St. Martin.

Part 3: Lake St. Martin Outlet Channel

11.0 LSMOC EXISTING CONDITIONS

11.1 Overview

Since 2011, with the initiation of the EOC Reach 3 channel, and between 2015 and 2019 for the current LSMOC, several field programs were conducted within the LSMOC portion of the LAA. These included test hole and monitoring well installation, instrumentation, pumping tests, groundwater monitoring and water quality sampling. Groundwater monitoring and water quality sampling was also completed up to 2021 (KGS 2021a, KGS 2021b, KGS 2022). Further details on hydrogeologic conditions of the LSMOC can be found in Appendix 1B and are summarized below.

The LMOC and LSMOC portions of the LAA each display a unique response, and overall range in observed seasonal (i.e., year-to-year) and intra-seasonal (i.e., within season) aquifer piezometric pressure variability. Piezometric pressure changes that occur within the LAA portion of each channel have a different set of implications, in terms of receptors. In terms of groundwater quality, while the existing regional conditions surrounding the LMOC and LSMOC are generally comparable, the implications of any water quality changes with respect to the receptors in the vicinity (LAA portion) of each channel are different. Importantly, the implications for piezometric pressure variability/changes and/or groundwater quality changes within the LAA portion of the LMOC are related to a large number of 3rd party domestic and agricultural well users, along with the natural environment and nearby wetlands. Within the LSMOC portion of the LAA, the key sensitivity of groundwater discharge related to aquifer piezometric pressures and/or any groundwater quality changes is connected directly to groundwater contributions to the wetlands and fens that are pervasive in the LAA portion of the LSMOC. Because of these unique differences between the LMOC and LSMOC, adaptive management planning and associated setting of trigger levels within the adaptive management plans are somewhat unique and are directly reflective of the key needs within each LAA portion, to facilitate timely mitigative actions that are triggered appropriately and effectively.

Locations available for groundwater measurements within the LAA portion of the LSMOC are provided in Figure 9. Key regional recharge areas of note for the confined bedrock aquifer occur near Gypsumville, and along outcrop areas that occur immediately to the north-northwest and south of the Lake St. Martin Narrows (Figure 10). In addition, the high elevation bedrock bluff area approximately 10 km southeast of Lake St. Martin also functions as a sub-regional bedrock aquifer recharge area, with the bedrock surface in this location situated well above the aquifer piezometric pressure surface. In the region surrounding the LSMOC, in the Dauphin River area, or in any location in proximity to Lake Winnipeg or Lake St. Martin, the confined piezometric pressure within the bedrock aquifer is measured (KGS 2021b) very near, and in some cases above, the ground surface (i.e., flowing artesian). This occurs because Lake Winnipeg and Lake St. Martin, and associated near-lake low-lying wet areas, are key discharge areas for the bedrock aquifer. Because of this, a strong upward gradient for discharge is anticipated and has been observed to be present in areas close to Lake Winnipeg, including within the region of the LSMOC.

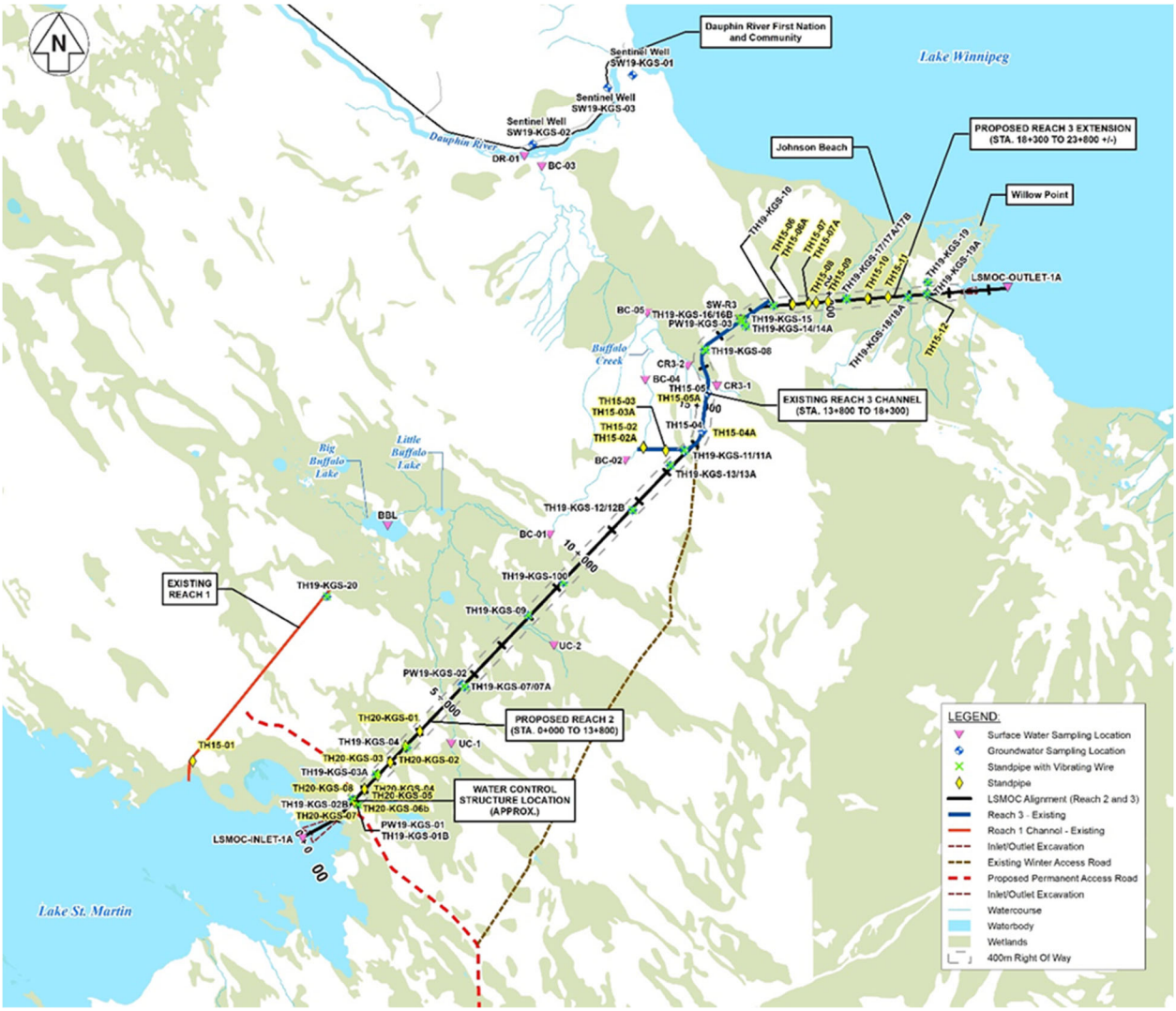


Figure 9: Monitored Well and Test Hole Locations

Detailed contours of the bedrock aquifer piezometric pressures observed in instrumented test holes and monitoring have been contoured, and a schematic of these piezometric pressure contours for the confined bedrock aquifer are presented in Figure 10. This figure also includes the locations of artesian groundwater spring sites as interpreted from aerial photography and field observations.

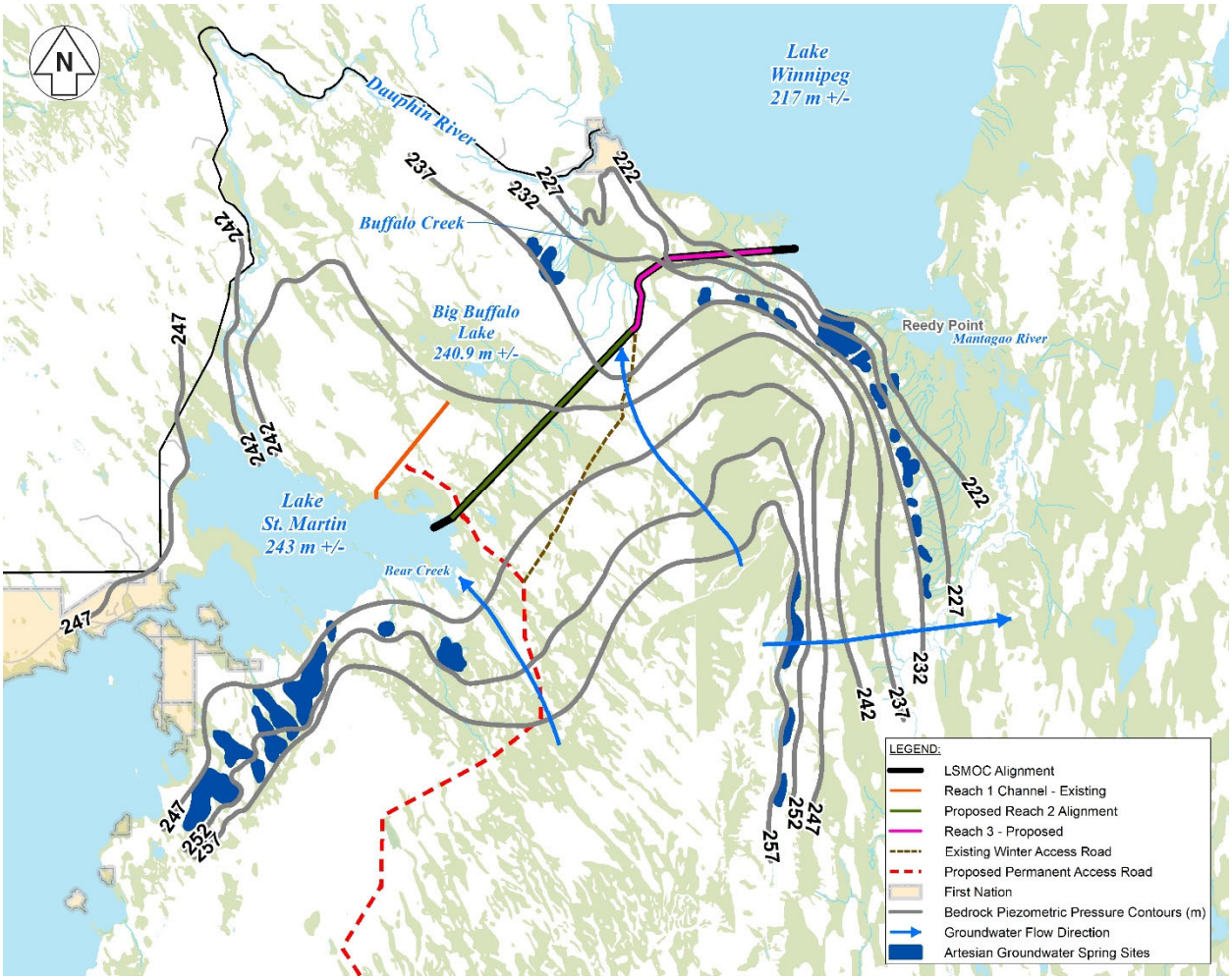


Figure 10: Schematic of Regional Artesian Spring Sites and Contoured Bedrock Aquifer Piezometric Pressures

Artesian spring sites form when bedrock is relatively close to surface (e.g., at escarpments and/or where the till is also thin), and importantly, where the underlying bedrock aquifer pressure is sufficient to overcome the confining weight of the overlying aquitard soils. Discharge of the confined bedrock aquifer in the form of artesian groundwater springs are noted in the region surrounding the LSMOC as follows:

- As baseflow to Lake St. Martin and Lake Winnipeg, limited by the condition of the overlying till aquitard found below the recent lake sediments.
- As baseflow through exposed bedrock to the existing Reach 3 Channel.
- A series of flowing artesian springs draining northwestward to Lake St. Martin and discharging at ground surface elevations between approximately invert elevation 250 m to El. 255 m at the west toe of slope of the high ground area located immediately east-southeast of Lake St. Martin narrows.

- A series of flowing artesian springs draining northerly to Lake St. Martin in the vicinity of the north basin and forming tributaries of Bear Creek and discharging at ground surface elevations of approximately El. 250 m at the west-northwest toe of slope of the high ground area located immediately east-southeast of Lake St. Martin narrows and the north basin of the lake.
- A series of flowing artesian springs draining easterly to the Mantagao River and discharging at ground surface elevations of approximately El. 255 m at the easterly toe of slope of the high ground area located immediately east-southeast of Lake St. Martin narrows and the north basin of the lake.
- Based on the peat morphology and surface water elevation relationships of the Big Buffalo Lake Complex (El. 240.9 m to El. 241.5 m), and bedrock piezometric pressure conditions measured along the LSMOC channel in adjacent areas (e.g., minimum of El. 242.6 m), there is an inferred aquifer discharge condition at the Big Buffalo Lake Complex.
- A series of flowing artesian springs draining northeasterly, forming tributaries that connect to Big Buffalo Creek, and discharging at ground surface elevations of approximately El. 235 m and located north-northeast of the big Buffalo Lake Complex.
- A series of flowing artesian springs draining northeasterly to Lake Winnipeg and forming tributaries of the Mantagao River and discharging at ground surface elevations of approximately El. 220 m to El. 230 m, at the northern and northeasterly toe of slope located immediately along the shoreline of Lake Winnipeg, near Reedy Point.
- Piezometric Pressure Conditions and Variability Along LSMOC.
- The confined bedrock aquifer pressure condition, driven by infiltration within aquifer recharge areas of relatively high bedrock elevation and thin overburden cover, results in strong gradients for groundwater discharge, or exfiltration (to flowing artesian conditions) along the Lake St. Martin channel alignment, and with regional bedrock groundwater flows toward discharge at Lake St. Martin and Lake Winnipeg (Figure 9).

11.2 Groundwater Piezometric Head

Figure B-2 (Appendix 1B) is a longitudinal stratigraphic profile of the LSMOC. Along the base of the drawing (i.e., X-axis), the channel stationing (in meters) is shown, which provides the location along channel in lineal meters, where the inlet area within Lake St. Martin is station (Sta.) 0+000, and the outlet area within Lake Winnipeg is station 24+500. Bedrock aquifer pressure conditions are broadly defined as follows, based on channel reaches, defined by the channel stations noted below (Refer also to Figures 9 and 10):

- Lake St. Martin – Sta.10+500: Between approximately El. 245.0 m (Sta. 1+618) - El. 242.6 m (Sta. 8+000); and in places exhibiting flowing artesian conditions; influenced by the surface water elevation at the Big Buffalo Lake Complex (El. 240.9 m – El. 241.5 m) and its possible interconnection to the bedrock aquifer; vertical gradients within the bedrock aquifer are upward (i.e. a discharge condition), and vertical gradients between the bedrock aquifer and overlying till aquitard are also upward;

- Sta. 10+500 – Sta. 18+000: Between approximately El. 236.5 m (Sta. 11+716) - El. 230.5 m (Sta. 17+673); comparable in general to ground surface elevations; influenced by artesian spring discharges at ground surface elevations of approximately El. 235 m, and located north-northeast of the Big Buffalo Lake Complex; influenced by artesian spring discharges at ground surface elevations of approximately El. 230 m, and draining northeasterly to Lake Winnipeg and forming tributaries of the Mantagao River, and near Reedy Point; vertical gradients within the bedrock aquifer are upward (i.e., a discharge condition), and vertical gradients between the bedrock aquifer and overlying till aquitard are also upward, in particular within the existing Reach 3 channel area (however this can vary locally); and
- Sta. 18+000 – Lake Winnipeg: Between approximately El. 222.5 m (Sta. 20+416) - El. 218.3 m (Sta. 22+490); typically well below ground surface elevations; influenced by artesian spring discharges at ground surface elevations of approximately El. 220 m, and draining northeasterly to Lake Winnipeg and forming tributaries of the Mantagao River, and near Reedy Point; vertical gradients within the bedrock aquifer are upward (i.e. a discharge condition), and while the bedrock aquifer remains confined by the till, vertical gradients between the bedrock aquifer and overlying till aquitard are in general downward, reflecting the enhanced decrease in piezometric pressure of the bedrock aquifer in the lower reaches of the channel alignment, and the strong influence of aquifer drainage through the artesian spring sites near Lake Winnipeg and the Mantagao River. However, where the bedrock is deeper, and in closest proximity to Lake Winnipeg, the vertical gradients between the bedrock and the overlying aquitard can be strongly upward, reflecting the strong exfiltration or discharge conditions for the bedrock aquifer at Lake Winnipeg.
- Flowing artesian well conditions from the bedrock aquifer system have also been observed in the Dauphin River area along the west slopes to Lake Winnipeg, and below Lake St. Martin and Lake Winnipeg, during drilling programs completed at the LSMOC inlet and outlet areas, by Manitoba Transportation and Infrastructure. These conditions are also consistent with the 2011 and 2015 field investigation results along the LSMOC where artesian flow conditions were encountered up to 1 m above ground surface (KGS Group 2021b).

Based on regionally-available multi-year data (KGS 2016, KGS 2021b), bedrock aquifer piezometric pressure conditions in the RAA of the LSMOC generally fluctuate (rise) by approximately 1.0 m to 1.2 m during the spring freshet. The duration and timing of the aquifer rise can vary, but in general these pressure changes are noted to occur between approximately mid-March and about mid-May to the end of May, each year. Additional monitoring of the bedrock aquifer in the region of the Project indicates that the bedrock aquifer piezometric pressure can vary by approximately 1.5 m +/- 0.5 m (i.e., 1.0 m to 2.0 m) due to seasonal conditions and as a response to high intensity precipitation events in the region (KGS 2021b).

11.3 Groundwater Quality

Existing groundwater quality in the LAA portion of the LSMOC was characterized using data from groundwater samples collected from on-site wells installed since 2019 (KGS 2021a, KGS 2022). The purpose was to:

- establish a preconstruction baseline of the groundwater quality so that changes occurring during or after construction can be identified
- assess the potential effects of groundwater being discharged to the surface during depressurization on surface water quality

In the LSMOC portion of the LAA, groundwater quality monitoring data is a compilation of data collected in field programs conducted between 2019 and 2020 and as part of the ongoing pre-construction monitoring program where monitoring and groundwater samples were collected during 2021 field programs (KGS 2022). Four sampling events were conducted during 2019, two during 2020, and two during 2021, including both groundwater and surface water monitoring and sampling during the field programs (KGS 2022, KGS 2021a).

Water quality results from these programs were assessed, using multiple lines of evidence, during 2021 (KGS 2021a), and also in general compared to applicable CCME and HC-CDWQG criteria (KGS 2022). Based on reviewing existing data and the Project-specific monitoring, groundwater quality in the aquifer appears to be good and the aquifer currently provides good quality groundwater of drinking water. The groundwater quality generally meets applicable CCME and MWQSOG criteria and is comparable to the existing surface water quality in the area.

Detailed assessment of pre-construction water level data and water quality data are provided in separate memos (KGS 2021a, KGS 2021b) and are summarized below:

- The geochemistry of surface water samples collected from the perched peat (fen) deposits show a similar chemistry to the bedrock groundwater, including a more neutral pH and a carbonate geochemical signature. These samples were collected prior to the spring melt in 2019 when surface water contribution would be lowest and groundwater contribution would be highest. Groundwater discharge to artesian springs at numerous locations in the LSMOC watershed appears to control the surface water chemistry in the perched peat and fen surface water system overall, as well as the chemistry of the wetlands and fens themselves. Even in areas where the thick low permeability till aquitard prevents direct discharge of bedrock groundwater to the surface, the water quality in the peat and fens has a bedrock groundwater signature, presumably due to artesian spring discharge in other locations in the region of the LSMOC.
- The till groundwater geochemistry is unique from the bedrock aquifer groundwater geochemistry, and surface water geochemistry, and shows generally higher dissolved solids and more frequent elevated percentages of sulphate and chloride than in the bedrock groundwater or surface water system. One well at the proposed location of the WCS is atypically high in dissolved solids and sulphate. The low permeability of the till limits any water influx into the till, either from discharge from fresher groundwater below, or recharge from fresher surface water and wetland sources perched above the till. The integrity and functioning of the till aquitard is demonstrated by its thickness and low

permeability characteristics, combined with its unique groundwater geochemistry, and with the observation of upward gradients (to flowing artesian conditions) and because it demonstrates a confining condition for the underlying bedrock aquifer throughout the region of the LSMOC.

- Bedrock groundwater geochemistry north of the Dauphin River in the community of Dauphin River First Nation (including domestic wells and Project sentinel wells) is distinct from groundwater found south of the river (including a sentinel well and bedrock wells along the channel alignment). A higher proportion of sulphate and chloride is found in the wells north of the Dauphin River. This would indicate that the Dauphin River is a discharge boundary condition of the regional aquifer.
- Bedrock groundwater geochemistry along the channel alignment is generally similar and consistent, with a few wells showing more mineralized conditions, with higher dissolved solids and sulphate. One well near the end of the channel towards Lake Winnipeg shows significant fluctuations in water type seasonally, which could indicate connection with surface water sources, or seasonal changes in groundwater flow paths.
- Stable isotope results for oxygen indicate a generally recent recharge source for the groundwater system, and relatively short aquifer residence times, which is also consistent with the overall geochemical results. Tritium results also indicate that groundwater at two locations is representative of very recent, modern recharge (i.e., post-1950), and that the groundwater in the vicinity of the WCS has had the longest residence time in the region of the LSMOC (which is furthest away from the observed artesian spring sites in the region of the LSMOC).

11.4 Groundwater-Surface Water Interactions

Two distinct groundwater systems are known to be present within the LSMOC portion of the LAA - an upper saturated peatland/fen system, and a lower confined carbonate bedrock aquifer. Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat groundwater flow system, and the underlying confined carbonate bedrock aquifer system. A detailed assessment of the water level conditions monitored at the available site instrumentation was completed in 2021 (KGS 2021b).

The upper, saturated peat and fen unit is perched above the clays (where present) and underlying till units. The peat is recharged directly from surface rainfall and snowmelt. Groundwater flows within the peat are locally controlled. Small-scale flow systems develop from raised bog/peat mound areas, flowing radially outward toward relatively lower-lying depressions and other associated open water areas. The water table within the peat is at, or near, ground surface, with an overall hydraulic gradient, including surficial flow, to the east.

Water levels within the perched peat and fen wetlands are largely impacted by surface water measures and drainage modifications described within the Project SWMP. Any changes in bedrock piezometric pressures as a result of the LSMOC are not predicted to cause measurable effects on the peatlands in areas in proximity to the LSMOC, due to the presence of the extensive silty clay and dense silt till aquitard in most of the Project region. Changes in groundwater piezometric pressures within the confined bedrock aquifer could possibly alter the total discharge of groundwater to the surface wetlands and in particular the fens that are directly interconnected via artesian springs, such as in proximity to the Big Buffalo Lake complex and Big Buffalo Creek, and along the shores of Lake Winnipeg near Willow Point. These possible changes in baseflow

discharge of bedrock aquifer groundwater to the surface water system could potentially impact the associated aquatic and terrestrial habitat. Analysis of the geochemistry of the artesian spring discharge groundwater data (KGS 2021a) shows that it is typical of bedrock groundwater geochemistry found in Project wells along the LSMOC channel alignment.

The geochemistry of surface water samples collected from the perched peat (fen) deposits show a similar chemistry to the bedrock groundwater, including a more neutral pH and a carbonate geochemical signature. These samples were collected prior to the spring melt in 2019 when surface water contribution would be lowest and groundwater contribution would be highest (KGS 2021a). Groundwater discharge to artesian springs at numerous locations in the LSMOC watershed appears to control the surface water chemistry in the perched peat and fen surface water system overall, as well as the chemistry of the wetlands and fens themselves. Even in areas where the thick low permeability till aquitard prevents direct discharge of bedrock groundwater to the surface, the water quality in the peat and fens has a bedrock groundwater signature, presumably due to artesian spring discharge in other locations in the region of the LSMOC.

Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat and fen groundwater flow system, and the underlying confined carbonate bedrock aquifer system. The perched water levels in the surficial peat are maintained by the regional surface water drainage patterns combined with the influence of the underlying low permeability aquitard, restricting any downward drainage. The aquitard also maintains confined piezometric pressure, to flowing artesian pressures, within the bedrock aquifer. The piezometric pressures confined within the bedrock, over geologic time, have also given rise to relatively high piezometric pressures within the overlying till aquitard as well. Along the upper reaches of the LSMOC, piezometric pressures within the till aquitard are very near the top of the aquitard itself, and near the base of the overlying peat. In these areas there is an upward gradient between the bedrock aquifer and till aquitard piezometric pressures.

The till groundwater geochemistry is unique from the bedrock aquifer groundwater geochemistry, and surface water geochemistry, and shows generally higher dissolved solids and more frequent elevated percentages of sulphate and chloride than in the bedrock groundwater or surface water system (KGS 2021a). The low permeability of the till limits any water influx into the till, either from discharge from fresher groundwater below, or recharge from fresher surface water and wetland sources perched above the till. The integrity and function of the till aquitard is demonstrated by its thickness and low permeability characteristics, combined with its unique groundwater geochemistry, and with the observation of upward gradients (to flowing artesian conditions) and because it demonstrates a confining condition for the underlying bedrock aquifer throughout the region of the LSMOC.

In areas closer to the artesian spring sites and down channel from the existing EOC Reach 3 channel, bedrock aquifer pressures remain confined but are somewhat reduced, due to the natural discharges of bedrock groundwater to the surface water system at the artesian spring sites (KGS 2021b). In these areas, the till and clay aquitard pressures are somewhat higher than those measured in the bedrock aquifer. Here, downward gradients from the aquitard to the bedrock aquifer are more common. Negligible recharge through the aquitard to the bedrock is expected, as recharge to the bedrock occurs regionally within bedrock outcrop areas, and/or where the bedrock topography is high, and the overlying till cover is thin.

Oxygen stable isotope results indicate a generally recent recharge source for the groundwater system, and relatively short aquifer residence times, which is also consistent with the overall geochemical results (KGS 2021a). Tritium results also indicate that groundwater at two locations is representative of very recent, modern recharge (i.e., post-1950), and that the groundwater in the vicinity of the WCS has had the longest residence time in the region of the LSMOC (which is furthest away from the observed artesian spring sites in the region of the LSMOC).

12.0 LSMOC SUMMARY OF EFFECTS

12.1 Overview

Groundwater conditions along and in the vicinity of the LSMOC are complex and driven by the regional groundwater aquifer system in the Interlake (i.e., between Lakes Manitoba and Winnipeg), and particularly between groundwater recharge and discharge areas associated with Lake St. Martin and Lake Winnipeg. Management of the groundwater conditions is critical for the successful construction of the Project as discussed below. Responsible management of the groundwater conditions has been identified as critical to aboriginal treaty rights, health, social conditions and sustainability of these communities.

Confined to flowing artesian bedrock aquifer conditions are present in most areas of the LSMOC as shown by 2015 and 2019 groundwater elevation/pressure data that is shown on Figure 10 In areas where the excess confined bedrock aquifer pressures are elevated relative to the thickness of the confining till and silty clay aquitard units, there is a potential for basal heave/hydraulic fracturing of the till. The potential for this to occur is greatest during channel excavation, due to unloading of the confining aquitard units, which may in turn heave due to the underlying confined bedrock aquifer piezometric pressures, thereby inducing a connection of the bedrock aquifer to discharge at the base of the channel excavation. Under these conditions, there is a possibility for groundwater discharge to the channel excavation area(s), which will require management during construction of the channel. This condition is known to have developed naturally and has been observed in the region of the LSMOC where artesian spring sites are common (Figure 10). The total flow of groundwater from the bedrock aquifer to the LSMOC is anticipated to be limited by the low transmissivity of the fractured bedrock observed to date within existing exploration areas, and within the base of EOC Reach 3. There remains potential for variability and localized karstic and higher transmissivity bedrock within other areas of the Project. Because these excess bedrock aquifer piezometric pressure conditions cannot be avoided in the LSMOC portion of the LAA, one of the Project design considerations is that there will be some groundwater discharge baseflow to the channel excavation, originating from discrete and somewhat limited source areas.

In general, consideration of groundwater piezometric pressures and any associated aquifer depressurization requirements during the design phases of the Project will apply not only to the channel excavation, but also to the channel inlet/outlet excavations, the channel drop structure installations, and the channel WCS foundations (including associated long-term WCS uplift pressure mitigation measures).

In terms of geotechnical stability, groundwater discharge areas along the centerline and base of the channel may pose fewer short- and long-term challenges than if they were to occur near the channel side slope, or near (or beneath) an engineered structure. Minimizing and mitigating groundwater discharges is being addressed as part of detailed design and in construction sequencing.

Active depressurization of high groundwater pressures with temporary groundwater depressurization systems pumping from bedrock wells are anticipated to be required to facilitate deep foundation excavations for construction of concrete structures (i.e., the WCS). Following construction, passive sub drains are planned to lower piezometric pressures beneath the base of the WCS to protect against uplift.

The LSMOC is currently directly interconnected with the exposed bedrock in a portion of the existing EOC Reach 3 channel. Additional interconnection will occur as the channel is deepened and widened through the Reach 3 area. Groundwater discharge will occur with this work; however, the degree of groundwater discharge will be controlled by the low bulk transmissivity of the bedrock encountered, which to-date has been calculated based on water well pump testing results, and with measurement of baseflow along the existing Reach 3 channel.

The excess bedrock piezometric pressures will be considered during the excavation of the channel inlet, and outlet, within the cofferdam areas, depending on the depth of lake bottom excavation determined during design optimization. Seepage discharge areas may develop at the base of the excavation from the confined bedrock aquifer foundations or from Lake St. Martin and Lake Winnipeg via lake bottom deposits, and the resulting discharge must be managed.

Drop structures are being designed to account for excess piezometric pressures, specifically within construction excavations, so that the hydraulic, geotechnical and constructability requirements are satisfied throughout the short and long-term timeframes.

The nearest groundwater well users are at the Dauphin River First Nation community, 5 to 6 km north and northeast of the channel (Figure 9). Most of the community wells are on the north side of the Dauphin River, which serves as a groundwater discharge, hydraulically isolating domestic wells on the north side. A few wells are located on the south side (i.e., Project side) of the Dauphin River.

Although the development and operation of the LSMOC is very unlikely to result in any temporary or permanent water quality or water level impacts to domestic wells in the region, protection of the regional groundwater aquifer must be considered as practicable during design optimization. The monitoring of potential effects of the Project on groundwater (levels and quality) is provided at sentinel wells located in the community on both sides of the Dauphin River (Figure 9). Continuous monitoring of groundwater elevations will be provided to track any long-term groundwater elevation changes. Water quality monitoring in the Sentinel wells will establish baseline and long-term trends.

Water levels within the perched peat wetlands are largely impacted by surface water measures and drainage modifications described within the SWMP. Any changes in bedrock piezometric pressures as a result of the LSMOC are not estimated to cause any measurable effect on the peatlands as a whole in any areas in proximity to the LSMOC, due to the presence of the extensive silty clay and dense silt till aquitard.

Changes in groundwater piezometric pressures could possibly alter the total discharge of groundwater to wetlands that are directly interconnected via artesian springs, such as in proximity to Big Buffalo Lake, and along the shores of Lake Winnipeg near Willow Point. These possible changes in baseflow discharge to surface could potentially impact the associated aquatic and terrestrial habitat. However, there is no scenario where these naturally occurring spring discharge sites would cease to flow entirely because of the LSMOC.

12.2 Groundwater Piezometric Head

The bedrock aquifer piezometric pressure conditions will rise in response to the change in boundary conditions – specifically the staging or rise of surface water within the LSMOC channel in these interconnected channel areas. This will act to return the bedrock aquifer system to a discharge (exfiltrating) condition at the channel in these interconnected channel areas, even with the channel full, and in operation. With repeated, short-lived pressure conditions favoring infiltration from the channel to the bedrock aquifer, development of a localized influx of infiltrated channel surface water, local to the channel and moving further down gradient in the bedrock aquifer groundwater system near the channel, is a possibility (KGS 2021b). These mixed surface and ground waters are expected to migrate through the aquifer system to the next available discharge area, located either within the LSMOC channel itself, at an existing downgradient artesian spring site, or possibly in the longer term as baseflow to Lake Winnipeg.

12.3 Groundwater Quality

Repeated infiltration of small quantities of surface water may cause local and short-lived water quality changes to the regional bedrock aquifer resource in close proximity to the LSMOC. It is important to distinguish that infiltration may only occur in areas where there is a physical connection from the channel to the bedrock aquifer. These interconnections are localized and will occur only where the till aquitard has been fractured or heaved during excavation of the channel, or where bedrock is exposed within the channel (such as at Reach 3, currently). However, there are no nearby domestic well users and the overall hydraulic gradient (groundwater flow direction) in the area is to the east northeast, with discharge to existing downgradient artesian spring sites, and ultimately into Lake Winnipeg.

12.4 Groundwater-Surface Water Interactions

The creation of new groundwater discharge pathways into the LSMOC channel will locally increase the direct connection of exfiltrating groundwater to channel surface water, originating from the underlying bedrock aquifer. The bedrock aquifer in the LAA portion of the LSMOC is confined, and as such responds quickly in piezometric pressure to changes in aquifer boundary conditions (i.e., changes to water levels or pressure conditions at aquifer recharge and discharge areas). The LSMOC is situated in an area of high confined bedrock aquifer groundwater pressures, which drives groundwater discharge to the LSMOC channel as baseflow under virtually all scenarios of variability in aquifer boundary conditions. However, during certain times of channel operation, such as the rapid staging of surface water within the channel as it is opened, downward vertical gradients may be temporarily developed between the surface water within the operating channel and the underlying bedrock groundwater aquifer, resulting in short-term (hours) and localized infiltration of surface water to the bedrock aquifer. This will only occur in locations where there is a physical interconnection of the LSMOC channel to the bedrock through the till aquitard, or where the bedrock aquifer is directly exposed within the LSMOC channel base, and only during the limited period of time when the water level within the LSMOC channel is higher in elevation than the piezometric pressure of the underlying confined bedrock aquifer.

The channel optimization through the detailed engineering design phase will include consideration to mitigate the potential for any downward vertical gradients to the bedrock aquifer by minimizing the difference between the operating (staged) channel water level, and the current static piezometric pressure in the underlying bedrock aquifer, particularly in the exposed bedrock area of EOC Reach 3.

Water levels within the perched peat wetlands adjacent to the LSMOC are largely impacted by local surface water conditions. Based on water quality analyses, the perched peat wetlands (fens) are also fed by carbonate bedrock aquifer groundwater at artesian spring sites that are visible in the region, and possibly other diffuse seepage areas that are harder to identify without the surface expression of the spring sites themselves. Many peatland areas in the region of the LSMOC are fens, due to these naturally occurring water regime conditions where the bedrock aquifer is discharging to the surface water (fen) system. Measures to address surface water drainage modifications are included in the SWMP. Any changes in bedrock piezometric pressures as a result of the construction and operation of the LSMOC are not expected to cause any measurable effect on the peatlands and fens as a whole in any areas in proximity to the LSMOC, where there is an extensive silty clay and dense silt till aquitard.

Changes in groundwater piezometric pressures could alter the discharge of groundwater to wetlands that are directly interconnected via artesian springs, such as in close proximity to Big Buffalo Lake, and along the shores of Lake Winnipeg near Willow Point. These possible changes in baseflow discharge to surface have the potential to impact the associated aquatic and terrestrial habitat. Some change in artesian spring site flows to the wetlands are expected to occur naturally with seasonal variability in the aquifer piezometric pressure conditions, and with LSMOC construction activities, where there may be some limited bedrock aquifer piezometric pressure reductions in the confined bedrock aquifer. It is highly unlikely that these naturally occurring spring discharge sites would cease to flow entirely as a result of only the estimated bedrock piezometric pressure reductions related to LSMOC.

13.0 LSMOC MITIGATION MEASURES

13.1 Overview

The effect of the hydrogeologic conditions on construction and long-term operation of the outlet channel and structures has been considered in the design, as described below. This includes consideration of the baseline groundwater flow system, and changes to the flow system estimated to be a result of LSMOC construction, and/or when the channel is operated. All depressurization designs were developed in conjunction with geotechnical engineering specialists, with the goal to mitigate the magnitude and duration of any potential impacts to the bedrock aquifer piezometric pressures in the region of the LSMOC.

The channel profile optimization process includes considerations to minimize the potential for interconnection of the channel invert with the bedrock aquifer groundwater system. The maximum channel water elevation within EOC Reach 3 (where bedrock is exposed within the channel and is directly interconnected) has been constrained so that it is comparable to the current, naturally occurring piezometric pressure elevation of the bedrock aquifer at this location. Groundwater-surface water interconnections currently exist and are expected to remain at Reach 3 due to exposed bedrock and thinner overburden conditions. Limiting the channel water elevation serves to minimize the potential for the development of short-term downward gradients from the surface water to the bedrock groundwater system in the Reach 3 area. Reducing the maximum channel water elevation at this location also lowers the potential for channel-induced increased bedrock aquifer piezometric pressures in down-channel areas, where the potential could be increased for uncontrolled groundwater discharge (i.e., artesian spring breakouts) in downstream areas, where the topography drops markedly to the east.

In the remainder of the channel, the proposed invert is based in till; however, areas are present along the channel where excavating to the design invert would result in an increased potential for basal heave and fracturing of the till in the base of the channel. This could result in uncontrolled groundwater discharge from the underlying bedrock aquifer.

Construction sequencing is proposed to help manage this risk by promoting interconnections in a concentrated, central channel, area, should they occur. Channel excavation will proceed such that full excavation to design invert in these higher risk areas would proceed using a central pilot ditch and progress outwards to the full channel excavation width, as detailed in Section 12.3.

This excavation staging will minimize the potential for uncontrolled discharge in large areas of the channel base, particularly in areas closer to the channel side slopes, whose stability conditions are most sensitive in terms of overall channel excavation.

Excavation of the channel Inlet at Lake St. Martin and the channel Outlet at Lake Winnipeg will occur in the lake bottom till sediments. At the Inlet and Outlet works, groundwater discharge may occur within the construction area. If this area must be dewatered for ease of construction, any groundwater discharge will be directed to a sump and pumped out during construction. After construction, the water elevation of Lake St.

Martin and Lake Winnipeg will control the long-term rate of any groundwater discharge baseflow to the lakes. Since groundwater discharge baseflow is already occurring to both lakes from the surrounding regional bedrock aquifer, development of additional discharge zones within the inlet are considered to be acceptable where it cannot be avoided. There is no scenario where these naturally occurring groundwater baseflows to the lakes would cease to flow entirely as a result of the LSMOC. Control of surface water within the cofferdams is discussed in the SWMP.

Active groundwater depressurization (i.e., bedrock aquifer depressurization pumping with wells) will be required during construction of deeper excavations at the WCS. Design of the LSMOC is based on the WCS being located and founded on bedrock. As such, active pumping will be required to maintain the integrity of excavation as it progresses to completion and exposure of the underlying bedrock, and thereafter to dewater the excavation and exposed bedrock, in preparation for, and throughout the WCS construction activity. Long-term subsurface passive drainage of groundwater beneath the foundation will be incorporated into the active depressurization pumping well design to relieve any long-term uplift pressures on the foundation from bedrock aquifer groundwater contributions.

The drop structures incorporate a sheet pile seepage cut-off wall within the foundations, and across the width of the structure. The sheet pile wall also forms the crest, which acts as a weir to concentrate normal channel baseflow within the LSMOC. It is likely the sheet pile installation below the channel invert will require some groundwater control, anticipated to be achieved with pumping from surface sumps, or similar means. However, there is one exception to the above construction configuration at the channel drop structure founded on bedrock. The drop structure in this scenario will be comprised of a concrete weir founded on a shallow footing bearing directly on bedrock. Bedrock grouting may be required to limit seepage beneath this structure and is under evaluation in the Detailed Design.

Additional measures are required to mitigate groundwater pressures acting on the tills at the channel excavation base, and some associated structures during construction (WCS and drop structures). These are described below.

Channel

Construction sequencing will use an initial central drainage channel to control and direct areas of groundwater discharge and allow for controlled pressure relief of the bedrock aquifer groundwater system. Bedrock aquifer discharge from the existing Emergency Reach 3 channel exists currently. Groundwater discharge from other portions of the channel may also occur, with construction of the LSMOC. Bedrock aquifer groundwater conditions will equilibrate beneath, and in the vicinity of, the LSMOC channel, creating a post-construction groundwater flow system that remains in an overall discharge condition to the LSMOC, and to Lake St. Martin, Lake Winnipeg, and associated artesian spring sites. Depending on the total amount of additional bedrock aquifer baseflow to the LSMOC, the piezometric pressure condition of the aquifer may decline locally, however the regional recharge-discharge relationships will remain the same.

Water Control Structure

Active temporary groundwater depressurization will use pumping wells installed in the bedrock aquifer. Subsurface passive drainage of groundwater piezometric pressures may also be required long term at the WCS to relieve uplift pressures on the foundation.

Drop Structures

Active temporary groundwater depressurization will occur by pumping seepage from the open excavation for the sheet pile cut-off wall, during installation. No long-term measures are planned.

13.2 Aquifer Depressurization During Construction

13.2.1 LSMOC Depressurization

A construction sequencing plan is under development for construction of the LSMOC. This construction sequencing plan will require temporary bedrock depressurization at construction locations specific to each construction contract; notably at the WCS, and possibly at the channel drop structures. Because depressurization requirements for one contract area have the potential to influence other channel construction areas, the timing of a group of construction contracts and their limits needs to be considered in order to optimize the depressurization plan. Accordingly, active aquifer depressurization plans will be developed for each year of construction as a requirement of the Contractor on the various construction contracts to meet the needs of the design, which will involve the installation of temporary depressurization wells in the required areas to reduce bedrock aquifer groundwater pressure to the required targets. Groundwater quality will be monitored and mitigated as required prior to discharge to the surface drainage system.

Groundwater depressurization wells will be installed in the confined aquifer in the area of construction and groundwater will be actively pumped out to lower the pressure in the bedrock aquifer during construction, in key areas such as the WCS and at drop structures. The depressurization will continue long-term, but passively, during long-term channel operations. An estimate of the drawdown using analytical models was developed, and sensitivity analysis was performed by varying transmissivity and storativity coefficients (KGS 2021c). Typical seasonal piezometric head variation in the aquifer in the area of the LSMOC is 1.5 m +/- 0.5 m (i.e., 1.0 m to 2.0 m) per year. At the WCS, the piezometric pressure drawdown would be about 10 m during construction, reducing to a drawdown of 1.0 m at approximately 4 km distance from the WCS. Along the channel, if all drop structures were being actively depressurized during construction, approximately 8 m to 9 m of depressurization at the drop structures would reduce to 1.0 m within about 4 km of the channel. In most cases (at a distance of approximately 3 km) and in all cases (at a distance greater than 5 km), the decrease in piezometric pressure) from the Project depressurization will be well within the typical season variation of pressure and is not expected to have any impacts on domestic well operation.

13.2.2 Groundwater Piezometric Head

General

The piezometric head elevation in the LAA of the LSMOC area ranges from 245 masl near Lake St. Martin to 218.5 masl near Lake Winnipeg and is up to approximately 1.5 m to 2.0 m above ground level nearest Lake St. Martin. While still confined, the bedrock aquifer pressures decline to below ground surface below the existing EOC Reach 3 channel, due to the drawdown influence of existing artesian spring sites, in close proximity to Lake Winnipeg. The bedrock aquifer is fully saturated. In all areas along the channel and for a distance to each side, the bedrock aquifer piezometric pressure will remain above the physical bedrock surface (i.e., under a confined condition). The typical confined condition bedrock aquifer response to a project with similar conditions as for the LSMOC, and as is expected at LSMOC, is described in detail elsewhere (KGS 2021b).

Key regional recharge areas of note for the confined bedrock aquifer occur near Gypsumville, and along outcrop areas that occur immediately to the north-northwest and south of the Lake St. Martin narrows. In addition, the high elevation bedrock bluff area approximately 10 km southeast of Lake St. Martin, also functions as a sub-regional bedrock aquifer recharge area, with the bedrock surface in this location situated well above the aquifer piezometric pressure surface. In the region of the LSMOC, in the Dauphin River area, or in any location in proximity to Lake Winnipeg or Lake St. Martin, the confined piezometric pressure within the bedrock aquifer has been observed to be very near, and in some cases above, the ground surface (i.e., flowing artesian). This occurs because Lake Winnipeg and Lake St. Martin, and associated near-lake low-lying wet areas, are key discharge areas for the bedrock aquifer. Because of this, a strong upward gradient for discharge is anticipated and has been observed to be present in areas close to Lake Winnipeg, including within the region of the LSMOC. With the construction depressurization and long-term depressurization in place, the aquifer is expected to continue to recharge in the same areas, and discharge to both Lake St. Martin and Lake Winnipeg - either directly or via the LSMOC.

Channel

As the channel is constructed, any long-term (operation) depressurization measures for any section of the channel under construction, or at the WCS, will be installed. Therefore, both the short-term (during construction) and the long-term (post-construction) depressurization effects will need to be considered. Long-term measures may include passive drainage via wells at the WCS, and granular filters at individual channel drop structures and/or channel areas where groundwater baseflow may occur within the channel excavation itself.

Water Control Structure

A temporary construction aquifer depressurization system consisting of pumping wells is anticipated to be required during construction of the WCS. This will be a temporary measure used to protect against uncontrolled groundwater discharge and basal heave in open excavations during the construction phase of the WCS.

Specific depressurization requirements in the construction work area will be established during the final design of the WCS and will be specified in the tender. The Contractor would then be responsible for developing a system capable of meeting the design depressurization requirements.

Activities during the final design process will include those items needed to further define aquifer conditions, design depressurization target elevations and assess regional drawdown effects for the purpose of groundwater licensing. These may include:

- finalize detailed design of the WCS, and depressurization requirements
- design and location of additional drilling and testing programs to be carried out to further define aquifer conditions within the ROW of the Project (to be determined prior to construction).
- analysis of associated pump test results
- design of depressurization target elevations
- specify discharge water requirements (discharge point, quality, quantity, and turbidity)
- drawdown assessment in the area of work
- regional drawdown assessment
- preparation and submission of an Application for Temporary Aquifer Depressurization to MECP Water Licensing
- development of tender documents

The Contractor will be responsible for developing a construction depressurization system to achieve the design requirements and other specifications listed in the tender. Activities to be conducted by the Contractor typically include:

- design and location of drilling and testing programs to further define aquifer conditions. Analysis of associated pump test results (in consultation with the Contract Administrator)
- development of pumping system configuration for required combined total pump flow rate and individual flow rates, and discharge water requirements and associated handling of discharge groundwater (in consultation with the Contract Administrator)
- development of a groundwater depressurization plan to be approved by the Contract Administrator.
- Supply, installation and testing of bedrock pumping wells and associated observation wells according to types, sizes, materials and construction specifications, as required in the tender documents or otherwise approved by the Contract Administrator for the WCS
- supply, installation and testing and commissioning of a bedrock groundwater depressurization pumping system at the WCS, including such items as pumps, power supply, drop piping, wellhead connections, well system header discharge piping, well caps and flow meters
- bedrock groundwater depressurization system operation including preparation of discharge area for erosion control and aeration at discharge header outlet
- on-site monitoring (flow and water levels) in the area of work

In addition to monitoring the environmental effects of the construction phase depressurization program, the Contract Administrator will, as part of the adaptive management plan, monitoring, and follow-up, will conduct the following activities:

- oversight and verification of Contractor monitoring in work area
- water quality testing of the WCS and channel excavation depressurization system pump discharge water during pump test and channel construction operations
- regional monitoring of groundwater elevations at the adaptive management sites (See section 14.3.1) and sentinel wells (Figure 9)

Drop Structures

A temporary construction aquifer depressurization system consisting of pumping from a sump within the excavation area at each of the drop structures will likely be required. This is a temporary measure used to protect against uncontrolled groundwater discharge and basal heave in open excavations during the construction phase of the drop structures.

The specific depressurization requirements in the area of work will be defined during the final design and will be specified in the tender documents. The Contractor will be responsible for developing a system capable of meeting the design requirements.

Activities during the final design process will include those items needed to further define aquifer conditions, design depressurization target elevations to facilitate construction. The contractor will be responsible for developing a construction depressurization system to achieve the design requirements and other specifications listed in the tender. Activities to be conducted by the Contractor may include:

- development of a sump configuration and required combined flow rate and discharge water requirements and associated handling of discharge groundwater
- development of a groundwater depressurization plan to be approved by the contract administrator.
- Supply, installation and testing of sump materials, sump pumps according to types, sizes, materials and construction specifications, as required in the tender documents or otherwise approved by the contract administrator for the drop structure(s)
- supply, installation, testing and commissioning of the sump dewatering system at the drop structure(s), including such items as sump pumps, power supply, piping, connections, discharge piping and flow meters
- sump dewatering system operation including preparation of discharge area for erosion control and aeration at discharge header outlet
- on-site monitoring (flow and water levels) in the work area

13.2.3 Groundwater Quality

The key mitigation to protect groundwater quality in the LSMOC portion of the LAA will be to maintain channel operating water levels within the range of existing bedrock aquifer groundwater piezometric pressures and reduce the risk of surface water influences on groundwater quality, where the surface water system and groundwater systems may be interconnected due to channel excavation, specifically along the reach of the existing EOC Reach 3 channel. Construction and operation of the LSMOC will require depressurization of the aquifer to reduce the potential for basal heave, till fracturing and channel side slope failures. However, even with active depressurization during construction, the bedrock aquifer in the LAA portion of the LSMOC will remain under positive pressure, although the pressure elevation may no longer exceed the ground elevation (i.e., may no longer be under a flowing artesian condition), in places. Recharge of the aquifer via the base of the LSMOC is not expected to occur as the upward pressure gradient of the groundwater in the upper carbonate aquifer will promote groundwater discharges with re-equilibration of the groundwater system with channel construction and operations (KGS 2021b).

Should a change occur such that bedrock aquifer groundwater pressure decreases and the elevation of the piezometric pressure drops below the elevation of the bedrock surface (which is not anticipated anywhere along the LSMOC), the overlying till aquitard and passive reverse granular drains (which will be installed where interconnections through the aquitard might occur) would act as filters and as a reduced permeability for flow, for the infiltrating surface water. Pressure changes are considered to be transient events and not sufficient to cause any substantive change to the groundwater quality (KGS 2021b). Regular monitoring of the aquifer in the region will be conducted during, and post-construction.

13.2.4 Groundwater-Surface Water Interaction

An estimate in changes in groundwater flow and discharge rates was made for the construction phase of the LSMOC (Stantec 2021). Total flows are anticipated to stay the same as current conditions in the analyzed system but will be re-allocated from one discharge area to another with construction of the LSMOC. Approximately 30% of the overall annual average discharge contributions to Lake Manitoba, Lake St. Martin, and Lake Winnipeg is planned to be redirected back to the lakes during operation via the Project depressurization system and channels. The total discharge (including the channels discharge) will be the same as during baseline conditions, equal to the average annual baseline discharge (Stantec 2021). The discharge into the Project channels (LMOC and LSMOC together) that may occur during construction or operation is also predicted to be very small relative to the size of these channels. The groundwater discharge into the channels ranges from 2,000 m^3/d to 3,600 m^3/d (0.023 m^3/s to 0.045 m^3/s). These flows would be difficult to detect in the channels that have capacities of 212 to 326 m^3/s (7,500 cubic feet per second [cfs] and 11,500 cfs) (Stantec 2021). Total discharge estimated to the LSMOC during construction is approximately 0.037 cubic metres per second (m^3/s) (Stantec 2021).

13.3 Aquifer Depressurization During Operations

13.3.1 Design of Operation Depressurization Plan

To depressurize the bedrock aquifer along the LSMOC a hydraulic connection through the relatively low permeability aquitard is required. Two depressurization options are estimated to be required, including passive wells at the WCS and reverse granular drains within channel excavation and channel drop structure areas.

In some reaches of the LSMOC the excavation of the channel will intersect the bedrock directly (i.e., at the WCS, and at the existing EOC Reach 3 channel), or only a relativity thin layer of till will remain between the channel invert and the top of bedrock. In these areas pressure relief can be effectively provided by excavating to the bedrock and infilling with fine to medium grained free draining granular material. This filter material will act as a cover and provide the free drainage required to allow water to flow upward from the bedrock. This provides passive depressurization along of the bedrock where these filters are installed.

As with the passive depressurization wells at the WCS, the reverse drains along the channel will flow year-round under positive pressure (i.e., an upward gradient relative to the channel surface water levels). The reverse drain is not expected to pose a threat of contaminating the aquifer as it will be installed in aquifer discharge zone(s), not recharge zone(s). Should the groundwater pressure decrease, allowing transient surface water to infiltration to the aquifer, the drain will act as a filter for surface water as it enters the subsurface (KGS 2021b).

Depressurization wells or sumps will be placed at the LSMOC WCS with each well pumped to release groundwater from the confined bedrock aquifer into the channel, thereby reducing aquifer pressure. These wells would remain under artesian pressure and therefore flow upward year-round and will act as a discharge zone for the bedrock aquifer. As a result, a portion of the aquifer groundwater, currently naturally discharging into Lake St. Martin continuously, will be artificially discharged to the LSMOC through these passive WCS wells. The positive pressure in the aquifer depressurization wells and continuous discharge condition, will protect against surface water infiltration and associated potential for aquifer contamination.

13.3.2 Operations and Maintenance Plan

Based on experience gained through construction, an operations and maintenance plan will be developed for groundwater management components such as monitoring wells and depressurization works as part of long-term operations and maintenance activities.

13.3.3 Groundwater Piezometric Head

The piezometric head elevation in the LAA portion of the LSMOC ranges from 245 masl near Lake St. Martin to 218.5 masl near lake Winnipeg and is up to approximately 1.5 m to 2.0 m above ground level nearest Lake Saint Martin. While still confined, the bedrock aquifer pressures decline to below ground surface below the existing EOC Reach 3 channel, due to the drawdown influence of existing artesian spring sites, in close proximity to Lake Winnipeg. The bedrock aquifer is fully saturated. In all areas along the channel and at

distance from the LSMOC channel, the bedrock aquifer piezometric pressure will remain above the physical bedrock surface (i.e., under a confined condition). The typical confined condition bedrock aquifer response to a project such at this at LSMOC, and as is expected at LSMOC, is described in detail elsewhere (KGS 2021b).

Passive confined bedrock aquifer depressurization is required to reduce the potential for post-construction basal heave. A long-term target level for operating piezometric pressures remains similar to conditions currently observed (i.e., pre-construction); however, it is estimated that up to approximately 2.0 m of long-term aquifer piezometric pressure reduction may occur with construction of the LSMOC (KGS 2021c), within approximately 1 km of the LSMOC.

Key regional recharge areas of note for the confined bedrock aquifer occur near Gypsumville, and along outcrop areas that occur immediately to the north-northwest and south of the Lake St. Martin Narrows. In addition, the high elevation bedrock bluff area approximately 10 km southeast of Lake St. Martin also functions as a sub-regional bedrock aquifer recharge area, with the bedrock surface in this location situated well above the aquifer piezometric pressure surface. In the region of the LSMOC, in the Dauphin River area, or in any location in proximity to Lake Winnipeg or Lake St. Martin, the confined piezometric pressure within the bedrock aquifer has been observed to be very near, and in some cases above, the ground surface (i.e., flowing artesian). This occurs because Lake Winnipeg and Lake St. Martin, and associated near-lake low-lying wet areas, are key discharge areas for the bedrock aquifer. Because of this, a strong upward gradient for discharge is anticipated and has been observed to be present in areas close to Lake Winnipeg, including within the region of the Lake St. Martin Outlet Channel. With the construction depressurization and long-term depressurization in place, the aquifer will continue to recharge in the same areas, and discharge to both Lake St. Martin and Lake Winnipeg either directly or via the LSMOC.

13.3.4 Groundwater Quality

The key mitigation to protect groundwater quality in the LAA portion of the LSMOC was to maintain channel operating water levels within the range of existing bedrock aquifer groundwater piezometric pressures and reduce the risk of surface water influences on groundwater quality, where the surface water system and groundwater systems may be interconnected due to channel excavation, specifically at the existing EOC reach 3 channel. Construction and operation of the LSMOC will require depressurization of the aquifer to reduce the potential for basal heave, till fracturing and channel side slope failures. However, even with active depressurization during construction, the bedrock aquifer in the LAA portion of the LSMOC will remain under positive pressure although the pressure elevation may no longer exceed the ground elevation (i.e., may no longer be under a flowing artesian condition), in places. Recharge of the aquifer via the base of the LSMOC is not expected to occur as the upward pressure gradient of the groundwater in the upper carbonate aquifer will promote groundwater discharges with re-equilibration of the groundwater system with channel construction and operations (KGS 2021b).

Should a change occur such that bedrock aquifer groundwater pressure decreases and the elevation of the piezometric pressure drops below the elevation of the bedrock surface, which is not anticipated anywhere along the LSMOC, the overlying till aquitard and passive reverse granular drains (which will be installed where interconnections through the aquitard might occur) would act as filters and as a reduced permeability for

flow, for the infiltrating surface water. Pressure changes are considered to be transient events and not sufficient to cause any substantive change to the groundwater quality (KGS 2021b). Regular monitoring of the aquifer in the region will be conducted during, and post-construction.

13.3.5 Groundwater-Surface Water Interaction

An estimate in changes in groundwater flow and discharge rates was made for the LSMOC (Stantec 2021). Total flows are anticipated to stay the same, in the analyzed system, but will be re-allocated from one discharge area to another with construction of the LSMOC. Approximately 30% of the overall annual average discharge contributions to Lake Manitoba, Lake St. Martin, and Lake Winnipeg is planned to be redirected back to the lakes during operation via the Project depressurization system and channels. The total discharge (including the channels discharge) will be the same as during baseline conditions, equal to the average annual baseline discharge (Stantec 2021). The discharge into the Project channels (LMOC and LSMOC together) that may occur during construction or operation is also very small relative to the size of these channels. The groundwater discharge into the channels ranges from 2,000 m^3/d to 3,600 m^3/d (0.023 m^3/s to 0.045 m^3/s). These flows would be difficult to detect in the channels that have design flow values of 212 to 326 m^3/s (7,500 cfs and 11,500 cfs) (Stantec 2021). Total discharge estimated to the LSMOC during operations is approximately 0.024 m^3/s (Stantec 2021).

14.0 LSMOC MONITORING

14.1 Objectives

The objectives of the LSMOC groundwater monitoring program include:

- verify the anticipated effects to groundwater levels, quality, and quantity and based on the EA completed for the Project
- determine the effectiveness of mitigation measures
- assess the need for additional mitigation measures if initial measures are not adequate
- determine the effectiveness of any additional/adapted measure(s)
- confirm compliance with regulatory requirements relevant to ground water quality and quantity

Groundwater monitoring in the LSMOC portion of the LAA has, and will be, generally be conducted three times per ear, in the spring, summer and fall - prior to, during, and for 2 years following construction, which will be modified, if/as necessary, so that one full season of channel operations and one year post flood is captured in the data. During specific construction phases of the Project where active depressurization is required, monitoring and sampling frequency may increase to monthly, in support of adaptive management plans. In all Project phases, groundwater will be monitored for both quality and quantity (i.e., groundwater level [pressure head]). Standard field and laboratory quality assurance/quality control (QA/QC) protocols will be followed, including the use of trip blanks and collection of field blanks and blind duplicate samples. Monitoring results and analysis will be completed and communicated via written report on an annual basis. Multi-year/trend analysis may also be needed.

14.2 Baseline Monitoring

Groundwater-related investigations have been undertaken in the Project area since 2011. A total of 12 Instrumented test holes were drilled during the 2015 investigations and instrumented with a total of 24 nested standpipe piezometers (SP). Survey and monitoring of these instruments was completed as part of the 2019 field program. In 2019, as part of the Preliminary Design Phase Monitoring Program, several baseline groundwater monitoring programs were carried out, including: test hole drilling and well installation, instrumentation, hydraulic conductivity testing, pump testing, groundwater monitoring and water quality sampling. Groundwater piezometric head data for the LAA portion of the LSMOC was collected from locations shown in Figure 9 and during Project-specific monitoring programs described above and up to 2021 (KGS 2021a, KGS 2021b, KGS2022).

14.2.1 Groundwater Piezometric Head

The following groundwater monitoring locations and associated collected data were used to define the piezometric groundwater conditions in the LSMOC portion of the LAA.

There are a total of 58 SPs (24 installed in 2015 and 34 in 2019) and 32 Vibrating Wire Piezometers (VW) installed within the 46 test holes along the LSMOC alignment (see Figure 9). A high-level summary of the instrumentation is as follows:

- Peat – 19 installations
- Silty Clay / Clay Till – 8 installations
- Silt Till – 36 installations
- Sand – 2 installations (local to Sta. 5+606)
- Bedrock – 25 installations

Test Holes

In 2019 34 test holes along the LSMOC alignment were completed and surveyed. A series of nested piezometers were installed in the drilled test holes consisting of SP and VWs. A total of 34 SPs and 32 VWs were installed.

Pumping Wells

Bedrock pumping wells (125 mm diameter) were completed at 3 locations along the LSMOC alignment: near the inlet, in Reach 2 and in Reach 3. These locations are plotted on Figure 9 as follows: PW19-KGS-01 at Sta. 1+618 near the inlet, PW19-KGS-02 at Sta. 5+606 in Reach 2, and PW19-KGS-03 at Sta. 17+668, in Reach 3.

Sentinel Wells

Three sentinel wells (SW19-KGS-01 to 03) were drilled and installed within the Dauphin River First Nation community located approximately 6 km northeast of the LSMOC (Figure 9). The purpose of the sentinel wells is to collect baseline groundwater information (groundwater levels and water quality parameters) on the bedrock aquifer within the community and allow ongoing monitoring of conditions during the design and construction phases of the project, as part of the adaptive management network of groundwater monitoring sites for the LSMOC. The sentinel wells were installed as an independent system separate from intrusive monitoring of the network of existing domestic wells.

The location of the sentinel wells is shown on Figure 15. One sentinel well (SW19-KGS-01) is located on the south side of the Dauphin River near the southeastern edge of the First Nation boundary and serves as the nearest monitoring point between the community and the LSMOC site. Two wells (SW19-KGS-02 and 03) are situated on the north side of the Dauphin River within the network of existing domestic wells. Drilling and installation of the sentinel wells occurred in two stages; SW19-KGS-01 was installed in March 2019 via ice road across the Dauphin River, and SW19-KGS-02 and 03 were installed in September 2019 via road access.

14.2.2 Groundwater Quality

Groundwater quality samples are collected three times per year from the groundwater wells shown in Figure 9. Collected samples are analyzed for the suite of parameters listed in Table 5 to characterize baseline groundwater quality conditions. The analytical suite of parameters was selected to characterize the groundwater and includes:

- field monitoring to determine aquifer conditions [temperature, pH, DO and ORP
- potability testing to determine the quality and type of groundwater
- trace metal analyses
- petroleum hydrocarbon constituents and microbiological components due to the proximity of developed areas to the LMOC (to assess potability and risk of surface water- groundwater interactions)

The results of the groundwater sampling program are documented in several reports (KGS2021a, KGS2022).

Table 5:Groundwater Parameters Measured in Pre-Construction Monitoring Program

Category	Parameters
Field Monitoring	temperature, pH, electrical conductivity, DO, oxygen reduction potential, overburden groundwater elevations, bedrock aquifer piezometric pressure
Potable Water	electrical conductivity, hardness, pH, TDS, turbidity, alkalinity, bicarbonate, carbonate, fluoride, hydroxide, nitrate and nitrite (as N), nitrate (as N), nitrite (as N), sulfate
Dissolved and Total Metals	aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, cesium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, phosphorus, potassium, rubidium, selenium, silicon, silver, sodium, strontium, sulfur, tellurium, thallium, thorium, tin, titanium, tungsten, uranium, vanadium, zinc, zirconium
Environmental Stable Isotopes	deuterium, oxygen, tritium
Microbiological	*E.Coli*, total coliforms (pumping wells and sentinel wells only)

14.2.3 Groundwater-Surface Water Interactions

Groundwater/ Surface water interactions were estimated using information collected from the annual monitoring reports on groundwater and surface water quality (KGS 2021a, KGS2021b)). This information includes static water levels and piezometric pressure head (groundwater), surface water elevations, and surface water and groundwater quality.

14.3 Pre-Construction Monitoring

Groundwater monitoring activities will continue during the detailed design phase of the LSMOC to support the finalization of engineering design prior to tendering and construction. These activities include:

- continued monitoring of groundwater levels (static water levels and piezometric head) at existing instrumentation (see Figure 9)
- collection of groundwater samples for laboratory analysis of the parameters in Table 5 (above).

14.3.1 Network Expansion

Apart from the three sentinel wells, many of the current monitoring well and instrumented test hole locations located within the LSMOC portion of the LAA will be decommissioned as channel construction progresses. Additional groundwater monitoring locations (groundwater monitoring wells and/or instrumented test holes), outside of the alignment, will be installed during the pre-construction phase to provide coverage of the channel and major structures at key locations, such as the WCS and in channel excavation areas of greater potential for basal heave/hydraulic fracturing of the till. The number and location of additional groundwater monitoring locations will be determined during detailed design.

To-date, and as shown in Figure 9, the existing network of instrumentation and sites measured and sampled for groundwater are largely located to facilitate engineering design and are within the ROW of the LSMOC portion of the LAA. These existing installations will be decommissioned with the construction of the LSMOC and with channel excavations, construction of dykes, and placement of excavated spoil materials. The existing sentinel wells at Dauphin River will remain through construction and operation of the LSMOC.

It will be important to establish a network of piezometers and installed instruments that measure water levels and allow for water quality sampling, from within the upper perched peatlands, from within the till aquitard, and from the carbonate bedrock aquifer below. Nests of monitoring wells will be established in key sensitive habitat areas, to allow for measurement and monitoring of any changes that might occur during, or post-construction. Knowledge obtained from field performance will be used to modify programs as necessary as construction progresses.

The monitoring well sites would be installed prior to implementing the site clearing contract, which is envisioned to be undertaken during the winter season. It is also envisioned that there would be overlap in monitoring periods between existing, on-site instrumentation in the field (and within the LSMOC ROW), and the future adaptive management monitoring sites that are yet to be installed. The existing installations within the LSMOC ROW will be decommissioned as channel excavation contracts are executed, leaving the newly

established adaptive management monitoring sites behind for the long-term (i.e., construction and operations periods for the LSMOC). It is recognized that there likely will be somewhat limited concurrent data collection overlap among future adaptive management monitoring sites and the existing LSMOC ROW instrumentation that has been collecting baseline groundwater level data since 2019.

At each installation site (there are up to 9 installation sites described here in total), the following would be installed at each of the 9 sites:

1. Bedrock standpipe, with pressure transducer continually measuring pressure and temperature.
2. Stacked (2) grouted in VWs, installed in borehole annular space. One in deep till, second in shallow till or clay/clay till strata; complete with data logger for continuous measurement.
3. Standpipe in peat/wetlands, with pressure transducer continually measuring pressure and temperature.

The locations and rationale for the construction and operations phase monitoring well network is as follows (Table 6) and will form the basis for data collection as required during and post construction, and as needed for input to the adaptive management plan for groundwater conditions at the LSMOC.

Table 6: Proposed Locations of Monitoring Wells and Instrumentation to be Installed for Construction Phase and Post-Construction Monitoring

Locations (9 in total)	Description	Rationale
Vicinity of the WCS	2 sites; one NW of LSMOC, one SE of LSMOC	Monitor and sample groundwater conditions near the location of WCS construction phase active depressurization, and possible long term operations phase passive depressurization
Vicinity of Big Buffalo Lake Complex	2 Sites; one NW side of LSMOC; one SE of LSMOC	Monitor and sample groundwater conditions near Big Buffalo Lake Complex, and to capture region of artesian groundwater spring sites to the SE of the LSMOC
Vicinity of artesian spring sites along Big Buffalo Creek	One site, in proximity of artesian spring sites	Monitor and sample groundwater conditions in region of artesian groundwater spring sites that provide baseflow to Big Buffalo Creek
Region of bedrock exposure at existing Emergency Reach 3 Channel	2 sites, one on each side of the LSMOC	Monitor and sample groundwater conditions at the exposed bedrock portion of the existing Emergency Reach 3 channel and future LSMOC, where gradients for flow and water quality conditions require assessment as related to infiltration/exfiltration conditions that may occur along this portion of the LSMOC

Locations (9 in total)	Description	Rationale
Region of Lake Winnipeg artesian spring sites	2 sites, one on each side of the LSMOC; One in proximity to existing TH19-KGS-19 on the Lake Winnipeg side of the LSMOC; the other on opposite side of the LSMOC	Monitor and sample groundwater conditions in region of artesian groundwater spring sites that provide baseflow to wetlands in close proximity to Lake Winnipeg

14.3.2 Groundwater Piezometric Head

Continuous level monitoring using pressure transducers and VWs with dataloggers, at the locations specified above (Table 6). Ideally, the existing instrumentation sites (Figure 9), used to develop the understanding of the LSMOC portion of the LAA existing conditions (KGS 2021a, KGS 2021b) will be monitored for a period of time concurrent to the establishment of the additional sites described above (Table 6). The goal would be to establish overlap in data collection in advance of decommissioning of existing instrumentation and monitoring wells that will occur with the advance of channel construction. All active sites will be used for construction depressurization monitoring. Monitoring will be initiated before the bedrock depressurization begins.

14.3.3 Groundwater Quality

Continued monitoring of groundwater quality at existing sites (discussed in Section 14.2) and new sites (discussed in Section 14.3.1 and detailed in Table 6) will be undertaken during spring, summer and fall, with reporting completed annually. Collected samples will be analyzed for the suite of parameters listed in Table 5 to characterize baseline groundwater quality conditions. New wells discussed in Section 14.3.1 will be monitored at least once prior to the initiation of depressurization.

14.3.4 Groundwater-Surface Water Interactions

The planned instrumentation and monitoring wells (See Section 14.3.1 and Table 6) will be monitored prior to depressurization to determine the preconstruction groundwater conditions. Analyses such as those completed to establish existing groundwater piezometric pressure and quality conditions in the LAA portion of the LSMOC (KGS 2021a, KGS 2021b) will be assessed as data becomes available. Data collected during monitoring of these well and instrumentation sites will be provided at regular intervals (i.e., following each monitoring and sampling event) to the wetlands monitoring team for incorporation into their assessment and to inform recommendations made to the Project EAC and Manitoba Transportation and Infrastructure to inform recommendations made to Manitoba Transportation and Infrastructure. Any identified change (i.e., water quality) will be cause for immediate notification to the wetlands monitoring team.

14.4 Construction Monitoring

Construction groundwater aquifer monitoring events will be conducted during the LSMOC construction period. Monthly manual monitoring and groundwater sampling events are planned at the adaptive management monitoring sites during each construction year. Instrumentation installed at each of the adaptive management monitoring locations will record groundwater level and groundwater temperature data continually and will be downloaded during each monthly monitoring and sampling event that will occur during the construction period of the LSMOC.

14.4.1 Groundwater Piezometric Head

Monitoring will focus on identifying any local or regional effects of construction activities, such as active aquifer depressurization pumping, and/or channel excavation and basal heave or fracturing of the till aquitard which may have an effect on groundwater quality and levels.

Continuous level monitoring gauges will be maintained, and groundwater quality monitoring will continue annually in spring, summer and fall during construction with reporting completed annually. Additional construction monitoring of the overburden groundwater levels and bedrock aquifer piezometric pressures for geotechnical purposes will be conducted separately, as required, particularly during active depressurization for the WCS construction contract.

14.4.2 Groundwater Quality

Groundwater quality will be monitored in the established LSMOC monitoring well network and at the sentinel wells based on location and proximity to the LAA portion of the LSMOC. This data will be used to establish a baseline data set for the Project. Regular monitoring and water quality sampling of groundwater quality at the wells will continue to occur three times per year. All groundwater samples will be collected following standard procedures, will be submitted to an accredited laboratory for analysis and subject to standard laboratory quality assurance (QA)/quality control (QC) processes.

The groundwater water quality is not expected to change beyond currently observed variations (KGS 2021a) and is estimated to maintain a stable trend into the future. Monitoring of groundwater quality will continue throughout LSMOC construction, and for 2 years post-construction (i.e., one flood event and one-year post flood).

Parameters with be reviewed after each monitoring event during construction and post-construction. In some cases, groundwater concentrations of some parameters (e.g., iron, manganese, fluoride) may be present at concentrations above the water quality guidelines during the baseline period. In these instances, the threshold would be the presence of a statistically significant increasing trend. Associated actions and mitigations would be situation and site specific.

Groundwater removed during depressurization will be discharged to ground surface and /or surface water. Water quality monitoring, triggers, thresholds and management of this groundwater are discussed in Section 15. Once discharged groundwaters are part of the surface water system, the water quality management monitoring triggers and thresholds are also addressed in the SWMP.

14.4.3 Groundwater–Surface Water Interactions

The planned instrumentation and monitoring wells (See Section 14.3.1 and Table 6) will be monitored prior to depressurization to determine the preconstruction groundwater conditions. Analyses such as those completed to establish existing groundwater piezometric pressure and quality conditions in the LAA portion of the LSMOC (KGS 2021a, KGS 2021b) will be assessed as data becomes available. Data collected during monitoring of these well and instrumentation sites will be provided at regular intervals (i.e., following each monitoring and sampling event) to the wetlands monitoring team for incorporation into their assessment and decision-making. Any identified change (i.e., water quality or significant gradient changes) will be cause for notification to the wetlands monitoring team for incorporation into their assessment and to inform recommendations made to the Project EAC and Manitoba Infrastructure and Transportation for decision-making. Any identified change (i.e., water quality) will be cause for immediate notification to the wetlands monitoring team.

14.5 Operation Monitoring

Groundwater monitoring and sampling during operations will follow the same frequency of occurrence as during pre-construction and construction. Groundwater monitoring and sampling will continue for the first two years post-commissioning and including one flood event and one-year post-flood. A plan for long-term groundwater monitoring beyond two years post- commissioning will be developed based on the previous monitoring data, an assessment of any possible LSMOC effects and public engagement. The plan will include monitoring the effects of the channel on groundwater quantity (i.e., piezometric pressure head) and quality during channel operating and non-operating conditions. On-site and regional monitoring of the effects of any long-term passive aquifer depressurization will also be included in the plan.

14.5.1 Groundwater Piezometric Head

Monitoring will focus on the effect of any passive long-term aquifer depressurization, and any channel surface water/groundwater interaction during initial channel operating and non-operating conditions. Continuous water level data collection will be maintained with data downloaded at regular intervals (e.g., three times per year) for the first two years post-commissioning. Trends identified in the LSMOC portion of the LAA will be compared against other regional monitoring locations (i.e., Provincial well hydrographs) to decouple any naturally-occurring environmental variation (i.e., wet year versus dry year effects; Wang, 2011) from potential LSMOC related impacts.

After LSMOC commissioning, the regional groundwater piezometric head is estimated to stabilize at a lower elevation in some LAA areas than exists currently (pre-construction), such as at the WCS but higher than what is estimated to occur during the construction phase of the Project (KGS 2021c). There will be some natural

seasonal variation in piezometric pressure as has been identified to date (KGS 2021b). Monitoring will continue for 2 years post-commissioning. If any unanticipated effects are identified, adaptive management processes will be triggered (see Section 15).

14.5.2 Groundwater Quality

Operation phase groundwater quality parameters are expected to remain consistent with those analyzed during the pre-construction and construction phases and identified in Table 5. The frequency and locations of sampling may be adjusted based on monitoring results and environmental conditions. Similarly, analytical parameters may be adjusted depending on water quality results. Groundwater quality during operations is estimated to be consistent with that measured during the pre-construction phase.

Groundwater water quality is not estimated to change beyond natural variation (KGS 2021a) and to maintain a stable trend into the future. Monitoring of groundwater quality will continue through 2 years post-construction and reported annually. The suite of analytical parameters will be reviewed each year post-construction. If an unanticipated water quality effect is identified, adaptive management processes will be triggered (see Section 15).

14.5.3 Groundwater–Surface Water Interactions

The planned instrumentation and monitoring wells (See Section 14.3.1 and Table 6) will be monitored to determine the groundwater conditions. Analyses such as those completed to establish existing piezometric pressure and quality groundwater conditions in the LSMOC portion of the LAA (KGS 2021a, KGS 2021b) will be assessed as data becomes available. Data collected during monitoring of these well and instrumentation sites will be provided at regular intervals (i.e., following each monitoring and sampling event) to the wetlands monitoring team for incorporation into their assessment and decision making. Any identified change (i.e., water quality or significant gradient changes) will be cause for notification to the wetlands monitoring team for incorporation into their assessment and to inform recommendations made to the Project EAC and Manitoba Transportation and Infrastructure and to inform recommendations made to Manitoba Transportation and Infrastructure. Any identified change (i.e., water quality) will be cause for immediate notification to the wetlands monitoring team.

15.0 LSMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP

15.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The federal *Impact Assessment Act* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

Follow-up is one step in the overall continuous improvement process which aims to evolve practices and processes based on feedback. Continuous improvement is generally a four-stage process: Plan, Do, Check and Act. This loop allows work to be planned, executed, reported on and then corrected as required.

In the context of groundwater management for the Project, the design will be implemented while managing risks with monitoring, as generally described in Section 14.0. As described in Section 12.4.1.1 of the Project EIS, the objective of the groundwater follow-up and monitoring program is to determine whether there are changes to the volume and accessibility or quality of the groundwater in the groundwater LAA as a result of construction or operations and update and implement mitigation measures and responses accordingly. The predicted residual effects during construction and operation of the Project include:

- a change in local groundwater flow due to depressurization operations,
- a change in local groundwater quality due to depressurization operations; and
- a change in groundwater–surface water interaction due to surficial drainage diversion and bedrock aquifer depressurization.

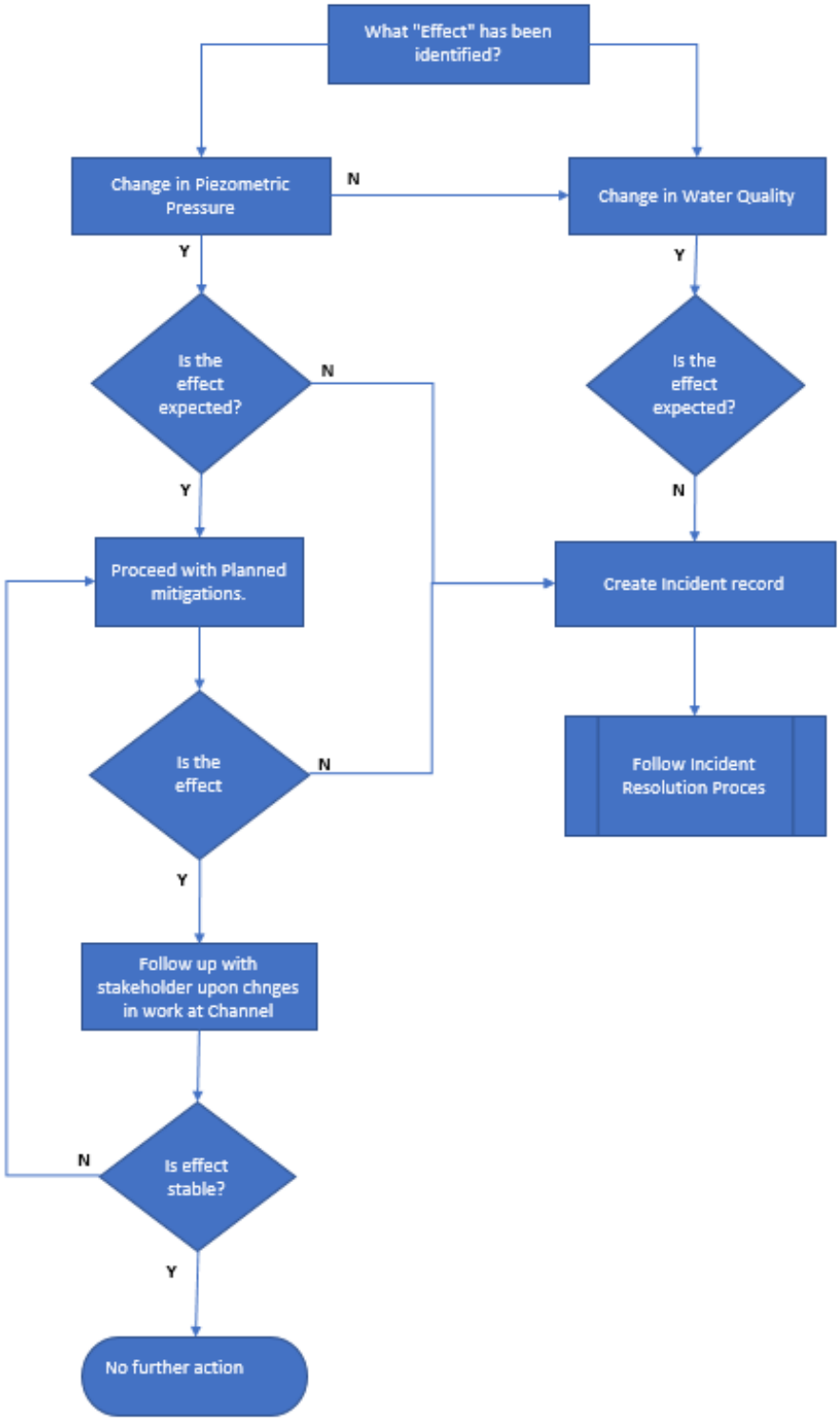


Figure 11: Adaptive Management Process

The monitoring and analysis program will provide information to better predict and quantify potential effects and confirm which locations of the groundwater LAA should be further monitored during aquifer depressurization. Existing data collection or monitoring programs will be applicable to inform development of Contractor construction phase monitoring plans, where identified, and to the extent feasible. Baseline groundwater quantity and quality will be established during the pre-construction monitoring program (in progress) which will form the basis for comparison to determine what, if any, effects are occurring. Knowledge obtained from field performance will be used to modify programs as necessary as construction progresses. It will be important to establish a network of piezometers and installed instruments that measure groundwater piezometric pressure and allow for water quality sampling, from within the upper perched peatlands, from within the till aquitard, and from the carbonate bedrock aquifer below. Nests of monitoring wells will be established in key sensitive habitat areas, to allow for measurement and monitoring of any changes that might occur during, or post-construction. Any proposed changes to the GWMP and monitoring as part of adaptive management would be discussed with Manitoba Transportation and Infrastructure and regulators, as necessary and documented.

15.2 Follow-up

The triggers and associated responses relative to groundwater conditions during construction and operations phases of the LSMOC are viewed as the same for both Project scenarios of Project construction and operation. As such, the triggers and response actions are provided below for both construction and operation phases.

15.2.1 Stakeholder Complaint Resolution Process

The Complaint Resolution Process will be implemented to allow private well owners to record any issues that they encounter with respect to their well performance or water quality. Complaints will be investigated, and mitigations determined on a case-by-case basis.

Changes in groundwater piezometric pressures (level) are expected to vary within the LAA portion of the LSMOC but are estimated to occur in areas within 3-5 km of the channel. The greatest changes will be seen at the wells most proximal to the channel alignment with an expected decrease reduction in the effect with distance from the channel. As previously stated, wells located > 5 km from the channel alignment, are expected to report variations in piezometric pressure within normal observed seasonal variation. These variations are not anticipated to impact well users. If a change is identified that is not anticipated, an incident will be created and investigated as shown in Figure 12. This investigation will determine whether the change is Project-related, the cause for the change and the parameters required to determine any required mitigations. In the short term, the effects can be mitigated by supplying a fresh water source, a pump and/or by lowering the pump intake (where applicable) until the circumstances and required actions are understood. Possible mitigation will be developed on a case-by-case basis, as required. Once the incident is resolved and stakeholder signoff is obtained, the report will be closed.

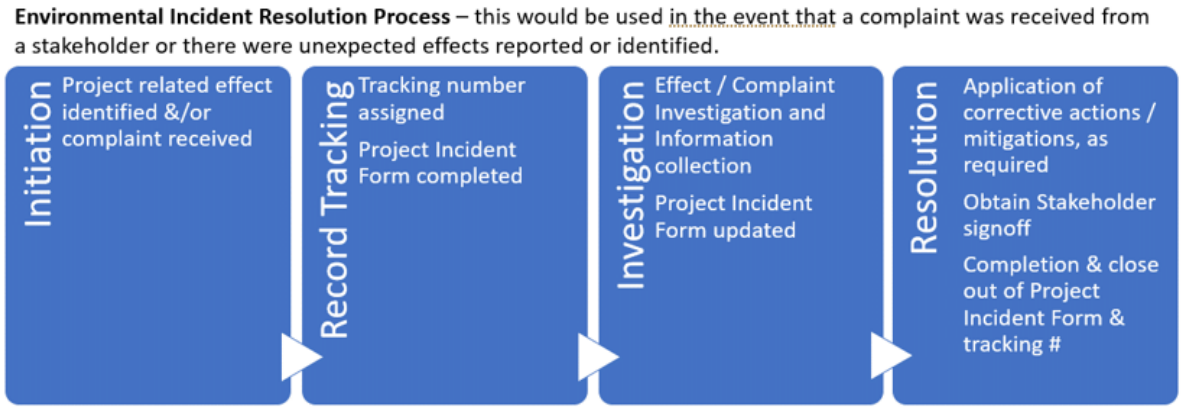


Figure 12: Incident Resolution Process

15.2.2 Groundwater Piezometric Head

The adaptive management monitoring well network for the LSMOC is envisioned to be comprised of the existing sentinel wells at Dauphin River, and the planned new monitoring sites that are to be installed outside of the LSMOC ROW and as described in Section 14.3.1. The identified groundwater piezometric pressure trigger levels for LSMOC are different than LMOC, to address fundamental differences in the LAA portion of each channel. The LAA portion for each channel has a unique response and overall range in observed seasonal and intra-seasonal (i.e., responses to high intensity, short duration rainfall events) aquifer pressure variability. Importantly, the implications for piezometric pressure variability/changes on each channel have a very different set of key receptors, where LMOC must address a large number of 3rd party domestic and agricultural well users, and LSMOC must address the sensitivity of groundwater discharge and contributions to the peatlands and fens that are pervasive in the LSMOC portion of the LAA.

In general, seasonal site-specific trigger water level elevations will be set at these adaptive management monitoring sites. These trigger values are determined based on the evaluation of existing condition water level data for the region of the LSMOC (KGS 2021b), and the predicted maximum extent of the cone of influence under construction and operations of the LSMOC (KGS 2021c). The reasons for these exceedances include the oversimplification of the methodology setting trigger values in a fractured rock aquifer (i.e., there often is variability in fractured confined bedrock aquifer transmissivity, and boundary conditions can occur over time that also may limit or enhance drawdown propagation with distance). More importantly, a simplified approach tends to neglect to account for the full impact of seasonality. As noted previously, it is common to observe 1.5 m +/- 0.5 m (i.e., 1.0 to 2.0 m) of aquifer piezometric pressure variability in the region of the LSMOC. Seasonal variability in groundwater levels as well as observed changes in the timing the seasons, have been observed, as have been more active aquifer pressure responses to short term high intensity seasonal rainfall events (KGS 2021b; KGS 2016).

A key objective of the adaptive management methodology is to use the concept of long-term trends from either prolonged climatic changes or those which are largely associated with aquifer dewatering. Prolonged climatic changes mean sustained periods of departure from "normal precipitation amounts" such as droughts or wet cycles. These precipitation trends result in noticeable effects on groundwater levels. Short-term trends (i.e., seasonal) should also be evaluated; however, they should not cause a concern if an exceptionally dry year results in water levels that drop below a minimum reported or predicted water level. This overall response of aquifer systems to wetter than average or dryer than average years (and particularly consecutive years of wetter than average or drier than average conditions) has been clearly demonstrated for all major aquifer systems within the province of Manitoba (Wang, 2011).

The LSMOC adaptive management plan for aquifer water levels will rely on the Seasonal Mann-Kendall Test to statistically interpret trend analysis of groundwater elevations at the adaptive management monitoring well sites. Statistically definable results can be utilized to manage groundwater resources, assess drought or wet cycle conditions, and evaluate long-term groundwater trends. The Seasonal Mann-Kendall Test considers the seasonality of the data series. This means that for monthly data with seasonality of 12 months, trends comparing month to month data will be done (i.e., comparison of one of January to another, and so forth). The Seasonal Mann-Kendall test is established on the basis that the trend is cyclically varying in relation to the seasons of the year and is used to analyze time series data for the possible existence of an upward or downward trend, at significance level, while accounting for the effect of seasonality. Data will be analyzed within the following reaches of the channel:

- Lake St. Martin to LSMOC Sta. 10+500: Typical GW El. 245.0 m - El. 242.6 m
- LSMOC Sta. 10+500 to Sta. 18+000: Typical GW El. 236.5 m - El. 230.5 m
- LSMOC Sta. 18+000 to Lake Winnipeg: GW El. 222.5 m - El. 218.3 m

As described below, appropriate triggers set for each reach, as groundwater levels vary significantly due to the naturally occurring flow system in the region of the LSMOC, specifically where the LSMOC is influenced by the proximity to the artesian spring sites near Lake Winnipeg. For any reach of the LSMOC, the minimum recorded groundwater level is considered the "0th percentile" of the dataset.

Stage 1:

- Trigger: Measured seasonal groundwater levels in the bedrock aquifer fall below the 10th percentile.
- Response actions:
  - Review monitoring methods/protocols
  - Review groundwater monitoring data to determine potential origin of trigger occurrence
  - Increase monitoring frequency to weekly if current frequency is monthly

Stage 2:

- Trigger: Measured seasonal groundwater levels in the bedrock aquifer fall below the 5th percentile.
- Response actions:
  - Conduct detailed trend analysis
  - If a problematic trend is determined identify source or cause of the trigger exceedance; adjust depressurization schemes/construction staging/methodologies as practicable.

It is anticipated that the monitoring well network within the LSMOC portion of the LAA the will be installed during the clearing activity and will collect continuous water level data via planned use of pressure transducers and vibrating wire transducers with dataloggers. It should be noted that the final scheduling of routine field monitoring, data downloads, and water quality sampling of the well network will be developed prior to construction to allow for detection of water level deviations that fall within the designed trigger levels identified above.

15.2.3 Groundwater Quality

The water quality monitoring program for the LSMOC will take place at the adaptive management well installations. Water samples will be analysed for the list of parameters given within Table 5. The groundwater trigger thresholds provided below (Table 7) have the objective to provide early warning related to the potential for adverse effects to surface water/wetlands/fens in the LAA portion of the LSMOC, and to provide a method to assess the cause(s) and implications. These trigger levels for water quality are defined as a proportional percentage of the relevant guidelines, so that action is taken quickly enough to effect a mitigative change as required for the protection of the natural system, but also with sufficient allowable variance to account for expected natural variability. Triggers are set (Table 7) for scenarios where existing conditions are below the guidelines, are above guidelines, or for scenarios where there are not existing guidelines. In each scenario a 20% variance is allowed, and exceedance of this variance will initiate the trigger action, which is a reasonable reflection of natural variability within the groundwater system. In addition, because at the LSMOC the groundwater system is an important contributor to the surface wetland (i.e., fen) system, the checking of trends for specific nutrients, ions, and pH are proposed to facilitate maintenance of the groundwater discharge quality which contributes to the surface water system. These kinds of proportional thresholds, based on the guidelines, are routinely applied in groundwater adaptive management plans and are defensible and reflective of other typical groundwater quality adaptive management plans. Should the groundwater quality triggers occur as described below, it is anticipated that the SWMP and possibly the wetlands monitoring plan would come into effect, with the means and methods for monitoring and mitigating surface water conditions, and monitoring of wetlands taking an equal or possibly primary role in assessing the potential for any adverse effects to wetlands and fens in the region of the LSMOC. As indicated, threshold exceedances will be cause for notification to the wetlands monitoring team for incorporation into their assessment and to inform recommendations made to the Project EAC and Manitoba Infrastructure and Transportation for decision-making. Any identified change (i.e., water quality) will be cause for immediate notification to the wetlands monitoring team.

Table 7: Thresholds, Actions and Possible Mitigations for Unanticipated Project-Related Water Quality Effects

Parameter	Trigger	Response Action
Water Quality Parameters with CCME guidelines where the baseline condition is below these guidelines	Within 80% of the guideline and greater than 20% over baseline conditions	• Review sampling and analytical methods/protocols • Review groundwater quality monitoring data to determine potential origin of exceedance • Sampling frequency is monthly during construction; Increase sampling frequency to monthly if current sampling frequency is quarterly, or less • Conduct trend analysis • If a problematic trend is determined (e.g., increase in nutrients or salts and decrease in Ca, Mg, and/or pH); identify source or cause of the trigger exceedance; monitor wetlands as indicated within the WetMP
Water Quality Parameters with CCME guidelines where the baseline condition is currently elevated above these guidelines	Greater than 20% over baseline conditions	
Water Quality Parameters with no CCME guidelines	Greater than 20% over baseline conditions	
N, P, K, Ca, Mg, Na, Cl pH	Change in trend of these parameters	

15.2.4 Groundwater-Surface Water Interactions

Based on the water quality in the region of the LSMOC, and the known groundwater/surface water interactions, which are important to the fens and wetlands in the LSMOC portion of the LAA, any changes in water quality response triggers (specifically N, P, Ca, Mg, Na, K, Cl, and pH, as noted above), will be applied to trigger a response regarding groundwater and surface water interactions. For example, an increase in nutrients and/or salts, with a decrease in key parameters such as Ca, Mg, and pH in the groundwater quality signature, could indicate a shift from groundwater baseflow contributions to the fens.

As discussed in prior sections, data collected during monitoring of the well nests (see section 14.3.1) will be provided at regular intervals (i.e., following each monitoring and sampling event) to the wetlands monitoring team for incorporation into their assessment and decision-making. As indicated, threshold exceedances will be cause for notification to the wetlands monitoring team for incorporation into their assessment and to inform recommendations made to the Project EAC and Manitoba Infrastructure and Transportation for decision-making. The data would be used to inform mitigation planning and may include mitigations or execution of adaptive management processes identified in the SWMP, the CEMP, OEMP, PERs, EPP and or others depending on the nature of the change experienced.

15.3 Contingency Measures and Emergency Response

Contingency measures and emergency response will be included for unforeseen events or circumstances related to groundwater in various planning documents for the program. These will be developed and finalized prior to construction, and include the following:

- Groundwater Depressurization Plan – The Contractor's groundwater depressurization plan will include contingency measures for loss of power during active depressurization activities and will include provisions to increase or otherwise adjust and optimize pumping rates if possible or may include longer-term measures such as additional wells to provide additional depressurization if needed in key active depressurization areas.
- Safety and Health Plan – The health and safety plan for the Project and individual contractors must address all hazards associated with channel and deeper excavations where unplanned discharge of groundwater may occur in an emergency situation.
- Construction Environmental Management Program – The CEMP provides specific measures to address the potential contamination of groundwater from hazardous materials and waste, including materials and waste management and emergency spill response and reporting procedures.
- Complaint Resolution Plan – The complaint resolution plan describes the processes and procedures for receiving and responding to private well owner complaints related to groundwater quantity and/or quality issues identified within private water wells. The plan will outline the complaint response and investigation process. Mitigations will be determined on a case-by-case basis and determined by the outcome of the investigation.

16.0 LSMOC REFERENCES

Betcher, R.N., 1987, Groundwater AVADL Ability Map Series – Dauphin Lake (620), Manitoba Natural Resources, Water Resources.

Matile, G.L.D. and Keller, G.R. 2006: Surficial geology of southern Manitoba (south of 53°); Manitoba Science, Technology, Energy and Mines, Manitoba Geological Survey, Surficial Geology Compilation Map SG-SMB, scale 1:500 000 [online]. Available at https://www.gov.mb.ca/iem/geo/gis/sgcms/esri/SGCMS_SMB_2004.zip [accessed July 2020].

KGS Group. 2016. Assiniboine River and Lake Manitoba Basins Flood Mitigation Study; Lake Manitoba and Lake St. Martin Outlet Channels Conceptual Design Stage 2- Final Report. January 2016.

KGS Group. 2016. Lake St. Martin Area Groundwater Hydrograph Interpretation Letter. August 22, 2016.

KGS Group. 2017 Preliminary Design for Reach 2 of the Lake St. Martin Outlet Channel. Final Rev 0. KGS Group project 16-0300-005. June 2017.

KGS Group. 2017. Investigations and Preliminary Engineering for LMB Channel Options C and D Deliverable D2 Annual Monitoring Report to July 1, 2017. Final Rev. 0. KGS Group project 16-0300-006. July 2017.

KGS Group. 2017. Investigations and Preliminary Engineering for LMB Channel Options C and D Deliverable D3 Annual Monitoring Report to July 1, 2018. Final Rev. 0. KGS Group project 16-0300-006. August 2018.

KGS Group. 2021a. Lake St. Martin Outlet Channel Groundwater Quality Assessment – Final Memorandum. KGS Group project 18-0300-005.1208. July 2021.

KGS Group. 2021b. Lake St. Martin Outlet Channel Groundwater Water Levels Assessment – Final Memorandum. KGS Group project 18-0300-005.1208. July 2021.

KGS Group. 2021c. LSMOC Bedrock Aquifer Depressurization Estimates Memo, Rev 0 Memorandum. KGS Group project 18-0300-005.1208. August 2021.

KGS Group. 2022. Lake St. Martin Outlet Channel Groundwater and Surface Water Baseline Data Summary (2019 – 2021) Memorandum. KGS Group project 18-0300-005.1800. May 2022.

Stantec. 2021. Groundwater balance in the Region of the Lake Manitoba/Lake St. Martin Outlet Channels. E358159-1000-220-030-0002-Rev0. August 2021.

Wang, J., and Betcher, R.N., 2011, Groundwater, drought/wet cycle and climate change, Southern Manitoba, Canada. Geohydro 2011, “Water and Earth: The junction of Quaternary Geosciences and Hydrogeology” Quebec City, QC.

APPENDIX 1A

Lake Manitoba Hydrogeologic Conditions

1A.1 Site Characterization

Site geological and hydrogeological information from previous and ongoing studies, was used to develop an understanding of the existing groundwater regime. The data is contributing to the preliminary and detailed design of the LMOC construction and operation depressurization systems and will assist in informing and refining mitigation and monitoring programs.

The proposed LMOC is located within the Interlake area of the Manitoba lowland physiographic region. Paleozoic and Mesozoic carbonate bedrock, with minor clastic and argillaceous units dip gently to the southwest and are overlain by tills, proglacial lacustrine sediments and more recent organic deposits found in low-lying areas (Figure A-1).

The upper till layer thins in some places allowing bedrock to be present near or at the surface, particularly in proximity to Reed Lake just east of the LMOC alignment. The areas with near surface bedrock are shown on Figure A-1. Topography in the area is relatively flat, and the terrestrial environment is diverse, including agricultural areas, grasslands, forested areas, small lakes and larger regions of wetlands. Regional and local geology of the LMOC region has been described in Section 3.0 of this GWMP.

The Interlake region features one main aquifer that is associated with the extensive Paleozoic Carbonate Evaporite Unit (Betcher et. al.,1995). The upper carbonate aquifer has an effective depth of 15-30 m and is described as the most active zone of groundwater movement and storage of the carbonate aquifer (Simpson 1987). Recorded transmissivities in the Interlake area display considerable variation, ranging between less than 10 m^2/day to 10,000 m^2/day (Rutulis 1987; Render 1988). The primary recharge area for the aquifer lies in the central part of the Interlake, with flow occurring outwards towards Lake Manitoba on the west and Lake Winnipeg on the east (Betcher 1997). Although the aquifer is confined by till along the LMOC alignment, there are recharge areas to the east and west of the Project typically associated with areas of near surface bedrock (Figure 3).

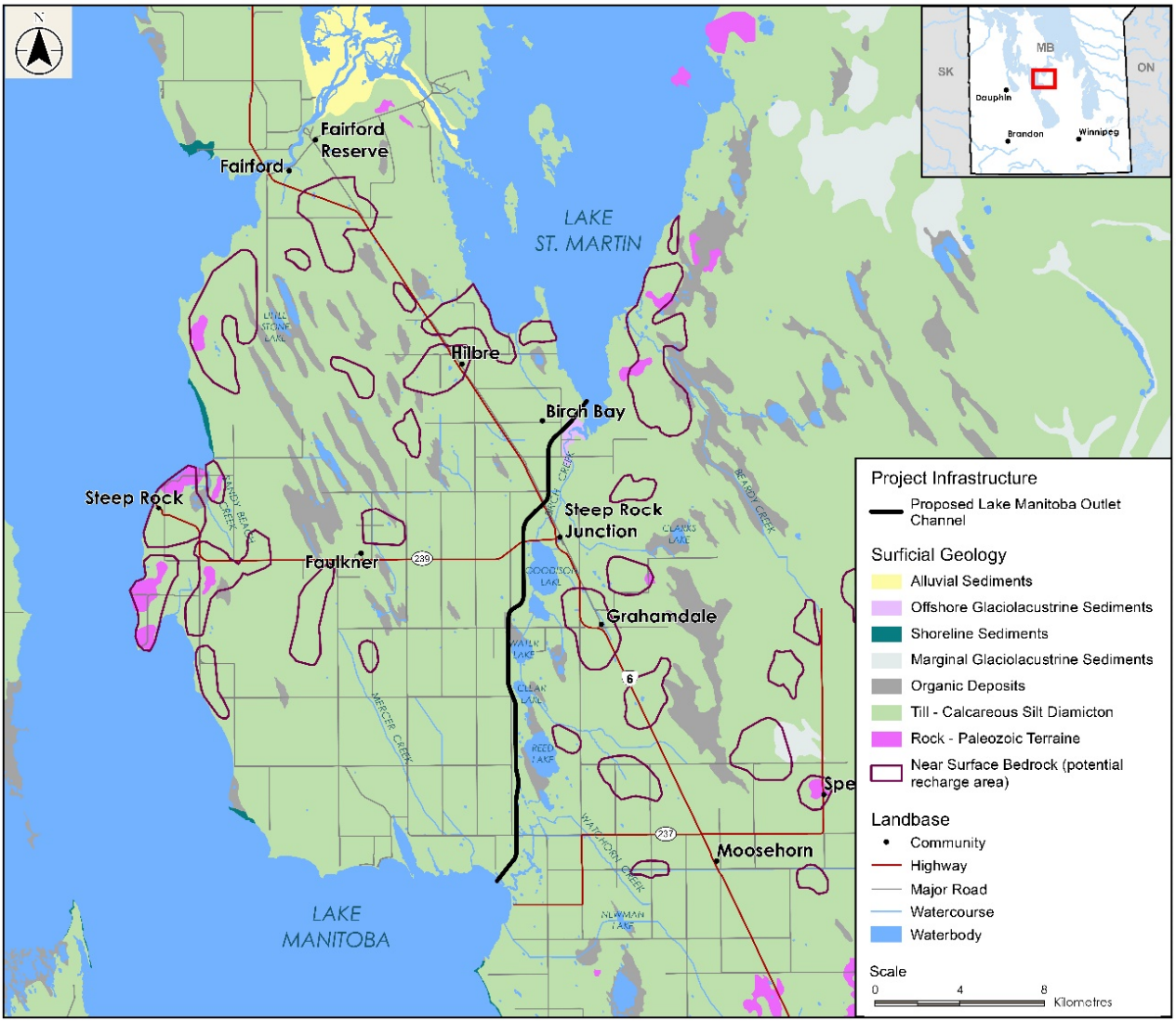


Figure A-1: Surficial Geology Within the LMOC Region

1A.2 Geologic Units and Aquifers

1A.2.1 Site Geological Stratigraphy

A geological model was developed based on subsurface, topography and geographic information system data. The geological units of the overburden were based on data from more than 1,600 borehole logs (Table A-1). Borehole logs were sourced from:

- publicly accessible well data from the Provincial Well Record Database (GWDrill), which includes data from the Groundwater Information Network between 1903 and 2017 (GWDrill 2018)
- previous reports (i.e., KGS 2017b)
- previous investigations by Manitoba Transportation and Infrastructure (Tetra Tech EBA, 2016)
- the 2019 field drilling program and hydrogeological field program

Table A-1: Sources of Borehole Data used in Geological Model

Borehole Data Source	Number of Boreholes
GWDrill[a]	1508
Existing Project Related Data[b]	28
2016 Lake Bottom Stratigraphy [c]	9
2019 Team Drilling Program [d]	57

Notes:
[a] GWDrill 2018
[b] KGS 2017
[c] TetraTech 2016
[d] TREK 2020

A generalized view of the LMOC stratigraphy along the LMOC is provided in Appendix 1A- Plate 1. In general, site stratigraphy consists of five Quaternary overburden units underlain by carbonate bedrock. The overburden stratigraphy from youngest to oldest is peat-topsoil at the surface, followed by clay, upper sand and gravel, till, lower sand and gravel and bedrock.

Peat-Topsoil

Peat-topsoil was observed at surface over the majority of the LMOC. The peat-topsoil is relatively evenly distributed in areas with very low relief as it accumulates in fen, bog, swamp, and marsh settings (Matile, 2004). It is composed of peat and muck deposits in wetland areas and topsoil on fields and ranges in thickness between <0.1 m and 3 m, with an average thickness of 0.5 m.

Clay

Clay deposits in the LMOC area are observed at surface in some areas or below the peat-topsoil deposits. Matile (2004) describes the deposits as clay, silt and minor sand, very low relief massive and laminated deposits. These sediments were likely deposited from suspension in the offshore, deep water of glacial Lake Agassiz and commonly sourced and homogenized by icebergs. The thickness of the clay generally ranges between 1 m and 5 m, with an average thickness of 2.7 m.

Till

The Quaternary till / glacial diamicton deposits are composed of calcareous silt diamicton and are predominately derived from Paleozoic dolomite and limestone (Matile 2004). Till is observed at surface in some areas or below the peat-topsoil, clay and/or upper sand and gravel deposits and ranges in thickness between 1 m and 15 m, with an average thickness of 8.6 m.

Till was encountered in every historical and recent investigation program. Sand and gravel lenses are present below, within and above the till unit. Parts of the till are overlain by sand and gravel deposits, clay and organic material such as peat and topsoil.

Upper and Lower Sand and Gravel

The upper and lower sand and gravel deposits represent preglacial, marginal glaciolacustrine and postglacial shoreline sediments. The glaciolacustrine deposits are composed of sand and gravel deposited by waves at the margin of glacial Lake Agassiz and are found as beach ridges, spits, bars or littoral sand and gravel. The shoreline sediments were formed by waves at the margins of modern Lake St. Martin and Lake Manitoba (Matile 2004). These deposits are observed at surface in some areas or below peat-topsoil and/or the clay deposits in other areas. The lower Sand and Gravel unit represents unconsolidated preglacial sediments lying within or underlying the less permeable till unit and show limited areal distribution (Betcher 1995). These deposits have the potential to host a sand and gravel aquifer at the bedrock-till interface (Betcher 1995).

Sand and gravel deposits were identified within the till unit in a few boreholes, but they had limited thickness and lateral extent. The deposits vary in thickness between 1 m and 8 m, with an average thickness of 2.5 m and 5.5 m for the upper sand and gravel and lower sand and gravel deposits, respectively.

Bedrock

The bedrock in the region consists of sedimentary rocks of Paleozoic age which are primarily carbonates with minor clastics and evaporite sequences. The Project area is underlain by fossiliferous dolomite of the Silurian Interlake Group in the northeast and Devonian rocks in the southwest. The Devonian rocks are subdivided into argillaceous dolomite and dolomitic shales of the Ashern Formation in the northeast and mottled limestones of the Elm Point Formation in the southwest. The Devonian Ashern and Elm Point Formations and Silurian Interlake Group underlie all of the above-mentioned units and is considered the principal aquifer in the region (the upper carbonate aquifer).

1A.2.2 Groundwater Systems – Aquifers and Aquitard

Groundwater flow and quality are closely dependent on geology. There are three main hydrogeological components, which correspond to lithologic formations in the LMOC area with the following characteristics:

- surficial aquifer - relatively thin, discontinuous, composed of soils, peat and isolated thin sand layers; related to wetlands.
- aquitard - undifferentiated till; this is the principal geological component in which the Project will be embedded. Intertill lenses composed of till occur with greater proportions of coarse sediments (water bearing) and major lakes intercept this horizon.
- bedrock aquifer - confined carbonate aquifer; it has a regional extent and is connected with major lakes.

The carbonate (bedrock) aquifer is overlain by a till aquitard at the LMOC. The fluted morphology of the till surface is particularly apparent with the distribution of low-lying organic deposits (wetlands) within till troughs. Those wetlands are believed to be fed with water from precipitation trapped within these low-lying depressions. Recent groundwater-surface water interaction investigations (Stantec 2021) suggest that groundwater discharge occur to the wetlands but represents a very small portion of their overall water budget, supporting the assertion that the wetlands are predominantly surface water/precipitation fed.

Domestic and livestock wells are generally fed by the carbonate aquifer in the LMOC area. Livestock wells are often flowing or artesian wells.

A generalized view of groundwater flow and piezometric head conditions in the LMOC area, based on pre-2019 data, is provided in Figure A-2. The regional carbonate bedrock aquifer is confined and underlies the LMOC. The carbonate aquifer recharge occurs in the upland areas (Figure A-2) under unconfined conditions where bedrock elevations are relatively high, above 280 masl, and sediment cover is thin to non-existent.

The groundwater flow radiates out from the uplands in all directions towards the major lakes (St. Martin, Manitoba and Winnipeg). In general, the uppermost 10 m of the carbonate bedrock aquifer exhibits some karsticity; this is the most productive horizon of the aquifer. The aquifer likely discharges into bogs, streams, and lakes; namely, Lake Manitoba, Lake St. Martin and Lake Winnipeg. Discharge to lakes could be widely distributed, but most likely near where bedrock outcrops occur. Discharge occurs under flowing artesian conditions in some places.

The aquifer pressure head varies seasonally as shown at two Province of Manitoba Water Resources Branch (long term monitoring wells (WRB 122050 and WRB-116766). The upland well (WRB 116766) piezometric head varies between 272 masl and 277 masl (Figure A-3), rising after spring snow melt and dropping over the winter, indicating that recharge locally occurs in the uplands at elevations above 277 masl.

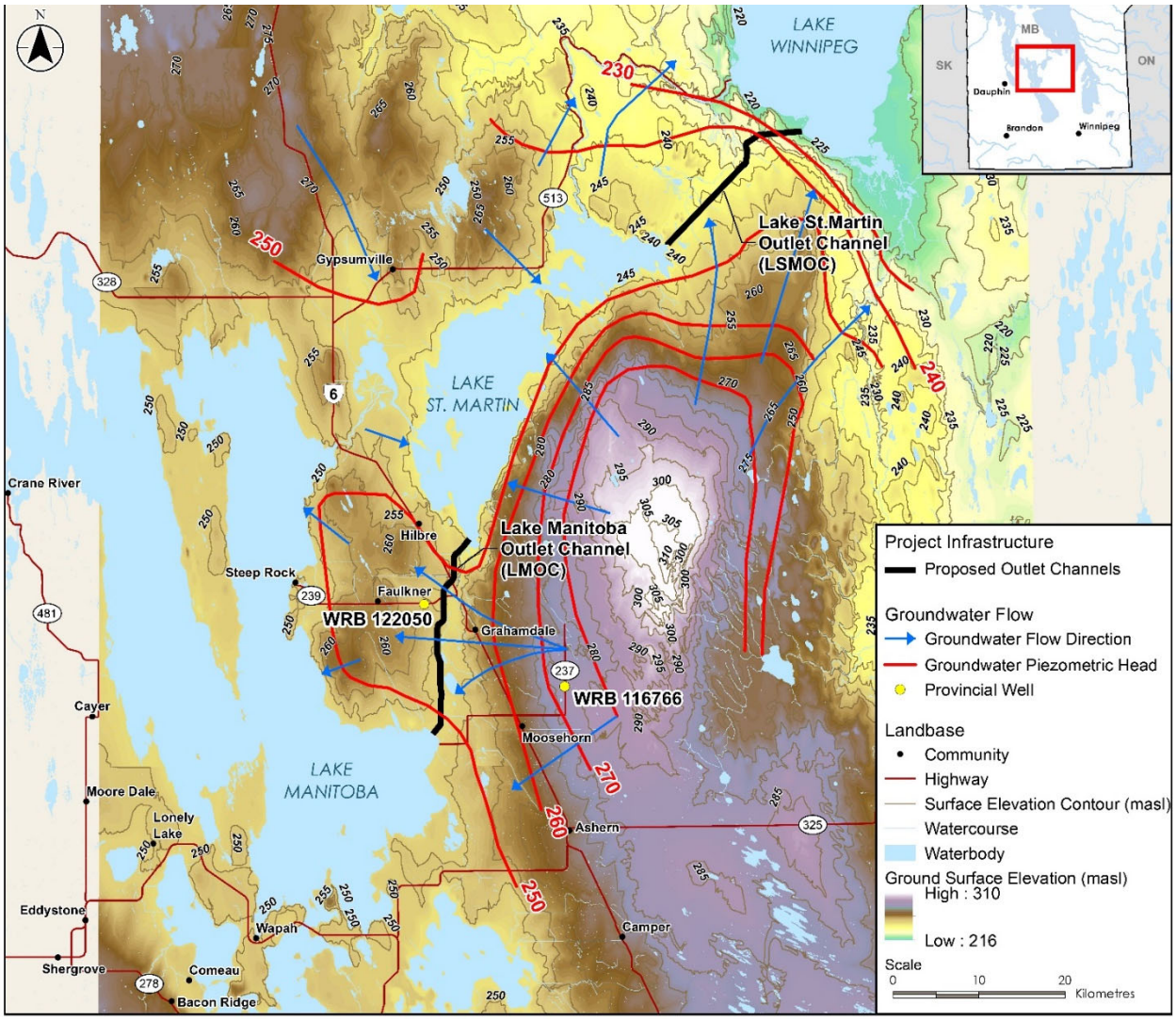


Figure A-2: Regional Groundwater Flow and Piezometric Head Conditions

The upper carbonate aquifer in the Project area is overlain by 5 m to 18 m of till. The LMOC is located in the Birch Creek valley, which has a ground surface elevation between 246 masl and 250 masl. The piezometric head in this area ranges from 249 masl to 255 masl and is therefore up to 5 m higher than the elevation of the ground surface. Seasonal variation, as measured by the provincial monitoring well (WRB 122050) has recorded piezometric head variations between a minimum of 252 masl and a maximum of 256 masl (Figure A-3) with typical seasonal piezometric head variations between 2.5 m and 3 m per year in the LMOC area.

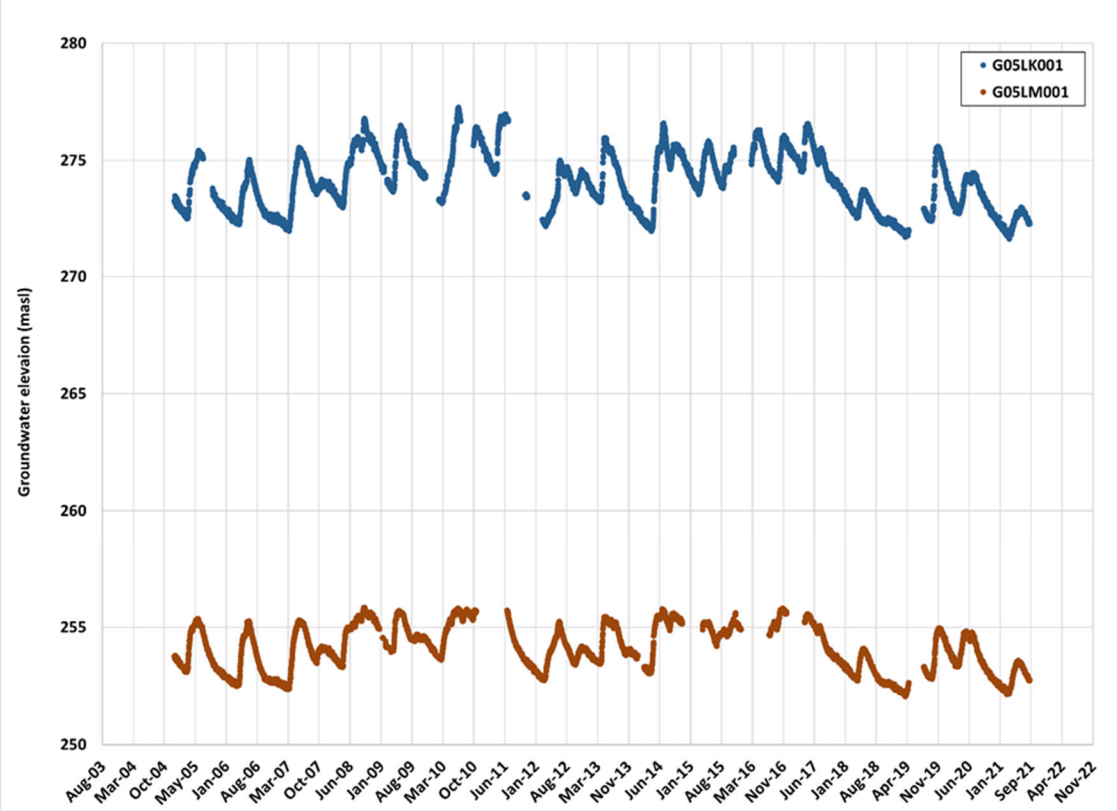
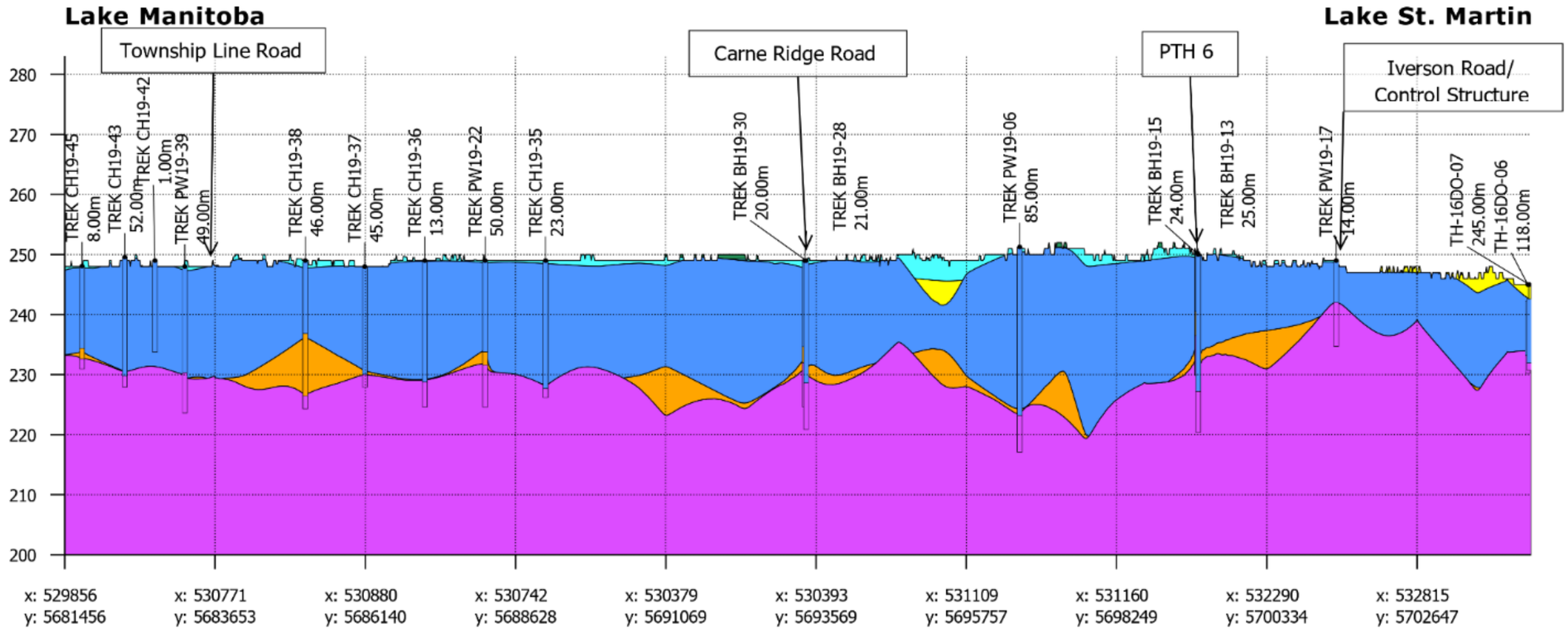


Figure A-3: Piezometric Water Elevations in the Carbonate Aquifer (2005-2021)

Stratigraphical profile along proposed LMOC



Conceptual model

- Bedrock (Carbonate Aquifer)
- Peat-Topsoil
- Clay
- Till
- Lower Sand and Gravel
- Upper Sand and Gravel

* Note: measurement next to borehole states borehole distance to cross section.

Location

Lake Manitoba: 529856, 5681456

Lake St. Martin: 534062, 5704073

Scale: 1:80,000

Vertical exaggeration: 100x

0m 5000m

Plate 1: Cross section of the geological model along the proposed LMOC. Selected boreholes and structures are indicated. Vertical exaggeration is 100x.

APPENDIX 1B

Lake St. Martín Outlet Channel Hydrogeologic Conditions

1B.1 Site Characterization

Hydrogeologic conditions in the vicinity of the LSMOC are interpreted from available information, previous field studies and the groundwater field programs conducted as part of the Preliminary Design for the LSMOC (KGS 2021a, KGS 2021b, KGS 2022).

The proposed LSMOC is located within the Interlake area of the Manitoba lowland physiographic region. The Manitoba lowland is a region of gentle relief situated east of the Manitoba Escarpment. The lowland is underlain by gently southwestward dipping Paleozoic and Mesozoic sediments consisting of carbonate rocks, with minor clastic and argillaceous units. The bedrock is predominantly overlain by tills, proglacial lacustrine sediments, and more recent organic deposits found in low-lying areas. An overview of the regional and local surficial geology modified from Matile and Keller (2006) is provided in Figure B-1 below.

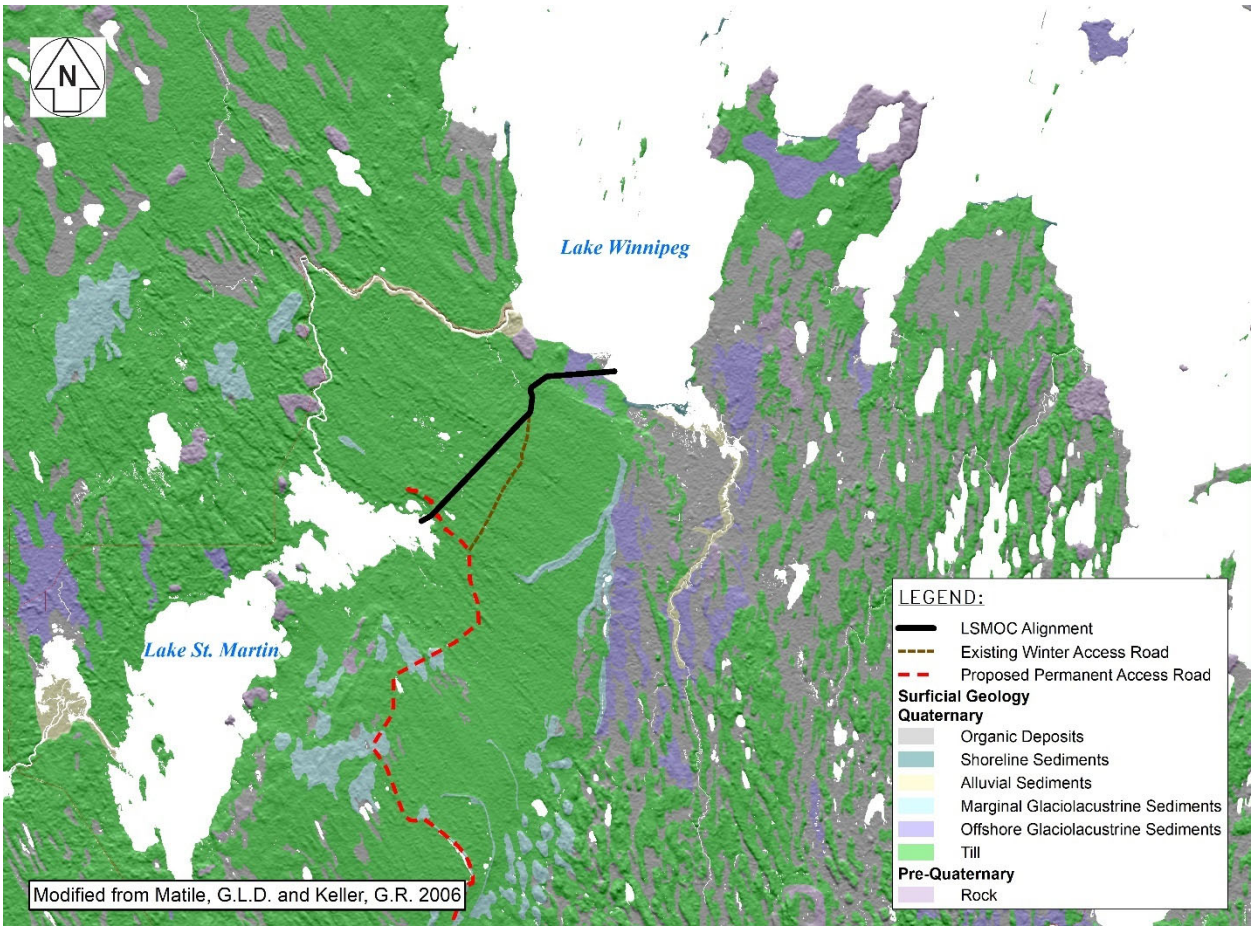


Figure B-1: Surficial Geology Within the Region of the LSMOC

Two distinct groundwater systems are known to be present within the region of the LSMOC - an upper saturated peat, and an underlying confined carbonate bedrock aquifer. Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat groundwater flow system, and the underlying confined carbonate bedrock aquifer system.

Lake Winnipeg and Lake St. Martin are key discharge areas for the bedrock aquifer and flowing artesian conditions have been observed in the area due to confined piezometric pressure within the bedrock aquifer. The lakes within the Manitoba lowland collect drainage from the southern portion of the Province, which is directed through Lake Winnipeg into the Nelson River system. Discharge of the drainage system ultimately occurs at Hudson Bay.

1B.2 Geologic Units and Aquifers

1B.2.1 Site Geological Stratigraphy

Stratigraphy in the LSMOC portion of the LAA was interpreted based on the results of recent field investigations and from previous studies in the area. It was also interpreted based on stratigraphy observed along the Reach 3 of the Emergency Outlet Channel (EOC) during construction in 2011/2012.

A generalized view of the LSMOC stratigraphy along the LSMOC is provided in Appendix 1B- Plate 1. In general, the overburden layer in the LSMOC portion of the LAA varies in thickness along the channel alignment from 1 m to 24 m. As described below, the stratigraphy encountered in the test holes drilled generally consists of peat over silty clay, glacial till (consisting of clay till and silt till) and isolated sand, gravel, and cobble lenses, underlain by bedrock.

Peat

Peat was observed at surface along the majority of the LSMOC portion of the LAA. The peat is generally described as black to dark brown in colour, moist to wet, and is fibrous to amorphous and ranges in thickness between about 0 m to 3.0 m (however, it is typically about 1.0 m to 2.0 m in thickness).

Silty Clay

A silty clay unit was observed below the peat surface and is most apparent downstream of the existing Reach 3 of the EOC towards Lake Winnipeg. The silty clay is brown to grey in colour, moist, soft to stiff, intermediate to high plasticity (low plasticity in some instances), containing trace silt pockets, trace fine- to coarse-grained sand, trace gravel, and ranges in thickness between approximately 0.5 m to 4.0 m.

An additional zone of inter-till clay soil was described in one borehole advanced along the LSMOC. A 5.1 m thick zone of soft (putty-like) clay was encountered below the silt till and above the bedrock surface in TH19-KGS-04 (Station [Sta.] 3+500).

Clay Till

A clay till unit is located either immediately below the peat, or below the silty clay, and above the silt till. The predominant grain size within the clay till varied spatially and with depth. The clay till is generally described as silty, brown to dark grey in colour, moist to wet, firm to stiff, intermediate to high plasticity (low plasticity in some instances), containing trace to some silt pockets, trace to some sand, trace gravel, trace cobbles, trace boulders, and ranges in thickness between about 0 m to 5.0 m.

Silt Till

A silt till unit is present below either the silty clay or clay till units and overlying the bedrock. The predominant grain size within the till varied spatially and with depth. The silt till is described as tan to grey in colour, dry to moist, dense to very dense, low plasticity, containing some to with clay, trace to some sand, trace to some gravel, trace to some cobbles and boulders, and ranges in thickness between about 1.5 m to 21.0 m. The silt till is generally thickest upstream of the existing Reach 3 EOC between Sta. 0+000 and 13+800, ranging from approximately 7.0 m to 21.0 m along this reach of the LSMOC. In the upstream section of the EOC Reach 3 itself (between approximately Sta. 13+800 to 17+000) the till thickness ranges between approximately 1.5 m and 12.0 m. The downstream section of the Reach 3 emergency channel (between approximately Sta. 17+000 to 18+300) is characterized by a bedrock high, and has a limited thickness of silt till ranging from approximately 0 m to 1.5 m. Downstream of the Reach 3 emergency channel (i.e., between approximately Sta. 18+300 to 24+000), the silt till thickness ranges from approximately 2 m to 9 m.

Sand / Gravel / Cobbles

Isolated sand, gravel, and cobble layers were encountered at various locations and depths along the channel alignment. Sandy gravel and sand layers were observed on the lake bottom surface within Lake St. Martin in TH-17-LSMI-10 and -11, with thicknesses of 1.1 and 0.7 m, respectively. A near surface sand layer approximately 0.2m thick was observed beneath the peat in TP19-KGS-07 (Sta. 1+614).

A discontinuous inter-till sand unit was observed within the silt till, from 6.2 m to 7.4 m below grade, and also from 8.7 to at least 12.0 m below grade (end of test hole), in test hole TH19-KGS-07 (Sta. 5+606). Inter-till sand layers ranging in thickness from at least 0.6 m to 1.2 m were also encountered near Lake St. Martin in test holes TH-17LSMI-10 and -11 at depths of 10.7 m and 7.7 m, respectively. A cobble and gravel layer ranging in thickness from 0.5 m to 1.7 m was observed at the base of the silt till unit immediately above bedrock within Lake St. Martin and Lake Winnipeg in test holes TH-17LSMI-13, -14, and TH17-LWGO-16.

Bedrock

The bedrock encountered along the channel alignment was intersected at depths ranging from approximately 1.0 m to 24.0 m below grade based on drilled test holes. The bedrock is generally described as dolomite to dolomitic limestone. Layers of carbonaceous shale were observed at several test hole locations, generally downstream of approximate station 13+200.

1B.2.2 Groundwater Systems – Aquifers and Aquitard

Two distinct groundwater systems are known to be present within the region of the LSMOC, within the upper saturated peat and the lower confined carbonate bedrock aquifer.

Perched Peat Flow System

The upper, saturated peat unit is perched above the clays (where present) and underlying till units. The peat is recharged directly from surface rainfall and snowmelt, and from groundwater discharge of the carbonate aquifer at artesian spring sites. Groundwater flows within the peat will be locally controlled, though some other areas of seepage from the bedrock may be more diffuse and harder to identify when a distinct spring site is not visible at surface. Small-scale spring site flow systems develop from raised bog/peat mound areas, flowing radially outward toward relatively lower-lying depressions and other associated open water areas.

The water table within the peat is at or near ground surface, with an overall hydraulic gradient, including surficial flow, to the east. The water quality within the upper perched peatlands has a signature associated with the confined carbonate bedrock in the region of the LSMOC.

Aquitard

Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat groundwater flow system, and the underlying confined carbonate bedrock aquifer system. Aside from regional surface water drainage patterns, the low permeability nature of the aquitard is a key element in maintaining perched water levels in the surficial peat and confined head in the bedrock aquifer and overlying silt till. It is likely that only negligible recharge occurs through the aquitard to the bedrock, as recharge to the bedrock occurs regionally within bedrock outcrop areas, and/or where the bedrock topography is high, and the overlying till cover is thin. The water quality within the till aquitard is unique from the carbonate bedrock, and perched peatland water qualities (KGS 2021a).

Carbonate Bedrock Aquifer

The underlying, confined bedrock aquifer is comprised of a Paleozoic rock sequence commonly referred to in Manitoba as the “Carbonate Aquifer System.” This aquifer system is isolated from the peat unit by the upper clay and till aquitard zone. The confined bedrock aquifer is recharged via rainfall and snowmelt regionally, with recharge areas occurring at locations of bedrock outcrop or in areas where the bedrock is covered by a thin overburden layer.

Well yields are highly variable in the region, a direct result of the fractured rock conditions. Water yields depend on the number of fractures intersected by a well, their size (aperture), extent, and interconnection to other fractures. East of Lake Manitoba the water quality is generally fresh, with TDS <1,000 mg/L. Water quality is generally Mg Ca-HCO3 type, with TDS in the order of 400 mg/L to 650 mg/L (Betcher, 1987). This water quality reflects the substantial contribution of atmospheric precipitation to the aquifer recharge zone noted within the Interlake area (Betcher, 1987). Due to more complex geology and evaporate mineralogy in the Gypsumville area, water quality varies and is locally poorer with TDS concentrations up to 4,550 mg/L (Betcher, 1987). Typical bedrock piezometric pressure variability in the region of the LSMOC is measured at 1.5 m +/- 0.5 m (KGS 2021b). The water quality within the carbonate bedrock aquifer in the region of the LSMOC is distinct from surface water (e.g., Lake St. Martin and Lake Winnipeg), is distinct from the water quality within the till aquitard and is similar to the water quality observed within the perched peatland system, to which it discharges at artesian spring sites (KGS 2021a).

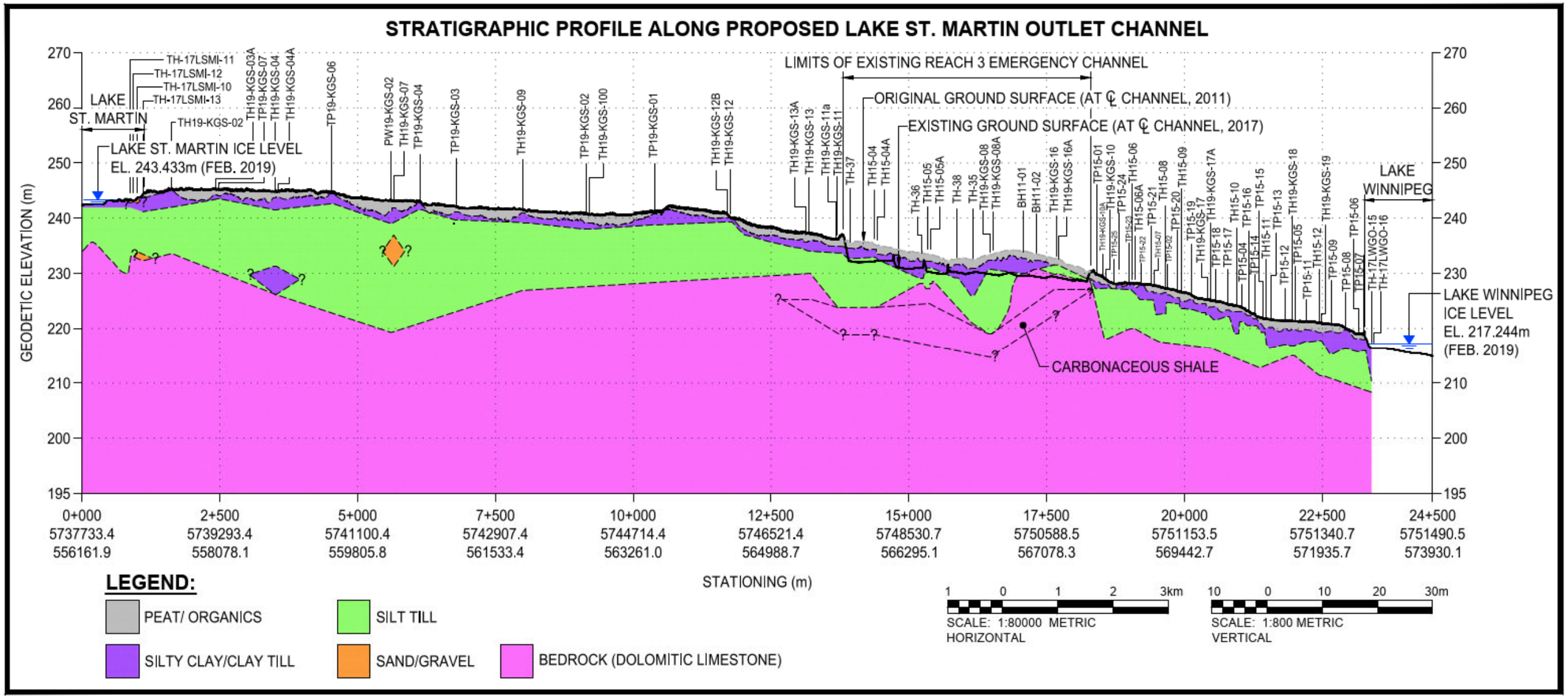


Figure B-2: Stratigraphic Profile of Proposed LSMOC as Interpreted from Borehole Logs

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Revegetation Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vii

Part 1: Introduction 1

1.0 PURPOSE AND SCOPE 1

2.0 OBJECTIVES 3

3.0 RELEVANT LEGISLATION AND GUIDELINES 4

3.1 Provincial Seed Mix Guidance 4

3.2 Weed Control Operating Procedure 4

3.3 Legislation 6

3.4 Other Wildlife Considerations 7

Part 2: Lake Manitoba Outlet Channel 8

4.0 LMOC PROJECT INFORMATION 8

4.1 Project Description 8

4.2 LMOC Operation 9

4.3 Site Characterization 9

4.3.1 Soil Conditions 9

4.3.2 Vegetation Conditions 10

4.3.3 Non-Native Invasive Species and Weeds 11

4.3.4 Wildlife Habitat 12

5.0 LMOC CONSTRUCTION PHASE 14
5.1 Rehabilitation Sites and Zones 14
5.2 Rehabilitation and Revegetation Treatments 15
5.3 Revegetation Sequence and Schedule 16
5.4 Weed Control 17
5.5 Erosion and Sediment Control 18
6.0 LMOC OPERATIONS PHASE 19
6.1 Weed Control 19
6.2 Vegetation Management 20
6.2.1 Channel Maintenance 20
7.0 LMOC MONITORING 21
7.1 Construction Phase Monitoring 21
7.1.1 Monitoring Cover Vegetation 22
7.1.2 Monitoring for Effects on Vegetation 23
7.2 Operations Phase Monitoring 24
7.2.1 Monitoring Cover Vegetation 24
7.2.2 Monitoring for Effects on Vegetation 25
8.0 LMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP 27
8.1 General 27
8.2 Follow Up Response 28
8.2.1 Construction Phase 31
8.2.2 Operations Phase 31
9.0 LMOC REFERENCES 33
Part 3: Lake St. Martin Outlet Channel 35
10.0 LSMOC PROJECT INFORMATION 35
10.1 Project Description 35
10.2 LSMOC Operation 36

10.3 Site Characterization 36
10.3.1 Soil Conditions 36
10.3.2 Vegetation Conditions 37
10.3.3 Non-Native Invasive Species and Weeds 37
10.3.4 Wildlife Habitat 38
11.0 LSMOC CONSTRUCTION PHASE 39
11.1 Rehabilitation Sites and Zones 39
11.2 Rehabilitation and Revegetation Treatments 39
11.2.1 Active Revegetation Zones 39
11.2.2 Natural Regeneration Zones 44
11.3 Revegetation Sequence and Schedule 44
11.4 Weed Control Operating Procedures 45
11.4.1 Objectives and Targets 45
11.4.2 Prevention 45
11.4.3 Thresholds for Action 46
11.4.4 Methods and Treatments 47
11.5 Erosion and Sediment Control 47
11.5.1 Site Preparation and Grading Approaches 47
11.5.2 Temporary Cover Crops and Nurse Crops 47
11.5.3 Erosion Control Materials/Products 48
12.0 LSMOC OPERATIONS PHASE 49
12.1 Weed Control 49
12.1.1 Prevention 49
12.1.2 Identification 50
12.1.3 Monitoring and Reporting 50
12.1.4 Thresholds for Action 50
12.1.5 Treatment Approaches and Methods 50
12.1.6 Evaluation 51

12.2 Vegetation Management 51
12.2.1 Remedial Revegetation 51
12.2.2 Channel Maintenance 51
13.0 LSMOC MONITORING 52
13.1 Construction Phase Monitoring 52
13.1.1 Monitoring Cover Vegetation 52
13.1.2 Monitoring for Effects on Vegetation 53
13.2 Operations Phase Monitoring 54
13.2.1 Vegetation Condition Following Channel Operation 54
13.2.2 Effects on Vegetation 55
14.0 LSMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP 56
14.1 General 56
14.2 Follow Up Response 57
14.2.1 Construction Phase 57
14.2.2 Operations Phase 61
15.0 LSMOC REFERENCES 63
APPENDIX 1A 64
APPENDIX 2A 67
APPENDIX 2B 81
APPENDIX 3A 88
APPENDIX 3B 179

List of Tables

Table 1: Noxious weeds and invasive plant species identified in the ROW

Table 2: Revegetation Schedule for the Lake Manitoba Outlet Channel

Table 3: Indicators, Threshold and Targets for Measuring Revegetation Success

Table 4: Indicators, Threshold and Targets for Measuring Revegetation Success

Table 3B-1: List of Commercially Available Seed Suitable to the Lake St. Martin Region

Table 3B-2: Non-exhaustive List of Tame Grass Species Suitable For Use in Lake St. Martin Outlet Channel Revegetation

List of Figures

Figure A: EMP Process

Figure 1: Lake Manitoba Outlet Channel Project Area

Figure 2: Schematic of Revegetation Prescription and Options

Figure 3: Overview Plan of the of the Lake St. Martin Outlet Channel

Figure 4: LSMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Revegetation Management Plan (RVMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

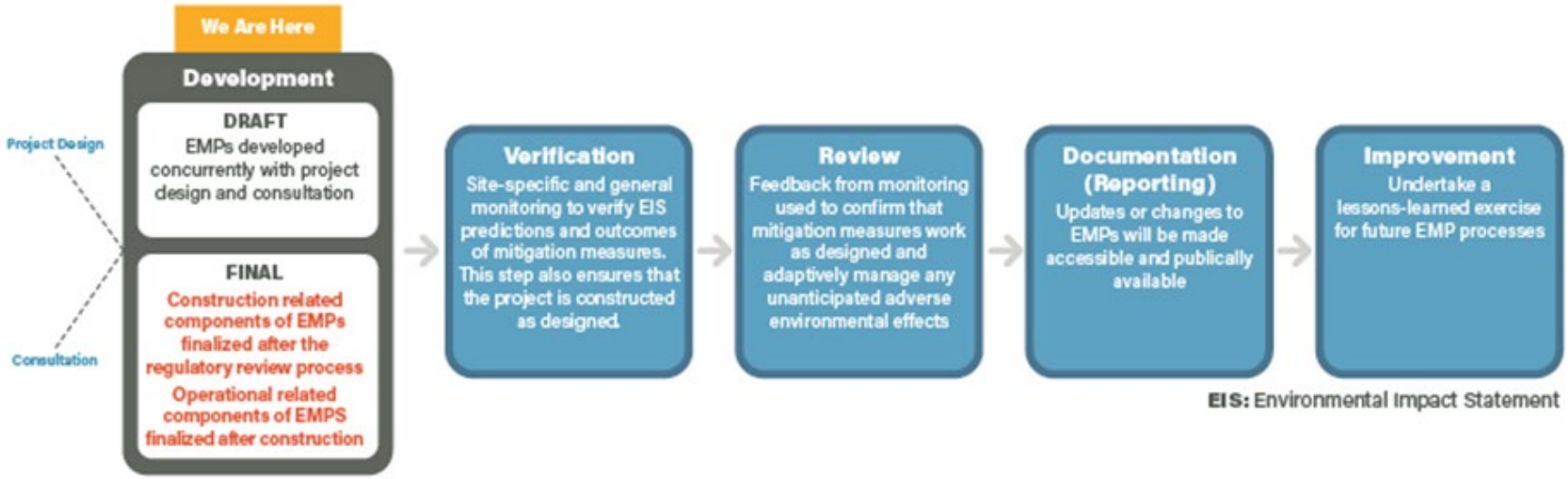


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	Percent
AgBMP	Agricultural Biosecurity Management Plan
Cm	Centimeter
CEMP	Construction Environmental Management Program
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	Environmental Assessment
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
Ha	hectare
ISCM	Invasive Species Council of Manitoba
IVM	Integrated Vegetation Management
Km	kilometre
LMOC	Lake Manitoba Outlet Channel Project
LSMOC	Lake St. Martin Outlet Channel Project
LS	Lower Slope
M	metre
MBCA	*Migratory Birds Convention Act*
MESEA	Manitoba Endangered Species and Ecosystems Act
MS	Mid-Slope
NIR	Near-infrared
NWA	*Noxious Weeds Act*
PDA	Project development area
PERs	Project Environmental Requirements
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project

RAZ	Restricted Access Zone
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SAR	Species at Risk
SARA	*Species at Risk Act*
SMP	Sediment Management Plan
SOCC	Species of Conservation Concern
spp.	Species, more than one
SWMP	Surface Water Management Plan
UB	Upland Berm
VC	valued component
WCP	Wetland Compensation Plan
WMP	Wildlife Management Plan

Glossary of Terms

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Critical habitat: The habitat that is necessary for the survival or recovery of a listed wildlife species [under the *Species at Risk Act*] and that is identified in a recovery document for the species.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the project to support the structural design of the bridge or structure.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee (EAC).

Invasive plant species: Plants that are growing outside the country or region of origin and outcompeting or replacing native plant species. The Invasive Species Council of Manitoba (ISCM) provides lists of invasive plant species and direction on management and eradication (ISCM 2022).

Invert (channel): The stream bed or floor within a structure or channel.

Noxious weed: A plant that is harmful to the environment or animals and is designated as a tier 1, tier 2 or tier 3 noxious weed in the regulations of the *Manitoba Noxious Weeds Act* and includes the seed of a noxious weed, whether it is still attached to the noxious weed or is separate from it.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work.. This phase is the design process typically supports the pre-construction engagement and consultation process with the public and rights-holders, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting or blasting.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Restricted Access Zone: areas within which access by workers is restricted due to special agricultural biosecurity concerns. Within the context of the RVMP, areas of weed infestation are considered a restricted access zone. Workers require permission from Manitoba Infrastructure and Transportation to access these areas, and a site-specific management and monitoring plan is required for treatment.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

(Revegetation) Site Preparation: Activities such as surface roughening, decompaction, and topsoil placement to prepare the surface for seeding, planting or foster natural regeneration.

Species at Risk: Species that are listed, tracked and protected under the *Species at Risk Act* (SARA).

Species of Conservation Concern: Species in addition to species at risk (SAR) that are listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); for listing under SARA as special concern, threatened, or endangered (Government of Canada 2019a) or those listed provincially under *The Endangered Species and Ecosystems Act* and by the Manitoba Conservation Data Centre as provincially rare (i.e., S1 or S2 rankings; MB CDC 2019).

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Weed Infestation: An area overrun by noxious weeds or invasive plant species, such that control and/or eradication may be difficult using standard approaches and left untreated could cause immediate, serious, or irreparable environmental, economic or social harm to areas within the ROW or areas adjacent to the ROW.

Wetland: Refers to:

(a) a marsh, bog, fen, swamp or ponded shallow water, and

(b) low areas of wet or water-logged soils that are periodically inundated by standing water and that can support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

Part 1: Introduction

1.0 PURPOSE AND SCOPE

The Revegetation Management Plan (RVMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project (the Project). The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

The purpose of the RVMP is to describe the measures that will be used to establish vegetation in areas impacted by the Project. The Project will result in clearing and grubbing for the excavation of the Lake Manitoba Outlet Channel Project (LMOC) and Lake St. Martin Outlet Channel Project (LSMOC), local drainage construction, and road construction/realignment. Revegetation will be conducted in disturbed areas of the Project as a key component of the Sediment Management Plan (SMP). In addition, monitoring will be undertaken to determine the success of revegetation efforts as well as potential Project impacts to adjacent vegetation and plant communities.

The following sections of the RVMP have been developed to provide direction on the methods and processes involved in establishing long-lived perennial vegetative cover across the LMOC and LSMOC right-of-way (ROW). Revegetation using native plant species will provide long-term erosion and sediment control for the site, while also helping to mitigate the potential impacts of the Project on adjacent natural vegetation and plant communities.

The RVMP addresses all Project phases. RVMP activities during early phases of construction will include weed management, coarse woody debris management and temporary revegetation of soil stockpiles. Permanent re-vegetation activities will begin as soon as possible after finished grades are established.

The RVMP is intended to be a living document that will be refined over the life of the Project and will be updated prior to Project construction and operation and, as indicated, will consider applicable conditions of *The Environment Act* provincial license, federal *Canadian Environmental Assessment Act 2012* Decision Statement conditions, other approvals, any other pertinent findings through the design and regulatory review processes and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Additional information from community feedback or EAC will inform Project monitoring (e.g., locations of rare plants or species of cultural concern).

Different revegetation management strategies are required for the LMOC and the LSMOC as these distinct components of the Project are located in substantially different land use settings. The LMOC, for example, is located in a well-developed agricultural area, whereas the LSMOC is located primarily in an undeveloped

wetland and forested area. Furthermore, the strategies for revegetation site preparation, weed management and monitoring differ between the two channels as their specific designs affect how revegetation prescriptions are implemented. Given these overarching site-specific differences, the RVMP is organized into three parts:

- Part 1 contains general information that is common to both the LMOC and LSMOC.
- Part 2 contains information that is specific to the LMOC.
- Part 3 contains information that is specific to the LSMOC.

The RVMP includes revegetation prescriptions for areas disturbed due to road realignment and the areas of the Channel ROW above the waterline including:

- the dikes and spoil piles
- temporary topsoil stockpiles
- channel side areas
- outside drains
- temporary project support ancillary features (such as construction laydown areas) within the channel ROW

The RVMP also identifies site characteristics, activities during construction and operation, monitoring requirements and adaptive management strategies. This RVMP will be developed further during the detailed design stage as the Project progresses. The RVMP considers environmentally sensitive features and species at risk (SAR). Through establishing a vegetation cover, the RVMP also supports the Surface Water Management Plan (SWMP), SMP, Agricultural Biosecurity Management Plan (AgBMP), Wetland Compensation Plan, (WCP) and Wildlife Management Plan (WMP).

2.0 OBJECTIVES

The RVMP for the Project will be implemented as one of the plans associated with the EMP, as described in Section 3.7 of the Project Environmental Impact Statement (EIS). The objectives of the RVMP are as follows:

- establish self-sustaining permanent plant cover
- provide erosion and sediment control
- control the spread of invasive plant species along the channel and into adjacent environments

The RVMP provides a process to track revegetation progress, to monitor for environmental compliance, and to identify deficiencies and requirements for remedial planting work. Reclamation targets relate to plant community function and do not include targets for species richness, diversity, plant community structure or species composition. Long-term vegetation monitoring and management requirements will be developed as part of an operations and maintenance manual (to be developed). The RVMP also provides monitoring requirements for potential effects to the vegetation adjacent to the channel to identify Project-related changes to vegetation species diversity.

3.0 RELEVANT LEGISLATION AND GUIDELINES

This section outlines the guidelines and legislation that are considered relevant to the revegetation work for the Project, in terms of design and monitoring programs.

3.1 Provincial Seed Mix Guidance

Based on experience in constructing and maintaining infrastructure in Manitoba, Manitoba Transportation and Infrastructure has developed generally accepted vegetation practices and regional seed mixes. These seed mixes were reviewed and where applicable (e.g., realignment of Provincial Road [PR] 239) were considered or applied in the revegetation prescriptions.

3.2 Weed Control Operating Procedure

The control of non-native invasive plant species is regulated in Manitoba by the *Noxious Weeds Act (NWA).* This act currently lists 90 regulated non-native invasive plants across three tier designations (Appendix 1A):

- Tier 1 species must be destroyed or eradicated immediately upon discovery.
- Tier 2 species are already established in Manitoba and have been observed to spread easily.
- Tier 3 species are all other designated species that do not require immediate control unless the spread of the occurrence poses a threat to the economy, environment, or the well-being of residents.

This legislation provides guidance on what species need to be treated and reporting, and the types of acceptable treatment. The weed management protocols listed in this document are developed to be compliant with the current Act and will be updated during the life of the Project, if/as necessary. Invasive plant species are species that are 1) non-native (or foreign or alien) to the Project agricultural region, and 2) whose introduction could cause economic or environmental harm. Invasive plant species are species listed by the Invasive Species Council of Manitoba (ISCM) and not listed as a noxious weed under the Noxious Weed Act (NWA), or other species identified as such, by environmental monitors responsible for revegetation surveys of the PDA and other opportunistic visual assessments completed within the PDA under the RVMP.

Weed infestation is an area overrun by noxious weeds or invasive plant species, such that control and/or eradication may be difficult using standard approaches and left untreated could cause immediate, serious, or irreparable environmental, economic or social harm to areas within the PDA or areas adjacent to the PDA.

Restricted Activity Zones (RAZ) are described in the AgBMP, one category of which are areas of known weed infestations identified within the PDA through monitoring. A weed infestation is defined as an area overrun by noxious weeds or invasive plant species, such that control and/or eradication may be difficult using standard approaches and left untreated could cause immediate, serious, or irreparable environmental, economic or social harm to areas within the PDA or areas adjacent to the PDA. Under the AgBMP they are considered a RAZ until they are effectively treated as outlined in the RVMP and no longer considered an area of weed infestation.

There are currently no weed infestation RAZ identified within the PDA; however, these RAZs may be identified during construction and operation through the monitoring prescribed under the RVMP or other environmental monitoring activities. The following requirements pertain to these RAZs:

- Workers should not access weed infestation RAZs within the PDA without explicit permission from Manitoba Transportation and Infrastructure.
- Construction activities should not occur within weed infestation RAZs located within the PDA until weeds in these areas are adequately controlled or destroyed as described in the RVMP (described in Section 5.4).
- A site-specific management and monitoring plan should be developed and implemented to treat the weed infestation. Management measures should be appropriate to treat the site-specific weed infestation with objectives consistent with those outlined in Section 5.4 (i.e., destroy, control or prevent spread) according to the type of noxious weed and/or invasive species present. Management measures should also address specific requirements for work to be conducted within the RAZ (e.g., mowing, special construction activities, soil excavation, etc.). Monitoring should be implemented to confirm management measures have effectively treated the area such that it is no longer considered a weed infestation, at which point additional monitoring is not required.
- Until response measures effectively treat (i.e., control or destroy) the weed infestation, vehicles, equipment and workers conducting approved work within the RAZ (e.g., weed treatment, mowing) are required to utilize fine cleaning (disinfection not required) when exiting the RAZ.
- Soils from within these RAZs should not be excavated, moved or stockpiled prior to implementation of a site-specific management and monitoring plan.
- Mowing of these areas should not be conducted prior to implementation of a site-specific management and monitoring plan, and if mowing is required, approved mowing of RAZ should only occur after mowing of areas not deemed a RAZ or having known weed concerns.
- Once the weed infestation is effectively treated, the weed infestation RAZ designation may be removed on approval by Manitoba Transportation and Infrastructure, following which time general construction activities may be undertaken in these areas and general biosecurity management measures under the AgBMP will apply.

Construction and Operations Phase monitoring and weed control operating procedures will also document and respond to unranked weed species not listed under the NWA that have the potential to impact the integrity of revegetation targets and adjacent plant communities.

3.3 Legislation

Legislation is described for wildlife species, as there are known wildlife species at risk present. While no plant species at risk have been identified, there are plant species of conservation concern occurring in the PDA, and the same legislation would apply if protected species were found.

Wildlife species, including those receiving regulatory protection, are described in Section 10.3.4. There are four wildlife-related acts that affect the RVMP. The Project intersects habitat that supports species that are regulated under the *Species at Risk Act* (SARA). This legislation provides a framework to facilitate recovery of species listed as threatened, endangered, or extirpated and to prevent species listed as special concern from becoming threatened or endangered. The SARA provides protection for both SAR and their critical habitat by prohibiting: 1) the killing, harming, or harassing of endangered or threatened SAR (Sections 32 and 36); and 2) the destruction of critical habitat and endangered or threatened SAR (Sections 58, 60, and 61; Government of Canada 2002). Threatened and endangered ecosystems and plant and animal SAR in Manitoba are protected under Manitoba's *Endangered Species and Ecosystems Act* (MESEA). The MESEA facilitates the management and development of recovery strategies for threatened, endangered, and extirpated or extinct species to prevent further declines and promote recovery. MESEA-listed species are those that "are of ecological, educational, aesthetic, historical, medical, recreational and scientific value to Manitoba and the residents of Manitoba" (Government of Manitoba 2015, 2019). Revegetating suitable areas of the Project for wildlife habitat has been considered in the selected prescriptions of plant species, as well as monitoring wildlife habitat adjacent to the Project. For example, the addition of shrubs to the edges of the LMOC and LSMOC ROWs may provide foraging habitat for eastern whip-poor-will (*Antrostomus vocife*rous; SARA-listed as threatened) (See Eastern whip-poor-will Habitat Management Plan).

Migratory birds, including nests and eggs, are protected under the *Migratory Birds Convention Act, 1994* (MBCA). Relative to the Project, protection is afforded to all native bird species, except for American white pelican (*Pelecanus erythrorhynchos*), double-crested cormorant (*Phalacrocorax auritus*), upland gamebirds, raptors, belted kingfisher (*Megaceryle alcyon*), owls, corvids (crows, ravens, jays, magpies, etc.), and icterid blackbirds (bobolink, meadowlarks, grackles, etc.) (Government of Canada 1994). The *Wildlife Act* provides general provisions for regulating the activities relating to the take and trade of wild animals in Manitoba. A "wild animal" is defined as "an animal or bird of a species or type listed in Schedule A or declared by the regulations to be a wild animal," and includes select amphibian, reptile and mammal species and most bird species (including those not protected under the MBCA) known to exist in Manitoba (Government of Manitoba 2000). The *Wildlife Act* includes protection for bird species not already afforded protection under the MBCA (Schedule A, Division 6), and as such, all bird species in Manitoba are considered protected by law. These two acts influence mitigation of vegetation clearing effects on avian habitat via scheduling to avoid nesting periods and/or confirming the absence of nests prior to construction activities. Bird nesting habitat considerations are also incorporated into revegetation prescriptions through prescription of suitable plant species and, where feasible, snag installment to support nesting of species such as red headed woodpecker (*Melanerpes erythrocephalus*) (See Red-headed Woodpecker Habitat Management Plan).

3.4 Other Wildlife Considerations

When mowing is required along the LMOC/LSMOC ROW - whether for weed control, vegetation management, or for haying during times of drought - mowing methods and practices will be adopted that seek to reduce impacts to local wildlife (e.g., migratory birds including species at risk, and culturally important wildlife such as sharp-tailed grouse, rabbit and white-tailed deer). Timing of mowing is the most important factor influencing wildlife mortality and will be considered when planning mowing. Where necessary, mowing will be delayed until after July 15th so waterfowl and grassland birds can complete a nesting cycle. This will also benefit culturally important species such as mallard, grouse, rabbits and deer inhabiting the ROWs (see Wildlife Monitoring Plan, Table 1). Other factors that will be considered in the planning of any mowing within the LMOC/LSMOC ROWs include cutting height, mowing direction, mowing date, mowing strategy, mowing frequency, and mowing technology (CIC & DWS, 2011). All mowing plans and activities will be subject to review by Manitoba Transportation and Infrastructure, with approval contingent on the mitigation of potentially avoidable wildlife mortality.

Part 2: Lake Manitoba Outlet Channel

4.0 LMOC PROJECT INFORMATION

4.1 Project Description

The Project will involve the construction and operation of the LMOC and associated components such as a water control structure with power connections, bridges, realignment of PR 239, and other ancillary infrastructure, as shown in Figure 1 and described in the EMP Framework. The construction methodology for the LMOC is described in the CEMP.

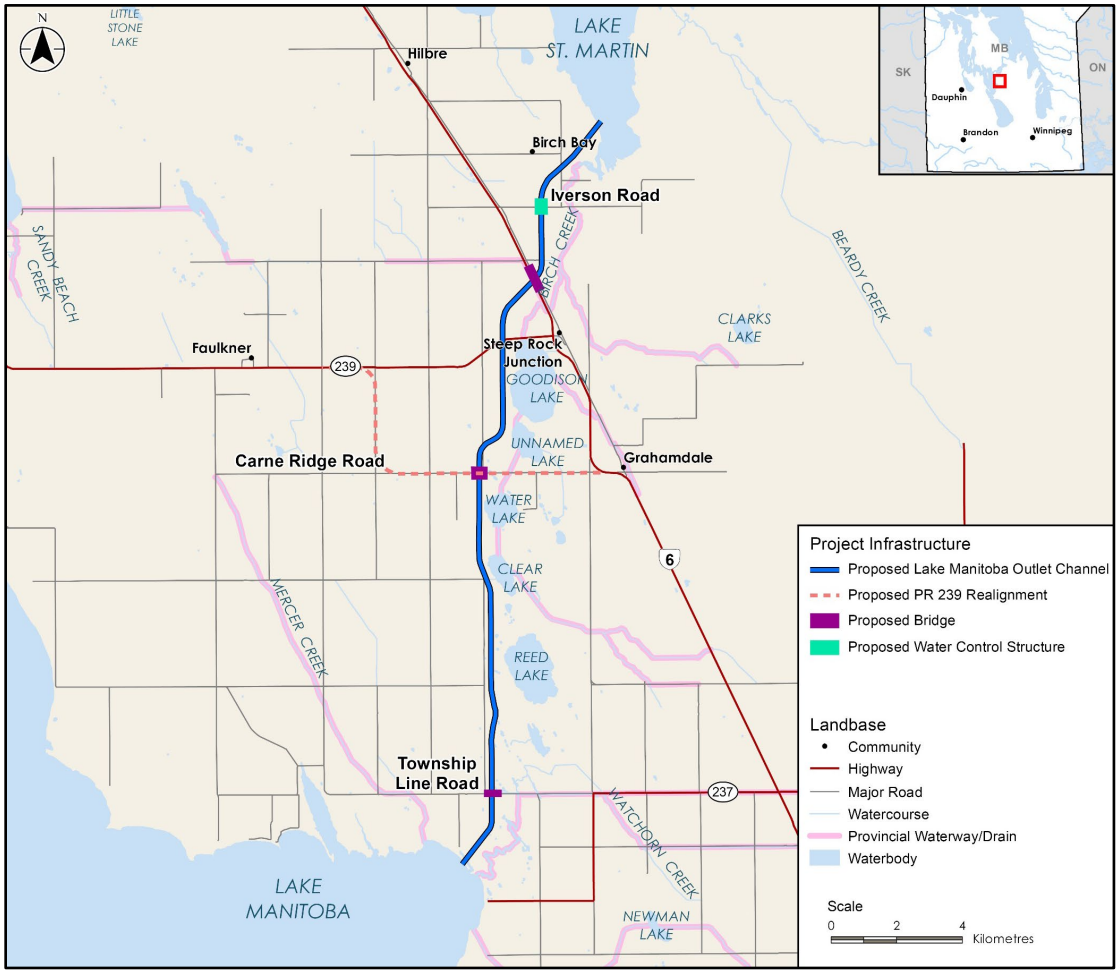


Figure 1: Lake Manitoba Outlet Channel Project Area

4.2 LMOC Operation

The mode of operation of the LMOC is such that some revegetated portions of the channel side slopes will experience alternating periods of submergence (wet) and exposure (dry). The duration, frequency, timing, and magnitude of channel operation will contribute to the response of the cover vegetation to flood events. When the flood tolerance of a specific species is exceeded, the plants will die back and will create gaps in the planting that can create opportunities for erosion and weed infiltration. Likewise, incidences of erosion as well as prolonged periods of drought also have the potential to impact vegetation cover along the channel side slopes.

4.3 Site Characterization

The RVMP planting prescriptions for the LMOC are based on the proposed Project features and pre-Project vegetation conditions in the LMOC ROW. The understanding of existing vegetation conditions was based on baseline data gathered in 2016 (EEI 2017a and b), the environmental assessment presented in the Project EIS, and Manitoba Transportation and Infrastructure supplemented those data by completing additional wildlife field investigations in 2020 (WSP 2020). General site information is summarized in the following subsections.

4.3.1 Soil Conditions

The surficial soils within the LMOC ROW are underlain by till substrates. The thickness of till over the underlying bedrock ranges from 10 to 20 metres (m). Based on modal soil properties from existing desktop soil resource information, the predominantly mineral surficial soils in the LMOC area will be expected to have topsoil (surficial organic and mineral A horizons) thicknesses ranging from 0 centimetres (cm) along shorelines to 40 cm in agricultural and deciduous forest areas (CanSIS 2019) as follows:

- Brunisol (40 cm) – deciduous parkland forest and agricultural lands
- Chernozem (30 cm) — agricultural lands and some areas of deciduous parkland forest
- Gleysol (40 cm) — imperfectly drained wetland soils or wet pastures
- Organic (15 cm) — wetlands that are peat forming in isolated areas near lower lying topographic areas near Goodison Lake, Clear Lake, Lake Manitoba and Reed Lake
- Regosol (0 cm) — newly formed soils with no topsoil such as shorelines

The soil materials occurring in the LMOC area from Lake Manitoba to the south end of Lake St. Martin (including the west and east side) consist primarily of extremely calcareous, very stony water-worked loamy textured glacial till (CanSIS 2019). A portion of this area was modified by wave action and scouring by ice during the retreat of glacial lake Agassiz (Smith et al. 1998). The ridges are generally composed of more coarse-textured, cobble and gravel deposits, while depressions contain finer deposits (Smith et al. 1998). Under current conditions, soils are rated predominantly as a negligible risk for wind erosion losses and a very low risk for water erosion losses. A significant portion of the assessment areas are rated as moderate, and no soils are rated as high, for water erosion losses (MTI 2020).

Sensitive soil sites identified along the LMOC ROW are sandy soils subject to erosion on both the Lake Manitoba (Watchorn Bay) and Lake St. Martin shorelines at the Inlet and Outlet, and areas near Goodison Lake. Two manure-impacted properties were identified within the ROW during the reconnaissance survey that will have to be addressed prior to construction. There are no immediate terrain sensitive sites as they are level to nearly level with slopes less than 2 percent.

Compaction risk is rated from low to moderate to the west of the LMOC channel and as predominantly high to the east of the LMOC channel (MTI 2020).

4.3.2 Vegetation Conditions

The August 2019 field reconnaissance survey was carried out to collect information on pre-Project vegetation conditions within the LMOC ROW in support of the RVMP design. The survey was carried out at the nine locations where roads presently cross the proposed channel route, and some adjacent areas. Results are summarized below.

The vegetation communities along the ROW comprised a mixture of cropland, pasture, wetlands, and parkland forests. Much of the ROW included forage crop and pasture supporting agronomic species. Pastured fields were an agronomic mix, and some contained weeds listed under the Manitoba NWA such as creeping or Canada thistle (*Cirsium arvense*). Cattle were present in many of the pastures, while some fields were croplands planted with wheat and some were planted with predominantly alfalfa and supported apiculture. Five rare plant species were recorded along the LMOC, and undocumented rare plant occurrences may also occur along the ROW.

Wetlands, including ditches and stream edges, were dominated by shallow marsh communities consisting of grasses, sedges and rushes, including narrowleaf cattail (*Typha angustifolia*), wooly bullrush (*Scirpus cyperinus*, bluejoint reedgrass (*Calamagrostis canadensis*), tussock sedge (*Carex stricta*), hard-stemmed bulrush (*Schoenoplectus acutus*) and willows along the edges, including pussy willow (*Salix discolor*), beaked willow (*S. bebbiana*), and sandbar willow (*S. interior*). A review of available rare plant information for the Project also indicates federally and provincially listed plant species at risk are generally found in wetlands, although none were observed during Project vegetation surveys and no known locations included in the Manitoba Conservation Data Centre database intersect the LMOC (Murray 2019). A vegetation baseline study report will be used to confirm this information.

Parkland forests were interspersed throughout the LMOC ROW and were predominantly deciduous young trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*) stands with shrubby understories of beaked hazelnut (*Corylus cornuta*), chokecherry (*Prunus virginiana*), western snowberry (*Symphoricapus occidentalis*), willows (*Salix species [spp.]*), prickly wild rose (*Rosa acicularis*), and Saskatoon (*Amelanchier alnifolia*) with groundcover of Canada goldenrod (*Solidago canadensis*), black-eyed Susan (*Rudbeckia hirta*), and bluegrass (*Poa spp.*). Bur oak (*Quercus macrocarpa*), fireberry hawthorn (*Crataegus chrysocarpus*) and Manitoba maple (*Acer negundo*) were minor components of most woodlands in the ROW especially near forest edges. Some of these forested areas contained dead standing trees that had evidence of bird use for nests and a source of food.

4.3.3 Non-Native Invasive Species and Weeds

The Project EIS includes baseline data gathered in 2016 (EEI 2017a and b); these data were supplemented by Manitoba Transportation and Infrastructure through additional field investigations in 2020 (WSP 2020). Additional field surveys to support revegetation planning were conducted in 2019. Within the ROW seven species of noxious weed listed by the NWA have been observed including one Tier 1 species, orange hawkweed (*Hieracium aurantiacum*), two Tier 2 species, ox-eye daisy (*Leucanthemum vulgare*) and nodding thistle (*Carduus natans*), and four Tier 3 species, absinthe (Artemisia absinthium), Canada thistle (*Cirsium arvense*), common burdock (*Arctium minus*), and perennial sow-thistle (Sonchus arvensis) (Table 1). Nodding thistle and ox-eye daisy are listed as Category 2 invasives by the ISCM early detection and rapid response) while Canada thistle, common burdock, perennial sow-thistle, prickly lettuce, and scotch thistle are listed as 'Other'. Smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), dandelion (*Taraxacum officinale*), yellow clover (*Melilotus officinalis*) and white clover (*Trifolium repens*) although not listed as noxious weeds or invasive species, can be problematic and are considered a moderate invasive species to native habitats.

Table 1: Noxious weeds and invasive plant species identified in the ROW

Common Name	Scientific Name	NWA Tier	ISCM Category
Absinthe	*Artemisia absinthium*	3	-
Canada thistle	*Cirsium arvense*	3	Other
Common Burdock	*Arctium minus*	3	Other
Nodding thistle	*Carduus nutans*	2	2
Orange hawkweed	*Hieracium aurantiacum*	1	-
Ox-eye daisy	*Leucanthemum vulgare*	2	2
Perennial sow-thistle	*Sonchus arvensis*	3	Other
Prickly lettuce	*Lactuca serriola*	-	Other
Scotch thistle	*Onopardium acanthium*	-	Other

4.3.4 Wildlife Habitat

Pasture, wetlands, and parkland forests occur along LMOC and have the potential to support a diversity of amphibians, reptiles, birds, and mammals including SAR and species of conservation concern (SOCC). Wildlife typical of open grass-dominated habitats include red-tailed hawk (*Buteo jamaicensis*), barn swallow (*Hirundo rustica)*, savannah sparrow, bobolink (*Dolichonyx oryzivorus)*, western meadowlark (*Sturnella neglecta*), coyote (*Canis latrans)* and red fox (*Vulpes vulpes)*. Wetlands, creeks, and streams support waterfowl such as ducks and geese, muskrat (*Ondatra zibethicus)*, beaver (*Castor canadensis)*, moose (*Alces alces*), deer (*Odocoileus spp*), lynx (Lynx canadensis), otter (*Lontra canadensis*), mink (*Neogale vison*), fox (*Vulpes vulpes*), coyote (*Canis latrans*), fisher (*Pekania pennanti*), weasel (*Mustela richardsonii*), bear (Ursus americana), sharp-tailed grouse (*Tympanuchus phasianellus*), and spruce grouse (*Canachites canadensis*), amongst many others.

Deciduous forest patches support red-eyed vireo (*Vireo olivaceus)*, ovenbird (*Seiurus aurocapilla)*, white-throated sparrow (*Zonotrichia albicollis*), and red-backed vole (*Myodes gapperi*), whereas edge species such as red-headed woodpecker (*Melanerpes erythrocephalus*), yellow warbler (*Setophaga petechia*), brown-headed cowbird (*Molothrus ater*), white-tailed deer (*Odocoileus virginianus)*, and American elk (*Cervus canadensis*) are found where grassland and haylands meet patches of deciduous forest.

The mosaic of habitats along LMOC have the potential to support a diversity of SAR and SOCC. Little brown myotis, northern myotis (both SARA-listed as endangered) and American badger (*Taxidae taxus;* SARA-listed as special concern) are the only mammal SAR having potential to occur along the LMOC. Bats forage in forest openings and over wetlands in the summer and hibernate in caves during the winter. The closest known bat hibernacula (federally designated as critical habitat) to LMOC occurs near the communities of Gypsumville and St. Martin. American badger is a grassland species that burrows in loose soil, often near ground squirrel colonies. Although badger have not been detected, they have the potential to occur along LMOC where grassland or pastureland exists.

Bird SAR and SOCC having potential to inhabit riparian and/or wetland habitats along LMOC and/or at the outlets are trumpeter swan (MESEA-listed as threatened), horned grebe (*Podiceps auritis;* COSEWIC-listed as special concern), least bittern (*Ixobrychus exilis;* SARA-listed as threatened), yellow rail (*Conturnicops noveboracensis;* SARA-listed as special concern), piping plover (*Charadrius melodus*; SARA-listed as endangered), and bank swallow (*Riparia riparia;* SARA-listed as threatened). Short-eared owl (*Asio flammeus;* SARA-listed as special concern), barn swallow (SARA-listed as threatened), and bobolink (SARA-listed as threatened) are associated with grassland habitat and eastern whip-poor-will (*Antrostomus vocife*rous; SARA-listed as threatened), common nighthawk (*Chordeiles minor;* SARA-listed as threatened*)*, red-headed woodpecker (SARA-listed as threatened), and evening grosbeak (*Coccothraustes vespertinus;* SARA-listed as special concern) are associated with forests, forest edges or forest openings.

Snags (dead standing trees) are important wildlife habitat, supporting nesting for species such as squirrels and marten. Red-headed woodpecker is a cavity-nesting woodpecker that breeds in open deciduous forest or forest edges, and open habitats (e.g., grasslands or pastures containing windrows) where mature or dying trees, or snags are available for nesting (COSEWIC 2007). The LMOC is near the northern limit of the species'

breeding range (MB BBA 2019) but suitable habitat, including two- 10 x 10 kilometre (km) squares of federally protected critical habitat, exists along the LMOC (ECCC 2019). The species is known to occur in hayland and pasture habitats located along the LMOC ROW near Reed and Goodison lakes.

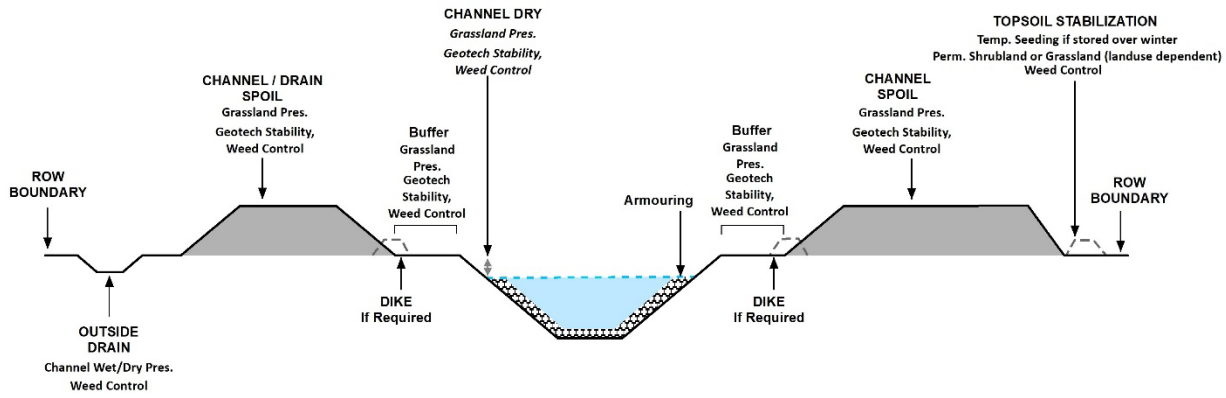
Northern leopard frog (*Rana pipiens*; SARA-listed as special concern) is the only at-risk amphibian known to occur along LMOC. Northern leopard frogs require shallow waterbodies for breeding, deep waterbodies for overwintering, and moist upland habitats (e.g., grasslands) for summer foraging and dispersal (COSEWIC 1998). Snapping turtle (SARA-listed as special concern) has the potential to occur along the LMOC where permanent waterbodies exist (COSEWIC 2008).

Two invertebrate SAR and one SOCC have the potential to occur along the LMOC: transverse lady beetle (*Coccinella transversoguttata*; COSEWIC-listed as special concern), yellow-banded bumble bee (*Bombus terricola*; SARA-listed as special concern), and gypsy cuckoo bumble bee (SARA-listed as endangered). All three invertebrate species have broad distributions in Canada and are habitat generalists, occupy a variety of habitats such as farmland, grasslands, riparian areas, and deciduous and coniferous forests (COSEWIC 2014, 2015, 2016).

5.0 LMOC CONSTRUCTION PHASE

5.1 Rehabilitation Sites and Zones

The proposed revegetation prescriptions for the LMOC are illustrated schematically on Figure 2 and spatially in Appendix 2A. More detailed revegetation information will be developed during detailed design.



Note : Pres. = Prescription; Perm. = Permanent.

Figure 2: Schematic of Revegetation Prescription and Options

The rehabilitation of LMOC is broadly divided into areas that have geotechnical and hydrological function considerations that influence revegetation prescriptions, and areas that will focus on connectivity with adjacent land uses which include wildlife habitat, shoreline ecosystems and agricultural land use. All disturbed areas will undergo revegetation site preparation prior to soil placement and preparation prior to seeding and planting activities. Revegetation zones are composed of upland areas comprising top of channel spoil or top of dike, mid-slope (dry channel slope and spoil slopes), and lower slope zones (wet/dry channel area and ditches and drains).

After Project construction, access routes not required for ongoing maintenance of the LMOC will be decommissioned by contouring, de-compacting and trimming to encourage natural revegetation and will be seeded and/or planted as required.

5.2 Rehabilitation and Revegetation Treatments

The proposed rehabilitation treatment measures to be used for LMOC are described in Table 1 and in revegetation prescription fact sheets in Appendix 2B, which will be further developed in the detailed design phase. Measures to be undertaken prior to channel and drain excavation include salvaging coarse woody debris and snags and salvage of topsoil to be stored and then replaced on applicable Project features prior to revegetation. Any areas of weed infestation will be treated prior to soil salvage and replacement. Areas that are compacted or rutted will be ripped prior to soil replacement. Soil replacement depth will be up to 30 cm and will be left rough and loose in the shrubland planting areas and will be furrowed for grassland areas.

Seed mixes will be applied to areas that are not structurally critical for channel operation. Native seed mixes and plants will be used where possible; however, non-invasive agronomic species that support cover establishment will be used where appropriate. Planned seeding considered Manitoba Transportation and Infrastructure's Native Revegetation Program Guidance Document and was adapted to meet specific revegetation design criteria. The prescription placement areas are shown in the cross-section in Figure 2 and on the plan view in Appendix 2A. The prescriptions are summarized below:

- A grassland prescription consisting of a native and agronomic seed mix will be used to revegetate the upper portion of the channel side slopes, the buffer between the channel and the spoil piles, dikes, and spoil piles. The seed mixes will be designed with consideration of potential future haying as well as include native wildflowers to provide pollinator habitat.
- Periodically flooded areas of the channel side slopes and the outside drain will have a wet/dry prescription for species that can tolerate both flooded and dry conditions. Due to variable water levels, this prescription will be monitored if there are prolonged flood events.
- Areas along the edge of the Channel ROW, or areas where topsoil was located prior to soil replacement in areas requiring revegetation, will receive either a grassland or shrubland prescription. The determination of the shrubland prescription will be based on whether it existed in that location prior to disturbance. The shrubland will be planted with native shrubs (such as saskatoons, chokecherries, and cranberries) and some areas will receive enhancements such as coarse woody debris placement and installation of wildlife snags (dead standing trees) to support red-headed woodpecker (See Red-Headed Woodpecker Habitat Management Plan). Areas of shrubland may enhance habitat for eastern whip-poor-will (See Eastern Whip-poor Will Habitat Management Plan) and other wildlife (e.g., upland game birds, rabbits, red fox, white-tailed deer). Areas revegetated with a mix of grass and forbs may serve as potential nesting habitat for bobolink and foraging habitat for short-eared owl.
- The Inlet and Outlet areas that are disturbed but not armoured with riprap will have a shoreline prescription of seeding native wetland grasses and cattails, planting sedge plugs, and live staking of native willows that will support control of wind and wave erosion. These areas will also consider wildlife habitat along the shoreline and may receive live stakes collected from local willows in addition to seeding to control erosion.

- A topsoil stabilization prescription will be applied to temporary topsoil stockpiles during construction if stockpiles are to be left in place for more than a growing season. The stockpiles will be contoured and seeded to reduce erosion and control weed establishment. These locations are not indicated on the plan view in Appendix 2B as they will be applied as needed. The erosion control prescription will also be applied to other areas in the ROW as needed.
- A standard seed mix will be applied by broadcast methods to the roadsides for the PR 239 realignment (Appendix 1A). This is not indicated in the plan view in Appendix 2B.

5.3 Revegetation Sequence and Schedule

The timing of revegetation activities is seasonally dependent to support successful plant growth. Table 2 provides a summary of the activities and when they would generally occur. Manitoba Transportation and Infrastructure will endeavor to conduct revegetation using a staged approach and start as soon as practical after construction commences.

Table 2: Revegetation Schedule for the Lake Manitoba Outlet Channel

Revegetation Activity	Timing of Activity	Description of Activity
Weed Management	Construction and Operations	Weed management should occur during operations if weeds are present in topsoil stockpiles prior to replacement and during monitoring and maintenance.
Coarse Woody Debris and Snag Salvage	Construction (clearing)	Salvage of material for future revegetation for local provenance of coarse woody debris and snags for the shrubland prescription for supporting endangered species habitat, where required (See Red-Headed Woodpecker Habitat Management Plan).
Topsoil Salvage	Construction (excavation)	Salvage of soil and storage so that up to 30 cm of soil is preserved for future replacement. Volumes will be calculated prior to construction.
Revegetation	Construction (segment completion)	Seeding to be conducted as construction segments are completed. Optimal growth will occur in spring. Seeding outside of spring months will require adjustment of revegetation prescriptions to improve seed propagation. Planting of stakes and shrubs to occur in spring or fall.

Revegetation Activity	Timing of Activity	Description of Activity
Monitoring	Three years post-revegetation and Operations	Confirm sufficient vegetation cover and erosion and sedimentation are controlled. This monitoring will occur over the first three years after planting and during maintenance inspections after flood events.
Maintenance	Operations	Manage weeds, mow grass areas, and repair areas of erosion (as required).

5.4 Weed Control

Weed control is required when revegetating disturbed lands with an intended function (i.e., erosion control, aesthetics, protection of adjacent farmland, rare habitat, etc.). Persistent weed species have already established either in or near the LMOC ROW, where soil salvage and revegetation will occur; thus, weed treatment will be required prior to soil salvage, and may be required as part of on-going maintenance activities once revegetation is complete. The duration of, and the weed management techniques employed, will vary depending on level of infestation, as well as proximity to agricultural land, and fish-bearing waterbodies. As the LMOC construction will take more than one growing season, revegetation will be phased to help prevent the establishment of weeds in Project-disturbed areas to be revegetated.

To help avoid spreading weeds that have been documented during site investigations, treatment measures established by Manitoba Transportation and Infrastructure and the following actions are recommended:

- Weed and Invasive Species Control:
  - destroy all tier 1 noxious weeds found within the PDA;
  - destroy all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is less than five acres;
  - control all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is five acres or more;
  - control tier 3 noxious weeds and invasive species found within the PDA if the weed's uncontrolled growth or spread is likely to negatively affect an aspect of Manitoba's economy or environment in the areas adjacent to the PDA or the well-being of residents (e.g., individual agricultural producer or farm operation) in proximity to the PDA; and
  - prevent the spread of noxious weeds (tier 1, tier 2 and tier 3) or invasive species originating within the PDA to lands and waters beyond the PDA boundaries.

Additional measures for addressing surrounding farmland are described in the AgBMP. Areas of weed infestations are considered RAZ under the AgBMP and require special management measures to protect agricultural biosecurity in agricultural areas outside of the Project ROW. Areas of weed infestations require a site-specific management and monitoring plan for treatment, as previously described in Section 3.2.

Herbicide application will not occur within a 30 m setback from waterbodies and fish habitat, and they shall be handled and used under a pesticide use permit as described in the PERs (Section 2.6.4).

The following monitoring practices will be implemented to help identify areas where weeds may be establishing:

- Revegetated areas are to be monitored for weed encroachment until the vegetation cover is established. The survey should be undertaken by individuals that can identify plant species and make best practice weed control recommendations.
- When invasive weed species are documented, a timely and appropriate weed control response should be undertaken to control the weed infestation. A site-specific weed control strategy will be implemented.

5.5 Erosion and Sediment Control

The RVMP, through establishing a vegetation cover, provides mitigations supporting the SMP. Erosion control measures will be applied throughout the Project ROW as needed but will exclude the areas that will be occupied by concrete, or riprap armouring features and the areas covered by water in the channel and outside drain.

Revegetation will be conducted following completion of individual segment construction. The grassland prescription to be applied over the majority of the Project ROW includes some species that will establish quickly to promote vegetation cover. Additional erosion control measures will be applied as needed. Manufactured erosion control products may be used strategically in areas that pose the greatest risk of erosion and where impacts of erosion are most detrimental. Additional detail on the use of erosion control materials and products can be found in the SMP.

6.0 LMOC OPERATIONS PHASE

The design of seed mixes and seeding rates will be suitable for the range of site conditions anticipated during operation of the Project. Species used in areas that will be inundated during channel operation will be selected based on their inherent capability to withstand flooding as well as seasonal drought. Erosion control along the upper side slopes of the channel and in the outside drain under both dry and wet conditions will be implemented using dry and wet condition tolerant plants and seed mixes with some species in the seed mix establishing more quickly to promote vegetation cover. The portion of the channel bed permanently under water will be covered with a stone armour layer. Mitigation measures may be required to address the risk of poor vegetation growth on portions of the channel side slopes above the channel armouring in areas that will experience alternating periods of submergence and exposure as a result of long-term operation of the Project.

Drier areas on the new landscape may also develop on spoil piles. Seed mixes comprising species capable of tolerating these conditions into the long-term foreseeable future will include mix of native cool season and warm season species.

Weed management practices will be applied throughout the operation phase of the Project to minimize weeds and invasive plants, which is critical for success since seeded and planted areas may be outcompeted by weeds, adjacent land uses for farming may be detrimentally affected by the spread of weeds, and there is limited use for wildlife.

Other key considerations include plant species that support use by wildlife and hydraulic considerations (such as limiting the height of plant species that can be seeded in the channel to maintain the hydraulic capacity).

Table 2 outlined a general schedule of activities including the operation phase of the Project.

6.1 Weed Control

Weed treatment will be required as part of maintenance during the Operations Phase. Monitoring practices similar to the weed control practices during construction phase will be implemented, as follows:

- Revegetated areas are to be monitored for weed encroachment until the vegetation cover is established. The survey should be undertaken by individuals that can identify plant species and make best practice weed control recommendations.
- When invasive weed species are documented, a timely and appropriate weed control response should be undertaken to control the weed infestation.
- A site-specific weed control strategy will be developed as part of the soil salvage and revegetation schedules to achieve the following weed control targets:
    - weed and Invasive Species Control
    - destroy all tier 1 noxious weeds found within the PDA

- destroy all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is less than five acres
- control all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is five acres or more
- control tier 3 noxious weeds and invasive species found within the PDA if the weed's uncontrolled growth or spread is likely to negatively affect an aspect of Manitoba's economy or environment in the areas adjacent to the PDA or the well-being of residents (e.g., individual agricultural producer or farm operation) in proximity to the PDA
- prevent the spread of noxious weeds (tier 1, tier 2 and tier 3) or invasive species originating within the PDA to lands and waters beyond the PDA boundaries.

Additional measures for surrounding farmland areas are described in the AgBMP. Areas of weed infestations are considered RAZ under the AgBMP and require special management measures to protect agricultural biosecurity in agricultural areas outside of the Project ROW. Areas of weed infestations require a site-specific management and monitoring plan for treatment, as previously described in Section 3.2.

6.2 Vegetation Management

To promote establishment of a healthy vegetation cover for the Project and to allow for the proper function of water flow the following measures will be part of the maintenance program during the Operations Phase:

- maintenance of the vegetation cover in areas where erosion might be present
- ongoing mowing
- ongoing weed control, where required.

6.2.1 Channel Maintenance

To maintain the efficient conveyance of water in the channel, vegetation maintenance will be required. Over time, woody vegetation that establishes naturally, including willows and deciduous species such as poplar, will require management (e.g., mowing) to maintain channel hydraulic function. Channel areas are subject to water fluctuations during flood events and may require maintenance after prolonged flood events.

7.0 LMOC MONITORING

Revegetation monitoring will be conducted on a regular basis during the construction and operation phases to identify erosion and other noticeable incidents, to monitor the condition of cover vegetation and to monitor for Project impacts to adjacent vegetation and plant communities. The results of this monitoring will be presented in regulatory monitoring and inspection reports. All monitoring programs will be documented using a computer-based geographic information system (ESRI's ArcGIS) and will include GPS locations and photographs of the monitoring sites and monitoring parameters.

Monitoring results will be documented and used to measure the success of revegetation efforts and confirm that sufficient physical stability of the reclaimed landscape has been achieved to control surface erosion and sedimentation. In some areas of sensitive habitat, it may be feasible to determine revegetation success by observed wildlife use and by noting the structural and species composition of the sensitive habitat.

To avoid growth and establishment of weeds, topsoil and subsoil piles will be monitored for weed growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented where necessary. Shortly after construction, monitoring will be focused on assessing the rate of establishment of a healthy vegetation cover, and the quick recognition and mitigation of soil erosion. Areas of poor vegetation growth will also be identified for additional seeding. Proposed survey methods will be discussed with Manitoba Environment, Climate, and Parks in advance of field survey.

Wetland mapping will be evaluated to identify potentially affected wetlands, as further described in the Wetland Monitoring Plan. Manitoba Transportation and Infrastructure will follow the provincial requirements of *The Water Rights Act* (WRA) and its regulations for wetland compensation on this Project. Wetland compensation will include wetland creation, and wetland enhancement or restoration.

Any required updates, amendments, and supplementary submissions related to Project design and Project-valued component (VC) interactions (see Project EIS Volume 1, Section 4.4) will be incorporated into the scope of the monitoring program for the RVMP through the adaptive management framework. For example, as information from on-going surveys is made available, newly detected locations of invasive species will inform specific construction phase treatment plans. Likewise, detection of plant species of conservation concern or of cultural importance will inform and may direct aspects of the construction and operation phase monitoring plans.

7.1 Construction Phase Monitoring

During the construction phase of the Project, monitoring will be performed to evaluate and assess the condition of the LMOC ROW cover vegetation as well as the potential effects of the Project on adjacent vegetation and plant communities.

7.1.1 Monitoring Cover Vegetation

The establishment and condition of cover vegetation will be closely monitored throughout the site revegetation process so that issues with potential to cause erosion or allow weed infestations (see Section 8.2.1) are detected and acted upon rapidly. When remedial revegetation work is required in an area, the monitoring timeline for the area will be re-set and 3-year monitoring restarted. The LMOC ROW will be surveyed for plant establishment and condition; sampling will occur within each active revegetation zone as well as natural revegetation areas. Surveys will be conducted twice annually, likely in June and September, and biennial reporting will be provided. Information collected during revegetation monitoring includes:

- species
- seedling density
- percent live cover
- percent dead cover
- percent bare ground
- photographs
- site conditions (including visible dust deposits, erosion and weed presence)

The introduction of non-native and invasive species (species listed by the ISCM but not under the NWA) will be monitored through opportunistic visual assessments across the LMOC ROW during regular environmental monitoring. Any detection of invasive species will be reported to allow for rapid response and remedial action. Information that will be collected when weeds are detected includes:

- species of weed
- extent of weed and invasive species cover (by dominant species)
- description of existing vegetation community by dominant species and their relative cover
- site conditions
- geo-referenced location
- photographs showing the extent of occurrence and density of plants, as well as close-up photos of plants to support identification

Temporary vegetation cover of topsoil stockpiles will be considered stable if there is no decline in the following parameters between assessments:

- Plant cover (total and by species) provides a measure of the reduction in erosion potential and rainfall capable of reaching and infiltrating the ground.
- Observation of erosion issues such as rill erosion that may require adapted revegetation prescriptions.

Weed infestations that have been identified will be addressed prior to soil salvage. The monitoring will be based on the efficacy of the herbicide treatments prior to soil salvage.

7.1.2 Monitoring for Effects on Vegetation

Effects on vegetation will be monitored in the proximity of the LMOC and PR 239 realignment. During the construction phase, Project activities have the potential to transfer soil, manure, and weeds to and from the LMOC ROW and agricultural areas outside of the ROW. These materials may contain disease-causing pathogens, weeds or other pests as described in the AgBMP. The introduction of pests can have lasting adverse effects on production (reductions in yield and quality) and production cost (increased input and management costs). Diseases can spread between regions and fields by human-related means through transport of infested seed, soil and crop residues, and within and between fields by natural means (e.g., wind, rain, water and soil erosion and insects).

Monitoring will compare baseline conditions and track changes in community composition over time, allowing an accurate description of the effects of LMOC on the immediately adjacent upland and wetland vegetation communities, where accessible. The vegetation monitoring program includes permanent sample transects running perpendicular to the LMOC ROW. Permanent sample transects will be situated strategically to capture the diversity of vegetation community types present along the LMOC ROW while accounting for relative abundance of each community type. Baseline information on vegetation community structure will be collected at each selected permanent sample location, and again once annually, within a two-week window during the summer (likely July 15-30) for the duration of the construction phase. Site photographs will be taken, and site conditions will be described, including comments on visible dust deposits, erosion, and weed presence. Parameters that will be measured include:

- species
- diameter at Breast Height (DBH)
- percent alive canopy
- score

Monitoring for the invasion and establishment of non-native invasive or weed species, surveys will be conducted twice annually during the LMOC construction phase. These will focus on native vegetation communities adjacent to haul roads, roads, quarry and borrow areas and other areas identified as having a high likelihood of weed invasion. The first survey would generally occur between June 15-30 and the second would occur from August 1-15 to capture the anticipated range of cool and warm season weeds that could establish. To maximize the area covered by each survey, visual assessment (presence/absence) of high likelihood areas will be used. Information that will be collected when weeds are detected includes:

- species of weed
- extent of weed cover (by species)
- description of existing vegetation by dominant species and relative cover
- site conditions
- geo-referenced location
- photos showing the extent of occurrence and density of plants, as well as close-up photos of plants to support identification

Measures to protect cropland biosecurity will focus on preventing and minimizing the potential of soil and weed seed transfer from the ROW to agricultural areas outside of the ROW. Monitoring and salvage of important revegetation material (coarse woody debris and snags) supports environmentally sensitive features such as species of cultural importance, or species at risk habitat for eastern whip-poor-will and red-headed woodpecker. This measure will reduce effects to federally and provincially listed wildlife species, and effects to wetlands.

Remote sensing may be applied for monitoring vegetation health within and outside of the ROW. The vegetation health can be identified using near-infrared (NIR) energy, which is highly sensitive to vegetation stress detected through photosynthesis absorption and reflection rates (Carlson and Ripley 1997).

7.2 Operations Phase Monitoring

The purpose of ongoing operational vegetation monitoring will primarily be to monitor erosion and sediment control, with the frequency linked to Project maintenance works or prolonged flood or large storm events. A post-revegetation establishment monitoring program will determine if revegetation objectives are being met and support the development of ongoing vegetation maintenance.

Revegetation monitoring is planned to occur according to the following phases:

1. Within the first three growing seasons after revegetation treatments: measuring the effectiveness of the revegetation program which includes weed control, erosion and sediment control and establishment of the vegetation cover.
2. Long-term: monitoring for weeds and for confirming that erosion control in revegetated areas is maintained. The monitoring frequency will be once per year between June 15 and August 15 and may be adjusted depending on the long-term site-specific effectiveness of vegetation as an erosion control measure.

Additional mitigation measures may be required to address poor vegetation growth, identified during long-term operational monitoring, on portions of the channel side slopes above the channel armouring in areas that will experience alternating periods of submergence and exposure as a result of long-term operation of the Project.

7.2.1 Monitoring Cover Vegetation

Vegetation cover would be considered stable and self-sustaining if there is no meaningful decline in the following parameters between assessments:

- Species composition assessment: changes in composition and abundance over time, including non-native plant species and weed infestation. Species composition assessment provides a measure of species richness (number of species) and will indicate whether vegetation is dominated by native species.
- Plant cover (total and by species): provides a measure of the reduction in erosion potential and rainfall capable of reaching and infiltrating the ground.

- Health and vigor, including total plant biomass: biomass production provides a reliable measure of the live vegetative material present on a site. A sudden decline in plant biomass production following withdrawal of maintenance fertilization could indicate that the site is not yet self-sustaining.
- Observation of erosion issues such as rill erosion: may require adapted revegetation prescriptions.

7.2.2 Monitoring for Effects on Vegetation

Operations phase monitoring will track changes in adjacent community composition over time, to provide a description of any effects of the LMOC on adjacent upland and wetland vegetation communities. The vegetation monitoring program includes permanent sample transects running perpendicular to the LMOC ROW. Permanent sample transects will be situated strategically to capture the full diversity of vegetation community types present along the LMOC ROW while accounting for relative abundance of each community type.

Information on vegetation community structure will be collected at each selected permanent sample location annually within a two-week window during the summer (likely July 15-30) for up to the first three years after construction has completed. Following this annual monitoring phase, consideration should be given to reducing sampling frequency to a bi-annual interval. During monitoring, site photographs will be taken, and site conditions will be described, including comments on visible dust deposits, erosion, and weed presence. Parameters that will be measured include:

- species
- height
- diameter at breast height (DBH)
- percent alive canopy
- health score

Changes in hydraulics that may affect wetland function will be assessed against the baseline conditions to confirm Project EIS predictions.

The operations phase monitoring approach for introduction of non-native and invasive species will be informed by the outcomes of site revegetation and the associated monitoring. If infestations of listed noxious weeds are present on or near the LMOC PDA biennial monitoring of weed infestations will occur as described in Section 7.1.2 shall continue. Once listed noxious weeds or invasive species are determined to have been successfully treated at a site, long-term monitoring can shift to an annual interval. Surveys will follow a visual assessment approach to maximize area coverage. Visual assessments of pre-determined locations will be conducted, and opportunistic observations of weed establishment during normal site visits and inspections will be made. When monitoring has shifted to an annual interval, the general period of June 15-30 will be used for field surveys to maximize the detection of problematic weed species. When detected the following information about non-native and invasive plant species will be recorded:

- species of weed
- extent of weed cover (by species)
- description of existing vegetation

- site conditions
- geo-referenced location
- photos showing the extent of occurrence and density of plants, as well as close-up photos of plants to support identification

Vegetation performance within the ROW and outside of ROW for edge effects, such as changes in species composition, will be compared against the baseline conditions as identified in the Project EIS and the LMOC and LSMOC preconstruction environmental field work. An appropriate reference site will be established within the area that will not be disturbed by the Project for continuous vegetation performance assessment.

The ROW will be managed to reduce weed growth and the potential for weed transfer to agricultural land adjacent to the ROW. Remote sensing may be applied for monitoring vegetation health within and outside of the ROW. The vegetation health can be identified using near infrared (NIR) energy, which is highly sensitive to vegetation stress detected through photosynthesis absorption and reflection rates.

8.0 LMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP

8.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The *Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicates that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

As discussed in Project EIS (Volume 5, Section 12.6), vegetation monitoring will examine how predicted changes to vegetation species diversity and wetlands will be verified and how the effectiveness of mitigation strategies (e.g., revegetation) will be evaluated. As described in Section 7 of this RVMP, shortly after construction, monitoring will be focused on assessing the rate of establishment of a healthy vegetation cover, and the quick recognition and mitigation of soil erosion. To avoid growth and establishment of regulated weeds, topsoil and subsoil piles will be monitored for weed growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented where necessary. Areas of poor vegetation growth will also be identified for additional seeding.

Although the methods and recommendations outlined in this RVMP were developed based on site-specific expectations and conditions, it is recognized that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the decisions during construction and long-term operation. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the Project designs, while learning from field performance, to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback during construction, temporary measures described in this RVMP, as well as those included in the SWMP and SMP, will be revisited and updated, as required. For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate vegetating methods will be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

8.2 Follow Up Response

As described in Section 7, monitoring will include monitoring of cover vegetation establishment and Project effects on vegetation. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental regulatory approvals. Management thresholds developed as part of the monitoring plan utilize regulated criteria, input from rights-holders, stakeholders and regulators, and consideration of findings from applicable management plans. Based on the management thresholds and the results of the vegetation monitoring program, follow up activities will be implemented where conditions recorded appear to be outside of anticipated seasonal fluctuations of vegetation cover.

Table 3 summarizes the criteria indicators, methods and thresholds that will be used to assess the revegetation success and any adaptive management that may need to be implemented during the monitoring of LMOC.

Table 3: Indicators, Threshold and Targets for Measuring Revegetation Success

Indicators	Measure	Method	Targets	Timeline for Surveys	Thresholds	Mitigations for Adaptive Management
Soil Moisture Regime	Estimate in field (e.g., soil depth; texture; landscape position)	Test for soil moisture in the field (conditions that the vegetation is growing in)	Within the natural range of species planted	First year after soil replacement	Sufficient soil moisture for plant survivorship	Understanding soil moisture levels in the LMOC main channel and Outside Drain may need adjustments depending on final moisture levels achieved
Grassland Cover Areas	Cover (%) and seedling density	Survey plots (count/species)	Year 1: Minimum 6 seedlings per 0.1m^2 Year 2-3: 70% cover with no signs of rill erosion	First three years after revegetation	Less than 50% survivorship	Additional site prep needed or adjust seed mix for species that show good survivorship.
Weed Control	Management of weeds	Survey plots; site observations	Absence of Tier 1 noxious weeds and large infestations of Tier 2 noxious weeds No negative impact from Tier 3 noxious weeds No spread of large infestation or harm from species listed under the ISCM and non-native species	First three years after revegetation	Non-compliant with the *Noxious Weeds Act*	Remove noxious weeds. Note: if cover is less than 50% after weed removal reseed areas.

Indicators	Measure	Method	Targets	Timeline for Surveys	Thresholds	Mitigations for Adaptive Management
Shrub Area	Other woody plants (shrubs)	Survey plots (species diversity)	>2 shrub species survive with 40% cover, no weeds and wildlife use	First three years after revegetation	< 2 shrub species	Complete infill planting with a more tolerant species based on the establishment of naturally regenerated species or planted stock.
Shoreline Area	Willow stake survivor ship and grass seeding establishment	Survey plots (species diversity) and percent cover	>2 shrub species survive with minimum 40% cover, no weeds and wildlife use	First three years after revegetation	Stake survivorship is 40% or less from direct cuttings. Rill or gully erosion and/or soil surface deflation.	Willow stakes can be collected, and potted and then out planted to improve success. Grass cover should be reapplied as these sandy soils along the shoreline are sensitive to erosion.

8.2.1 Construction Phase

During the construction phase, adaptive management strategies may be needed within the ROW and in adjacent areas. For areas adjacent to the ROW the prevention of the spread of weeds and soil moisture changes and the associated vegetation response during construction should be monitored and, if needed, appropriate strategies developed to address any adjacent vegetation changes outside of the ROW.

Weed monitoring of temporary topsoil stockpiles will occur if left for more than one growing season to determine if herbicide treatment is required prior to topsoil spreading. If topsoil piles are to remain over winter, they will be monitored for sufficient vegetation cover in the early fall to determine if a temporary fall seed cover crop should be applied to reduce potential erosion in the spring.

Within the ROW, after permanent vegetation cover has been applied within the first growing season, there should be sufficient ground cover to reduce erosion and limit weed establishment. The thresholds are dependent on the revegetation prescription as outlined in Table 2. Follow-up monitoring and remedial revegetation activities will be continued until sufficient cover has established to mitigate the risk of erosion and controlling the spread of weeds. Weed control is needed for both the establishment of the required vegetation and to protect surrounding agricultural land and wildlife habitat. The type of weed control selected, whether mechanical and/or chemical treatment, will be based on site specific prescriptions that will consider the weed species being treated, extent of the infestation, time of year and assessing risk to water quality and adjacent land uses (e.g., apiculture).

8.2.2 Operations Phase

During the operations phase, observations on the condition of the cover vegetation following prolonged channel operation during the growing season, may prompt adaptive management by adjusting revegetation activities, or corrective weed control treatments. Adaptive management will be required in revegetated sections of the channel side slopes above the armouring and within the outside drain if:

- active erosion is occurring in the form of rills or gullies
- more than 40 percent (%) of the vegetation cover has died back and not recovered

The following recommendations are meant to guide decision-making where the objective is re-establishing cover vegetation that was lost following channel operation during a flood event. These thresholds should be evaluated and adjusted to help standardize remedial responses based on monitoring vegetation establishment success.

Dieback <20%

- Do nothing unless substantial active erosion is occurring. Correct erosion through surface preparation and seeding.

Dieback 20-40%

- Wait and see unless substantial active erosion is occurring. Correct erosion through surface preparation and seeding.

Dieback >40%,

- When plant dieback without excessive soil erosion is encountered, direct seeding priority areas with a drill seeder is the preferred method for remedial seeding. The drill seeder can be engaged and disengaged as machinery passes through vegetative cover and seeding can target priority areas.
- If soils have been eroded in areas of plant dieback, soil preparation will need to take place prior to seeding work.
- The assessment of plant species dieback will inform adjustments to the remedial seed mix design. Seed mix rates and species composition will be adjusted accordingly based on the how the vegetative cover responds to flooding.

While monitoring for effects to adjacent plant communities, detections of non-native invasive or weed species will prompt corrective weed control if this is determined to have originated from within the LMOC ROW. The management thresholds and mitigation action will depend on the species of weed detected and would use the same criteria identified during the construction phase.

During maintenance of the channel, there may be need for vegetation management due to safety, access, and operational considerations. Control of woody vegetation in the ROW is warranted when it:

- impedes safe use of the ROW,
- restricts site access, or
- impacts hydraulic conditions within the channel outside of the designed operational range.

Mowing has been identified as the preferred technique for controlling woody vegetation in the LMOC ROW. Other vegetation maintenance techniques to control the establishment of woody species include brushing, girdling, blading and use of herbicides.

9.0 LMOC REFERENCES

Canadian Soil Information Service (CanSIS). 2019. National Soil Database. Available from http://sis.agr.gc.ca/cansis/nsdb/index.html. Last Modified 2013-07-08.

Carlson, T. N., & Ripley, D. A. 1997. On the relation between NDVI, fractional vegetation cover, and Leaf Area index. *Remote Sensing of Environment*, 62(3), 241–252. https://doi.org/10.1016/s0034-4257(97)00104-1

CIC (International Council for Game and Wildlife Conservation) & Deutsche Wildtier Stifung (DWS). 2011. Mowing Mortality – in Grassland Ecosystems. Pp 9.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 1998. COSEWIC assessment and status report on the Northern Leopard Frog (*Rana pipiens*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 40 pp.

COSEWIC. 2007. COSEWIC assessment and update status report on the red-headed woodpecker (*Melanerpes erythrocephalus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON, ON. vi+ 27 pp.

COSEWIC. 2014. COSEWIC assessment and status report on the gypsy cuckoo bumble (*Bombus bohemicus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 56 pp.

COSEWIC. 2015. COSEWIC assessment and status report on the yellow-banded bumble bee (*Bombus terricola*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 60 pp.

COSEWIC. 2016. COSEWIC assessment and status report on the transverse lady beetle (*Coccinella transversoguttata)* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xi + 57 pp.

ECCC. 2019. Recovery strategy for the red-headed woodpecker (*Melanerpes erythrocephalus*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. viii + 118 pp.

EEI (EcoLogic Environmental Inc.). 2017a. Lake Manitoba outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.

EEI. 2017b. Lake St. Martin outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.

Government of Canada, 1994. *Migratory Birds Convention Act*. Available from http://laws-lois.justice.gc.ca/eng/acts/m-7.01/.

Government of Canada, 2002. *Species at Risk Act*. Available from http://laws-lois.justice.gc.ca/eng/acts/s-15.3/FullText.html.

Government of Manitoba, 2000. The Wildlife Act. Available from https://web2.gov.mb.ca/laws/statutes/ccsm/w130e.php.

Government of Manitoba, 2015. The Endangered Species and Ecosystems Act. Available from https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php.

Government of Manitoba, 2019. Species listed under the Manitoba Endangered Species and Ecosystems Act. Available from https://www.gov.mb.ca/sd/environment_and_biodiversity/species_ecosystems/index.html.

Invasive Species Council of Manitoba (ISCM), 2020. Website: Alien plant and animal species that threaten Manitoba's ecological balance. Available from http://invasivespeciesmanitoba.com/site/index.php?page=terrestrial-species. Accessed March 2020.

MB CDC, 2019. Historical Records and Species and Plant Database from Manitoba Sustainable Development. Available at: https://www.gov.mb.ca/sd/environment_and_biodiversity/cdc/index.html. Accessed June 2019.

Manitoba Transportation and Infrastructure (MTI)wetlands, 2020. Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. March 9, 2020.WSP, 2020. Lake Manitoba and Lake St. Martin Outlet Channel Project Preconstruction Environmental Field Work – Vegetation (CONS15843). Prepared for Manitoba Infrastructure by WSP, September 2020.

Part 3: Lake St. Martin Outlet Channel

10.0 LSMOC PROJECT INFORMATION

10.1 Project Description

The Project will involve the construction and operation of the LSMOC and associated components such as a water control structure with power connections, drop structures, and other ancillary infrastructure, as shown in Figure 3 and described in the EMP Framework. The construction methodology for the LSMOC is described in the CEMP.

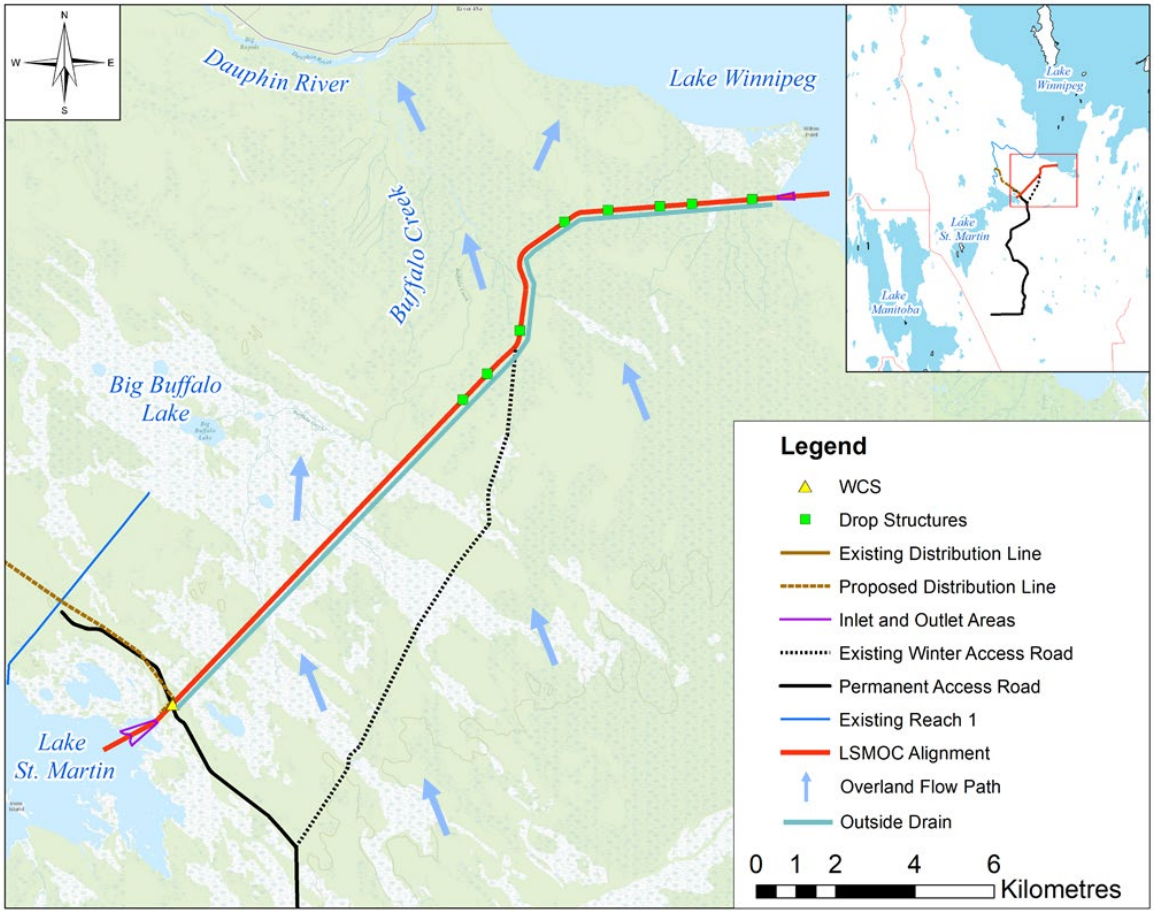


Figure 3: Overview Plan of the of the Lake St. Martin Outlet Channel

10.2 LSMOC Operation

As the LSMOC is operated, planting areas above the channel armouring and along the side slopes will become inundated and cover vegetation will be submerged for extended periods of time. The duration, frequency, timing, and magnitude of channel operation will contribute to the response of the cover vegetation to flooding. When the flood tolerance of a specific species is exceeded, the plants will die back and will create gaps in the planting that can create opportunities for erosion and weed infiltration. Likewise, incidences of erosion as well as prolonged periods of drought also have the potential to impact vegetation cover along the channel side slopes.

10.3 Site Characterization

The RVMP planting prescriptions for the LSMOC are based on the proposed Project features and pre-Project vegetation conditions in the LSMOC ROW. The understanding of existing vegetation conditions was based on the Project EIS and a reconnaissance survey completed in August 2019. General site information is summarized in the following subsections. The Project EIS includes baseline data gathered in 2016 (EEI 2017a and b) and Manitoba Transportation and Infrastructure supplemented those data by completing additional wildlife field investigations in 2020 (WSP 2020), 2021, and 2022.

10.3.1 Soil Conditions

A field survey of the LSMOC alignment was conducted in early June 2019, mainly within a 20 m wide alignment following the centerline of the channel. A total of 26 sampling locations were selected covering all representative land cover classes (Appendix 3A). At each survey site, vegetation was described, and soil samples were collected for analysis.

During soil sampling, frost was encountered at a depth of 20 to 30 cm in wetland and coniferous sites; therefore, soil sampling was mostly restricted to the 0 to 15 cm and 15 to 30 cm depths in these areas. Frost was absent from upland mineral soils associated with aspen cover and generally better drainage conditions. In these areas, field personnel were able to obtain additional soil samples from the 30 to 45 cm depth. Only occasionally was mineral soil encountered and this was typically in upland forest cover types where surface organics were relatively thin compared with wetland soils.

A subset of 15 soil samples representing major cover types was submitted for laboratory analysis. A summary of relevant soil parameters for revegetation are provided in Appendix 3A. Generally, sampled soils were found to be substantially more fertile than glacial till. Mineral soils were encountered only in cover classes containing deciduous forest cover types. All other soils were organic in nature. Soil pH and electrical conductivity were generally found to be within the environmental tolerance ranges of most grass species being considered for revegetation within the Project area.

10.3.2 Vegetation Conditions

Field reconnaissance surveys were carried out in 2019 to document pre-Project vegetation conditions within the LSMOC ROW in support of the RVMP design. Additional pre-construction vegetation surveys were carried out within the LSMOC PDA in 2020 to supplement baseline environmental information and to support environmental assessments. Select results are summarized below.

The LSMOC ROW passes through extensive peatlands comprised of bog and fen communities, as well as marsh, swamp, and upland forest communities. The plant communities were typically comprised of native species and are characteristic of undisturbed landscape across all cover types. Wetland cover types dominate the LSMOC PDA accounting for over 80% of the land cover expected to be impacted by the Project. Fens are the most abundant wetland type in the PDA, with Horizontal Fen and Stream Fen peatlands accounting for 37% and 26%, of the estimated impacted area in the PDA, respectively (WSP, 2020).

Treed wetland cover types were characterized by tamarack *(Larix laricina*) and black spruce (*Picea mariana*), with shrub species such as bog birch (*Betula pumila* sp. *glandulosa*) being abundant. These areas had groundcover vegetation that includes reed grass (*Phragmites* species), sedges (*Carex* spp.), horsetails (*Equisetum* spp.), bog rosemary (*Andromeda polifolia*) and palmate-leaved colt's foot (*Petasites palmatus*). Fen and marsh cover classes rarely had significant tree presence and only occasional pockets of shrubby vegetation such as bog birch and willow (*Salix* spp.). Groundcover was dominated by sedge species as well as mosses, and northern pitcher plant (*Sarracenia purpurea*) is a common component. Swamp cover types were characterized by a tamarack and black spruce overstory with occasional poplar, and their shrub slayers included alder (*Alnus* spp.), bog birch and Labrador tea (*Rhododendrum groenlandicum*). Upland cover types were much less prevalent throughout the LSMOC PDA, with the largest cover contributions coming from Aspen Hardwood (Forest Ecosystem Classification - V5) and Forest Cutover cover types. Aspen Hardwood Forest cover is dominated by trembling aspen (*Populous tremuloides*) and balsam poplar (*Populous balsamifera*) and featured relatively diverse herbaceous groundcover. Forest Cutover sample locations were typically characterized by young black spruce, with Labrador tea and poplar within the shrub layer and species that include bluejoint (*Calamagrostis canadensis*), marsh marigold (*Caltha palustris*), raspberry (*Rubus idaeus*) and velvetleaf blueberry (*Vaccinium myrtilloides*).

10.3.3 Non-Native Invasive Species and Weeds

During the June 2019 field survey, the LSMOC portion of the PDA was largely free of weed encroachment; however, Canada thistle (*Cirsium arvense*) and dandelions (*Taraxacum officinale*) were found in two areas. In both circumstances a small number of specimens were encountered on mineral soils within forested upland sites. Exposed upland mineral soils are generally more prone to weed encroachment than wetland soils encountered in the region.

The general lack of non-native plant species observed throughout the Project footprint is not surprising, given the undeveloped and undisturbed nature of the existing landscape. The presence of Canada thistle near the inlet location is notable and will be addressed as a priority at the start of the revegetation program

10.3.4 Wildlife Habitat

The LSMOC traverses relatively intact, remote patches of wetland and spruce-dominated peatlands. Wildlife typical of the spruce-dominated peatlands include moose, black bear, gray wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), fisher (*Pekania pennanti*), weasel (*Mustela* spp.), red fox (*Vulpes vulpes*), marten (*Martes Americana*), snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), red-backed vole and spruce grouse (*Falcipennis canadensis*). Bats also have potential to occur in this region due to the widespread availability of forest and wetland habitat.

Mammal SAR or SOCC having potential to occur along LSMOC include two bat species, little brown myotis and northern myotis (both SARA-listed as threatened) Bats forage in forest openings and over wetlands in the summer and hibernate in caves during the winter. The closest known bat hibernacula (federally designated as critical habitat) to LSMOC occurs near the communities of Gypsumville and St. Martin. Although suitable habitat types may exist for wolverine the LSMOC is outside of this species current range (COSEWIC 2014b).

SAR and SOCC having potential to inhabit riparian and/or wetland habitats along the LSMOC and/or at the outlet are trumpeter swan (MESEA-listed as threatened), horned grebe (COSEWIC-listed as special concern), least bittern (SARA-listed as threatened), yellow rail (SARA-listed as special concern), piping plover (SARA-listed as endangered), bank swallow (SARA-listed as threatened) and short-eared owl (SARA-listed as special concern). Eastern whip-poor-will (SARA-listed as threatened), common nighthawk (SARA-listed as threatened), eastern wood-pewee (*Contopus virens*; COSEWIC-listed as special concern), olive-sided flycatcher (*Contopus cooperi*; SARA-listed as threatened), golden-winged warbler (SARA-listed as threatened), rusty blackbird (SARA-listed as threatened), and evening grosbeak (SARA-listed as special concern) may inhabit forests, forest edges or forest openings along LSMOC.

Northern leopard frog (SARA-listed as special concern) has the potential to occur along LSMOC. Northern leopard frogs require shallow waterbodies for breeding, and moist upland habitats for summer foraging and dispersal (COSEWIC 1998). Snapping turtle (*Chelydra serpentina*; SARA-listed as special concern) has the potential to occur along the LSMOC where permanent waterbodies exist (COSEWIC 2008; ECCC 2020).

The only invertebrate SAR or SOCC having potential to occur along LSMOC are transverse lady beetle (COSEWIC-listed as special concern), yellow-banded bumble bee (SARA-listed as special concern), and gypsy cuckoo bumble bee (*Bombus bohemicus*; SARA-listed as endangered). All three invertebrate species have broad distributions in Canada and are habitat generalists, occupy a variety of habitats that include riparian areas, and deciduous and coniferous forests (COSEWIC 2014a, 2015, 2016).

11.0 LSMOC CONSTRUCTION PHASE

11.1 Rehabilitation Sites and Zones

The LSMOC revegetation plan can be broadly divided into active and passive revegetation zones and treatments. Areas where construction-related disturbance has occurred will be actively revegetated to an appropriate perennial native grass groundcover, while areas where vegetation clearing has occurred with limited soil disturbance will be encouraged to naturally regenerate, such as peripheral areas along the edge of the ROW. Active revegetation zones will require site preparation as well as cover soil placement and preparation prior to seeding activities. Conversely, natural revegetation zones will require much less site preparation and, depending on the rate of natural revegetation, may not require additional seeding.

11.2 Rehabilitation and Revegetation Treatments

11.2.1 Active Revegetation Zones

Following channel excavation and construction, large portions of the active revegetation zones will be composed primarily of exposed glacial till along with a mixture of other subsoil material. These exposed subsoils will require amendment with peat to be considered a suitable growth media for revegetation. Stockpiled peat and topsoil generated during channel construction will be used to amend the subsoils and create the cover soil that will be revegetated. Soil stockpiles not used in site rehabilitation will be stabilized by contouring and seeding to an appropriate perennial native grass cover.

Site Preparation and Cover Soils

Subsoil compaction will be alleviated to allow for deep seedling root penetration, which will improve long-term survival of the planting during periods of extended moisture limitation. Subsoils will be de-compacted to a depth of 20 to 30 cm using equipment such as a bulldozer with ripper teeth or tandem discs and a tractor prior to placing and blending the organics. Areas that have been heavily compacted (e.g., hauling routes and construction roads) may require multiple passes in multiple directions to alleviate compaction.

Results of field trials conducted within Reach 1 of the Emergency Outlet Channel during 2019 and 2020 suggest that an approximate depth of at least 15 cm of peat incorporated into exposed till is required to achieve satisfactory grass establishment and growth (Appendix 3A). Assuming 15 cm of peat is incorporated across this area, there is a requirement for up to 900,000 m^3 of peat for revegetation purposes after accounting for an expected loss of 30% during handling and spreading.

Organics (peat) will be spread over de-compacted subsoils using equipment and methods that avoid compacting prepared ground. Strategic staging of organics stockpiles along the ROW will allow the Contractor to efficiently place organics and minimize travel over the revegetation area. Once placed, organics will be incorporated into the mineral subsoils using discs or other suitable field-scale equipment to a depth of roughly 20 to 25 cm while ensuring organics are not buried.

The soil surface will require some level of conditioning after organic soils are placed and integrated to create seedbed conditions that will facilitate proper and consistent seed placement. Seedbed conditions must be smooth, level, firm and free of excessive woody debris to allow for accurate seed placement and consistency in the seeding rate. Firm seedbeds can also conserve moisture and facilitate good seed-to-soil contact.

Seed Mixes and Seed Sourcing

To facilitate revegetation, the LSMOC ROW has been divided into various active revegetation zones defined largely by an anticipated gradient in moisture availability from the uplands to the channel side slopes. These zones reflect patterns seen in natural communities but are also influenced by the potential for inundation during future channel operation. For the purposes of this plan, these zones are identified as the Upland Berm (UB) zone and the Lower Slope (LS) zone, with the Mid-Slope (MS) being a transitional zone between the two.

The UB zone includes sites that will regularly be subjected to drought conditions during dry summer months. In extreme wet conditions these sites may also experience flooding that will typically not exceed three to four days. Species planted in this zone will include drought tolerant native grasses well-suited to upland sites and local climatic conditions. Several species in this mix will also have a degree of flood tolerance to account for flooding potential.

The LS zone includes channel and drain side-slopes that will be periodically flooded during heavy rainfall periods and channel operation. In times of water deficit, this area may also be subjected to extended periods of drought. To account for these moisture variations, the seed mix in the LS zone will be designed using species capable of tolerating inundation as well as those adapted to drought conditions.

The transitional MS zone between UB and LS zones will be seeded to a cover that includes select species used in both the UB and LS zones.

An overview of native and tame perennial grass species that are suitable for use in the LSMOC Project setting are provided in Table 3B-1 and Table 3B-2, respectively (Appendix 3B). A summary of select growth characteristics of relevance to site revegetation are provided, including a preliminary indication of suitability to the UB and LS active revegetation zones.

Final perennial seed mixes will be developed prior to construction and finalized based on seed lot characteristics and seed availability at the onset of site revegetation. These perennial seed mixes will be designed to promote early growth and establishment as well as long-term competitiveness in seeded grass stands. Site appropriate warm season grasses will be included to reduce competition for nutrients and create a more sustainable perennial groundcover. Likewise, a site-appropriate native nitrogen-fixing species such as Canada milkvetch (*Astragalus canadensis*) will be included in the designed seed mixes, where appropriate, to improve soil fertility over time and yield a more sustainable long-term groundcover.

The final seed mixes developed for use on the LSMOC will be designed to allow for potential future haying of accessible portions of the ROW. While the remote setting of the LSMOC may present logistical constraints to regularly mowing and bailing the perennial grass stand, in times of extreme drought where local agricultural producers are in need of hay for livestock this area may present an available resource. Due to safety and

management considerations, access to the LSMOC ROW for haying purposes will be at the discretion of Manitoba Transportation.

Commercially sourced native grass seed will serve as the primary component of seed mixes employed during LSMOC revegetation work. Seed purchased for the Project would be adapted to the regional climate of the Project area. Given the substantial quantity of native grass seed required for site revegetation, seed procurement will be initiated well in advance of anticipated seeding dates to facilitate access to high quality seed lots that meet standards for weed seed content and percent purity.

Seeding Equipment and Methods

Drill seeding using a Truax brand native seed drill is the preferred method of seeding multi-species native grass seed mixes. These seed drills feature various optimization mechanisms to facilitate even and consistent placement of native seeds at the appropriate depth, they are available in a wide range of sizes, and different set-ups can be facilitated. In situations where drill seeding is not possible (e.g., too wet, too steep, or excessively rough surface conditions), broadcast seeding will be used as a back-up seeding method. Broadcast seeding requires approximately two times more seed than drill seeding and tends to result in less consistent grass establishment. Hydro-seeding should be regarded only as a last option and where other seeding methods are not feasible because this method typically does not provide the necessary seed-to-soil contact to promote reliable seed germination and seedling survival.

Native grass seeding is planned to occur in early spring, from May through mid-June. This seeding window gives establishing grasses access to spring moisture, which greatly enhances the establishment of seedlings. Seeding native grasses after mid-June exposes seedlings to periods of summer moisture deficit that can be detrimental to the establishing grasses. An alternate option is dormant seeding, which has a seeding window beginning approximately on October 20th and extending until frost or snow inhibits normal seed placement. Dormant seeding is ideal for cool season grass species but does not accommodate warm season grass species, which have seedlings that are sensitive to spring frosts.

Due to the slightly shorter growing season in the PDA, it is recommended that seeding be undertaken at the earliest possible opportunities within the recommended seeding windows. Seeding early in the recommended seeding windows helps to safe-guard planting success against uncharacteristic weather.

Erosion control cover crops can be seeded throughout the growing season, up until August 15th; however, as summer progresses the germination of seeded annual cover becomes dependent on getting a well-timed rainfall, typically, within two weeks of seeding.

Wildlife Habitat Cover Plantings

To provide improved habitat conditions for culturally important wildlife species and species of conservation concern (e.g., eastern whip-poor-will, rabbit, weasel, fox, lynx, upland game birds), native trees and shrubs will be planted in selected locations on the west side of the LSMOC. These habitat plantings will be 10 m wide and will form taller and denser cover along edges of the ROW and provide important habitat structure and resources for local fauna as committed to in the Project EIS. Habitat plantings will be focused in areas where the adjacent undisturbed land is an upland forest type to allow for continuity and connectivity to larger

patches of habitat (Figure 4). Once established, these plantings will not require on-going maintenance and they will be left to grow and mature naturally to form a plant community in relative synchrony with the adjacent upland forest habitat. Habitat cover plantings along the LSMOC ROW will be limited to the west side due to the need for on-going maintenance access along the outside drain of the east side of the ROW. Monitoring the use of cover plantings by wildlife will be completed as described in the Wildlife Monitoring Plan.

Habitat cover plantings in upland areas of LSMOC may provide foraging habitat for eastern whip-poor-will, a ground-nesting aerial insectivore that typically breeds in a variety of mature forest habitats, preferring well-drained sites that are structurally suitable with forest openings for nesting and foraging (COSEWIC 2009, ECCC 2018a). Habitat enhancements in the eastern whip-poor-will critical habitat square (Figure 4) will include only shrubs and will be done in proximity to deciduous forest on imperfectly drained soil. The Eastern Whip-poor-will Habitat Mitigation Plan provides for more information about these habitat enhancements and how they will be monitored for eastern whip-poor-will.

Fertilization and Irrigation

The Water Protection Act Nutrient Management Regulation restricts the application of nutrients within 35 m of the LSMOC due to its proximity and connection to Lake Winnipeg. In marginal soil conditions, such as those anticipated along the constructed LSMOC, a low-rate phosphorous fertilizer banded into the soil during seeding can improve the rate of establishment and growth of perennial grass seedlings. To hasten early establishment of seeded grass cover, it is recommended to supply a low rate of phosphorous fertilizer to areas of the disturbed ROW that are being actively revegetated to bring the available phosphorous levels within the range of 4 to 10 parts per million.

When native grass seed mixes are seeded following appropriate site preparation and seeding methods during the proper seeding window, irrigation is typically not needed for seedling establishment. When seeding takes place outside of the specified seeding window (after mid-June), or if unseasonable dry conditions occur throughout spring and early summer, irrigation may be required to facilitate grass establishment.

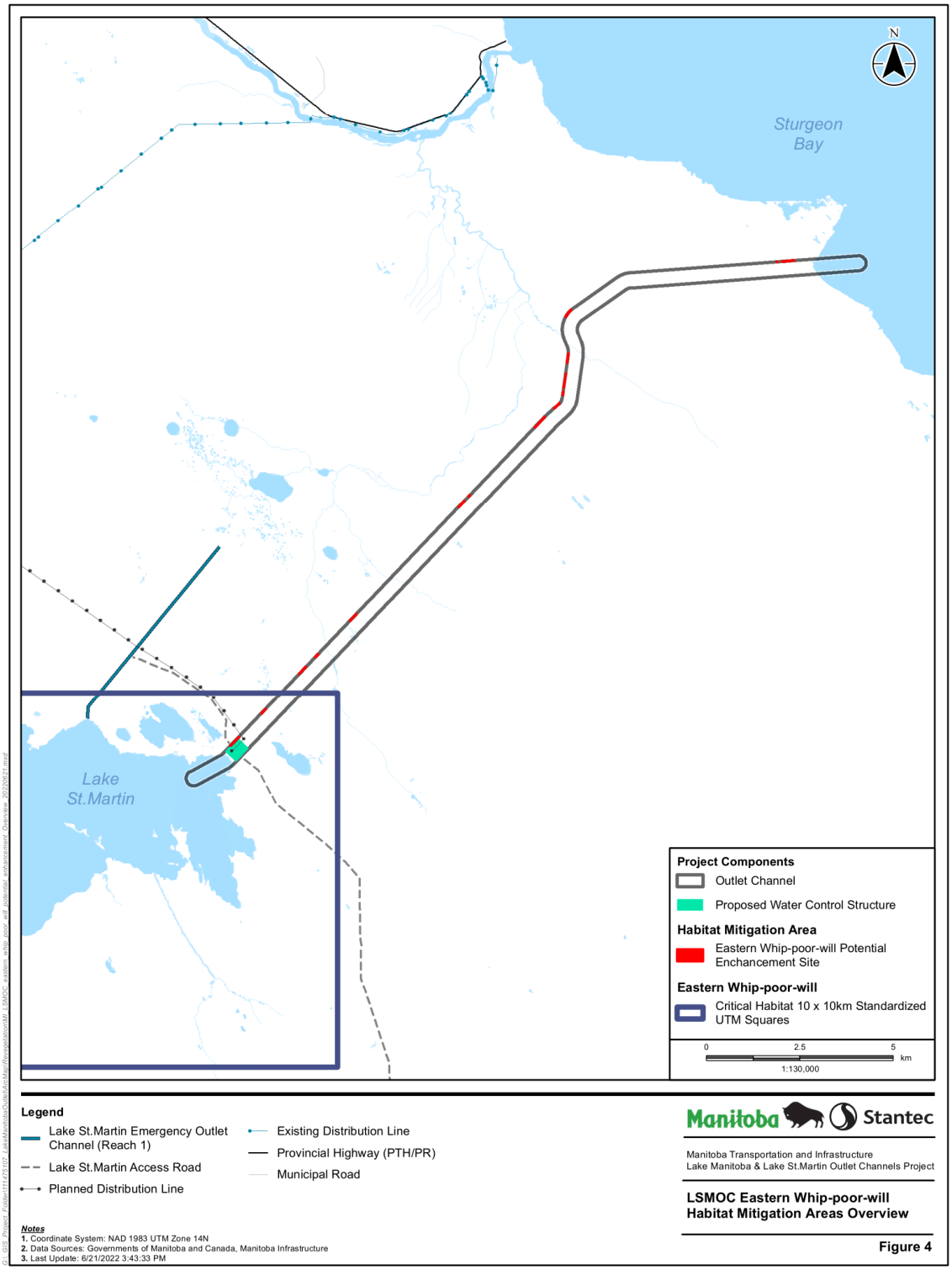


Figure 4: LSMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

11.2.2 Natural Regeneration Zones

Areas within the LSMOC ROW that are cleared but not substantially disturbed will be allowed to naturally revegetate through spontaneous regeneration. These areas will typically be along the outer periphery of the LSMOC ROW and will not include areas immediately surrounding the channel. These areas are expected to be relatively flat and will not pose a risk of active soil erosion and sedimentation. Under normal circumstances, these areas will be outside of the influence of channel operations.

Changes in light levels, soil temperatures, and hydrology will encourage a different assemblage of plant species relative to the pre-construction plant communities. However, in many cases the remaining vegetation and soil seed bank will be sufficient to rebound and re-establish healthy and sustainable cover vegetation. Pioneering woody plant species such as poplar and willow species, as well as many herbaceous species, are expected to regenerate rapidly in portions of the LSMOC ROW after tree clearing, particularly in areas with regularly high soil moisture levels.

Where channel construction has resulted in an alteration to the prevailing site conditions that differ markedly from the pre-construction conditions, some level of revegetation intervention will be needed. In these cases, seeding will be undertaken to hasten revegetation and introduce a plant cover that is better suited to altered growing conditions. Seed mixes will be specifically designed based on the post-construction site conditions to establish a functional plant cover that will support project objectives and hasten site naturalization. Site preparation and seeding methods in these areas will seek to minimize further disturbance to existing vegetation by employing low-ground pressure equipment and a minimum number of equipment passes. Surface conditions through these areas are expected to be rough and irregular due to the residual plant biomass and regenerating vegetation. Seeding will occur by broadcast seeding followed by light incorporation.

11.3 Revegetation Sequence and Schedule

Construction is currently anticipated to occur over approximately two and a half to three years followed by an additional one to two years for site clean-up, surveying and environmental offset works following the major construction works.

During construction of the LSMOC, tree clearing, soil stripping, excavation, soil handling and stockpiling will take place. Excavation of the LSMOC is anticipated to occur primarily during winter months and is expected to generate approximately 450 hectares (ha) of exposed mineral subsoils (channel/dike slopes, spoil piles made of mineral soil) that will require active revegetation treatments to establish desirable cover vegetation. As the channel construction will take place over multiple years, revegetation works will be phased into the overall channel construction to minimize the exposure of channel slopes and hasten the channel revegetation. Once a segment of the channel is fully excavated and constructed, site preparation and soil placement for revegetation will be phased in at the earliest opportunity possible.

After Project construction, access routes not required for on-going maintenance of the LSMOC will be decommissioned by contouring, de-compacting and trimming to encourage natural revegetation and will be seeded and/or planted as required.

11.4 Weed Control Operating Procedures

11.4.1 Objectives and Targets

Non-native invasive and weed species have the capacity to rapidly invade areas of disturbance and, once present, these species can expand into adjacent and interconnected natural communities. Weed management procedures have therefore been developed to mitigate the risk of weed invasion and establishment during the construction revegetation phase of the Project. Early detection and rapid response to incidences of invasive and weedy plant species is critical to ensuring small weed invasions do not become challenging infestations.

During revegetation activities, competition from weedy vegetation can result in poor native plant establishment and reduced growth rates, particularly during the first year after seeding native grass cover. By managing the weeds at this early stage, desirable plant establishment is hastened, which in turn becomes a barrier to weed invasion.

The main targets of weed management include:

- Noxious weed species as listed by the Manitoba NWA.
- Category 1 and 2 invasive species as identified by the ISCM.
- Unranked non-native plant species known to compete aggressively in native grass plantings.

11.4.2 Prevention

Where problematic weedy species are absent from landscapes prior to construction, which is the case for the LSMOC PDA, the need for pre-plant weed control is anticipated to be minimal or altogether unnecessary. In these cases, the best approach is to take appropriate steps so that weeds are not imported onto the site with machinery and equipment and to undertake proper revegetation measures on prepared sites as soon as possible.

To help avoid spreading broadleaf weeds that have been documented during site investigations, the following measures will be considered/implemented:

- Avoid stockpiling and using soils with a history of weeds or treat areas of known weed presence prior to soil salvage.
- When soils with a history of weeds must be used as growth media, the Owner should direct Environmental Monitors to inspect stockpiles for weeds and undertake appropriate weed control measures, including herbicide applications where required. Herbicide application will not occur within a 30 m setback from waterbodies and fish habitat, and they shall be handled and used under a pesticide use permit as described in the PERs (Section 2.6.4).

- Maintain equipment and machinery in a clean and weed-free state prior to reaching the Project site.
- Initiate revegetation process as soon as possible following channel construction to limit opportunities for weeds to invade and establish on-site.

11.4.3 Thresholds for Action

The management threshold for weed control action will depend on the species of weed detected. Tier 1 noxious weeds or Category 1 invasive species detected should be destroyed or eradicated immediately upon discovery. Identification of Tier 2 noxious weeds or Category 2 invasive species should prompt follow-up investigation to determine the full extent and distribution of the weed population, followed by an appropriate treatment response. Tier 3 species as well as unranked non-native plant species that could pose a risk to integrity of the planting or adjacent communities that are detected on the LSMOC ROW will be monitored in an ongoing fashion. Where it is determined that these species present a threat to native vegetation communities, or the successful establishment of desirable cover vegetation, appropriate treatment response will be implemented.

To help avoid spreading weeds that have been documented during site investigations, treatment measures established by Manitoba Transportation and Infrastructure and the following actions are recommended:

- Weed and Invasive Species Control:
  - destroy all tier 1 noxious weeds found within the PDA;
  - destroy all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is less than five acres;
  - control all tier 2 noxious weeds found within the PDA if the contiguous area colonized by the weeds is five acres or more;
  - control tier 3 noxious weeds and invasive species found within the PDA if the weed's uncontrolled growth or spread is likely to negatively affect an aspect of Manitoba's economy or environment in the areas adjacent to the PDA or the well-being of residents (e.g., individual agricultural producer or farm operation) in proximity to the PDA; and
  - prevent the spread of noxious weeds (tier 1, tier 2 and tier 3) or invasive species originating within the PDA to lands and waters beyond the PDA boundaries. Additional measures for surrounding farmland are described in the AgBMP. Areas of weed infestations are considered RAZ under the AgBMP and require special management measures to protect agricultural biosecurity in agricultural areas outside of the Project ROW. Areas of weed infestations require a site-specific management and monitoring plan for treatment, as previously described in Section 3.2.

11.4.4 Methods and Treatments

Treatment approaches and methods for weed control will be developed at the construction phase on a site and situation-specific basis depending on results of on-going monitoring. Specific treatment will be developed in response to the target species in question and will be influenced by the extent and distribution of the weed population. Weed control will follow integrated approaches that include mechanical treatment (mowing, cutting, and cultivation), targeted herbicide application, and active revegetation. While prescribed burns are used as a management tool for native prairie grass stands this is not anticipated to be a viable approach along the LSMOC, given site-specific considerations and implications. Treatment approaches will seek to minimize impacts to non-target vegetation while achieving maximum long-term control on the target species. Treatment approaches should be developed in consultation with professional personnel with local expertise in integrated weed management and weed control in natural settings and perennial grass stands.

11.5 Erosion and Sediment Control

Erosion and sediment control is a major consideration in the construction and revegetation of the LSMOC. Perennial vegetation is typically considered a stable erosion protection measure once 75% live groundcover has been achieved. To achieve this level of consistent vegetative cover, temporary and alternative measures are needed to prevent soil loss and allow for establishing vegetation to take hold. The approaches described below are intended to supplement the SMP during site rehabilitation and revegetation.

11.5.1 Site Preparation and Grading Approaches

Site preparation and grading approaches will be implemented to reduce the likelihood of soil erosion and sediment loss. For example, organic stockpiles will be windrowed strategically to control water runoff and reduce rill formation on the side slopes prior to soil placement and incorporation. Likewise, throughout the revegetation process surface conditions will be left in a rough, unfinished state to reduce overland water velocity and minimize erosion.

11.5.2 Temporary Cover Crops and Nurse Crops

Temporary cover crops and nurse crops are a cost-effective way to stabilize soils during periods where perennial vegetation has not been seeded or has not yet established sufficiently to provide soil protection. During the revegetation of the LSMOC, cover crops will be used to mitigate erosion risks in prepared soils that cannot be seeded to perennial cover due to the seasonal timing of soil preparation (i.e., during hot summer conditions). Likewise, nurse crops will be included within the seed mixes during perennial seeding activities to provide erosion protection during early seedling growth and establishment.

Areas that cannot be prepared and seeded during the May to mid-June seeding window can still be prepared throughout the growing season, and once soil has been placed and incorporated, these areas can be protected by seeding an annual cereal crop like common oats (*Avena sativa*). Common oats will be seeded until mid to late August, but late summer seeding may yield poor plant establishment due to high temperatures and low moisture availability.

Perennial grass seed mixes should include an annual nurse crop component composed of an annual cereal crop like common oats, at a rate of approximately 5.6 to 8.9 kilograms/ha when revegetating an erodible slope. The fast-growing annual crop species facilitate native grass seedling establishment by assisting in erosion protection during early establishment, while also serving to improve soil conditions and competing with undesirable weed species.

11.5.3 Erosion Control Materials/Products

Manufactured erosion control products may be used strategically in areas that pose the greatest risk of erosion and where impacts of erosion are most detrimental. Additional detail on the use of erosion control materials and products can be found in the SMP.

12.0 LSMOC OPERATIONS PHASE

Revegetation activities required during the operations phase of the Project will primarily relate to the frequency and duration of channel operation. The duration, frequency, timing, and magnitude of channel operation will affect the health and rigor of all planted species. Prolonged channel operation may result in periods of inundation that exceed the inherent flood tolerance of species planted on the side slopes. In this scenario, vegetation die-off will leave gaps in plant cover. Likewise, extended periods of drought, particularly during early stages of revegetation, can result in weak or inconsistent plant cover, potentially leading to a requirement for remedial revegetation.

The following section describes the approach to remedial revegetation after channel operation, as well as long-term management consideration relating to weed control and vegetation management.

12.1 Weed Control

Weed control during operation and maintenance will be directly influenced and largely informed by the initial post-construction revegetation outcomes of the LSMOC. That being the case, the current weed control plan is considered generic and will be updated to reflect existing site conditions following the completion of revegetation and during the initial years of the operation and maintenance phase.

Elements of an integrated management plan include:

- prevention
- identification
- monitoring
- thresholds for action
- treatment approaches and methods
- evaluation

12.1.1 Prevention

Preventing introduction of non-native and invasive species is the most effective method of weed control. Preventative measures are particularly important during construction and revegetation while the site is disturbed and subject to introductions, largely via equipment, construction materials, and seed. During operations, prevention will be achieved by thorough follow-through on any outstanding weed control issues left following revegetation and by maintaining established controls over seed import via vehicle access and in seed mixes used for remedial seeding.

Heathy and undisturbed native vegetation communities are inherently resistant to invasion of non-native species. Monitoring the condition of vegetation for signs of decline and limiting disturbances to established vegetation will provide opportunities for preventing conditions that will encourage introductions of non-native and invasive plant species. There is no foreseeable way to prevent the introduction of weed seed via

wildlife and water conveyance during channel operation. Regular monitoring will serve to mitigate the risk of invasion over long-term operations of the LSMOC.

12.1.2 Identification

The primary target vegetation to be controlled on the LSMOC ROW are noxious and invasive species, specifically those listed in *The Noxious Weeds Act* and those identified by the ISCM (2020) as Category 1 and Category 2 species (Appendix 1A). Unranked non-native plant species with potential to impact the integrity of the planting area or adjacent communities will also be documented and tracked as part of the weed control monitoring.

12.1.3 Monitoring and Reporting

Monitoring and reporting requirements for weed control are described in Section 13.0. These include opportunistic visual assessment across the entire LSMOC ROW (on-going throughout operations phase) as well as annual targeted visual assessment in areas adjacent to roads, quarries, and other disturbed areas. When remedial revegetation works are required after channel operation, follow-up monitoring of revegetation outcomes will include a survey for weed establishment.

Any detection of Tier 1 noxious weed or Category 1 invasive species will be immediately reported to the ISCM and uploaded to the early detection and distribution mapping system for the Prairie Region (Manitoba and Saskatchewan). Weed control activities will be documented and reported on annually, complete with results from follow-up monitoring and assessment of treatment efficacy.

12.1.4 Thresholds for Action

The management threshold for weed control action will depend on the species of weed detected. Any Tier 1 noxious weed or Category 1 invasive species detected will be destroyed or eradicated immediately upon discovery. Identification of any Tier 2 noxious weed or Category 2 invasive species will prompt follow-up investigation to determine the full extent and distribution of the weed population, followed by an appropriate treatment response. Tier 3 species and unranked non-native plant species that are detected on the LSMOC ROW will be monitored in an on-going fashion. Where it is determined that these species present a threat to native vegetation communities, or the successful establishment of desirable cover vegetation, appropriate treatment response will be implemented.

12.1.5 Treatment Approaches and Methods

Treatment approaches and methods to weed control during the operations phase will be developed on a site and situation-specific basis in response to the target species in question and will be influenced by the extent and distribution of the weed population. Weed control will be achieved by following integrated approaches that include mechanical treatment (mowing, cutting, and cultivation), targeted herbicide application, and active revegetation. While prescribed burns are used as a management tool for native prairie grass stands, it is not anticipated that this would be a viable approach along the LSMOC, given site specific considerations

and implications. In all cases, treatment approaches will seek to minimize impacts to non-target vegetation while achieving maximum long-term control on the target species. Treatment approaches will be developed in consultation with professional personnel with local expertise in integrated weed management and weed control in natural settings and perennial grass stands.

12.1.6 Evaluation

Evaluation is a key component of the integrated weed management program for the operation and maintenance phase. Weed control activities will be evaluated during follow-up monitoring to determine if additional measures are required and to inform future management and treatment approaches through the adaptive management framework.

12.2 Vegetation Management

As the LSMOC ROW is revegetated and construction activities subside, the site will enter a period of naturalization where species that are adapted to the prevailing site conditions will begin to colonize the site. The adjacent forested environments will act as a catalyst for the encroachment of woody vegetation along the ROW peripheries and in places of higher regular soil moisture. Over time, the control of woody species will be required to allow for safe and efficient operation of the channel. As the channel is operated, impacts to cover vegetation may occur, prompting remedial seeding.

12.2.1 Remedial Revegetation

When channel operation results in the die-off of established cover vegetation, some degree of remedial seeding may be required to mitigate the potential for erosion. The approach to remedial seeding will depend on the site conditions once the water levels drop for a prolonged period. Post-operation monitoring and site assessment, conducted once there is no projection of additional flooding, will inform all subsequent activities. If results of site assessments suggest that the reasons for vegetation cover failure cannot be overcome, alternative long-term solutions will be considered. Remedial activities will reflect site conditions at the time of assessment and are subject to change if remedial activities are not implemented in a timely fashion. Greatest efficiencies and most reliable revegetation outcomes are realized when small disturbances are corrected upon their detection. Small impacts to vegetation left un-corrected can quickly degrade resulting in more costly and time-consuming remedial work. Recommended management thresholds for remedial revegetation activities are described in Section 14.0.

12.2.2 Channel Maintenance

Over time, naturally-establishing woody vegetation along the channel will require management so that this vegetation does not impact its hydraulic function. Willow (*Salix spp*.) and poplar (*Populus spp*.) species, in particular, are common pioneering species along water conveyance and drainage features where soils are wet but periodically dry down.

13.0 LSMOC MONITORING

Revegetation monitoring will be conducted on a regular basis during the construction and operation phases to identify erosion and other noticeable incidents, to monitor the condition of cover vegetation and to monitor for Project impacts to adjacent vegetation and plant communities. The results of this monitoring will be presented in regulatory monitoring and inspection reports on the Project website. All monitoring programs will be documented using a computer-based geographic information system (ESRI's ArcGIS) and will include GPS locations and photos of the monitoring sites and monitoring parameters.

During construction and revegetation, cover establishment will be monitored to confirm that surface erosion and sedimentation are effectively controlled. Likewise, the LSMOC ROW and some adjacent areas will be monitored to mitigate the risk of noxious or invasive non-native plant species establishment during this phase. Adjacent native plant communities will be monitored for changes in composition and structure.

During operations, cover vegetation will be monitored after channel operation to detect any loss of perennial cover due to flooding. Monitoring for non-native and invasive weed establishment are planned to continue during operations, and adjacent native plant communities may be monitored for changes in composition and structure.

Wetland mapping will be evaluated to identify potentially affected wetlands, as further described in the WCP. Manitoba Transportation and Infrastructure will follow the requirements of the Manitoba WRA and its regulations for wetland compensation on this Project. Wetland compensation will include wetland creation, and wetland enhancement or restoration.

Updates, amendments, and supplementary submissions related to Project design and Project-VC interactions will be incorporated into the scope of the monitoring program for the RVMP through the adaptive management framework. For example, as information from on-going vegetation surveys are made available, newly detected locations of invasive species will inform specific construction phase treatment plans. Likewise, detection of plant species of conservation concern or of cultural importance will inform and may direct aspects of the construction and operation phase monitoring plans.

13.1 Construction Phase Monitoring

During the construction phase of the Project, monitoring will be performed to evaluate and assess the condition of the LSMOC ROW cover vegetation as well as the potential impacts of the Project on adjacent vegetation and upland and wetland plant communities.

13.1.1 Monitoring Cover Vegetation

The establishment and condition of cover vegetation will be closely monitored throughout the site revegetation process (minimum 3-years) so that any potential issues are detected and acted upon rapidly. When remedial revegetation work is required in an area, the monitoring timeline for the area will be re-set

and 3-year monitoring restarted. The entire LSMOC ROW will be surveyed for plant establishment and condition; sampling will occur throughout each active revegetation zone as well as natural revegetation areas. Surveys will be conducted twice annually, likely in June and September, and biennial reporting will be provided. Information collected during revegetation monitoring includes:

- species
- seedling density
- percent live cover
- percent dead cover
- percent bare ground
- photographs
- site conditions (including visible dust deposits, erosion and weed presence)

The introduction of non-native and invasive species will be monitored through opportunistic visual assessments across the entire LSMOC ROW during regular environmental monitoring duties. Any detection of invasive species will be reported immediately to allow for rapid response and remedial action. Information that will be collected whenever weeds are detected includes:

- species of weed
- extent of weed cover (by species)
- full description of existing vegetation
- site conditions
- geo-referenced location
- photography

13.1.2 Monitoring for Effects on Vegetation

Monitoring will describe baseline conditions and track changes in community composition over time, allowing an accurate description of the effects of LSMOC on adjacent upland and wetland vegetation communities. The vegetation monitoring program includes permanent sample transects running perpendicular to the LSMOC ROW. Permanent sample transects are situated strategically to capture the full diversity of vegetation community types present along the LSMOC ROW while accounting for relative abundance of each community type. Baseline information on vegetation community structure will be collected at each selected permanent sample location, and again once annually, within a two-week window during the summer (likely July 15-30) for the duration of the construction phase. Site photographs will be taken, and site conditions will be described, including comments on visible dust deposits, erosion, and weed presence. Parameters that will be measured include:

- species
- diameter at Breast Height (DBH)
- percent alive canopy
- score

To monitor for the invasion and establishment of non-native invasive or weed species, surveys will be conducted twice annually during the LSMOC construction phase. These will focus on native vegetation communities adjacent to haul roads, roads, quarry and borrow areas and other areas identified as having a high likelihood of weed invasion. The first survey would occur between June 15-30 and the second would occur from August 1-15 to capture the full range of cool and warm season weeds that could establish. To maximize the area covered by each survey, visual assessment (presence/absence) as described by meander surveys throughout identified high likelihood areas will be used. Information that will be collected whenever weeds are detected includes:

- species of weed
- extent of weed cover (by species)
- full description of existing vegetation
- site conditions
- geo-referenced location
- photography

13.2 Operations Phase Monitoring

During the operations phase of the Project, monitoring will be performed at least once per year between June 15 and August 15 to assess the condition of the LSMOC ROW cover vegetation following maintenance activities and channel operation, as well as to evaluate the potential impacts of the Project on adjacent vegetation and upland and wetland plant communities.

13.2.1 Vegetation Condition Following Channel Operation

Monitoring and assessment of vegetation conditions should be completed three weeks after high water levels have receded. This delay in monitoring will allow any live cover vegetation to re-sprout and an accurate assessment of any vegetation dieback can be made. Since the effects of flooding will be confined to the channel side slopes, all monitoring activities related to channel operation will be restricted to this area. Monitoring efforts will seek to achieve full coverage of the channel alignment, when possible. Aerial imagery or the use of a drone may be used to expedite initial monitoring, but follow-up ground monitoring is required for any areas with significant vegetation die-back. Information collected during post-operation monitoring includes:

- species
- height
- number of live plants (by species)
- number of dead plants (by species)
- percent cover live plants (by species)
- percent cover dead plants (by species)
- photographs
- site conditions (including erosion and weed presence)

13.2.2 Effects on Vegetation

Operations phase monitoring will track changes in adjacent community composition over time, allowing an accurate description of the effects of the LSMOC on adjacent upland and wetland vegetation communities. The vegetation monitoring program includes permanent sample transects running perpendicular to the LSMOC ROW. Permanent sample transects will be situated strategically to capture the full diversity of vegetation community types present along the LSMOC ROW while accounting for relative abundance of each community type.

Information on vegetation community structure will be collected at each selected permanent sample location annually within a two-week window during the summer (likely July 15-30) for up to the first three years after construction has completed. Following this annual monitoring phase, consideration will be given to reducing sampling frequency to a bi-annual interval. During monitoring, site photographs will be taken, and site conditions will be described, including comments on visible dust deposits, erosion, and weed presence. Parameters that will be measured include:

- species
- height
- diameter at breast height (DBH)
- percent alive canopy
- health score

Changes in hydraulics that may affect wetland function will be assessed against the baseline conditions to confirm Project EIS predictions.

The operations phase monitoring approach for introduction of non-native and invasive species will be informed by the outcomes of site revegetation and the associated monitoring. If infestations of listed noxious weeds are present on or near the LSMOC PDA, biennial monitoring as described in Section 12.1.3 shall continue. Once listed noxious weeds or invasive species have been successfully treated site, long-term monitoring can shift to an annual interval. Surveys will follow a visual assessment approach to maximize area coverage. Visual assessments of pre-determined locations will be conducted, and opportunistic observations of weed establishment during normal site visits and inspections will be made. When monitoring has shifted to an annual interval, the period of June 15-30 will be used for field surveys to maximize the detection of problematic weed species. When detected the following information about non-native and invasive plant species will be recorded:

- species of weed
- extent of weed cover (by species)
- full description of existing vegetation
- site conditions
- geo-referenced location
- photography

14.0 LSMOC ADAPTIVE MANAGEMENT AND FOLLOW-UP

14.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The *Canadian Environmental Assessment Act 2012* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicates that "a follow-up program is used to:

- verify predictions of environmental effects identified in the EA
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects
- provide information on environmental effects and mitigation that can be used to improve and/or support future EAs including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects.

As discussed in Project EIS (Volume 5, Section 12.6), vegetation monitoring will examine how predicted changes to vegetation species diversity and wetlands will be verified and how the effectiveness of mitigation strategies (e.g., revegetation) will be evaluated. As described in Section 13 of this RVMP, shortly after construction, monitoring, and thresholds for adaptive management will be focused on assessing and responding to the rate of establishment of a healthy vegetation cover, and the quick recognition and mitigation of soil erosion. To avoid growth and establishment of regulated weeds, topsoil and subsoil piles will be monitored for weed growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented where necessary. Areas of poor vegetation growth will also be identified for additional seeding.

Although the methods and recommendations outlined in the SMP were developed based on site-specific expectations and conditions, it is accepted that these conditions are subject to change. For example, weather conditions and climate change will inevitably drive some of the decisions during construction and long-term operation. By employing adaptive management strategies, assumptions used in the initial design will be evaluated and management practices modified in response to the outcomes during the Project construction period and subsequent operation phase based on baseline investigations, follow-up monitoring and reporting.

Adaptive management uses the Project designs, while learning from field performance to manage risk and allow the incorporation of new knowledge into subsequent steps. The foundation of this process relies on data input and implementation of sound monitoring programs. Based on the monitoring results and feedback during construction, temporary measures described in this RVMP, as well as those included in the SWMP and SMP, should be revisited and updated, as required. For example, if the establishment of vegetation following excavation work is more difficult than expected, alternate vegetating methods will be considered, or additional temporary erosion control measures may be warranted. Adaptive management will play an important role in acknowledging and working through management challenges in the presence of uncertainty.

14.2 Follow Up Response

As described in Section 13, monitoring will include monitoring of cover vegetation establishment and Project effects on vegetation. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental licensing requirements. Management thresholds developed as part of the monitoring plan utilize regulated criteria, input from rights-holders, stakeholders and regulators, and consideration of findings from applicable management plans. Based on the management thresholds and the results of the vegetation monitoring program, follow up activities will be implemented where conditions recorded appear to be outside of anticipated seasonal fluctuations of vegetation cover. For example, if there are areas where cover vegetation does not establish sufficiently, it may warrant remedial action. If certain grass species are documented to better perform in certain locations/situations than other planted species, future seed mixes can be adjusted to include higher rates of the successful species.

14.2.1 Construction Phase

During the construction phase observations on the condition of the cover vegetation and adjacent plant communities may prompt remedial revegetation activities, or corrective weed control treatments. At the end of the first growing season, active revegetation zones seeded to perennial vegetation should show a minimum of six mature grass seedlings per 0.1 m^2. Areas that do not meet these criteria will warrant re-enforcement seeding or full re-seeding during the next available seeding window. In the natural revegetation zones, revegetation mitigation actions will be triggered if after one full growing season, no native vegetation has established, and active soil erosion is observed. In subsequent years, revegetation targets for the active revegetation zones are 70% cover establishment with no signs of rill erosion.

Re-enforcement seeding should only be done by drill seeding to limit disturbance to other seedlings present while full re-seeding can be done following either method as described in Section 11.2.1. Areas with insufficient perennial cover should be protected by seeding a temporary cover crop until they can be seeded to perennial cover. Follow-up monitoring and remedial revegetation activities shall be continued until sufficient cover has established to mitigate the risk of erosion.

The management threshold for weed control mitigation action will depend on the species of weed detected. Tier 1 noxious weeds or Category 1 invasive species detected should be destroyed or eradicated immediately upon discovery. Identification of Tier 2 noxious weeds or Category 2 invasive species should prompt follow-up investigation to determine the full extent and distribution of the weed population, followed by an appropriate treatment response. Tier 3 species as well as unranked non-native plant species that are detected on the LSMOC ROW will be monitored and if it is determined that these species present a threat to native vegetation communities, or the successful establishment of desirable cover vegetation, appropriate treatment response will be implemented.

Treatment approaches and methods for weed control will be developed on a site- and situation-specific basis in response to the target species in question and will be influenced by the extent and distribution of the weed population. Weed control will follow integrated approaches that will include mechanical treatment (mowing, cutting, and cultivation), targeted herbicide application, and active revegetation.

Table 4 summarizes the criteria indicators, methods and thresholds that will be used to assess the revegetation success and any adaptive management that may need to be implemented during the construction phase monitoring of LSMOC.

Table 4: Indicators, Threshold and Targets for Measuring Revegetation Success

Indicators	Measure	Method	Targets	Timeline for Surveys	Thresholds	Mitigations for Adaptive Management
Soil Moisture Regime	Estimate in field (e.g., soil depth; texture; landscape position)	Test for soil moisture in the field (conditions that the vegetation is growing in)	Within the natural range of species planted	First year after soil replacement	Sufficient soil moisture for plant survivorship.	Understanding soil moisture levels in the LSMOC main channel and Outside Drain may need adjustments depending on final moisture levels achieved.
Plant Cover in Active Revegetation Zones	Cover (%) and seedling density	Survey plots (count/species)	Year 1: Minimum 6 seedlings per 0.1m^2 Year 2-3: 70% cover with no signs of rill erosion	First three years after revegetation	Less than 50% survivorship	Additional site prep needed or adjust seed mix for species that show good survivorship.
Plant Cover in Natural Revegetation Zones	Cover (%) and seedling density	Survey plots (count/species)	Year 1: >15% cover with no active erosion	First three years after revegetation	<15% cover with signs of active erosion	Active revegetation methods as described in Section 12.2.1

Indicators	Measure	Method	Targets	Timeline for Surveys	Thresholds	Mitigations for Adaptive Management
Habitat Cover Planting Zones	Other woody plants (shrubs)	Survey plots (species diversity)	>2 shrub species survive with 40% cover, no weeds and wildlife use	First three years after revegetation	< 2 shrub species	Complete infill planting with a more tolerant species based on the establishment of naturally regenerated species or planted stock.
Weed Control	Management of weeds	Survey plots; site observations	Absence of noxious and invasive weeds	First three years after revegetation	Non-compliant with the *Noxious Weeds Act;* unranked species at densities that can impact planting	Remove noxious weeds. Note: if cover is less than 50% after weed removal reseed areas.

14.2.2 Operations Phase

During the operations phase monitoring, observations of the condition of the cover vegetation following channel operation may prompt remedial revegetation activities, or corrective weed control treatments. Thresholds for remedial revegetation activities following channel operation will depend on both the extent of vegetation dieback as well as the risks associated with erosion. Remedial revegetation activities will be required in sections of the channel side slopes if:

- more than 20% of the vegetative cover has been lost and active erosion is occurring, or
- more than 40% of the vegetation cover has been lost, regardless of active erosion.

The following recommendations are designed to guide decision-making where the objective is re-establishing cover vegetation that was lost following channel operation. These thresholds should be continually revisited following channel operation to adjust and optimize remedial responses based on evaluation of the effectiveness of remedial activities.

Dieback <20%

- Do nothing unless substantial active erosion is occurring. Correct erosion through surface preparation and seeding.

Dieback 20-40%

- Wait and see unless substantial active erosion is occurring. Correct erosion through surface preparation and seeding.

Dieback >40%,

- When plant dieback without excessive soil erosion is encountered, direct seeding priority areas with a drill seeder is the preferred method for remedial seeding. The drill seeder can be engaged and disengaged as machinery passes through vegetative cover and seeding can target priority areas.
- If soils have been eroded in areas of plant dieback, soil preparation will need to take place prior to seeding work. The amendment of eroded soils with peat moss may be required prior to seeding. In these cases, site conditions will typically favour broadcast seeding methods.
- The assessment of plant species dieback will inform adjustments to the remedial seed mix design. Seed mix rates and species composition will be adjusted accordingly based on the how the vegetative cover responds to flooding

While monitoring for effects to adjacent plant communities, detections of non-native invasive or weed species will prompt corrective weed control. The management thresholds for weed control mitigation action will depend on the species of weed detected. Management thresholds and mitigation actions during the operations phase will remain consistent with those described in Section 14.2.1.

Finally, in some cases, there may be a need for vegetation management due to safety, access, and operational considerations. Control of woody vegetation in the LSMOC ROW is warranted when it:

- impedes safe use of the ROW
- restricts site access
- impacts hydraulic conditions within the channel outside of the designed operational range.

In order to manage the encroachment of woody species, Manitoba Transportation and Infrastructure will follow an Integrated Vegetation Management (IVM) strategy to control woody plant growth as required. Typically, an IVM includes the following principles (Manitoba Hydro 2019):

- remove tall, woody vegetation where required
- encourage the establishment of low-growing, ecologically appropriate plant species that can inhibit the establishment of taller woody species
- allow for a shared use of the project area with local peoples
- respect culturally important plant species and potential harvesting sites

There are several options for controlling woody vegetation in the LSMOC ROW; they include mowing, brushing, girdling, and blading. Another option for control is the use of herbicide application. Selection of herbicides and application methods for vegetation management must be considerate of the proximity to the waterway and potential for downstream transport to Lake Winnipeg. Methods and products should be developed in consultation with a professional agronomist in compliance with applicable provincial and federal regulations. Broadcast application methods must be avoided in proximity to the channel. There are numerous methods to conduct herbicide applications on woody vegetation; they include the following application options:

- basal bark method
- cut surface
- selective foliar
- broadcast foliar
- injections

15.0 LSMOC REFERENCES

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 1998. COSEWIC assessment and status report on the Northern Leopard Frog (*Rana pipiens*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 40 pp.

COSEWIC. 2008. COSEWIC assessment and status report on the Snapping Turtle *Chelydra serpentina* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 47 pp.

COSEWIC. 2014a. COSEWIC assessment and status report on the gypsy cuckoo bumble (*Bombus bohemicus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 56 pp.

COSEWIC. 2014b. COSEWIC assessment and status report on the wolverine (*Gulo gulo*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xi + 76 pp.

COSEWIC. 2015. COSEWIC assessment and status report on the yellow-banded bumble bee (*Bombus terricola*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 60 pp.

COSEWIC. 2016. COSEWIC assessment and status report on the transverse lady beetle (*Coccinella transversoguttata)* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xi + 57 pp.

EEI (EcoLogic Environmental Inc.). 2017a. Lake Manitoba outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.

EEI (EcoLogic Environmental Inc.). 2017b. Lake St. Martin outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.

Environment and Climate Change Canada (ECCC). 2020. Management Plan for the Snapping Turtle (Chelydra serpentina) in Canada. Species at Risk Act Management Plan Series. Environment and Climate Change Canada, Ottawa, iv + 40 p.

Manitoba Hydro, 2019. Bipole III Transmission Project – Integrated Vegetation Management Plan. Licensing and Environmental Assessment Department.

WSP. 2020. Lake Manitoba and Lake St. Martin Outlet Channel Project: preconstruction environmental field work. Winnipeg, MB.

APPENDIX 1A

Plant Species Listed in the NWA and ISCM as of 2020

Designated Tier 1 Noxious Weeds Common name	Scientific name	Area for which Designation applies
Amaranth, Palmer	*Amaranthus palmeri*	Whole province
Bartsia, red	*Odontites vernus*	All areas of the province outside the Municipality of Bifrost-Riverton and the Rural Municipalities of Armstrong, Fisher, Gimli, Rockwood, St. Andrews and St. Clements
Crupina, common*	*Crupina vulgaris*	Whole province
Cupgrass, woolly *	*Eriochloa villosa*	Whole province
Goatgrass, jointed*	*Aegilops cylindrica*	Whole province
Hawkweed, orange	*Hieracium aurantiacum*	Whole province
Hogweed, giant	*Heracleum mantegazzianum*	Whole province
Hound's-tongue	*Cynoglassum officinale*	Whole province
Knapweed, diffuse*	*Centaurea diffusa*	Whole province
Knapweed, Russian*	*Acroptilon repens*	Whole province
Knapweed, spotted*	*Centaurea stoebe*	Whole province
Knapweed, squarrose	*Centaurea virgata*	Whole province
Knotweed, Japanese	*Fallopia japonica*	Whole province
Mile-a-minute weed*	*Persicaria perfoliata*	Whole province
Mustard, garlic	*Allaria petiolata*	Whole province
Patterson's curse*	*Echium plantagineum*	Whole province
Pigweed, smooth	*Amaranthus hybridus*	Whole province
Saltcedar*	*Tamarix ramosissima*	Whole province
Star-thistle, yellow*	*Centaurea solstitialus*	Whole province
Tussock, serrated	*Nassella trichotoma*	Whole province
Waterhemp, tall	*Amaranthus tuberculatus*	Whole province
Designated Tier 2 Noxious Weeds		**Area for which Designation applies**
Alyssum, hoary	*Berteroa incana*	Whole province
Baby's-breath	*Gypsophila paniculata*	Whole province
Bartsia, red**	*Odontites vernus*	Municipality of Bifrost-Riverton and the Rural Municipalities of Armstrong, Fisher, Gimli, Rockwood, St. Andrews and St. Clements
Bouncingbet**	*Saponaria officinalis*	Whole province
Brome, downy**	*Bromus tectorum*	Whole province
Brome, Japanese**	*Bromus japonicas*	Whole province
Campion, bladder	*Silene vulgaris*	Whole province
Chamomile, scentless** ¥	*Matricaria perforata*	Whole province
Common reed, invasive**	*Phragmites australis australis*	Whole province
Daisy, ox-eye** ¥	*Leucanthemum vulgare*	Whole province
Nutsedge, yellow	*Cyperus esculentus*	Whole province
Scabious, field**	*Knautia arvensis*	Whole province
Spurge, Cypress	*Euphorbia cyparissias*	Whole province
Spurge, leafy**	*Euphorbia esula*	Whole province
St. John's-wort**	*Hypericum perforatum*	Whole province
Tansy, common**	*Tanacetum vulgare*	Whole province
Thistle, nodding** ¥	*Carduus nutans*	Whole province
Toadflax, Dalmatian**	*Linaria dalmatica*	Whole province
Designated Tier 3 Noxious Weeds **Common name**	**Scientific name**	**Area for which Designation applies**
Absinth	*Artemisia absinthium*	Whole province
Barberry	*Berberis vulgaris*	Whole province
Barley, foxtail	*Hordeum jubatum*	Whole province
Bellflower, creeping	*Campanula rapunculoides*	Whole province
Buckthorn, European**	*Rhamnus cathartica*	Whole province
Burdock, common	*Arctium minus*	Whole province
Burdock, greater ¥	*Arctium lappa*	Whole province
Burdock, woolly	*Arctium tomentosum*	Whole province
Campion, biennial	*Silene dioica*	Whole province
Catchfly, night-flowering	*Silene noctiflora*	Whole province
Cleavers	*Galium aparine*	Whole province
Cleavers, false	*Galium spurium*	Whole province
Cockle, white	*Silene alba*	Whole province

Designated Tier 3 Noxious Weeds Common name	Scientific name	Area for which Designation applies
Dandelion, common*** ¥	*Taraxacum officinale*	Whole province
Dodder	genus *Cuscuta*	Whole province
Fleabane, Canada	*Conyza canadensis*	Whole province
Flixweed	*Descurainia sophia*	Whole province
Hawk's-beard, narrow-leaved	*Crepis tectorum*	Whole province
Hemlock, poison	*Conium maculatum*	Whole province
Hemp-nettle ¥	*Galeopsis tetrahit*	Whole province
Hoary-cress	*Cardaria draba*	Whole province
Jimsonweed	*Datura stromonium*	Whole province
Kochia	*Kochia scoparia*	Whole province
Lamb's quarters	*Chenopodium album*	Whole province
Lettuce, prickly	*Lactuca serriola*	Whole province
Milkweed, common	*Asclepias syriaca*	Whole province
Milkweed, showy	*Aslepias speciosa*	Whole province
Mustard, wild	*Sinapis arvensis*	Whole province
Nightshade, American black	*Solanum americanum*	Whole province
Nightshade, cutleaf	*Solanum triflorum*	Whole province
Nightshade, hairy	*Solanum sarachoides*	Whole province
Parsnip, wild ¥	*Pastinaca sativa*	Whole province
Ragweed, common	*Ambrosia artemisiifolia*	Whole province
Ragweed, false	*Iva xanthifolia*	Whole province
Ragweed, giant	*Ambrosia trifida*	Whole province
Sow-thistle, annual	*Sonchus oleraceus*	Whole province
Sow-thistle, perennial ¥	*Sonchus arvensis*	Whole province
Sow-thistle, spiny annual	*Sonchus asper*	Whole province
Stinkweed	*Thlaspi arvense*	Whole province
Stork's bill	*Erodium cicutarium*	Whole province
Thistle, bull	*Cirsium vulgare*	Whole province
Thistle, Canada*** ¥	*Circium arvense*	Whole province
Thistle, Russian	*Salsola pestifer*	Whole province
Toadflax, yellow**	*Linaria vulgaris*	Whole province
Water hemlock, bulb-bearing	*Cicuta bulbifera*	Whole province
Water hemlock, northern	*Cicuta virosa*	Whole province
Water hemlock, spotted	*Cicuta maculata*	Whole province
Water hemlock, western	*Cicuta douglasii*	Whole province
Whitetop, hairy	*Cardaria pubescens*	Whole province
Whitetop, lenspod	*Cardaria chalepensis*	Whole province
Category 1 Invasive Species not lsited by Noxious Weed Act		
Common name	**Scientific name**	
Purple nutsedge	*Cyperus rotundus*	Whole province
Kudzu vine	*Pueraria montana*	Whole province
Category 2 Invasive Species not lsited by Noxious Weed Act		
Blueweed	*Echium vulgare*	Whole province
Flowering rush	*Butomus umbellatus*	Whole province
Himalayan balsam	*Impatiens glandulifera*	Whole province
Purple loosetrife	*Lythrum salicaria*	Whole province

*Category 1 Invasive Species.

**Category 2 Invasive Species.

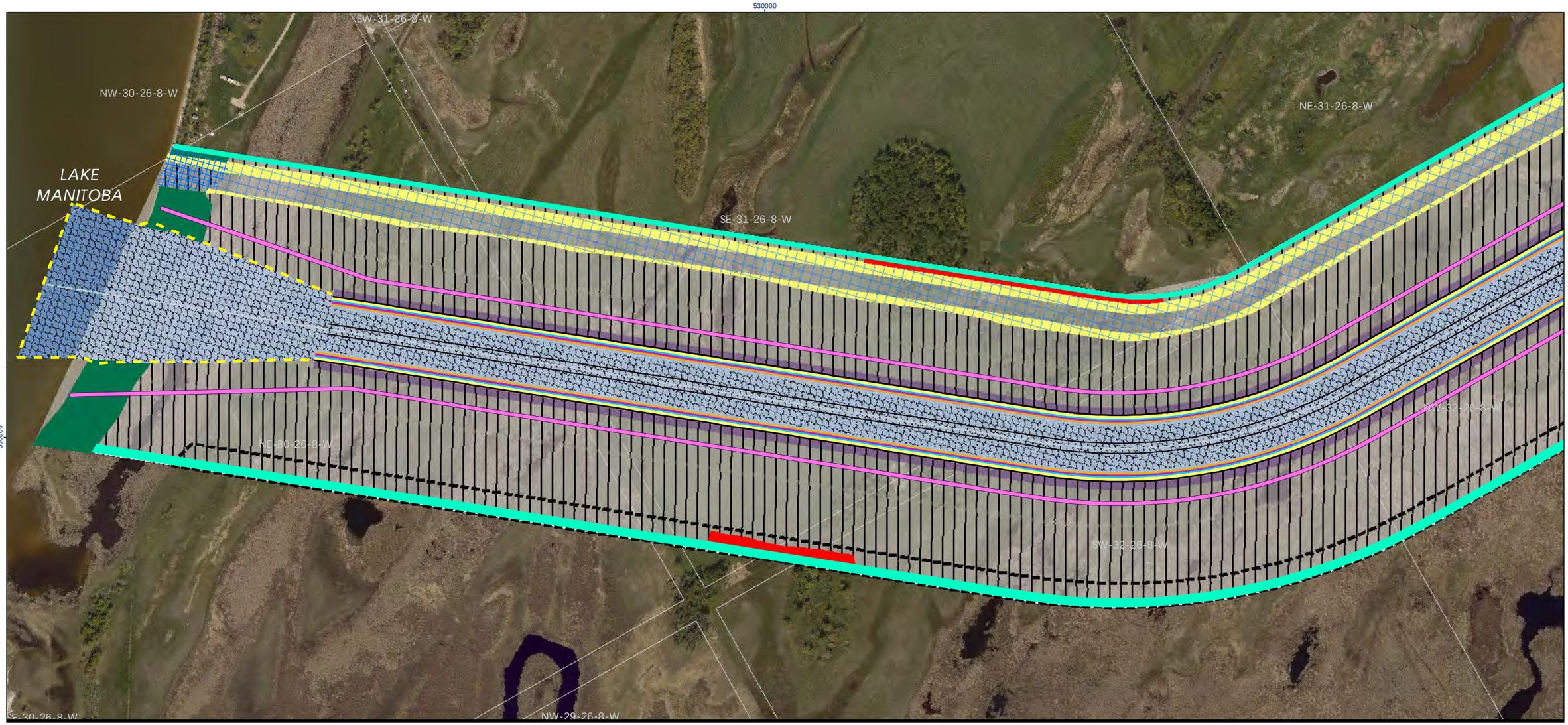
***Detected on LSMOC ROW during preliminary site investigations.

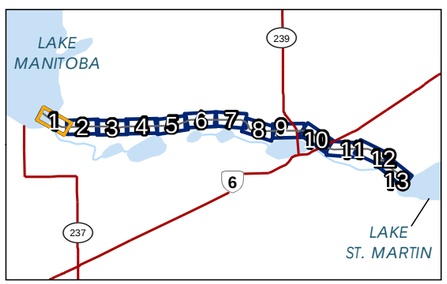
¥ Identified for LMOC ROW during a reconnaissance survey completed in August 2019 and based on available literature (SG Environmental 2016).

Hawkweed spp., water hemlock spp., and sow-thistle spp. are observed at LMOC ROW

APPENDIX 2A

LMOC Revegetation Map Book





Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Hatch, EcoLogic
3. Background: Air photo courtesy of MI
*Ground truthing required for confirmation of wetland areas (some wetlands on the map may not actually exist, or, some existing wetlands may not be identified on the map)

Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections
- Channel Inlet

Prescription Application
- Grassland
- Shrubland
- Inlet/Outlet Shoreline Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres
(At original document size of 11x17)
1:5,000

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

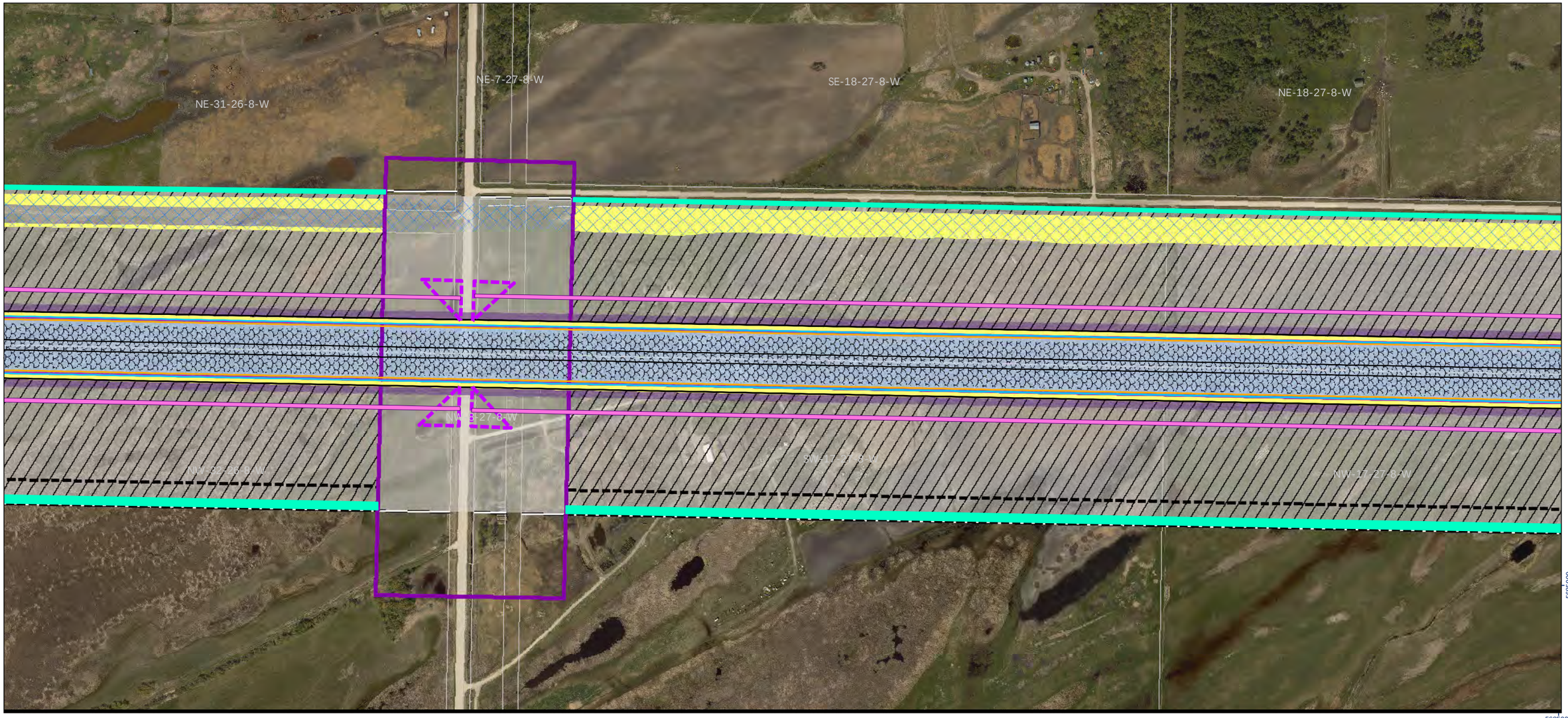
Client/Project
111475107 REVD
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

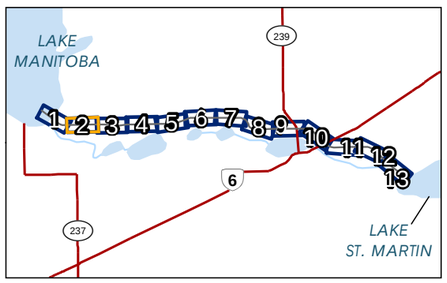
Figure No.
Figure A- 1

Title
Revegetation Prescription Locations

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Notes
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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
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- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Project Components
- Proposed Bridge

Prescription Application
- Grassland
- Bridge Approaches Revegetation Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres

(At original document size of 11x17)
1:5,000

N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
111475107 REVD
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

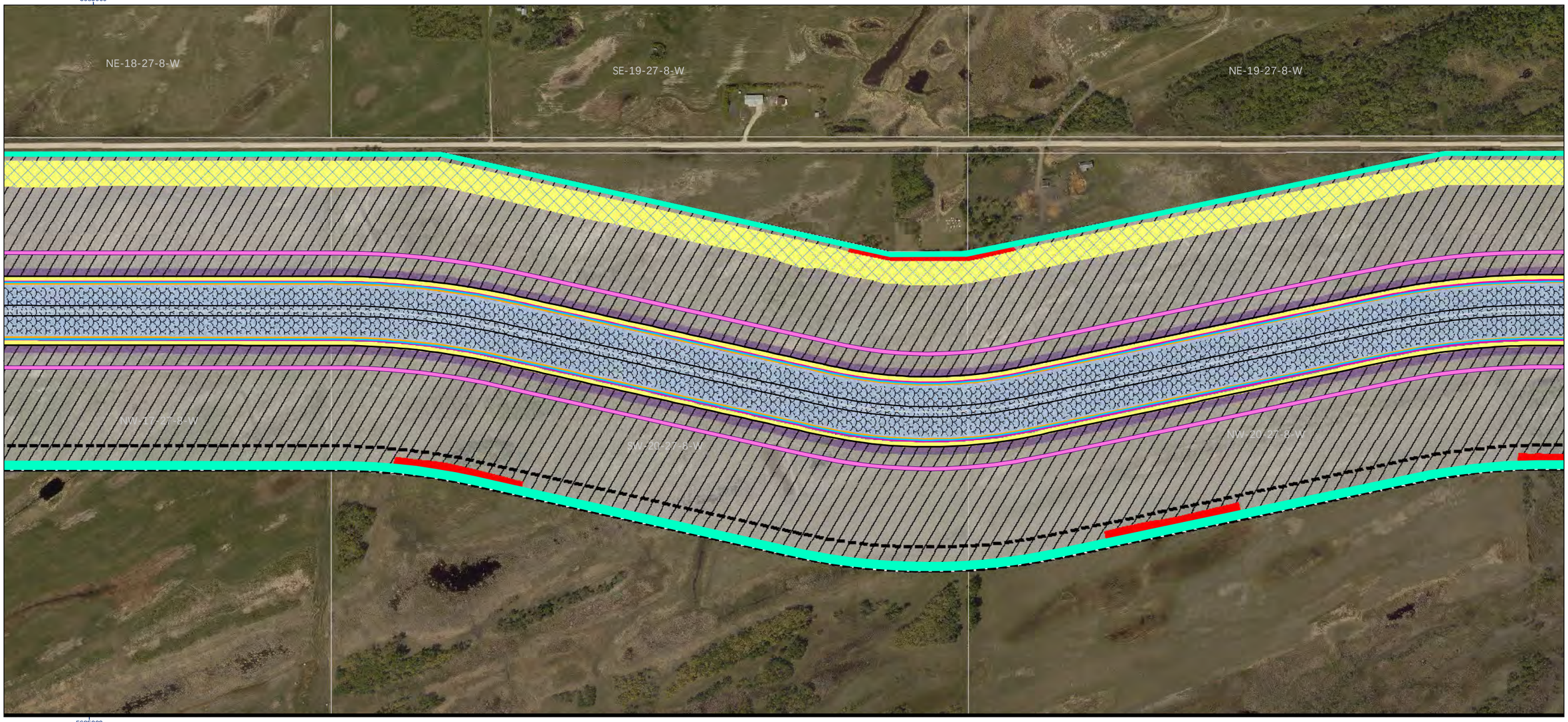
Figure No.
Figure A- 2

Title
Revegetation Prescription Locations

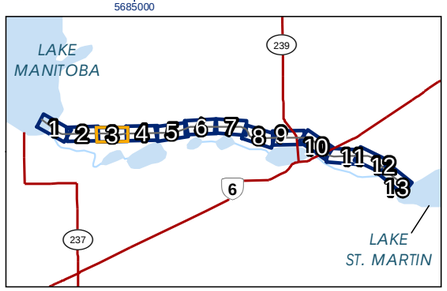
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5685000



5685000



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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
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- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Prescription Application
- Grassland
- Shrubland
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres

(At original document size of 11x17)
1:5,000

N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

111475107 REVD

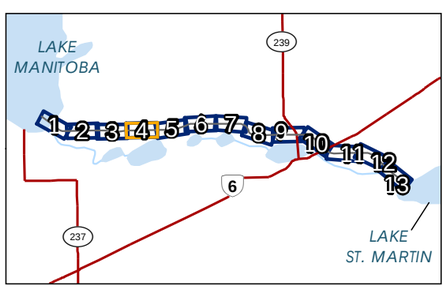
Figure No.
Figure A- 3

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
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- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Prescription Application
- Grassland
- Shrubland
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres

(At original document size of 11x17)
1:5,000

N

Notes
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Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

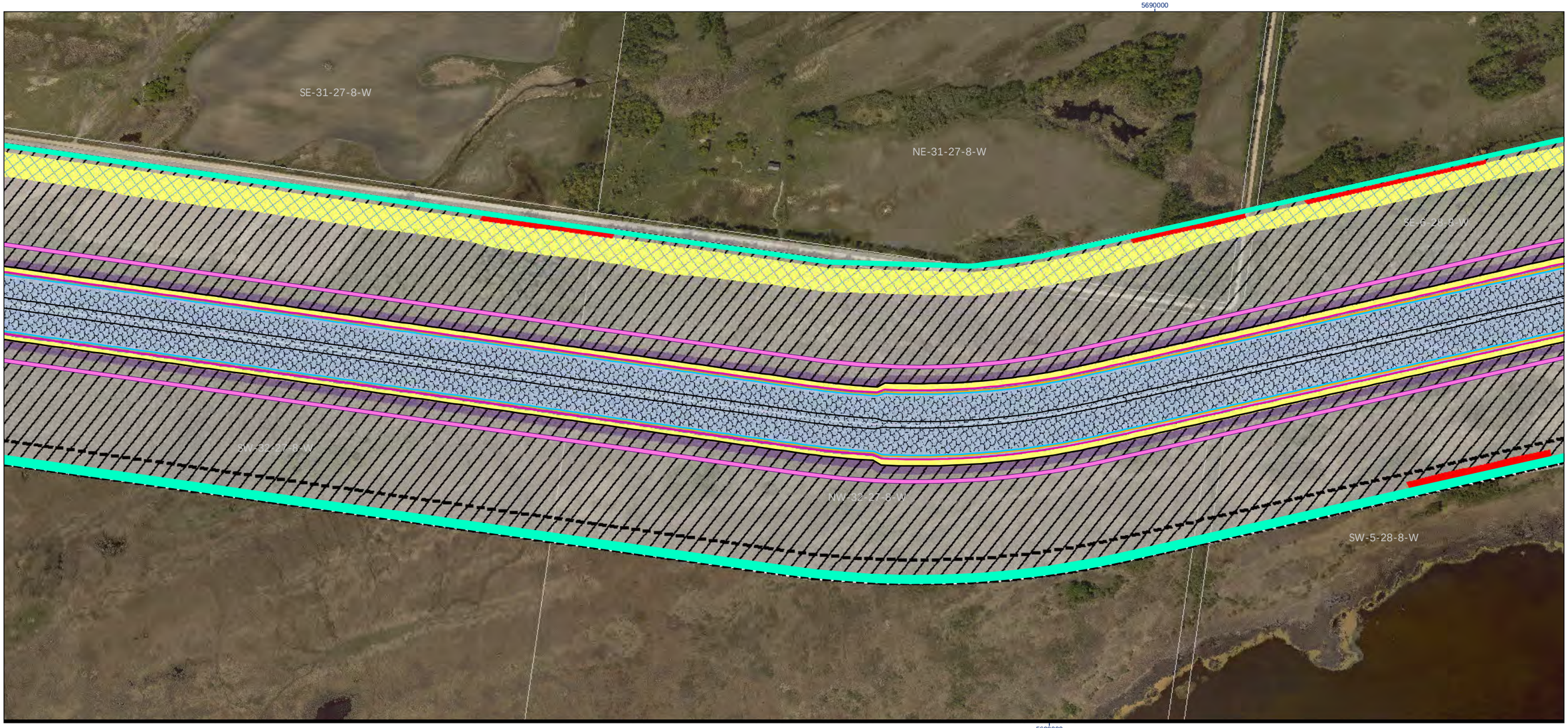
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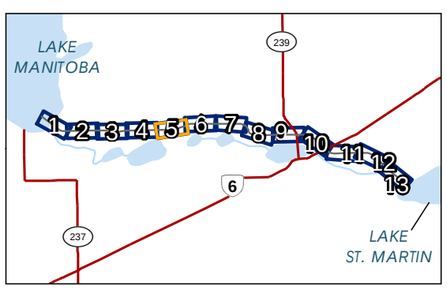
Figure No.
Figure A- 4

Title
Revegetation Prescription Locations

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Notes
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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Prescription Application
- Grassland
- Shrubland
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres
(At original document size of 11x17)
1:5,000

N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
111475107 REVD

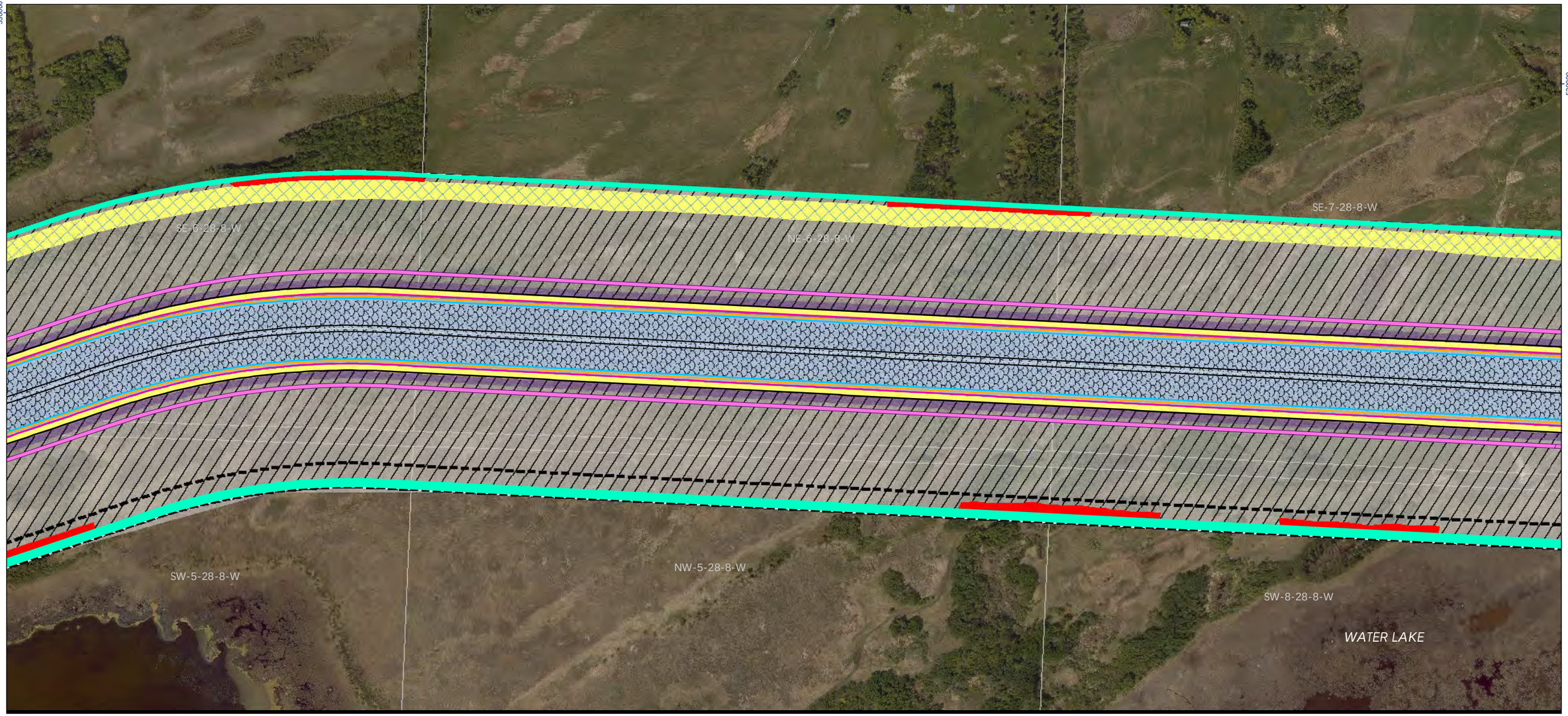
Revegetation Preliminary Design for the Lake Manitoba Outlet Channel

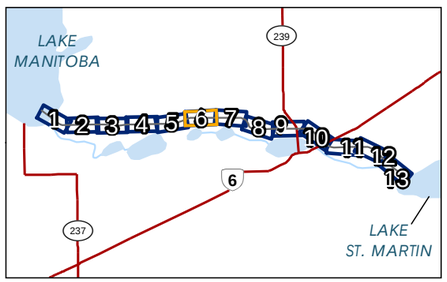
Figure No.
Figure A- 5

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Prescription Application
- Grassland
- Shrubland
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres
(At original document size of 11x17)
1:5,000
N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

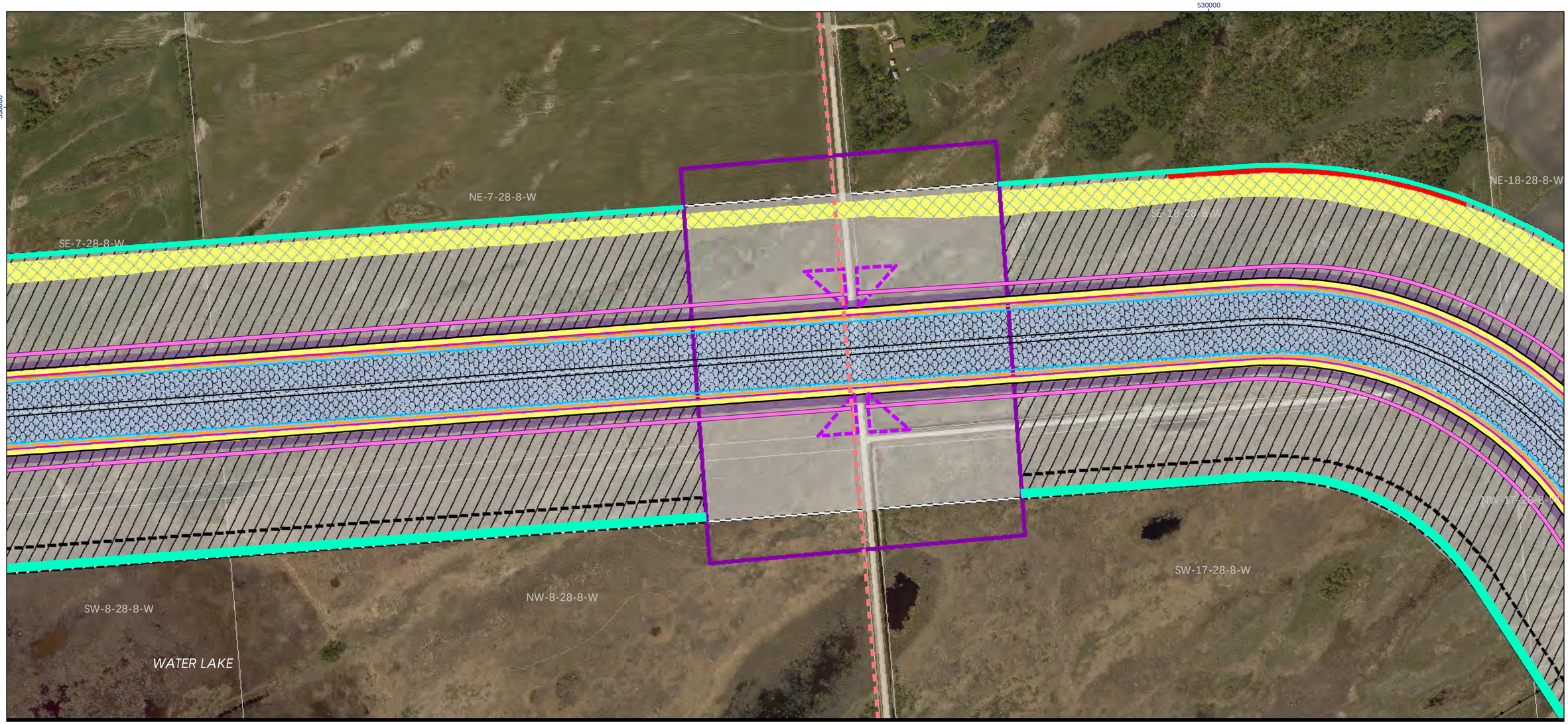
111475107 REVD

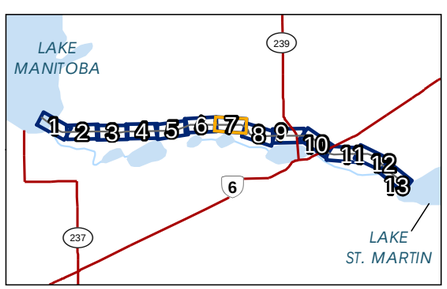
Figure No.
Figure A- 6

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections
- Existing Transmission Line

Project Components
- Proposed Bridge
- Proposed PR 239 Realignment

Prescription Application
- Grassland
- Shrubland
- Bridge Approaches Revegetation Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres
(At original document size of 11x17)
1:5,000

N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

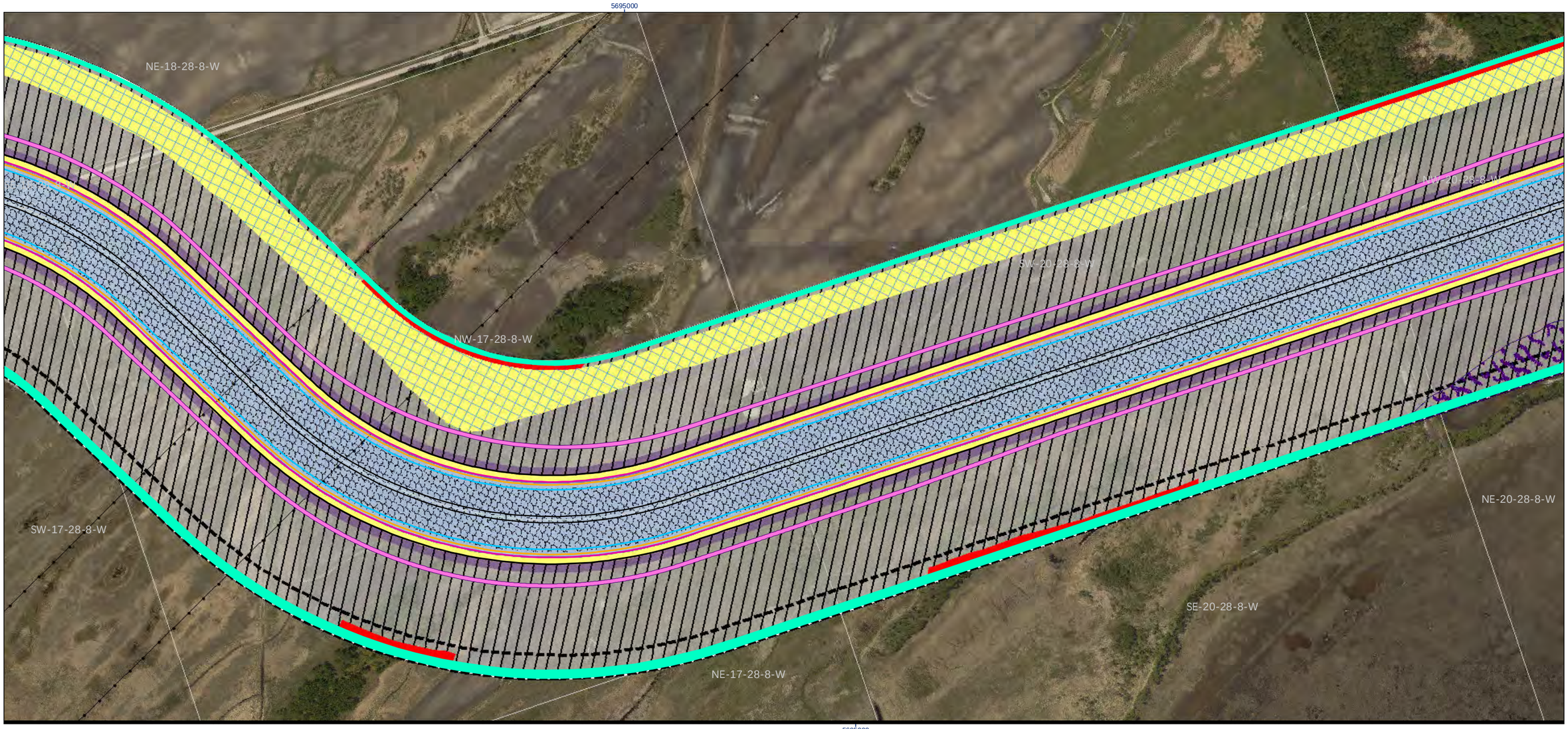
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111475107 REVD
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

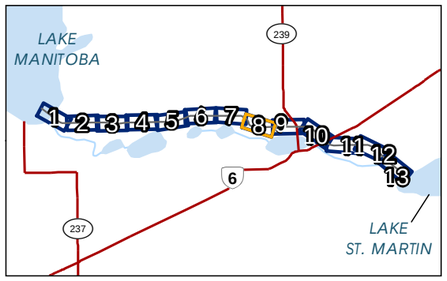
Figure No.
Figure A- 7

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections
- Existing Transmission Line

Prescription Application
- Grassland
- Shrubland
- Erosion Control Mix
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres

(At original document size of 11x17)
1:5,000

N

Notes
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Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

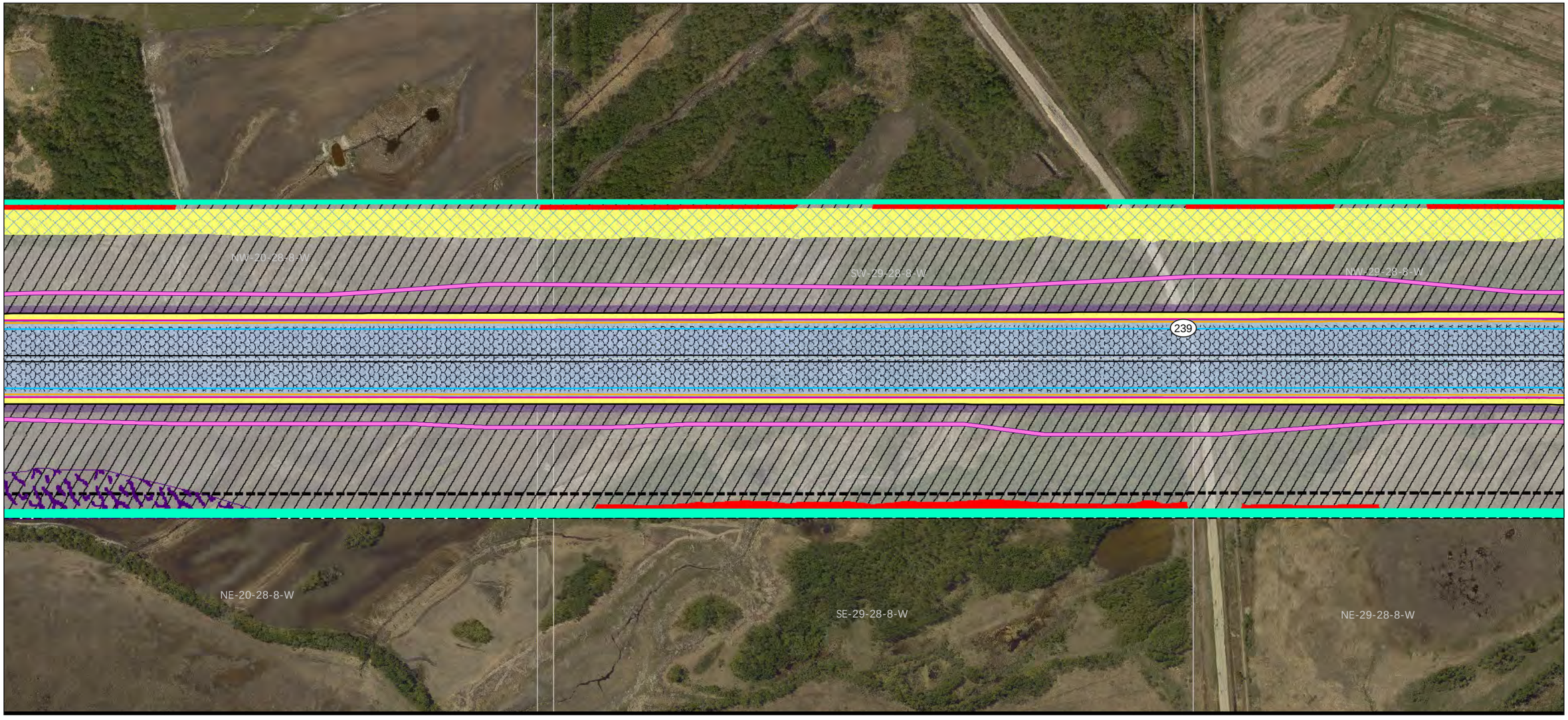
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Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

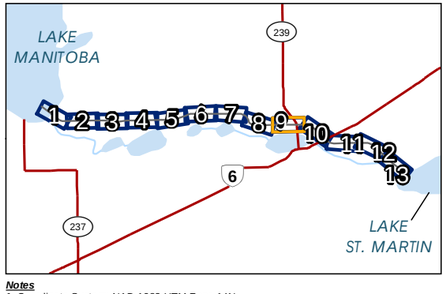
Figure No.
Figure A- 8

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Prescription Application
- Grassland
- Shrubland
- Erosion Control Mix
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres

(At original document size of 11x17)
1:5,000

N

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

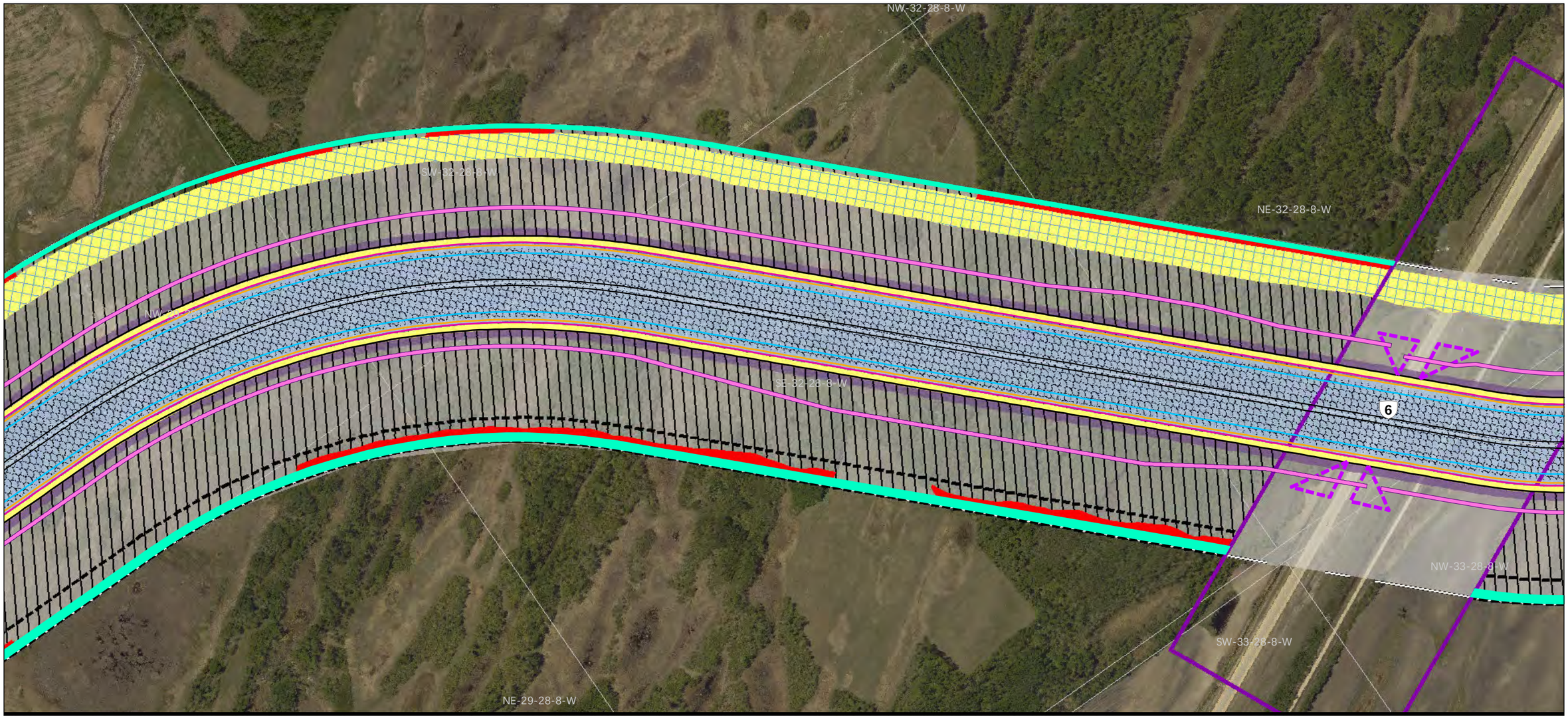
111475107 REVD

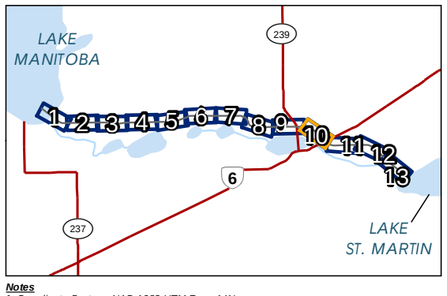
Figure No.
Figure A- 9

Title
Revegetation Prescription Locations

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
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- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Project Components
- Proposed Bridge

Prescription Application
- Grassland
- Shrubland
- Bridge Approaches Revegetation Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

0 100 200 metres
(At original document size of 11x17)
1:5,000

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

111475107 REVD

Figure No.
Figure A- 10

Title
Revegetation Prescription Locations

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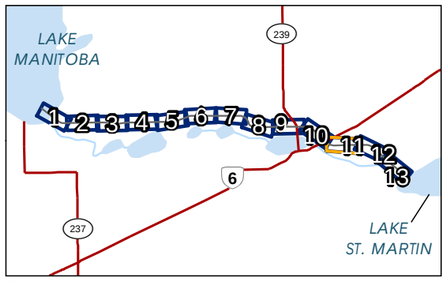
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NW-4-29-8-W

SW-4-29-8-W

NW-33-28-8-W

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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
- Top of Dike buffer
- Dike Crest (no revegetation)
- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections

Project Components
- Proposed Bridge
- Proposed Water Control Structure

Prescription Application
- Grassland
- Shrubland
- Bridge Approaches Revegetation Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

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Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Hatch, EcoLogic
3. Background: Air photo courtesy of MI

*Ground truthing required for confirmation of wetland areas (some wetlands on the map may not actually exist, or, some existing wetlands may not be identified on the map)

Note: Details for bridge design not yet available.

Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

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Manitoba Transportation and Infrastructure
Revegetation Preliminary Design for the
Lake Manitoba Outlet Channel

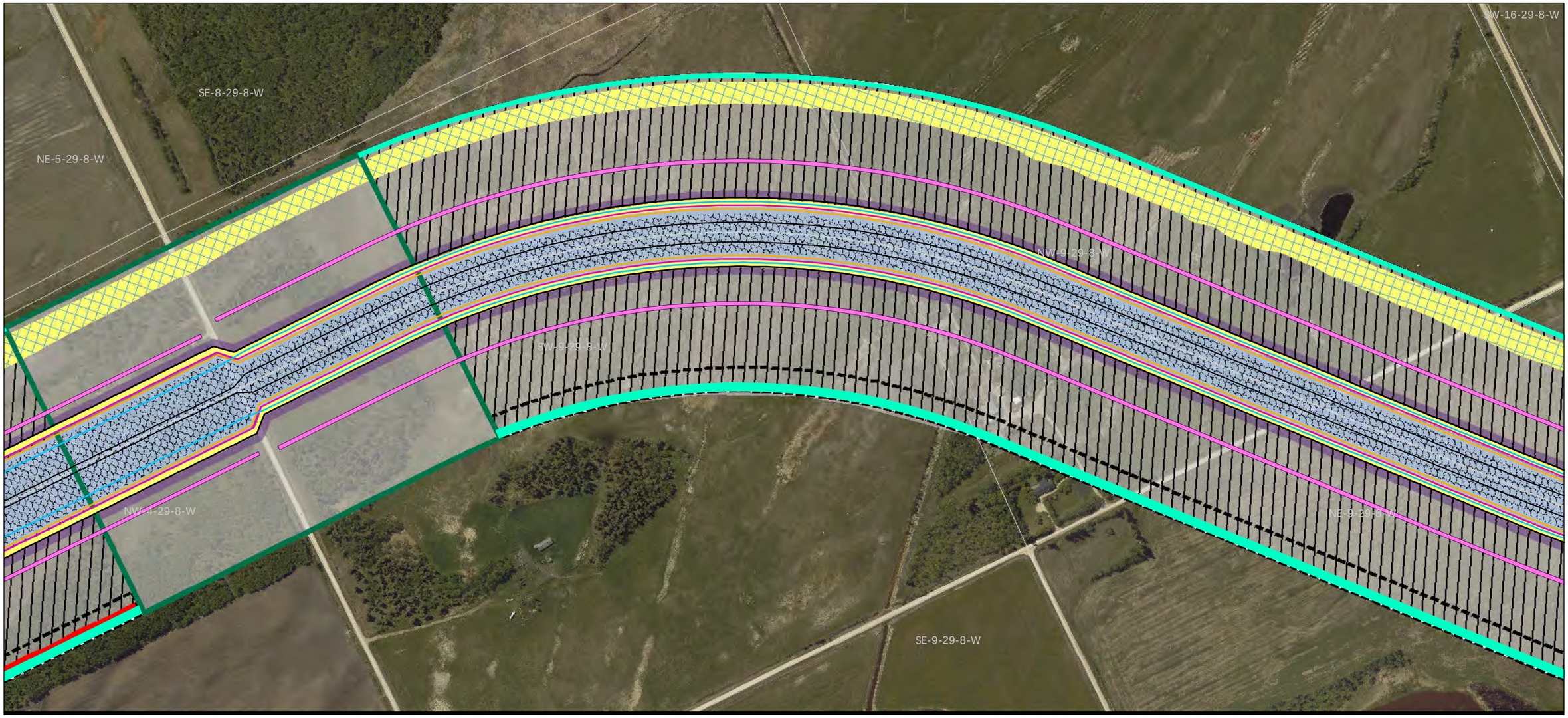
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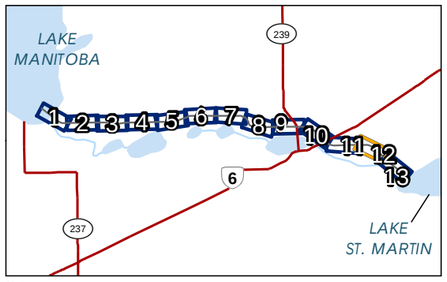
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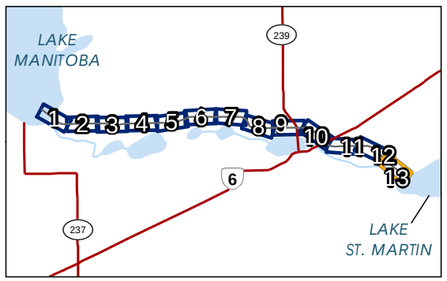
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Legend

Latest Channel Design

Channel Design
- Top of Dike
- Invert

Water Levels
- Top Lake Level
- Bottom Lake Level
- Peak Flow

- Outside Drain
- Topsoil Stockpile - Temporary Seeding Followed by Shrubland (RHWP Breeding Habitat) or Grassland
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- Buffer - Vegetation intact

Original Channel
- Channel ROW Boundary
- Channel Centerline
- Channel / Drain Spoil Piles
- Channel
- Quarter Sections
- Channel Outlet

Prescription Application
- Grassland
- Shrubland
- Inlet/Outlet Shoreline Prescription
- Channel and Outside Drain Wet/Dry
- Armouring

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Prepared by AC on 2022-06-27
TR by SB on 2022-06-27

Client/Project
111475107 REVD
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Figure No.
Figure A- 13

Title
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APPENDIX 2B

LMOC Revegetation Prescription Fact Sheets

Revegetation Prescription: Grassland

A mix of native and agronomic grasses and with native legumes and wildflowers to be applied to spoil piles, dikes, in buffer between channel and spoil piles, areas where topsoil was located (if grassland existed prior to disturbance), and within the assigned locations on RoW beyond the spoil piles. Areas revegetated with a mix of grass and forbs may serve as potential nesting habitat for bobolink and foraging habitat for short-eared owl.

Predicted Landuse	Hayland and support surrounding apiculture.

Site Preparation

Provide rough and loose soil placement. Apply 30 kg per ha seed mix through broadcast seeding. Spring planting. Required fertilizer application during broadcast seeding, 15-15-15 NPK.

Site information

Soil capping depth:	30 cm
Location on ROW:	KPs variable along full length of Channel ROW. (i) above water portion of the slopes of the channel, outside drain, dikes, spoil berms, and topsoil (temporary cover) and (ii) along the top of dikes, buffer between the channel and the spoil piles, and top of spoil berms.
Landscape position:	On spoil piles, dikes, in buffer between channel and spoil piles, and adjacent to farmer fields.

Management Considerations

On the dikes and spoils, limit tree growth through annual mowing and haying. May require weed management.

Revegetation

Candidate Species

8% oats (*Avena sativa*)
15% fowl bluegrass (*Poa palustris*)
20% slender wheatgrass (*Elymus trachycaulus*)
20% Awned wheatgrass (*Agropyron subsecudum*)
20% sheep fescue (*Festuca ovina*)
10% timothy (*Phleum pratense*)
4% Canada milk vetch (*Astragalus canadensis*)
1% Purple prairie clover (*Dalea puporea*)
2% native flowering species

Native flowering species to support pollinators, subject to availability:
Monarda fistulosa (wild bergamot)
Echinaceae angustifolia (Purple coneflower)
Linus lewisii (Blue flax)
Oenothera biennis (Evening primrose)
Note: Species count and mix may vary depending on availability

Wildlife associations

Habitat Subtype: Prairie grassland.

Other associated species: Ground nesting birds including bobolink and short-eared owl, white tailed deer, butterflies.

Typical Drawing/Photograph



Revegetation Prescription: Bridge Approaches

Broadcast seeding of seed mixes accepted by Manitoba Infrastructure will be used to revegetate the bridge approach areas at the three bridges within LMOC.

Predicted Landuse	Bridge approach.

Site Preparation

Provide rough and loose soil placement. Apply 30 kg per ha seed mix through broadcast seeding. Spring planting. Required fertilizer application during broadcast seeding, 15-15-15 NPK.

Revegetation

Candidate Species

Seed mixes accepted by the Highway Planning and Design Branch of Manitoba Infrastructure, policy/standard No. 300-02 (Attached below).

Site information

Soil capping depth:	30 cm
Location on ROW:	Bridges at 34+50 KP, 133+10 KP, and 198+50 KPs in the ROW.
Landscape position:	Bridge approaches.

Management Considerations

May require weed management.

Wildlife associations

Habitat Subtype: Prairie grassland.

Other associated species:

Revegetation Prescription: Topsoil Stabilization

Erosion control by seeding applied to temporary topsoil stockpiles if in place for longer than one growing season. The erosion control prescription will also be applied to other areas in the ROW as needed. Coco matting with seeding as an alternative.

Predicted Landuse	Recreational and other types of landuse covered under grassland, shoreline, and channel prescription fact sheets.

Site Preparation

If compaction density of the top 30-cm layer was below 1.55 g/cm^3 no site preparation needed. If compaction density is above 1.55 g/cm^3 the site prep (e.g. disking or cover soil placement) of the top 30 cm is required. Coco matting with seeding as an alternative.

Site information

Soil capping depth:	None unless decompaction not possible then 30 cm may be needed.
Location on ROW:	KPs variable along full length of Channel ROW.
Landscape position:	Temporary topsoil stockpiles if in place for longer than one growing season. Spoil piles, dikes, and other sloped areas in the ROW, where topsoil stockpiles will be left over winter or where signs of erosion are visible after revegetation prescription has been applied.

Management Considerations

Compaction specification is needed in developing this prescription.

Initial candidate revegetation species

For seeding

Common Name (*Scientific Name*)	**% seed by weight**
Local spp.:	
• Canada bluejoint (*Calamagrostis canadensis*)	20
• Tufted hairgrass (*Deschampsia ceaspitosa*)	20
• Fringed brome (*Bromus ciliolatus*)	30
• Winter wheat (usually *Triticum aestivum*) – annual quick cover crop	25
• Little bluestem (*Schizachyrium scoparium*)	5

Wildlife associations

Habitat Subtype: Prairie grassland and riparian

Other associated species: migratory birds, ungulates and furbearers

Example of Coco matting with grass seeding



Revegetation Prescription: Inlet/Outlet Shoreline

Seeding and transplanting and may receive live staking using local plant species with brush layering depending on slope along the shoreline located within the Right-of Way at inlet and outlet to protect from wind and wave erosion. Live staking is a part wildlife habitat considerations.

Predicted Landuse

Traditional, recreational, and wildlife habitat.

Site Preparation

If compaction density of the top 30-cm layer was below 1.55 g/cm^3 no site preparation needed. If compaction density is above 1.55 g/cm^3 p (e.g. disking or cover soil placement) of the top 30 cm is required. Spring planting.

Site information

Soil capping depth:	None.
Location on ROW:	Inlet in Watchorn Bay in Lake Manitoba; Southwest of KP 20+00. Outlet in Birch Bay in Lake St. Martin; Northeast of KP 250+00.
Landscape position:	At Watchorn Bay, shoreline (8 m back from the water's edge) and berms parallel to shoreline, if any. At Birch Bay, shoreline (10 m from the water's edge).

Management Considerations

Minimizing disturbance footprint. Armoring of the bottom of the inlet and outlet is recommended.

Initial candidate revegetation species

For live staking

Common (*Scientific Name*) (density)

Local willow spp.: (spacing - 50 x 50 cm2). Willow species considered for staking will depend on site soil conditions and include the following:

- Sandbar willow (*Salix exigua*)
- Beaked willow (*Salix bebbiana*)
- Hoary willow (*Salix candida*)
- Sandbar willow (*Salix exigua*)
- Slender willow (*Salix petiolaris*)

For seeding

Common (*Scientific Name*) (% seed by weight)

Local spp.:

- Canada bluejoint (*Calamagrostis canadensis*) (50%)
- Tufted hair grass (*Deschampsia cespitosa*) (30%)
- Narrow leaved cattail (*Typha angustifolia*) (20%)

For transplanting/plugging

Common (*Scientific Name*) (density)

Local spp.:

- Beaked sedge (*Carex utriculata*) (1 x 1 m^2)
- Tussock sedge (*Carex stricta*) (1 x 1 m^2)

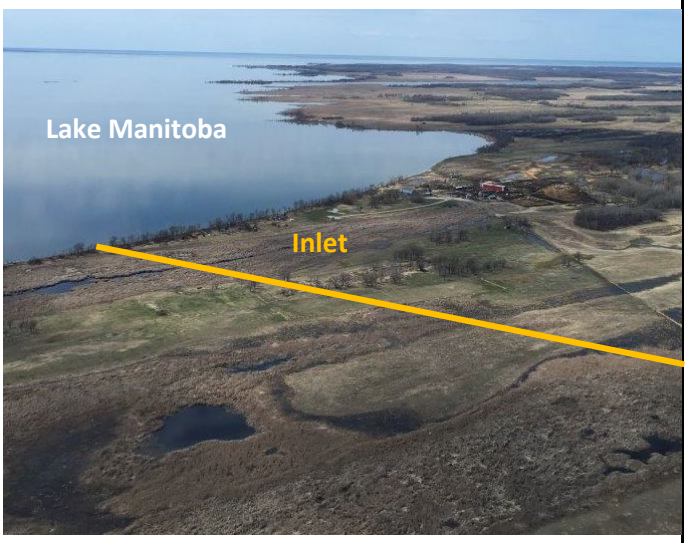
Wildlife associations

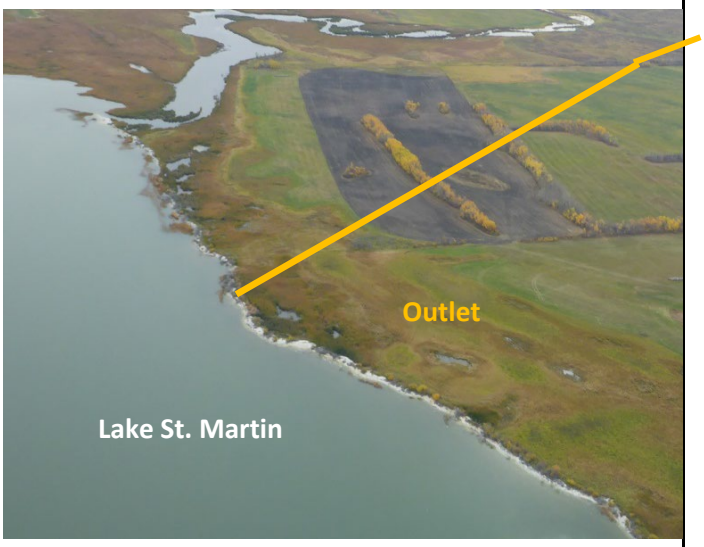
Habitat Subtype: At Watchorn Bay, shoreline habitat is composed of a compacted gravel – cobble – sand substrate. Dense vegetation cover (mixture of long grasses, low shrubs and deciduous trees) is present along the extent of the shoreline, beyond which land has been developed for agricultural use.

At Birch Bay, shoreline habitat is composed of a compacted gravel-cobble substrate with scattered boulders and with wetland habitat extending between 62 m and 127 m back from the shoreline.

Other associated species: migratory birds, amphibians, ungulates, furbearers

Typical Drawing/Photograph





Revegetation Prescription: Channel Wet/Dry

Seeding flood and dry condition tolerant species within periodically flooded (wet/dry) and shallow (<1 m) area of the channel and outside drain slopes. Possible jute mats with seeds will be installed in case of erosion and/or ice damage.

Predicted Land Use	Recreational, grassy riparian habitat.

Site Preparation

If compaction density of the top 30-cm layer was below 1.55 g/cm^3 no site preparation would be needed. If compaction density is above 1.55 g/cm^3 the site prep (e.g., disking or cover soil placement) of the top 30 cm is required.

Site information

Soil capping depth:	None
Location on ROW:	Along the length of the channel from inlet to outlet, and along the length of the Outside Drain.
Landscape position:	Periodically flooded channel areas and

Management Considerations

If density of soil on the slope is greater than 1.55 g/cm^3 then soil surface would need to be loosened to provide a receptive seed bed. If compaction is above 1.8 g/cm^3 then non-vegetative methods of erosion control would be researched. Compaction specification is needed in developing prescriptions.

Monitoring, if there are prolonged flood events, and adjustment of seed mixes, if required, to address the risk of poor vegetation growth.

Routine inspection and maintenance of vegetation (mowing/cutting) to ensure the channel maintains hydraulic capacity in the long-term.

Initial candidate revegetation species

For seeding

Common Name (*Scientific Name*)	**% seed by weight**
Local spp.:	
• Canada bluejoint (*Calamagrostis canadensis*)	40
• Tufted hair grass (*Deschampsia cespitosa*)	25
• Fringed brome (*Bromus ciliolatus*)	15

Wildlife associations

Habitat Subtype: Shrubby riparian.

Other associated species: Migratory birds, ungulates and furbearers.

Revegetation Prescription: Shrubland

A native shrub community that will buffer intersected forested parkland area along the edge of the ROW that support endangered woodpecker and/or whip-poor-will and other wildlife movement near the inlet and outlet structures (i.e., along lake shores). Areas along the edge of the Channel ROW or areas where topsoil was located prior to soil replacement, if shrubland existed prior to disturbance. A dense herb and graminoid layer is included to suppress weeds. Shrubs will be purchased from commercial greenhouses. Some areas will receive enhancements such as coarse woody debris placement and installation of wildlife snags to support bird nesting, including eastern whip-poor-will habitat.

Predicted Landuse	Forage and/or nesting habitat for wildlife that use forest edges (e.g., red-headed woodpecker, eastern whip-poor-will, white-tailed deer, elk), predator cover for wildlife moving along Lake Manitoba and Lake St. Martin shorelines.

Site Preparation

Provide rough and loose soil placement. Apply 30 kg per ha herb/graminoid seed mix through broadcast seeding. Potted live shrubs, or live stakes if available, should be planted at approximately 50 cm x 50 cm spacing (0.25m^2 density per ha). Spring seeding and planting. Required fertilizer application during broadcast seeding, 15-15-15 NPK.

Optional wildlife enhancements:

Snags

Locate salvaged dead or dying trees (minimum 20 cm diameter at breast height) up to 100m from edges of mature deciduous forest bisected by the ROW. Select sites on both sides (east and west) of the ROW for enhancements (erect 12-24 snags/ha).

Coarse woody debris (CWD)

Minimum 8 cm diameter. Place 4 m piles of CWD in areas of shrubland, preferably two or three piles per acre, about 100 feet apart. Build on base of rocks to reduce decomposition rate if possible, and layer with bigger debris on bottom and finer materials on top.

Rock piles

Place 4 m piles of rocks and/or boulders in areas of shrubland, preferably two or three piles per acre, about 100 feet apart.

Site information

Soil capping depth:	30 cm
Location on ROW:	KPs variable. Former soil stockpiles and edge of ROW.
Landscape position:	Dikes and along shoreline near inlet and outlet; areas where forest edges ROW, clearing along edge of forests with 50 m to 100 m width into the ROW.

Management Considerations

May require weed management until ground cover establishes. As no seeding planned – erosion control if noticed after planting can be added at 10kg/ha application rate initially to allow shrubs to survive.

Revegetation

Candidate Species for Planting/Seeding

Scientific Name	Common Name	% seed by weight
Alnus viridis ssp. crispa	Green Alder	15
Cornus sericea ssp. sericea	Red Osier Dog Wood	15
Ribes americanum	Wild Black Currant	10
Rubus idaeus	Raspberry	5
Ribes lacustre	Black Gooseberry	5
Amelanchier alnifolia	Saskatoon	10
Corylus cornuta	Beaked Hazel	5
Elaeagnus commutata	Wolf willow	10
Symphoricarpos albus var. pauciflorus	Snowberry	15
Sheperdia argentea	Buffalo Berry	5

Note Target 1000 stems/ha – 50 cm spacing

Wildlife associations

Habitat Subtype: Riparian or transitional forest habitat; escape cover for small-bodied wildlife

Other associated species: migratory birds including species at risk, white-tailed deer, elk, furbearers, small mammals, amphibians, reptiles.

APPENDIX 3A

LSMOC Preliminary Revegetation Design Report

LAKE ST. MARTIN OUTLET CHANNEL:

PRELIMINARY REVEGETATION DESIGN REPORT

September 2020

Submitted to:

KGS GROUP

Prepared by:

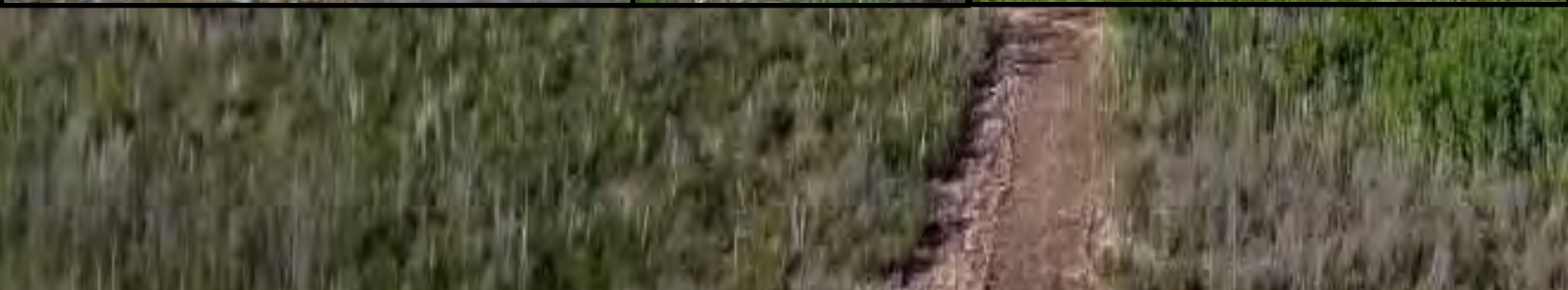
SCATLIFF + MILLER + MURRAY











Front Photo: Aerial photo of Lake St. Martin Outlet Channel alignment, June 11th, 2019

Front Photo (inset): Lake St. Martin Emergency Outlet Channel – Reach 1 (left); Early grass seedling establishment (middle); Well established native grass planting on roadside ROW (right).

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EXECUTIVE SUMMARY

Flooding throughout southern Manitoba during 2011 led the Province of Manitoba to construct the Lake St. Martin Emergency Outlet Channel (EOC), which included the Reach 1 and Reach 3 channels. While these channels served their initial purpose they were not intended to provide long-term permanent flood protection. Subsequently the Province is proceeding with the design and construction of a permanent flood relief channel connecting north basin of Lake St. Martin to Lake Winnipeg. This new permanent Lake St. Martin Outlet Channel (LSMOC) will be approximately 400m in width and will run 23.8 kilometers from the northeast shore of Lake St. Martin through low-lying upland landscape and connect to Lake Winnipeg immediately south of Willow Point.

It is expected that the project environmental license will stipulate that all disturbed sites associated with the project shall be revegetated with ecologically appropriate grass-based native vegetation in order to stabilize surface soils and limit the establishment of invasive weeds. The objective of this document is to provide a step-wise description of the preliminary planning considerations required to achieve a robust native grass planting in the LSMOC project area based on current understanding of revegetation conditions.

This document describes pre-plant site preparation requirements, planting considerations and scheduling, as well as construction and revegetation sequencing. Specifically, planning elements that are described include growth media preparation, integrated erosion control measures geared to large scale projects, seed mix design and seeding rate rationale, planting zones, planting methods, key dates and how revegetation measures may be coordinated. Native species and a selection of non-invasive tame species that are known to be suited to the region are identified and discussed herein.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

1.0 INTRODUCTION 7
- 1.1 Background 7
- 1.2 Project Description 9
- 1.3 Ecological Context 10
- 1.4 Rationale for Revegetation 11
- 1.5 Revegetation Field Trials 11
- 1.6 Goals and Objectives 11

2.0 CURRENT AND ANTICIPATED SITE CONDITIONS 13
- 2.1 Revegetation Field Survey 13
- 2.2 Channel Design Parameters (Anticipated) 13
  - 2.2.1 Construction Overview 13
  - 2.2.2 Base Materials (Subsoils) 14
  - 2.2.2 Availability of Organics for Revegetation 14

3.0 SITE PREPARATION FOR REVEGETATION 16
- 3.1 Organics Salvage, Stockpiling and Use 16
  - 3.1.1 Quantity of Oorganics Required for Revegetation 16
  - 3.1.2 Organics Handling and Management 16
- 3.2 Base Material Preparation 19
  - 3.2.1 Alleviation of Compaction 19
- 3.3 Growth Media Preparation 19
  - 3.3.1 Organic Soil Placement and Incorporation 19
  - 3.3.2 Seedbed Preparation 20
  - 3.3.3 Fertilization and Irrigation 21

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3.4 Erosion and Sediment Control 22
3.4.1 Site Preparation and Grading Approaches 22
3.4.2 Temporary Cover Crops and Nurse Crops 22
3.4.3 Erosion Control Materials/Products 24
3.5 Weed Control 25

4.0 PLANTING CONSIDERATIONS 28
4.1 Revegetation Design 28
4.1.1 Revegetation Zones and Plant Species 28
4.2 Plant Material Procurement 30
4.3 Seed Mix Design and Seeding Rates 31
4.4 Planting (Seed Mix Installation) 34
4.4.1 Drill Seeding 34
4.4.2 Harrow-Broadcast-Harrow Seeding 35
4.4.3 Hydro-Seeding 36
4.4.4 Erosion Control Measures 36
4.4.5 Timing of Seeding 37
4.5 Propagule Plantings 37
4.6 Weed Control 38
4.6.1 Coordination of Weed Control in Seeding Year 39

5.0 SEQUENCING OF SITE PREPARATION AND REVEGETATION 40
5.1 Peat Extraction and Stockpiling 40
5.2 Overview of Preliminary Revegetation Plan 40

6.0 REFERENCE 43
7.0 APPENDIX 44

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LIST OF TABLES

Table 1. Manitoba Land Initiative forest cover types along the LSMOC project footprint. 10

Table 2. Relevant attributes of native grass species that may be used in LSMOC revegetation.....32

Table 3. Relevant attributes of non-native grass species that may be used in LSMOC revegetation.....33

LIST OF FIGURES

Figure 1. Land cover classifications of the Lake St. Martin Outlet Channel project.....8

Figure 2. Typical right-of-way cross section for the Lake St. Martin Outlet Channel (KGS, 2019).....9

APPENDICES

Appendix 1 – LSMOC Revegetation Site Investigations Report.....44

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1.0 INTRODUCTION

1.1 Background

Flooding throughout southern Manitoba during 2011 led to water levels in Lake Manitoba and Lake St. Martin resulting in significant damage to hundreds of properties, restricted road access to several communities, and long-term evacuation of four First Nations communities in the vicinity of Lake St. Martin (LSM). As part of emergency relief measures, the Province of Manitoba, through Manitoba Infrastructure (MI), constructed the LSM Emergency Outlet Channel (EOC), which included the Reach 1 and Reach 3 channels (Figure 1).

Since construction of the EOC, the Province has needed to operate the Reach 1 channel in 2011-2012 and again in 2014, while Reach 3 has not been operated. While these channels served their designed purpose over the short term, they are not considered sufficient for long term, permanent flood protection of the area and the Province is proceeding with design and construction of the LSM Outlet Channel (LSMOC), a permanent flood relief channel connecting the north basin of Lake St. Martin Lake Winnipeg at Sturgeon Bay.

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5755000 5750000 5745000 5740000 5735000

Dauphin River

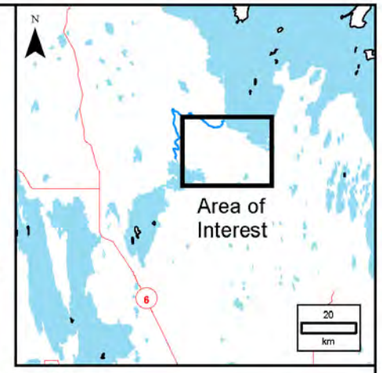
Lake Winnipeg

Buffalo Creek

Big Buffalo Lake

Little Buffalo Lake

Lake St. Martin



LEGEND:

- PDA
- LSMOC Alignment
- Reach 3 - Existing
- Reach 1 Channel - Existing
- Access Road
- Transmission Line

LAND COVER

- No Data
- Shadow
- Cloud
- Snow/Ice
- Rock/Rubble
- Exposed Land
- Water
- Shrub - Tall
- Shrub - Low
- Herb
- Bryoids
- Wetland - Treed
- Wetland - Shrub
- Wetland - Herb
- Coniferous - Dense
- Coniferous - Open
- Coniferous - Sparse
- Broadleaf - Dense
- Broadleaf - Open
- Broadleaf - Sparse
- Mixed Wood - Dense
- Mixed Wood - Open
- Mixed Wood - Sparse

1 0 1 2 3 4
Kilometres

SCALE: 1:100,000 METRIC 11"x17"

NO	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
X	20/08/28	ISSUED FOR REVIEW	XXX	XXX

REVISIONS / ISSUE

KGS GROUP

Manitoba Infrastructure

PRELIMINARY DESIGN OF THE LSM OUTLET CHANNEL PROJECT3

LAND COVER CLASSIFICATION FROM LAKE ST. MARTIN TO LAKE WINNIPEG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

AUGUST 2020 | FIGURE 01 | REV: X

FileName: P:\Projects\2018\18-0300-005\Dwg\GIS\MXD\Working\Land_Cover\18-0300-005_Fig01_Land_Cover_Rev1.mxd
11"x17" PLOT SCALE 1:1

1.2 Project Description

The 23.8 kilometer LSMOC will run from the northeast shore of LSM through low-lying upland landscape and connect to Lake Winnipeg immediately south of Willow Point (Figure 1). A significant elevation change occurs along the alignment of the channel, dropping from an elevation of 242m at LSM to an elevation of 216m at Lake Winnipeg. Almost 5km of the new channel will overlap with the existing Reach 3 channel although substantial widening and redevelopment of this reach is anticipated.

The LSMOC project has an approximately 400m wide right-of-way (ROW) along the alignment. This ROW comprises the channel and dyke (~150m), a reclaimed spoil area (~200m), a construction road (~20m), as well as an outer drain (~30m) (Figure 2). Associated construction components that are not part of the revegetation scope of work for this project, include a permanent access road connecting the LSMOC to the abandoned Reach 1 channel as well as a proposed transmission line (~15km), and temporary winter access roads. At select locations along the channel (e.g. control structures) permanent erosion protection measures such as riprap or other hard armoring is anticipated and no revegetation treatment will be required.

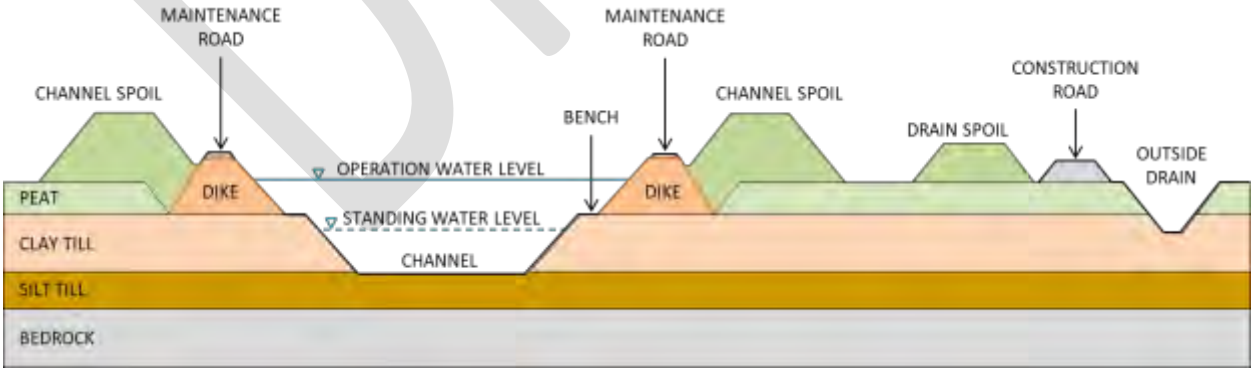


Figure 2. Typical right-of-way cross section for the Lake St. Martin Outlet Channel (KGS, 2019).

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1.3 Ecological Context

The LSMOC project is situated in the Mid-Boreal Lowland Ecoregion of the Boreal Plains Ecozone. The Ecoregion is broadly characterized by extensive peatland cover interrupted by mixed softwood/hardwood plant communities where drainage and mineral soils allow (Smith *et al.*, 1998). The vegetation on the peatlands varies with peatland type. Bogs are generally characterized by stunted black spruce with ericaceous shrub and moss cover. Moss cover is often dominated by species of sphagnum. Fens are generally dominated by sedges and brown mosses and contain varying quantities of shrubs such as swamp birch and stunted tamarack trees where conditions permit. Upland cover can vary with drainage, soil texture and fire history. Black spruce is widespread, but following forest fires, jack pine and, to a lesser extent, trembling aspen, become major forest components (Smith *et al.*, 1998). Wet uplands have black spruce and moss vegetation with shrubs such as willow and alder. Table 1 provides a breakdown of all Land Cover and Forest Types represented throughout the project footprint (MLI, 2019).

Table 1. Manitoba Land Initiative forest cover types along the LSMOC project footprint.

COVER CLASSES	AREA (Ha)	COVER (%)
Water	4.4	0.5
Exposed Land	1.5	0.2
Wetland - Treed	35.5	4.0
Wetland - Shrub	483.7	54.4
Wetland - Herb	228.3	25.7
Coniferous - Dense	55.9	6.3
Coniferous - Open	6.8	0.8
Broadleaf - Dense	16.1	1.8
Broadleaf - Open	1.0	0.1
Mixed Wood - Dense	56.2	6.3

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1.4 Rationale for Revegetation

Site naturalization and revegetation is an important and challenging component of the LSMOC project. The establishment of site appropriate, non-invasive perennial vegetation can serve to stabilize surface soils and protect against accelerated soil loss and erosion while limiting the establishment of non-native weedy plant species. Large linear infrastructure projects such as roads, transmission lines, and water diversion channels that connect otherwise separated landscapes can serve as conduits for the introduction of non-native and invasive plant species and can rapidly degrade local environments. Given the natural setting of the Project in addition to its large scope and scale, if site restoration and revegetation is not planned and implemented in a considerate and responsible fashion, its can have disproportionately high impact on the local and interconnected environments.

1.5 Revegetation Field Trials

Small scale revegetation field trials were conducted in 2019-2020 at Reach 1 of the LSM EOC. These trials were designed to evaluate the establishment and growth of native grass seedlings on the existing channel soils amended with different depths of organic soil (peat). The results of these trials are described in depth in Appendix 1 and will be used to inform and support revegetation methods described for active revegetation zones within the LSMOC ROW.

1.6 Goals and Objectives

The goal of this document is to provide preliminary planning information for revegetation of the LSMOC with site-appropriate, long-lived and ecologically appropriate species. This project features a number of challenges to revegetation, including the unpredictable duration and magnitude of flooding conditions along the channel. This document will outline the current understanding of the anticipated site conditions after construction and describe the recommended approach to revegetation.

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The objective of this document is to provide a step-wise description of the required elements to undertake successful revegetation in the project area based on our current understanding of revegetation conditions. Preliminary revegetation design is divided into the following elements;

1) Preparation of the disturbed ROW for revegetation

2) Revegetation design and plant material sourcing

3) Scheduling

4) Construction sequencing

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2.0 CURRENT AND ANTICIPATED SITE CONDITIONS

2.1 Revegetation Field Survey

A field survey was carried out in June 2019 to confirm the availability and suitability of soil resources for use in revegetating the LSMOC and to make note of invasive weeds that may be problematic to revegetation efforts. A total of twenty-six (26) sampling locations were distributed along the channel centerline representing nine land cover classes found within the LSMOC project area. Field observations of plant community cover were in-line with Manitoba Land Initiative (MLI) data with over 80% of the project area falling within the category of wetlands with deep organic soils. Analysis of the chemical properties of organics along the channel alignment revealed no apparent barriers to the growth and establishment of grass species that are appropriate for revegetating purposes within the LSMOC project area. That being said, these organic soils are characteristically low in plant available nutrients, and the revegetation design may need to account for improving soil fertility. Invasive weed encroachment was minimal and highly localized. Canada thistle and dandelion were encountered on two occasions; both cases occurred in the broadleaf tree MLI cover class. See Appendix 1 for further detail.

2.2 Channel Design Parameters (Anticipated)

2.2.1 Construction Overview

Construction of the Project is tentatively expected to occur over a period of approximately 2.5 to 3 years with approximately 1-2 years for post construction-related works, such as site clean-up, survey, and environmental offset works.

The proposed Project schedule includes the following major phases:

1. Construction will occur in the fall 2020 to spring/summer 2023
2. Operation and maintenance will start in the 2023 and continue indefinitely

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Construction of the LSMOC is expected to generate approximately 450ha of exposed mineral subsoils (channel/dyke slopes, spoil piles made of mineral soil) which will require active revegetation treatments to establish deliverable cover vegetation. As the channel construction will take place over multiple years, revegetation works will be phased into the overall channel construction in order to minimize the exposure of channel slopes and hasten the channel revegetation. Once a segment of the channel is fully excavated and constructed, site preparation and soil placement for revegetation will be phased in at the earliest opportunity possible.

2.2.2 Base Materials (Subsoils)

The channel will be constructed through glacial till deposits leaving large areas of exposed subsoils following final grading. Clay deposits may be present in places along the channel, but are expected to be a minor component of the overall base material composition. Exposed glacial till will act as an important component of final seedbed conditions but due to deficiencies in organics and available nutrients they cannot be relied on solely to support perennial cover. Soil organic content is a vital constituent of growth media and when incorporated into subsoils, improves revegetation results by enhancing soil moisture efficiency, fertility and seedbed conditions.

2.2.2 Availability of Organics for Revegetation

Topsoil and available organics will be salvaged as part of the LSMOC construction work and used to amend existing glacial till subsoils during revegetation work. The preliminary design of the LSMOC anticipates excavating approximately 3M m^3 of peat, which is more than the quantity of organics required for revegetation as described in Section 3.1.1.

Soil analyses indicate that organics located in the project area pose no impediment for revegetation purposes. Revegetation trials undertaken on Reach 1 as part of 2019 site investigations support this assertion. These revegetation trials demonstrate that successful seedling establishment of key native grass species is achievable using organic amendments of 7.5cm and 15cm incorporated into local glacial till subsoil.

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Organics situated at depths of >20cm or greater should be considered for use as a source of organics for revegetation purposes as these are more decomposed.

Material staging should be considered from the onset of construction to facilitate all phases of the Project, including site revegetation. Stockpiling and staging organics soils should occur outside of the area of active channel construction. Where space for material staging within the ROW is limited, alternative arrangements will be made. Greater detail on site specific material staging will be provided in the detailed design phase.

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3.0 SITE PREPARATION FOR REVEGETATION

Anticipated site conditions following construction of the LSMOC have been described in Section 2.0. The exposed glacial till subsoils are deemed unsuitable for revegetation given their deficiency in plant available nutrients and organic matter. As such, in order to create conditions that will allow the establishment of a perennial groundcover, suitable quantities of organics (peat) must be integrated into the existing glacial till. The following section considers the planning elements necessary to create favorable site conditions for seedling establishment and the development of a long-lived perennial cover.

3.1 Organics Salvage, Stockpiling and Use

3.1.1 Quantity of Oorganics Required for Revegetation

Cover soils created by blending organic soil with mineral subsoils typically have a target ratio of between 50:50 and 70:30 (organics: subsoil). For perennial grass plantings it is recommended that up to 15cm of organics be integrated into subsoils while remaining within the target blend ratio (AEW, 2012). Quantity calculations need to account for an expected volume loss of up to 30% during salvage, storage and re-spreading organic soils.

Assuming 0.150m of peat is incorporated across this area, there is a requirement for up to 877,500m^3 of peat for revegetation purposes (including 30% expected loss). Given that there is an expected excavation volume of approximately 3M m^3 of peat, we anticipate a surplus of >2M m^3 of peat across the whole project ROW. The detailed design phase will consider methods and approaches to manage surplus peat quantities to mitigate any potential negative impacts of this excess material

3.1.2 Organics Handling and Management

Organic soils will be stripped and stockpiled early in site development during the winter construction season for use in site reclamation. The methods and sequence of organics salvage can vary and are generally determined by ease of access, which is in-

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turn determined by weather conditions, depth of frost, and moisture content of the peat and underlying mineral soil layers. During organics salvage and stockpiling, the Contractor may need someone on site to identify soil types in order to handle and stockpile these materials appropriately. Alternatively, construction crews, including excavator operators will need to be sufficiently informed and trained on the specified approach to soil salvage.

Construction logistics and material staging must take into account the total area required for the stockpiling of organic soils that will be used in site revegetation. Stockpiles must be re-spread promptly to avoid degradation and loss of viability that can occur when organic soils are stockpiled for more than one winter. Stockpiled organic soils should be re-spread across the area to be revegetated as soon as the channel has been excavated, rough graded, and decompacted. If organic soils are expected to remain stockpiled for more than one month during the active growing season (May to October), these stockpiles must be managed to protect from erosion, weed establishment and degradation.

Organics should be staged strategically for to minimize the number of times machinery is required to travel over prepared sites. Organics should only be incorporated during appropriate weather conditions (i.e. not too wet, not frozen, and under appropriate wind conditions). Due to the low expected nutrient content of the peat, leaching from these stockpiles is not considered a concern. That said, stockpiles should be staged a minimum of 30m from the channel slopes to ensure any potential localized leaching has an opportunity to be bound in the mineral soils prior to reaching the channel.

Given that we are anticipating a significant surplus of organic soils, the project Erosion and Sediment Control Plan (ESCP) will provide additional detail on methods and approaches to managing organic soil erosion and movement.

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Other general considerations for organic soil salvage and handling include:

- Coarse woody debris should be separated from organic stockpiles and disposed of prior to soil placement and integration. The Contract Tender will state that the Contractor will be responsible for appropriate wood waste management, but specify that woody debris cannot be chipped and mulched into the organics or across the revegetation area.

- Peat sources should be inspected for noxious weeds and either rejected if weeds are present, or undergo weed control prior to spreading. This may include weed control before stripping, and/or weed control on peat stockpiles. Pre-construction surveys will allow opportunities for in-situ inspection of the surface soils while construction monitoring will provide opportunities for inspection of stockpiled soils for use in revegetation.

- Organic stockpiles should be left in a 'rough and loose' condition to allow rainfall to infiltrate into the soil and prevent erosion from rainfall.

- Organic stockpile grades should be left no steeper than 4:1 to accommodate the potential for cover crop seeding as an erosion protection measure.

- Position stockpiles in a sheltered area away from active construction works (i.e. along a forests edge) to minimize exposure to wind erosion.

- Organic soil stockpiles that freeze overwinter may take a very long time to thaw in the spring because of the insulating effect of the material. Smaller stature stockpiles will thaw faster than larger stockpiles.

- Windrowing organics stockpiles to a height of roughly 2 meters facilitates ease of stockpile maintenance where organics are to be stockpiled for prolonged periods of time.

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3.2 Base Material Preparation

3.2.1 Alleviation of Compaction

Subsoil compaction must be alleviated prior to the integration of organics. Doing so enables proper seeding depth, allows for better root penetration and enhances establishment and long-term survival of the planting. Areas that have been compacted through equipment traffic may require multiple passes, in multiple directions, to alleviate heavy compaction. Decompaction of the subsoils to a depth of 20 – 30cm prior to placing and incorporating the organics is recommended. Heavy equipment such as a bulldozer with ripper teeth or tandem discs and a tractor can be used to alleviate compaction.

3.2.2 Rill Repair

Rills that emerge prior to seeding and plant establishment will need to be repaired to allow for accurate and effective native grass seeding. Small rills in the base material that develop prior to decompaction will be sufficiently repaired during decompaction work, but if small rills are allowed to develop into larger rills or gullies, more effort will be required for repair. Small rills that develop after organic soil placement and incorporation, but prior to seeding can be repaired using harrows, chains or a toothed bucket on low-ground pressure equipment (e.g. tracked skid steer). Rills that emerge after seeding will need to be carefully monitored to determine if they should be repaired and reseeded immediately, or if a wait-and-see approach should be taken. In all cases, the cause/source of the active erosion that is leading to rill formation should be investigated and addressed, as needed, through light grading and earthworks, erosion control materials, or other actions.

3.3 Growth Media Preparation

3.3.1 Organic Soil Placement and Incorporation

Organics should be spread over decompacted subsoils using equipment and methodology that avoids compacting prepared ground. Strategic staging of organics stockpiles along the ROW will facilitate timely and efficient organics placement. Low

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ground pressure equipment (e.g. small to medium wide base, wide blade, tracked bulldozer) with GPS linked grade control systems are well-suited to accurately spreading specific depths of organic soils prior to incorporation, provided existing rough grades are accurate. As described in Section 3.1.1, a depth of 10 – 15cm of organics should be placed across the project footprint in all areas that will be revegetated.

Once placed, organics should be incorporated into the mineral subsoils using discs to a depth of roughly 20 – 25cm. Other equipment such as field cultivators or an aggressive set of harrows may also be used for incorporating organics. This incorporation will result in a blended cover soil with an organics to mineral soil ratio within the target range. These conditions should provide suitable growth media conditions for seeding and establishment of a perennial grass groundcover. It is important that organic soils placed over the decompacted base material are not buried or blended too deeply, which could result in poor surface soil conditions and unsuitable seedbed characteristics.

3.3.2 Seedbed Preparation

Creating proper seedbed conditions is a crucial element of preparing site for seeding. Seedbed conditions must be smooth, level, firm and free of excessive woody debris in order to allow a seed drill to deliver seed at an accurate rate and depth. Firm seedbeds conserve moisture and ensure good seed-to-soil contact. The seedbed is considered firm enough when a person's footprint only penetrates 0.6 to 1.2cm deep. The surface should be free of rills and gullies and wherever possible, slopes should not exceed 4:1 to allow machinery to operate safely and properly.

The soil surface will require some level of conditioning after organic soils are placed and integrated to create seedbed conditions that will facilitate proper and consistent seed placement. Harrowing is generally sufficient to breakdown large chunks of soil creating a smooth level condition ideal for seeding. Harrowing may also serve to remove minor debris from the surface which could otherwise interfere with seed placement. In some cases, surface packing with a coil or roller packer may be required to create firm seedbed conditions after harrowing.

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3.3.3 Fertilization and Irrigation

The Water Protection Act Nutrient Management Regulation restricts the application of nutrient within 35m of the LSMOC due to its proximity and connection to Lake Winnipeg. In marginal soil conditions, such as those anticipated along the constructed LSMOC a low rate phosphorous fertilizer banded into the soil during seeding can improve the rate of establishment and growth of perennial grass seedlings. For reference, a summary of soil analysis results obtained during the 2019 Field Investigations is provided in Appendix 1. To hasten early establishment of seeded grass cover, it is recommended to supply a low rate of phosphorous fertilizer to areas of the disturbed ROW that are being actively revegetated to bring the available phosphorous levels within the range of 4 – 10 ppm.

Once established, further application of nutrient is not anticipated. As such, other elements of the site naturalization and revegetation approach will be designed to alleviate long-term nutrient limitations. For example, cool season native grass species generally have greater nitrogen requirements than warm season species. Use of appropriate warm season grasses will reduce competition for nutrients and create a more sustainable perennial groundcover. Similarly, the inclusion of a site appropriate native nitrogen-fixing species, such as Canada milkvetch (*Astragalus canadensis*) in the designed seed mix can serve to improve soil fertility over time and yield a more sustainable long-term groundcover.

When native grass seed mixes are seeded following appropriate site preparation and seeding methods during the proper seeding window (see Section 4.4.5), irrigation is typically not needed for seedling establishment. When seeding takes place outside of the specified seeding window (after mid-June), or if unseasonable dry conditions occur throughout spring and early summer, irrigation may be required to ensure grass establishment. Site preparation techniques, such as leaving the soil in a somewhat rough condition, can help to trap moisture and improve seedling establishment. Likewise, the use of hydraulically applied wood fibre mulch can improve moisture retention and improve seedling establishment. When seeding outside of the specified seeding windows, the Contractor should be prepared to provide irrigation.

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3.4 Erosion and Sediment Control

Erosion and sediment control is a major consideration in the construction and revegetation of the LSMOC. The existing Reach 1 and Reach 3 of the EOC provide evidence of the erosion that can be expected if channel side slopes are not secured with perennial vegetation. Perennial vegetation is considered a stable erosion protection measure once 75% live groundcover has been achieved. In order to achieve this level of consistent vegetative cover, temporary and alternative measures are needed to prevent soil loss and allow for establishing vegetation to take hold.

3.4.1 Site Preparation and Grading Approaches

Site preparation and grading approaches can be implemented to reduce the likelihood of soil erosion and sediment loss. For example, organic stockpiles may be windrowed strategically to control water runoff and reduce rill formation on the side slopes prior to soil placement and incorporation. Likewise, throughout the revegetation process surface conditions should be left in a rough, unfinished state to reduce overland water velocity and minimize erosion.

3.4.2 Temporary Cover Crops and Nurse Crops

Temporary cover crops and nurse crops are a cost-effective way to stabilize soils during periods of time where perennial vegetation has not been seeded or has not yet established sufficiently to provide soil protection. Cover crops are typically used in reclamation projects as a primary means of preserving and improving site and soil conditions prior to the establishment of perennial vegetation. In these cases, cover crops are seeded at, or near, a full field-rate to provide erosion control, competition against weeds, as well as other ancillary benefits to soil quality. Nurse crops on the other hand, are typically seeded at the same time as perennial vegetation, at a much lower rate, in order to improve growing conditions and facilitate establishment of the intended final vegetation cover. During the revegetation of the LSMOC, cover crops will be used to mitigate erosion risks in prepared soils that cannot be seeded to perennial cover due to the seasonal timing of soil preparation (i.e. during hot summer conditions). Likewise, nurse crops will be included within the seed mixes during all

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perennial seeding activities.

Seeding of a perennial grass seed mix, particularly a native seed mix with a significant warm season grass species component should occur during a relatively tight seasonal window of time (described further in Section 4.4) from May through mid-June. Given the scope and scale of the LSMOC construction project, it is reasonable to expect that all site preparation and seeding work will not be completed within one seasonal seeding window. Areas that cannot be prepared and seeded within the May – mid June seeding window can still be prepared throughout the growing season, and once soil has been placed and incorporated, these areas can be protected by seeding an annual cereal crop like common oats (*Avena sativa*). Common oats may be seeded until mid- to late August, but late summer seeding may yield poor plant establishment due to high temperatures and low moisture availability. Seeding of an annual cover crop any later in the growing season is unlikely to produce sufficient biomass to provide any reliable erosion protection, and is therefore not recommended. Dormant seeding of a cover crop is not completely reliable, but certain cold hardy species and varieties can be dormant seeded. Considering the LSMOC project, if dormant seeding (after October 20th until frost prevents seed placement) is being considered, it may be more advantageous to proceed directly to seeding the perennial grass mix, rather than seeding an annual cover. In these cases, consideration must be given to seed mix design (some species do not establish well by dormant seeding), as well as site specific factors such as risk of erosion, likelihood of flooding, and spring site accessibility,

In some instances, measures should be taken to limit biomass production by planted cover crops. Excessive stems and stubble can interfere with proper seeding rate and seed placement during native seeding operations. Therefore, cover crops are generally either mowed to a height of 15 – 20 cm or are desiccated using herbicide roughly 6 – 8 weeks after planting (while 'in – boot' just prior to flowering). If timed properly, cover crop desiccation can be integrated into ongoing weed control efforts.

All perennial grass seed mixes should include an annual nurse crop component composed of an annual cereal crop like common oats, at a rate of approximately 5.6 – 8.9 kg/hectare when revegetating an erodible slope. The fast growing annual crop

species facilitate native grass seedling establishment by assisting in erosion protection during early establishment while also serving to improve soil conditions and competing with undesirable weed species. Nurse crop seeding rates must be designed to maximize their positive impact while making sure that they do not negatively impact perennial seedling establishment through competitive effects.

3.4.3 Erosion Control Materials/Products

The use of manufactured erosion control products to safeguard prepared sites from erosive forces may be required in certain circumstances. Given the large scale of the LSMOC, extensive use of erosion control products in all situations that typically necessitate them may be unrealistic. As such, manufactured erosion control products may be used strategically in areas that pose the greatest risk of erosion and where impacts of erosion are most detrimental. Steep and long slopes, pathways of directed surface runoff, and ditches and drains that receive high volumes and rapid velocities of surface water are candidate locations for installation of erosion control materials/products.

Use of rolled erosion control blanket (ECB) is costly and inefficient in large-scale work. Hydraulically applied wood fiber mulch products present an alternative because of the relative ease and speed of application, as well as their ability to provide good coverage on uneven surfaces. Strategic use of hydraulic mulches should not be ruled out as an erosion protection measure in areas that include steep slopes or where long slope runs may require supplemental erosion control. When used, hydraulically applied mulches should be applied immediately following seeding operations, prior to seed germination. Installation of any erosion control measures, including application rates, should follow manufactures specifications and industry standard best practices

Strategic use of straw waddles or silt fencing may also be considered during construction and revegetation of the LSMOC as sediment barriers or slope interrupters. These products are highly modular, easy to install under variable site and climatic conditions, and are capable of providing rapid control of sediment where there is a risk of discharge. These products can be particularly useful in slowing overland water flow along extensive slopes where concentrated water flow may result in rill formation. By

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slowing the flow of surface run-off, the rate of sediment dislodgement and transportation can be reduced and plant establishment can be hastened.

3.5 Weed Control

Ordinarily, weed control is required when revegetating disturbed land with ground cover with an intended function (i.e.; erosion control, aesthetics, protection of adjacent rare habitat, etc.). This is especially true in areas where persistent weedy species have already established either on or near the site that is to undergo revegetation. In these cases, weed control is typically undertaken prior to planting (pre-plant weed control) and during the establishment of the planting (post-plant weed control). The duration and tactics involved in pre- and post-plant weed control measures varies with weed spectrum and level of infestation.

Where problematic weedy species are absent from landscapes prior to construction, which is often the case in remote wilderness sites like the LSMOC project area, the need for pre-plant weed control may be highly limited or altogether unnecessary. In these cases, the best approach is to take steps to ensure that weeds are not imported onto the site with machinery and equipment and to undertake proper revegetation measures on prepared sites as soon as possible. In this fashion, a desired grass planting on the LSMOC is more likely to establish properly without interference by weeds and become competitive against invasive plant species. For large multi-year construction projects, revegetation should be phased-in as sections of the project are completed to help prevent the establishment of weeds on disturbed sites. Monitoring for invasion and establishment of weed species during the construction phase of work is further described in the Vegetation Monitoring Plan. Monitoring will include both incidental observations during environmental monitoring as well as targeted surveys in locations of higher likelihood of invasion.

As noted above, the LSMOC project area is largely free of weed encroachment however Canada thistle (*Cirsium arvense*) dandelion (*Taraxacum officinale*) were found in two areas noted during the site investigations in June 2019. Specifically Canada thistle encroachment was noted within the first kilometer of the new LSMOC channel alignment. Dandelion was noted at approximately kilometer 3.8. In both cases, these

weeds occurred in mineral soil conditions associated with broadleaf treed areas. Mineral soil habitat is more favourable to the kinds of weeds that pose problems for establishing seeded grass stands. By comparison, the boreal wetland habitat that dominates the project area is considerably less hospitable to weeds. Canada thistle, in particular, is a highly problematic perennial weed that is aggressively rhizomatous and produces large quantities of viable seed. Species like thistle can rapidly spread and out-compete native seedlings. Salvaging and spreading soils containing the seeds and live roots of weeds like Canada thistle will stimulate the rapid regeneration and dispersal of this tier three noxious weed onto prepared areas.

To help avoid spreading broadleaf weeds that have been documented during site investigations, the following is recommended:

- Avoid stockpiling and using soils with a history of weed colonization. Nearby soils free of weed species should be used instead. Given the expected surplus of suitable organic material, no additional excavation should be required to avoid weed contaminated soils.

- When soils with a history of weeds must be used as growth media, project managers should direct environmental monitors to inspect stockpiles for weed regeneration and undertake appropriate weed control measures, including herbicide applications where required.

In spite of these precautions invasive weed species may still become a problem to planting establishment. Some weeds, as mentioned, have the potential to spread and infest large areas in a very short period of times. Normally an infestation of Canada thistle or other broadleaf weeds can be avoided with timely monitoring and corrective measures early in the construction phase. The following practices are strongly recommended:

- Ensure that all machinery mobilized to the project site has been thoroughly washed to minimize importing weed seeds from other sites.

- All disturbed sites in the project footprint should be regularly monitored for

weed encroachment by individuals that can identify plant species and make best practice weed control recommendations.

- When invasive weed species are documented in the project footprint, a timely and appropriate weed control response should be undertaken to control the weed infestation at its onset, before it becomes a larger issue.

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4.0 PLANTING CONSIDERATIONS

Planting considerations include; design of revegetation zones and corresponding plant species, plant and seed procurement, quantity requirements, installation methodology, and weed control.

4.1 Revegetation Design

Changes in vegetation patterns seen in natural areas are reflective of changing environmental conditions (soils, slope, access to water, duration of flooding, etc.). Revegetation design for the LSMOC will mimic natural landscapes and incorporate plant species suited to the varying environmental conditions present within the disturbed ROW.

4.1.1 Revegetation Zones and Plant Species

Revegetation areas along the ROW should be divided into two planting zones, the lower berm zone and the upland berm zone. These zones are defined largely by an anticipated gradient in moisture availability from the uplands to the side slopes (Figure 2). These zones reflect patterns seen in natural communities but are also influenced by the potential for inundation during future channel operation. It is expected that there will be significant overlap in species selected for each zone but additional species that are suited to anticipated site conditions will be adjusted.

Upland Berm Zone

The upland berm zone (UBZ) includes sites that will regularly be subjected to drought conditions during dry summer months. In extreme wet conditions these sites may also experience flooding that will typically not exceed three to four days. Species planted in the UBZ will include drought tolerant native grasses well-suited to upland sites and local climatic conditions. Several species in this mix will also have a degree of flood tolerance to account for flooding potential.

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Lower Berm Zone

The lower berm zone (LBZ) includes channel and drain side-slopes that will be periodically flooded during heavy rainfall periods and channel operation. In times of water deficit, the LBZ may also be subjected to extended periods of drought. To account for these moisture variations, the seed mix in the LBZ will be designed using species capable of tolerating inundation as well as those adapted to drought conditions.

Vegetation Cover and Channel Operation

Flooding, rather than drought, is perhaps the most challenging constraint to establishing permanent grass cover on the LSMOC. The duration, frequency, timing and magnitude of channel operation will affect the health and rigor of all planted species. From year to year, plant cover surviving prolonged flooding will require an adequate period of time to recover between flood events and replenish root reserves. Late season flood events are likely more difficult for vegetation to endure than prolonged spring flooding. Prolonged channel operation in the LBZ environment may result in periods of inundation that exceed the inherent flood tolerance of species planted on the side-slopes. In this scenario, vegetation die-off will leave gaps in plant cover, the extent of which will depend on the timing and duration of inundated conditions and recovery periods between flood events.

Post Channel Operation Monitoring

Following the operation of the channel, a site investigation should be undertaken to document site conditions as well as the inundation tolerances among the planted native grass species. Areas where vegetation die-off is substantial may warrant remedial action, including seedbed conditioning and reseeding. If certain grass species are documented to better withstand channel operation than other planted species, remedial seed mixes can be adjusted to include higher rates of the successful species.

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4.2 Plant Material Procurement

Commercially sourced native grass seed will serve as the primary component of all seed mixes employed during LSMOC revegetation work. Commercially sourced seed should be certified. Seed lot certificates displaying seed quality data should be reviewed by a native revegetation specialist prior to purchasing seed. Seed certificates should display, at a minimum, seed % purity, weed seed content per 25mg sample, % germ or tetrazolium test results as well as cultivar information. All seed purchased for the project should be adapted to the regional climate of the project area. Seed lot point-of-origin should be reviewed by a native grass revegetation specialist. Given the substantial quantity of native grass seed required for site revegetation, seed procurement should be initiated well in advance of anticipated seeding dates to ensure access to high quality seed lots that meet standards for weed seed content and percent purity. Given the large seed needs for the LSMOC Project, seed procurement should begin > 1 year in advance of anticipated seeding dates.

Areas that persistently hold water can be challenging to revegetate efficiently by seeding. As an alternative method, these areas may be revegetated using live-rooted propagules transplanted from within the LSMOC project area. This method of planting is not considered to be a primary means of revegetation at LSMOC but certain areas may warrant it as a consideration. As an example, this revegetation treatment could be applied to areas immediately upstream of drop structures where water levels are expected to be consistently high. The detailed design process will investigate if, and where this treatment could be valuable and delineate these locations along the LSMOC ROW. Depending on the expected hydrologic conditions, emergent macrophytes or wet meadow vegetation may be suitable for use. Propagule harvest sites should be assessed by a revegetation specialist to ensure that the donor material is appropriate to the anticipated planting conditions.

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4.3 Seed Mix Design and Seeding Rates

Upper berm and lower berm seed mixes will contain a balanced mix of early establishing species and long-lived species, as well as tufted and rhizomatous species. Doing so promotes early growth and long term competitiveness in seeded grass stands. Candidate species for seeding at LSMOC are listed in Table 2. Non-invasive tame species that are considered suitable for revegetating at LSMOC are listed in Table 3. When designing the seed mixes, care will be taken to avoid overrepresentation of certain species that are aggressively rhizomatous, or those with highly competitive seedling vigor. When seeded at too high a rate, these species can out-compete certain long-lived species that may have weaker seedlings but when established, are critical to the long-term performance of the planting.

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Table 2. Relevant attributes of native grass species that may be used in LSMOC ROW revegetation.

					Chemistry			Zone***		Growth Habit				Life History			Seral Stage		
Scientific Name	Common Name	C3/C4*	Variety	Origin	E.C. (dS m^{-1})**	Salinity Tolerance	pH Range	Upland Berm	Lower Berm	Rhizomatous	Creeping	Sod Former	Bunch	Annual	Biennial	Perennial	Early	Mid	Late
Agrostis scabra	Rough hairgrass	C3	Common	Parkland Prairie	< 4	low	weakly acidic – weakly basic						●			●	●	●	
Andropogon gerardii	Big bluestem	C4	Bison	North Dakota	< 4	low	neutral – weakly basic				●		●			●		●	●
Astragalus canadensis	Canada milkvetch	C3	Common	Manitoba	N/A	none	weakly acidic – weakly basic				●					●	●	●	
Beckmannia syzigachne	Sloughgrass	C3	Common	Manitoba	N/A	medium	weakly acidic – weakly basic						●		●		●		
Bouteloua gracilis	Blue grama	C4	Badlands	North Dakota	< 4	none	neutral – weakly basic				●		●			●		●	●
Bromus anomalus	Nodding brome	C3	Common	Manitoba	N/A	low	weakly acidic – weakly basic						●			●	●	●	
Bromus ciliatus	Fringed brome	C3	Common	Manitoba	< 4	none	weakly acidic – weakly basic						●			●	●	●	
Deschampsia caespitosa	Tufted hairgrass	C3	Nortran	Alaska	N/A	low	highly acidic – weakly basic						●			●	●	●	●
Elymus canadensis	Canada wildrye	C3	Mandan	North Dakota	< 4	low	weakly acidic – weakly basic						●			●	●		
Elymus dasystachyum	Northern wheatgrass	C3	Polar	Western Prairies	< 8	low	weakly acidic – mod. basic			●		●				●		●	●
			Elbee	Saskatchewan	< 8	low	weakly acidic – mod. basic			●		●				●		●	●
Elymus innovatus	Hairy wildrye	C3	Common	Manitoba	< 4	none	weakly acidic – weakly basic				●					●	●	●	
Elymus trachycaulus var. *subsecundus*	Awned wheatgrass	C3	Spring	Southern Prairies	< 4	none	weakly acidic – weakly basic						●			●	●		
			Hillcrest	Alberta	< 4	none	weakly acidic – weakly basic						●			●	●		
Elymus trachycaulus var. *trachycaulus*	Slender wheatgrass	C3	Common	Saskatchewan	< 16	high	weakly acidic – strongly basic						●			●	●		
Elymus virginicum	Virginia wildrye	C3	Common	Minnesota	< 4	none	weakly acidic – weakly basic						●			●	●	●	
*Glyceria grandis*****	Tall manna grass	C3	Common	Manitoba	N/A	none	weakly acidic – mod. basic				●					●	●		
*Juncus arcticus*****	Alpine rush	C3	Common	Manitoba	N/A	medium	weakly acidic – strongly basic			●						●	●	●	●
Koeleria macrantha	June grass	C3	Common	Manitoba	< 4	none	neutral – weakly basic						●			●		●	●
Nassella viridula	Green needle grass	C3	Lodorm	North Dakota	< 4	none	neutral – weakly basic						●			●		●	●
			Mallard	Manitoba	< 4	none	neutral – weakly basic						●			●		●	●
Panicum virgatum	Switchgrass	C4	Dacotah	Manitoba	< 4	medium	neutral – weakly basic						●			●		●	●
Pascopyron smithii	Western wheatgrass	C3	W.R. Poole	MB, SK, AB	< 16	high	weakly acidic – mod. basic			●		●				●	●	●	●
			Rodan	North Dakota	< 16	high	weakly acidic – mod. basic			●		●				●	●	●	●
Poa palustris	Fowl bluegrass	C3	Common	Manitoba	N/A	medium	mod. acidic – weakly basic						●			●		●	●
Puccinellia nuttalliana	Nuttall's alkali grass	C3	Common	Manitoba	< 33	high	weakly acidic – mod. basic						●			●		●	●
Schizachyrium scoparium	Little bluestem	C4	Badlands	North Dakota	< 4	none	neutral – weakly basic						●			●		●	●
*Scholochloa festucacea*****	Whitetop	C3	Common	Manitoba	N/A	low–medium	weakly acidic – weakly basic			●						●	●	●	●
*Sparganium eurycarpum*****	Bur reed	C3	Common	Manitoba	N/A	none	weakly acidic – weakly basic			●						●		●	●
*Spartina pectinata*****	Cord grass	C4	Red River	North Dakota	< 4	none	neutral – weakly basic			●	●	●				●		●	●

* C3 denotes cool season and C4 denotes warm season.

** E.C. refers to electrical conductivity, used here as an indication of salt tolerance.

***Indicates expected suitability for use in different active revegetation zones of the LSMOC ROW – final seed mixes to be determined in detailed design.

**** For consideration in ditches and drains.

Notes: Commercial seed availability and quality (purity and germination) may vary from year to year.

Table 3. Relevant attributes of non-native grass species that may be used in LSMOC revegetation.

			Chemistry			Zone		Growth Habit				Life History			Seral Stage		
Scientific Name	Common Name*	C3/C4*	E.C. (dS m^{-1})**	Salinity Tolerance	pH Range	Upper Berm	Lower Berm	Rhizomatous	Creeping	Sod Forming	Bunch	Annual	Biennial	Perennial	Early	Mid	Late
Thinopyrum ponticum	Tall wheatgrass	C3	< 16	high	neutral - alkaline						●			●	●	●	
Dactylis glomeratus	Orchard grass	C3	4-8	low	mod. acidic - neutral						●			●	●		
Agrostis stolonifera	Redtop	C3	< 16	high	weakly acidic - strongly basic					●	●			●	●	●	●
Phleum pratense	Timothy	C3	< 4	low	mod. acidic - slightly basic						●			●	●	●	●
Festuca sp	Fescues	C3	4-8	low	weakly acidic - strongly basic				●		●			●	●	●	●
Medicago sativa	Alfalfa	C3	4-8	low	neutral - alkaline						●			●	●		

* C3 denote cool season species; C4 denotes warm sesason species.

**E.C. refers to electrical conductivity, used here as an indication of salt tolerance.

***Indicates expected suitability for use in different active revegetation zones of the LSMOC ROW - final seed mixes to be determined in detailed design.

Note: Commercial seed availability and quality (purity and germination) may vary from year to year.

Seeding rates will be determined on the basis of pure live seed. It has been found repeatedly that seeding at a proper rate promotes the survival and establishment of all species components in a seed mix and makes for a stronger, more competitive planting in the long-term. Percent-based seed mixes do not adequately account for individual species growth attributes or seed size. This tends to result in excessively high seeding rates and imbalanced seed mix characteristics. Seeding at too high a rate for example, results in excessive intra- and inter-species competition which in turn causes the failure of many key species in a mix to establish. Grass mixes seeded at too high a rate either fail to establish or are dominated by one or two species with competitive seedlings but poor long-term competitiveness. In both cases these stands tend to collapse into weed infestation in the relative short-term.

4.4 Planting (Seed Mix Installation)

4.4.1 Drill Seeding

The Truax native grass seed drill has proven to be the best method for seeding multi-species native grass mixes. The equipment and various internal mechanisms have been optimized to ensure even and consistent placement of native seeds at the appropriate depth. Seedbed preparation activities along the channel alignment are directed at achieving site conditions best suited to drill operation.

- Truax native seed drills can be run as several setups including; on a tractor with a three point hitch, towed as a trailer (end-wheel drive) or mounted to the front of a skidsteer. The three point hitch and skidsteer mounted options provide increased maneuverability and accuracy when seeding irregular shaped areas like forest edges or lay down sites. Larger Truax drills run as an end wheel drive trailer setup can be employed on long straight-away sections of the LSMOC right-of-way, maximizing seeding efficiency.

- Truax drills employed on the LSMOC ROW should be equipped with 'trash plows' for seeding in areas where excessive cover crop residue may be present on the soil surface.

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- Ideally, Truax drills are run on slopes no steeper than 4:1 for safe operation. This may preclude drill operation on some parts of the channel side slopes where harrow-broadcast-harrow seeding becomes the preferred option for safety reasons.

- Drill seeding should only be undertaken on smooth, firm, level ground free of excessive debris to ensure the accurate delivery of seed to the proper depth.

4.4.2 Harrow-Broadcast-Harrow Seeding

In the harrow-broadcast-harrow (HBH) seeding method, an initial pass over the seedbed is made with harrows in order to roughen the soil surface, allowing for better seed-soil contact. In a second pass, a broadcaster (ex. fertilizer spreader) distributes seed over the area at a specified rate. The broadcast seeding pass is followed by a final harrow pass that incorporates the seed into the soil.

- The primary disadvantage of HBH seeding is the fact that it uses a minimum of twice the amount of seed as drill seeding because not all of the broadcasted seed will become embedded in the soil following the final harrow pass. Therefore, seeding rates are doubled (2x the drill rate) to account for approximately 50% of the broadcasted seed usually being left at the soil surface where the chances of germination and establishment are greatly decreased.

- Another disadvantage of HBH seeding is harrow passes over a prepared seedbed may be impaired by cover crop residues clogging equipment during scarification. In places where cover crops have been seeded as a form of erosion protection, drill seeding with trash plows should be the primary method of seed installation.

- Harrow-broadcast-harrow seeding is highly effective when undertaken with equipment that is stable on slopes steeper than 4:1. In these instances, harrows

DRAFT

may run offset and downslope of the machinery pulling it. On slopes greater than 2.5:1, harrows are less effective unless downward force is applied.

4.4.3 Hydro-Seeding

Hydro-seeding should be regarded only as a last resort option and where other seeding methods are not feasible. Hydro-seeding typically does not provide the necessary seed-to-soil contact to promote reliable seed germination and seedling survival across prepared sites. Hydro-seeded sites are prone to uneven germination rates, uneven species germination, bare areas, and weed encroachment.

4.4.4 Erosion Control Measures

Erosive forces that could disturb and displace surface soils and planted seed must be mitigated during early plant establishment in order to hasten site revegetation. Low cost options such as site grading measures and cover crops (described in Section 3.4) will be implemented throughout the site, while critical areas with a high probability of accelerated erosion may warrant the application of manufactured erosion control products.

In large scale revegetation projects that feature steep or long slopes and highly erodible soils, rolled erosion control products can be costly and relatively ineffective. An attractive alternative to rolled erosion control products are hydraulically applied wood fiber mulches. These products provide similar project benefits which include:

- Can be applied more quickly than conventional ECB and provides superior direct soil coverage and protection.
- Covers irregular soil surfaces better than conventional ECB (i.e. small rock or woody debris at the surface will not interfere with its function).
- There is no need to remove the product once applied to seeded areas.
- Wood fiber mulch products are weed seed free and biodegradable.

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4.4.5 Timing of Seeding

Native grass seeding

The recommended native grass seeding windows should be closely followed to achieve best results. Cool season native seed mixes should be sown in the early spring as soon as conditions allow, until June 15th. Warm season mixes can be seeded from late May 20 to June 15. This seeding window gives establishing grasses access to spring moisture which greatly enhances the establishment of seedlings. Seeding native grasses after mid-June exposes seedlings to periods of summer moisture deficit which can be detrimental to the establishing grasses.

A dormant seeding window occurs after October 20th until frost or snow inhibits normal seed placement. Dormant seeding is ideal for cool season grass species but does not accommodate warm season grass species which have seedlings that are sensitive to spring frosts.

Due to the slightly shorter growing season in the project area, it is recommended that seeding be undertaken at the earliest possible opportunities within the recommended seeding windows. Seeding early in the recommended seeding windows, as opposed to waiting until the end of the window, helps to safe-guard planting success against uncharacteristic weather such as the early on-set of drought conditions.

Cover crop seeding

As previously noted, erosion control cover crops can be seeded throughout the growing season, up until August 15th, but as summer progresses the germination of seeded annual cover becomes dependant on getting a well-timed rainfall, typically, within two weeks of seeding. Cover crops are most reliably established when seeded between mid-April and mid-August.

4.5 Propagule Plantings

While not considered to be a primary revegetation technique at the LSMOC, the possibility of using wetland propagules to revegetate specific sites may be appropriate in certain circumstances and should be considered as the LSMOC

revegetation design evolves.

When planning to undertake propagule plantings it is recommended that the following be considered;

- Excavation, hauling and placement of propagules as well as the excavation of planting beds and trenches are best undertaken in early winter – late spring in frozen conditions (late November – early March).

- Planting beds or trenches can be amended with additional soil to prepare the site. This would require minor additional sub-cutting to accommodate organics placement.

- Propagules of emergent species cannot be planted deeper than 45 cm below anticipated water levels. Some propagule plantings may be placed at the toe of the slope.

4.6 Weed Control

It is recommended that MI be prepared to undertake weed control during the planting year. As previously noted the project is considered to be largely free of weeds therefore planting should be phased-in as soon as possible on prepared sites rather than delay and increase the chances of weeds establishing prior to seeding. Early establishment of desirable cover, prior to weed infiltration, will be an important part of the overall revegetation process

As noted, dandelion and Canada thistle were documented in deciduous treed cover during site investigations. There is significant potential for these species to establish and proliferate during the planting phase of the LSMOC project especially if organics in these areas are stockpiled and distributed onto prepared grades for revegetation purposes. These species, particularly Canada thistle, will interfere with short-term and long-term planting objectives and without early control can quickly become a severe infestation. Unless adequate weed control measures can be made available during construction and revegetation, it is strongly recommended that organics not be used

DRAFT

for the purpose of amending soils, from sites where invasive weeds have been documented. The requirement for large scale weed control measures can often be minimized through the early detection and subsequent prompt control of invasive weeds. Weed control efficacy is best achieved at the early onset of encroachment.

4.6.1 Coordination of Weed Control in Seeding Year

A weed control strategy on a project of this scale is influenced by construction and planting schedules, existing weed spectrum, as well as seedling leaf-stage development within a seeded area. A project specific integrated weed control strategy should be developed with consideration given to weed management best practices. When employing the use of herbicide for weed control, the following points should be considered;

- In-crop herbicide applications can only be undertaken after grass seedlings have reached the two to three leaf stage (typically late-June to early July depending on date of seeding and prevailing weather conditions).
- Non-selective herbicides cannot be applied after native seedling emergence.
- Only prescribed rates of broadleaf herbicide should be applied where native seeding has been undertaken.
- Where a localized weed encroachment is detected, MI should be prepared to undertake an appropriately timed herbicide application on up to three occasions during the growing season.

DRAFT

5.0 SEQUENCING OF SITE PREPARATION AND REVEGETATION

Due to the seasonal nature of revegetation work, start-up time for site preparation and seeding affects how revegetation activities unfold in a given year. Site preparation and planting activities are highly integrated and are sensitive to time of growing season. Subsequently, missing key dates for completion of various elements may set the project behind schedule for up to one year and may result in additional project costs associated with the introduction of cover crops or other temporary erosion control measures. Additional time contingency planning will be required. Staging of sufficient machinery and organics prior to, or during, construction will be critical to overall success of revegetation.

5.1 Peat Extraction and Stockpiling

Peat and organic soil extraction is anticipated to occur during the initial channel construction contract. Equipment will access designated peat borrow sites in frozen conditions to allow for efficient extraction of the material which can then be windrowed in the ROW. See Section 3.0 for further discussion on organics sourcing, handling, management and integration.

5.2 Overview of Preliminary Revegetation Plan

Each of the required steps for revegetation will unfold as a tightly coordinated series of '*passes*'. To make the most efficient use of seeding opportunities and to minimize exposure of prepared sites to further erosion, ground that is prepared should be seeded as soon as possible, ideally within 24 hours. It is therefore essential that all required equipment, personnel and soil resources be mobilized and coordinated before work commences.

The sequence of passes takes place in the following order after final grading has been achieved:

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FIRST PASS: Decompaction

- Decompaction will be required if subsoils are left in a compacted state following scheduled construction.

SECOND PASS: Organics placement

- Stockpiled organics can be staged adjacent the work site and placed/spread onto decompacted subsoils.

THIRD PASS: Organics integration and seedbed conditioning

- Organics are harrowed into decompacted subsoils to the appropriate depth.
- Harrow passes break up soil clumps following organics integration.
- More than one pass with harrows may be required to achieve a level seedbed.

FOURTH PASS: Seeding permanent cover

- Native grasses may be seeded from May – mid June or from October 20th – early November, depending on prevailing weather conditions and timing of site preparation.

FIFTH PASS: Seeding cover crop

- Once the seeding window for permanent cover has past, cover crop seeding can take place from April – August 15th.
- Areas seeded only with a cover crop will be revisited at the earliest permanent cover seeding window.

PROPAGULE PLACEMENT:

- Propagule, if required, is generally undertaken in the late-fall throughout winter.

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The rate of site preparation (i.e. decompaction, organics placement and incorporation, as well as seedbed conditioning) will depend on the amount and type of resources (equipment and personnel) dedicated to this work. Site preparation works can be accomplished outside of the seeding window for perennial vegetation (early spring until mid-June and after mid-October). Ideally areas that are prepared are seeded to perennial cover as soon as possible to minimize their exposure and risk of erosion. Typically, approximately 2-5ha can be prepared per day under favorable conditions. The detailed design phase of this project will provide a more accurate estimate for rate of site preparation, informed by a more complete understanding of the overall contracting approach for the project.

The more site preparation work that can be accomplished leading up to the spring seeding window, the more area can be seeded to perennial cover in a given year. Every effort should be given to maximizing the amount of continuous area that is prepared for seeding ahead of early May. Provided sites have been suitably prepared for seeding, 8-16ha can realistically be drill seeded per day (assuming 10hr day). Seeding efficiency is maximized by employing large scale equipment and by ensuring large continuous tracts of seedable area is prepared ahead of seeding. Reduced efficiency should be expected when seeding steep slopes, wet areas, and forest edges as these areas will require special attention to ensure accurate seeding. Experienced staff should be on hand to assist with coordination and quality control oversight during all seeding.

DRAFT

6.0 REFERENCE

Alberta Environment and Water. 2012. Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta. Prepared by MacKenzie, D. for the Terrestrial Subgroup, Best Management Practices Task Group of the Reclamation Working Group of the Cumulative Environmental Management Association, Fort McMurray, AB. March 9, 2011.

KGS Group Consulting Engineers. 2019. Lake St. Martin Outlet Channel Preliminary Design Report. Draft_REV A. KGS Group 18-0300-005. Pp. 75.

Manitoba Land Initiative. 2001. Core Maps – Data warehouse; accessed via: http://mli2.gov.mb.ca/mli_data/index.html

Government of Manitoba. "2001. Her Majesty the Queen in Right of Manitoba, as represented by the Minister of Conservation. All rights reserved."

Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts, An Ecological Stratification of Manitoba's Landscapes. Technical Bulletin 98-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Pp. 324.

DRAFT

APPENDIX 1

LAKE ST. MARTIN OUTLET CHANNEL

PRELIMINARY REVEGETATION DESIGN:

REVEGETATION SITE INVESTIGATIONS REPORT

Submitted to:

KGS GROUP

Prepared by:

SCATLIFF + MILLER + MURRAY



Front Photo: Aerial photo of Lake St. Martin Outlet Channel alignment, June 11th, 2019

Front Photo (inset): Reach 1 LSMEOC revegetation trials; Plot #2, September 23rd, 2019

EXECUTIVE SUMMARY

Field investigations were undertaken in 2019 by Scatliff+Miller+Murray Inc. (SMM) revegetation biologists as part of the overall Lake St. Martin Outlet Channel (LSMOC) Preliminary Naturalization Revegetation Plan. These investigations focussed on the availability and suitability of in-situ growth media resources within the LSMOC project area, some of which will be stockpiled for use during site revegetation. The field investigations consisted of two parts:

1. Field Survey - along the LSMOC Alignment
2. Revegetation Trials - on the existing Reach 1 Emergency Outlet Channel

The Field Survey was carried out primarily to confirm the availability and suitability of existing soil resources for use in revegetation of the LSMOC and to make note of invasive weeds. A total of twenty-six (26) sampling locations were distributed along the channel centerline to represent nine Land Resources Inventory (LRI) cover classes found within the LSMOC project area. Field observations of plant community cover were in line with expectations, with over 80% of the project area falling within the category of wetlands with deep organic soils. Analysis of the chemical properties of organic soils along the LSMOC alignment revealed no apparent barriers to the growth and establishment of grass species that are appropriate for revegetating purposes within the LSMOC project area. Invasive weed encroachment was minimal and highly localized. Canada thistle and dandelion were encountered on two occasions.

Revegetation trials were carried out on the existing Reach 1 to assess seedling establishment with and without salvaged organics. Establishment of a site-appropriate, grass-based native seed mix was tested in exposed till amended with 7.5cm (3'') and 15cm (6'') of salvaged organics. Glacial till sub-soils within the trial plots were decompacted to 15-20 cm prior to incorporating organics. Seedling establishment was also tested in a control treatment with no amendments but which was similarly decompacted. Seedling establishment was successful for both 7.5 cm and 15 cm organic amendment treatments. Seedling establishment on control plots was weak and, overall, did not meet the required performance criteria that has proven to be

effective in establishing long-lived grass stands. The 7.5cm amendment is considered here as the minimum condition required for successful short term seedling establishment. That being said, with the expectation that the LSMOC will experience periods of moisture limitation and drought, a 15cm depth of organic soil is recommended for the long term sustainability of revegetation efforts, rather than the minimum 7.5cm organic soil depth.

Analysis of the organics that were salvaged for Revegetation Trials were found to be comparable, both in texture and in chemical properties, to organics soils on the LSMOC alignment. The results of the vegetation trials suggest that the use of salvaged organic soil resources on the LSMOC alignment pose no barriers to revegetation objectives. The use of soils that are salvaged in areas where Canada thistle and dandelion were present is likely to cause proliferation of these weeds. Canada thistle is considered especially problematic for the establishment and long-term quality of seeded grass stands. It is recommended that soils likely to contain the seed bank and live roots of these weeds should either not be used, or a targeted weed control program be implemented as part of the channel revegetation phase.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

TABLE OF CONTENTS 5

LIST OF FIGURES 6

LIST OF TABLES 6

1.0 INTRODUCTION 7

1.1 Ecological Context 8

2.0 REVEGETATION FIELD SURVEY 11

2.1 Methods 11

2.2 Results 12

2.2.1 General Land Cover Observations 12

2.2.2 Invasive Weed Species 12

2.2.3 Soils 12

3.0 REVEGETATION FIELD TRIALS 14

3.1 Methods 14

3.2 Results and Observations 18

4.0 DISCUSSION – IMPLICATIONS FOR PROJECT REVEGETATION 21

4.1 Field Survey 21

4.2 Revegetation Trials 22

5.0 REFERENCES 24

APPENDIX 1 – Lake St. Martin Outlet Channel revegetation Survey Observations 25

APPENDIX 2 – Lake St. Martin Outlet Channel Field Survey Soil Sample Analysis 38

APPENDIX 3 – Revegetation Trials Photo Log 39

APPENDIX 4 – Eend-of-Season Revegetation Trials Field Data 45

LIST OF FIGURES

Figure 1: Showing the location and alignment of the LSMOC and LSMEOC as well as Land Cover Classification and Field Survey sample locations along the alignment.

Figure 2: Approximate location and position of trial plot replicates on Reach 1 of the Emergency Outlet Channel.

Figure 3: Plot configuration showing all three treatments and orientation of plots parallel to the channel alignment.

LIST OF TABLES

Table 1: Land resources inventory cover classes and proportional cover within the LSMOC right of way.

Table 2: Soil sampling summary table showing number of sampling locations by LRI Cover Class.

Table 3: Native grass seed mix and commercial lot numbers for revegetation trials.

Table 4: End-of-season native grass seedling inspection data showing density and maturity measures.

1.0 INTRODUCTION

Field investigations were undertaken by Scatliff+Miller+Murray Inc. (SMM) revegetation biologists as part of the LSMOC Preliminary Naturalization Revegetation Plan. Channel revegetation is described in the *Lake Manitoba and Lake St. Martin Outlet Channels Project Environmental Impact Statement* (EIS) (Manitoba Sustainable Development, 2019) as a major construction component aimed at mitigating channel surface erosion and colonization by invasive species. The intent of the field investigations was to assess opportunities or constraints in the existing bio-physical environment to channel revegetation within the LSMOC. The main purpose of these investigations was to determine the suitability of growth media resources for revegetation and to help determine the quantity of organic soils required to meet revegetation objectives.

Topsoil and organics will be salvaged and stockpiled as part of the channel construction phase. Stockpiled soils will then be deployed as part of the revegetation phase to create a suitable growth medium for the establishment of a perennial grass cover. Soil organics will be essential for the purpose of revegetation on the LSMOC as most graded areas will be composed of deep glacial till subsoils. Glacial till subsoils in the project area are comprised of a mix of coarse material and mineral fines (sand, silt and clay fractions). These mineral fractions are important components of a functioning growth media, but lack organic content and fertility. Gaining a better understanding of the chemical and physical nature of salvageable organics, as well as the quantities required to suitably amend subsoils will directly inform revegetation planning going forward.

The presence of invasive weed species in the project area prior to construction is considered to be an important factor for the establishment of desirable vegetation during the project revegetation phase. Salvaged soils contaminated with weed seeds and live roots will result in significant weed regeneration when these soils are used for growth media purposes and may confound revegetation efforts. The majority of the project area is largely undisturbed and unsuitable to weed species considered to be most problematic in seeded perennial grass stands. Nonetheless the presence of

weeds along the channel alignment was included as part of the field investigation for consideration during revegetation design and planning.

The revegetation field investigations consisted of two parts;

1. Field Survey of the LSMOC Alignment
2. Revegetation Trials

The Field Survey was carried out primarily to confirm the availability and suitability of soil resources for use in revegetating the LSMOC. Revegetation Trials were carried out on the existing Reach 1 to assess seedling establishment using salvaged organics that are comparable to soil resources on the LSMOC. The following sections describe the ecological context of the project area, outline the methodologies used, and describe the findings of the revegetation field investigations.

1.1 Ecological Context

The LSMOC project is situated in the Mid-Boreal Lowland Ecoregion of the Boreal Plains Ecozone. The Ecoregion is broadly characterized by extensive peatland cover interrupted by mixed softwood/hardwood plant communities where drainage and mineral soils allow (Smith et al., 1998). The vegetation on the peatlands varies with peatland type. Bogs are generally characterized by stunted black spruce with ericaceous shrub and mosses cover. Moss cover is often dominated by species of sphagnum. Fens are generally dominated by sedges and brown mosses and contain varying quantities of shrubs such as swamp birch and stunted tamarack trees where conditions permit. Upland cover can vary with drainage, soil texture and fire history. Black spruce is widespread, but following forest fires, jack pine and, to a lesser extent, trembling aspen, become major forest components (Smith et al., 1998). Wet uplands have black spruce and moss vegetation with shrubs such as willow and alder.

The LSMOC is 23.8km in length with a 400m right of way with the inlet situated at Lake St. Martin and the outlet at Lake Winnipeg (Figure 1). The overall area of the project is approximately 890 ha. The major land cover classes, as well as their total area and relative contribution to the overall project area are shown in Table 1.

During construction of the LSMOC, tree clearing, soil stripping, excavation, soil handling and stockpiling will take place. Following final grading it is anticipated that the areas to be revegetated will be composed primarily of exposed glacial till along with a mixture of other subsoil material. Glacial till is generally low in organics, fertility and biological processes and is not considered to be a suitable growth media for revegetation. Stockpiled organic soils will be used to amend exposed subsoils to create a suitable growth medium for the timely establishment of seeded native grass cover.

Table 1: Land resources inventory cover classes and proportional cover within the LSMOC right of way.

COVER CLASSES	AREA (Ha)	COVER (%)
Water	4.4	0.5
Exposed Land	1.5	0.2
Wetland – Treed	35.5	4.0
Wetland – Shrub	483.7	54.4
Wetland – Herb	228.3	25.7
Coniferous – Dense	55.9	6.3
Coniferous – Open	6.8	0.8
Broadleaf – Dense	16.1	1.8
Broadleaf – Open	1.0	0.1
Mixed Wood – Dense	56.2	6.3

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FileName: P:\Projects\2018\18-0300-005\Dwg\GIS\MXD\Preliminary_Naturalization_Revegetation_Plan\RevA\18-0300-005_Fig01_v2.mxd
11"x17" PLOT SCALE 1:1

555000 560000 565000 570000 575000

5750000 5745000 5740000

N W E S

Lake Winnipeg

Buffalo Creek

Big Buffalo Lake

Little Buffalo Lake

Lake St. Martin

0+000 1+000 2+000 3+000 4+000 5+000 6+000 7+000 8+000 9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000 19+000 20+000 21+000 22+000 23+000 24+000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

LEGEND:

- Soil Sample Location
- Classification Site
- Reach 1 Channel – Existing
- LSMOC Alignment
- Access Road
- Alignment Corridor (400 m)

LAND COVER

- No Data
- Shadow
- Cloud
- Snow/Ice
- Rock/Rubble
- Exposed Land
- Water
- Shrub – Tall
- Shrub – Low
- Herb
- Bryoids
- Wetland – Treed
- Wetland – Shrub
- Wetland – Herb
- Coniferous – Dense
- Coniferous – Open
- Coniferous – Sparse
- Broadleaf – Dense
- Broadleaf – Open
- Broadleaf – Sparse
- Mixed Wood – Dense
- Mixed Wood – Open
- Mixed Wood – Sparse

1 0 1 2 3
Kilometres

2.0 REVEGETATION FIELD SURVEY

2.1 Methods

The revegetation field survey of the LSMOC alignment was conducted by SMM revegetation biologists on June 11th and 12th, 2019, mainly within a 20m wide cleared area along the channel centerline. The survey was conducted on foot with transportation provided by helicopter.

A total of twenty-six (26) sampling locations were situated along the LSMOC centerline (Figure 1). Cover class information was obtained from the Provincial Land Resource Inventory (LRI) Land Use / Land Cover Landsat TM Maps (Gov. MB, 2001). Using ArcMap GIS software, survey locations were distributed roughly proportionally among the various LRI cover classes. At each sampling location, general vegetation cover observations were documented to confirm the major LRI vegetation cover types intersecting the LSMOC alignment. Land vegetation cover is considered to be a good indicator of soil conditions given the relationship between soil and drainage and the dominant plant community. Therefore cover type was linked to soil information to help extrapolate information gained from soil samples on the availability of soil resources throughout the project area. Any evidence of weedy or otherwise invasive plant species were also documented and given a UTM waypoint to mark locations.

Soil samples were taken at all sampling locations. The frequency and distribution of soil sampling was designed to proportionally represent existing cover classes depicted within the 400 meter wide LSMOC right-of-way (ROW). Soil sampling protocol for each sampling site was to obtain separate samples at depths of 0 – 15cm, 15 – 30cm and 30 – 45cm. Samples consisted of a minimum of three (3) cups of organics or mineral soils at each depth. Samples were stored in a freezer following field collections prior to being submitted for laboratory analysis. A subset of samples, representing major cover types were analysed for characteristics that are important for establishing native grass-based seed mixes. Chemical parameters that were analysed included organic content, pH, electrical conductivity and macro-nutrients such as phosphorus and nitrogen.

2.2 Results

2.2.1 General Land Cover Observations

Field observations of dominant vegetation cover/structure, for the most part, supported LRI cover classes. Survey vegetation data and representative photography of each sample location are provided in Appendix 1. Visually distinguishing between the various broadleaf cover classes *('Broadleaf Open', 'Broadleaf Dense' and 'Mixedwood Dense')* was difficult, and subsequently, these classes were consolidated into a new category; '*Broadleaf Treed*', for the purposes of this report.

The vegetation cover was native and characteristic of undisturbed landscape across all land cover classes. Observations were taken from the narrow clearing along the centerline of the LSMOC with occasional short forays into adjacent sites. Ground cover along the clearing was generally intact with a minimum of disturbance save for the removal of tree cover. Only occasionally was exposed mineral soil encountered and this was usually where aspen was encountered were surface organics were relatively thin compared with wetland soils.

2.2.2 Invasive Weed Species

Broadleaf weeds were encountered at two (2) locations. In both circumstances a small number of specimens were encountered on mineral soils within broadleaf treed areas. Roughly fifteen (15) Canada thistle (*Cirsium arvense*) plants were encountered within a cleared trembling aspen stand, on the channel center line, within one (1) kilometer of the inlet at Lake St. Martin (Sampling Location # 25). Dandelions were seen in a similar environment at Sampling Location #4. Exposed upland mineral soils are generally more prone to weed encroachment than wetland soils encountered in the region.

2.2.3 Soils

Soil samples were taken at all 26 sampling sites. Frost was encountered at 20 – 30cm in wetland and coniferous sites. Therefore soil sampling was mostly restricted to the 0 – 15cm and 15 – 30cm depths in these areas. Frost was absent from upland mineral soils associated with aspen cover and generally better drainage conditions. In these

areas field personnel were also able to obtain soil samples from the 30 – 45 cm depths.

A sample of exposed glacial till at the 0 – 15cm depth was taken from an embankment on a segment of Reach 3 that will be modified and integrated in to the LSMOC alignment. The assumption was made that the embankment was nearly entirely composed of excavated and graded till therefore it was deemed to be unnecessary to obtain deeper samples from 15 – 30cm and 30 – 40cm soil depths.

To minimize unnecessary duplication of soil testing and associated costs, a subset of soil samples representing major cover types was submitted for further analysis. Table 2 shows the distribution of the number of sampling sites that were submitted across representative cover classes. Soil samples from a total of fifteen (15) sites were submitted for laboratory analysis. A summary of relevant soil parameters for revegetation are provided in Appendix 2. Generally all sampled soils were found to be significantly more fertile than glacial till. Mineral soils were encountered only in cover classes containing deciduous forest cover types. All other soils were organic in nature. Soil pH and electrical conductivity were generally found to be within the environmental tolerance ranges of most grass species being considered for revegetation within the project area.

Table 2: Soil sampling summary table showing number of sampling locations by cover class.

COVER CLASSES	AREA (Ha)	COVER (%)	SOIL SAMPLING LOCATIONS
Exposed Land	1.5	0.2	1
Wetland – Treed	35.5	4.0	1
Wetland – Shrub	483.7	54.4	3
Wetland – Herb/Bryoid	228.3	25.7	4
Coniferous – Dense	55.9	6.3	1
Coniferous – Open	6.8	0.8	2
Broadleaf – Treed	56.2	6.3	3

3.0 REVEGETATION FIELD TRIALS

3.1 Methods

The experimental trials were conducted at Reach 1 of the Lake St. Martin Emergency Outlet Channel, at the north shore of Lake St. Martin, Manitoba (UTM 14U 554037 5740386) (Figure 1). The study site is located within the Interlake Plain Ecoregion of the Boreal Plains Ecozone (Smith et al., 1998). Mean annual precipitation ranges from approximately 500 to 525mm and experiences highly variable year-to-year precipitation rates.

The Emergency Outlet Channel was constructed in 2011 in order to provide emergency reduction to lake levels caused by flood water diversion in southern Manitoba. This channel reach was operated from 2011 to 2012 and again from 2014 to 2015. Existing soil conditions are described as un-vegetated glacial till exposed at the time of channel construction (i.e. base material). Soils are moderately alkaline (pH > 8), non-saline (EC < 1dS/m), lack soil organic matter (< 1.0%) and are infertile (N < 4ppm; P < 2ppm; K < 130ppm). Site soils have experienced variable levels of erosion and compaction since their construction, largely attributable to their position on site (i.e channel side slopes vs. terrace/bench).

The vegetation trials follow a split plot design and were replicated three times. The experimental variable being tested was rate of organic soil application and the study evaluated three application rates – 15cm (6''), 7.5cm (3''), and 0cm (no soil amendment). All other aspects of the revegetation approach were kept consistent between subplots, including method of base material decompaction, seedbed preparation, seeding, and plot maintenance.

An initial site investigation was conducted in late May 2019 in order to locate suitable sources of organic soils to use in the trials, as well as to confirm existing site conditions and finalize trial logistics and experimental set-up methodologies (Appendix 3 - Photo Array 1). During this site investigation, several potential sources of salvageable organics were located along the edge of the forest. These potential

sources were sampled and soil samples were submitted for analysis at Farmer's Edge Laboratories, in Winnipeg, MB. Ultimately, a source on the south side of the channel, approximately 600 – 700m east of the constructed weir at the inlet was selected for use in the trials based on the soil quantity and quality, as well as its relative proximity to the channel inlet (Figure 2).

Vegetation trial plots measured 2.5m by 9m and were sub-divided into three sub-plots (each measuring 2.5m by 3m) each of which received one of the three experimental treatments (15cm, 7.5cm, or 0cm organic soil amendment) (Figure 3). All vegetation trial plots were set up on June 3rd and June 4th, 2019. Trial plot set-up followed the following steps (Appendix 3 - Photo Array 2):

1. Plots were sited, measured and marked with corner posts;
2. Plots were decompacted to approximately 15 – 20cm manually using a pick-axe;
3. Organic soil was dug and hauled to decompacted plots using a wheel-barrow with a known volume/capacity;
4. The requisite volume of organic soil was placed and spread over the applicable treatment with bow rakes;
5. Placed soils were lightly blended into the decompacted till using pitch forks;
6. The plot seedbeds were prepared by raking the surface level with bow rakes;
7. Seed was broadcast across the plot using a push-broadcaster that had been calibrated to the desired seeding rate – the native grass seed mix and seeding rate is shown in Table 3;
8. Plots were lightly raked once more to incorporate the seed into the surface of the soil;
9. Animal exclusion measures were installed (chicken wire fencing and jute string and flagging tape).

Site inspections were conducted throughout the growing season to document plant establishment and growth. During each inspection, plots were surveyed by randomly placing a 0.1 m^2 quadrat five times in each sub-plot and collecting plant growth data within each quadrat. Quadrat drops avoided the outer 60cm of the plots to limit any potentially confounding edge effect on vegetation establishment. Plant measures

documented included seedling density (oat seedlings and native grass seedlings) and growth stage (including height and leaf stage), as well as the presence of un-seeded vegetation. General observations on plant growth, stress, and soil conditions were made during each site inspection and conditions were documented with photography (Appendix 3 – Photo Arrays 3-5).

The seeding rate was determined on the basis of pure live seed. The seed mix is shown below in Table 3. Oats were also included in the seed mix as a quick growing temporary nurse crop while the seed mix is establishing.

Table 3: Native grass seed mix and commercial lot numbers for revegetation trials.

Species	**PLS Seeding Rate** (kg/ha)	**Lot #**
Switchgrass	1.7	SG-18-801
Western wheatgrass	0.8	H4-16-87101 (504801)
Northern wheatgrass	0.8	514773
Rough hairgrass	0.2	171438219
Canada wildrye	1.1	504738
Big bluestem	2.8	BBS-18-18
Nodding brome	1.7	1801 (504447)
Slender wheatgrass	0.8	18-0028 (504775)
Canada milkvetch	0.2	----
Total	**10.1**	



Figure 2: Approximate location and position of trial plot replicates on Reach 1 of the Emergency Outlet Channel.

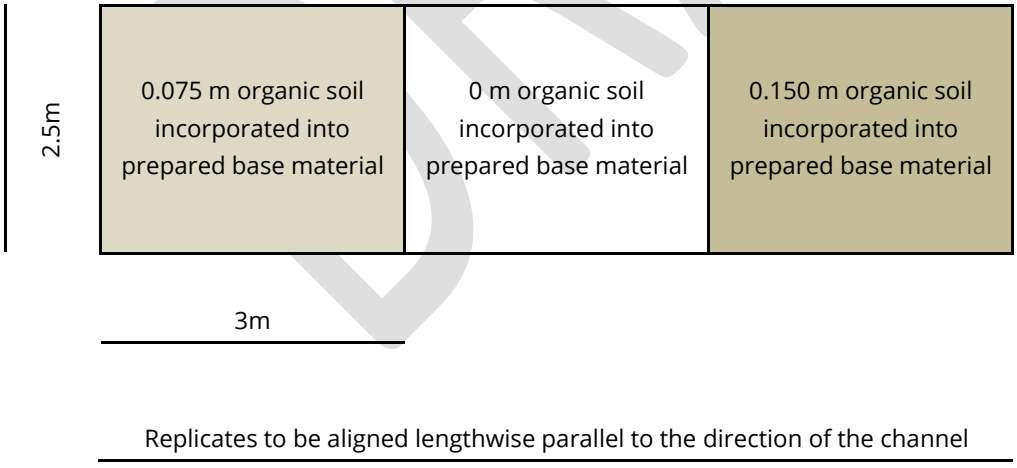


Figure 3: Plot configuration showing all three treatments and orientation of plots parallel to the channel alignment.

3.2 Results and Observations

While the target native grass seedling density of > 6 seedlings per 0.1m^2 was achieved in all three experimental treatments (Table 4), the required density of seedlings at the critical 4-leaf stage at the time of the final inspection was met only in the amended plots. Seedlings in the 'no soil' treatment were immature, stunted, and stressed, and failed to meet the minimum density of seedling at the required leaf stage in nearly all samples. Seedlings in the no-soil treatment are not expected to over-winter successfully or develop into a perennial groundcover capable of satisfying the revegetation objectives of mitigating surface erosion and weed establishment. Achieving the target seedling density, regardless of depth of soil placement, confirms that the site and seedbed preparation as well as seeding methods are appropriate for early grass establishment under the conditions at the LSMOC. However, growth rate and maturation (measured here as leaf stage), as well as observations on plant stress, are more important metrics to evaluate the success and long-term viability of the native grass planting.

Table 4: End-of-season summary data showing density and maturity measures.

	Average Oat Seedlings Density (#)	Average Native Grass Seedlings Density (#)	Average Native Grass Seedling Leaf Stage	Samples Meeting Criteria for Successful Establishment
15cm Soil Depth	4.9	10.0	≥4	80%
7.5cm Soil Depth	5.8	14.7	≥4	80%
0cm Soil Depth	5.2	8.9	<4	20%

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Native grass seedling rate of growth and development was directly related to organic soil application rate. The 15cm soil application rate was characterized by robust and mature native grass seedlings, while the 0cm soil application rate treatments were characterized by small, stunted native grass seedlings at a younger leaf stage. The 7.5cm soil application rate treatment was characteristically intermediate between the 0cm and 15cm treatments. This relationship between soil depth and grass seedling growth rate was likewise evident looking at the oat nurse crop. Nurse crop biomass, based on visual assessment, was noticeably less in 0cm amendments than that in both 7.5 and 15cm amendments, and nurse crop plants were most robust in 15cm amended plots.

Native grass seedlings established within the 0cm organic soil amendment treatment appeared very stunted and stressed as compared to the treatments that received organic soil amendment. These seedlings were small and less mature than other treatments and showed signs of stress including change in coloration (red pigment in leaves) as well as leaf tip necrosis. These seedlings are likely to suffer increased rates of mortality during the winter because of their stunted and stressed state. This treatment does not meet our criteria for successful plant establishment and serves to illustrate the importance of organic soil application in site revegetation.
While the native grass seedling density was comparable between all three soil depth treatments, a high degree of within- and between-plot variation was evident. For one, the plot that was positioned in the centre of the channel bench/terrace was characterized by notably higher seedling densities than the other two replicates that were positioned on either side of this plot (Appendix 4). During summer site investigations it was noted that after rainfall water was ponding near this centre plot, while no surface water was observed around the other two plots. While this condition was not evident during trial plot set-up, it suggests that drainage in this portion of the site is being impeded, leading to increased moisture availability for the seeded native grass mix. The improved moisture availability in this area resulted in seedling densities that were on average two-times greater than that documented in the other two replicates. This condition is likely the result of this area having been used as an access road during channel construction and operation, leading to compaction and low rates of internal drainage.

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Likewise, within sub-plots, regardless of soil depth treatment, the documented seedling densities varied considerably. For example, during the September 23rd site visit, seedling density in the 7.5cm soil depth treatment varied from as high as 23 to as low as 4 seedling per 0.1m^2 (Appendix 4). The observed high variability in seedling density across the revegetation trails can be attributed to a number of factors, most notably the small scale of the plots, the manual seeding operations, the somewhat rough and irregular nature of the soil surface at the time of seeding, as well as the randomness of quadrat placement. In larger scale applications using conventional field operations a more consistent level of plant establishment is typically achieved owing to greater precision in seedbed preparation and seeding rate calibration. Generally, given the study design, the variability in seedling numbers is considered to be reasonable and within the expected range.

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4.0 DISCUSSION - IMPLICATIONS FOR PROJECT REVEGETATION

4.1 Field Survey

Over 80% of the LSMOC project footprint traverses land cover types that are characterized by organic soils of varying depths. Geotechnical soil test logs can provide a better quantification of available organics at specific locations along the channel alignment, and should be used in detailed design to provide direction on construction staging and sequencing with respect to organic soil stockpiling. That being said, based on the ubiquity of organic soils throughout the project footprint, our expectation is that this important revegetation resource will not be a limiting factor in successful site revegetation.

The reasons that certain parts of the alignment may lack the required quantities of salvageable organics vary. For example, soils in areas where invasive weeds were encountered should not be used unless sufficient weed control resources are made available during the project construction and revegetation phases. Also, a large quantity of soil organics attached to plant roots may be lost during grubbing and tree disposal. These scenarios are more like to occur on mineral soils, which incidentally are associated with hardwood cover on the alignment. Given that mineral soil conditions appear relatively uncommon on the project alignment, any additional organics can theoretically be sourced from nearby adjacent sites where the thickness and overall coverage of organic material may be found in excess.

The general lack of non-native plant species observed throughout the project footprint is not surprising given the undeveloped and undisturbed nature of the existing landscape. The presence of Canada thistle near the inlet location is notable and should be addressed as soon as possible to ensure this Tier 3 Noxious Weed does not have the opportunity to spread and degrade the quality of adjacent landscapes and site soils. By selectively avoiding re-use of site soils that have a history of weed establishment, we can confidently accelerate the typical revegetation sequence and potentially save costs associated with extensive pre-plant weed control operations. To preserve the integrity of the site in the interim, and leading up to revegetation work, it

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is recommended that best practices to avoid weed seed importation be followed (e.g. clean all equipment before mobilizing to site).

4.2 Revegetation Trials

The revegetation of disturbed sites is often limited as a result of soil related factors such as soil compaction and moisture limitation due to a lack of soil organic matter and structure. Reclamation of disturbed soils devoid of structure or organic matter can be accomplished through the amendment of soils with an organic material, mechanical preparation and seeding a site appropriate long lived vegetative cover. The Revegetation Trials at the Emergency Outlet Channel have served to confirm the suitability of the local organic soil type for use in future revegetation of the LSMOC, and has provided valuable information relating to the quantity of soils required to achieve target and minimal establishment of native grass seedlings.

The results from the Revegetation Trials 2019 field season suggest that target mature (4-leaf stage) native seedling densities can reliably be achieved in a situation closely analogous to the anticipated site conditions along the LSMOC. The revegetation conditions at Reach 1 are very similar to those expected at the LSMOC, just as the soil characteristics of the organic soils used in the Revegetation Trials are very similar to those organic soils characterized along the LSMOC alignment. While trial plots were set-up manually using low-cost materials and a small scale, the methods are easily achievable at the field scale using commonly available heavy equipment and standard agronomic practices.

The ability of native grass seedlings to successfully over-winter and establish as a perennial groundcover is strongly related to maturity (measured here as leaf stage) at end of the growing season. A standard criterion for end of season establishment of native grass seedlings is the 4-leaf stage. With no organic soil application, only 20% of the sample quadrats achieved this maturity, while at the 7.5cm rate and at the 15cm rate, 80% of the sample quadrats had successfully reached this growth stage.

It should be noted that the provision of a higher rate of organic soils (i.e. 15cm) will impart the grass stand with a greater resilience to adverse climatic conditions,

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particularly periods of drought or low precipitation. Given that current climate models suggest that we will experience less predictable precipitation rates over the coming decades – with heavier rainfall during some months and dramatic reduction in rainfall during other months – providing a greater depth of organics during revegetation of the LSMOC is highly recommended.

It should also be noted that these revegetation trials illustrate the importance of seeding date on native grass establishment. Despite very low rainfall throughout the growing season, native grass seedlings establishment was predictable and reliable, comfortably achieving target seedling densities. Had seeding occurred later in the spring/summer, we expect that moisture limitation would have reduced grass establishment and growth.

Finally, these trial results would be greatly strengthened by follow-up investigations conducted in the 2020 growing season. The highly exposed nature of the channel will create harsh conditions for the young seedlings, and evaluating their ability to over-winter will inform the overall strategy for revegetation. Additionally, it should be noted that because of the lack of fertility of the subsoils, long term plant growth may become limited over time, resulting in decreased growth in grassy cover. Monitoring these plots for a second growing season will provide insight into their capability to accumulate biomass under low-nutrient conditions.

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5.0 REFERENCES

Government of Manitoba. 2001. Manitoba land initiative – Core Maps – Data warehouse http://mli2.gov.mb.ca/mli_data/index.html
"2001. Her Majesty the Queen in Right of Manitoba, as represented by the Minister of Conservation. All rights reserved."

Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts, An Ecological Stratification of Manitoba's Landscapes. Technical Bulletin 98-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Pp. 324.

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APPENDIX 1 - Lake St. Martin Outlet Channel revegetation Survey Observations

Sample Location Waypoint 1

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	Sparse black spruce clusters
Shrub Description	Sparse bog birch, tamarack saplings
Groundcover Description	Sedge spp., pitcher plant
Soils Description	0-30cm - Sedge peat; frozen at 30cm
Notes	



Sample Location Waypoint 2

Survey Data	Observations
Cover Classification	Coniferous Dense
Forest Description	Black spruce > 70%; Tamarack regen ~20%
Shrub Description	Labrador tea and poplar
Groundcover Description	Bluejoint, marsh marigold, raspberry, colts foot, blueberry
Soils Description	Sphagnum moss (0-10''); frozen at 10-12''
Notes	Woody debris ~5%



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Sample Location Waypoint 3

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	Black spruce and poplar – small clusters
Shrub Description	Bog birch – clusters
Groundcover Description	Sedge spp., pitcher plant, buck bean; sphagnum dominant
Soils Description	Sedge peat (0–14''); frozen at 14''
Notes	



Sample Location Waypoint 4

Survey Data	Observations
Cover Classification	Broadleaf Treed (aspen forest, couple conifers V9)
Forest Description	Trembling aspen 75%; Balsam poplar 5–10%; willow and tamarack sporadic
Shrub Description	Willow sp. ~40%
Groundcover Description	Bluejoint regen, some willow, lots of small seedlings; sparse regen on centre line; dandelion at forest edge
Soils Description	Clay loam (6–8''); grey clay (8–24'')
Notes	3 samples taken; dark clay loam near surface, grey silty clay below, roots throughout; few stones at surface



Sample Location Waypoint 5

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	None
Shrub Description	Sporadic bog birch
Groundcover Description	Sedge spp.
Soils Description	Organic, sedge peat
Notes	Water table at surface; sample from top 15''



Sample Location Waypoint 6

Survey Data	Observations
Cover Classification	Wetland Shrub (edge of Wetland Herb)
Forest Description	Black spruce and tamarack clusters
Shrub Description	Bog birch, tamarack and black spruce; denser as you reach forest edge, sparse throughout
Groundcover Description	Sedge spp., pitcher plant, bog rosemary, Labrador tea
Soils Description	Organic 0-14''; frozen at 14''
Notes	Water table within 10'' of surface



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Sample Location Waypoint 7

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Tamarack, Jack pine, black spruce – young; couple Jack pine out of place; productive
Shrub Description	Spruce, tamarack, bog birch
Groundcover Description	Sphagnum cover 100%, sedge spp., bog rosemary, Labrador tea
Soils Description	Organic soil; brown sphagnum 0-9'', frozen at 9''
Notes	Water table near frozen layer



Sample Location Waypoint 8

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Tamarack, black spruce; young coniferous forest V32
Shrub Description	Willow sp., tamarack, spruce, poplar, Labrador tea
Groundcover Description	Sphagnum ~100%; Labrador tea
Soils Description	Sphagnum peat 0-6'', frozen at 6''
Notes	



Sample Location Waypoint 9

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Tamarack, black spruce; young forest regen, some older BS and tamarack in distance
Shrub Description	Black spruce, tamarack, Labrador tea, dense shrubs in forest
Groundcover Description	Sedge spp., bog birch
Soils Description	Brown peat (0-4''); black peat (4-6''); frozen peat at 6''
Notes	2 samples taken



Sample Location Waypoint 10

Survey Data	Observations
Cover Classification	Shrub Tall
Forest Description	Black spruce and tamarack; sporadic older trees but mostly mid-aged
Shrub Description	Black spruce, tamarack, Labrador tea, dense shrubs in forest
Groundcover Description	Very little regen from clearing
Soils Description	Brown peat (0-4''); black peat (4-6''), frozen peat at 6''
Notes	Consistent with WPT018



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Sample Location Waypoint 11

Survey Data	Observations
Cover Classification	Coniferous Open
Forest Description	Black spruce and tamarack
Shrub Description	Black spruce and tamarack
Groundcover Description	Bog laurel, Labrador tea, moss and lichen; no regen from clearing
Soils Description	Dark peat (0-10''); frozen at 10''
Notes	



Sample Location Waypoint 12

Survey Data	Observations
Cover Classification	Wetland Treed or Wetland Shrub
Forest Description	Black spruce; trees all dead oy dying
Shrub Description	Bog birch, tamarack, cattail throughout
Groundcover Description	Cattail, sedge, marsh marigold, bog rosemary, buck bean
Soils Description	Organic, black peat on top then brown below
Notes	Frozen at 18''



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Sample Location Waypoint 13

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Tamarack, black spruce – sporadic in clusters
Shrub Description	Bog birch
Groundcover Description	Phragmites, cattail, sedge, equisetum, bog rosemary, colt's foots
Soils Description	Black peat to 10–12'' then frozen
Notes	



Sample Location Waypoint 14

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	None; small pockets of black spruce/tamarack
Shrub Description	Small patches of bog birch
Groundcover Description	Sedge spp., pitcher plant
Soils Description	Black sedge peat 0–6''; brown sedge peat 6–12''; frozen at 12''
Notes	Anaerobic; water table 4'' below surface



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Sample Location Waypoint 15

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	Clumps of black spruce around
Shrub Description	Sporadic bog birch around
Groundcover Description	Sedge spp., pitcher plant
Soils Description	Black peat 0-6''; brown sedge peat 6-12''; frozen at 12''
Notes	Water table 4'' below surface



Sample Location Waypoint 16

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	Shrubby willow cover
Shrub Description	Willow sp., some poplar, young black spruce
Groundcover Description	Raspberry, horsetail, bluejoint, Solomon seal, marsh marigold, colts foot, mertensia, fireweed
Soils Description	Black peat 0-24''; frost at 24''
Notes	Water table at 12-14''; 3 samples taken



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Sample Location Waypoint 17

Survey Data	Observations
Cover Classification	Coniferous Sparse
Forest Description	Young conifer forest, tamarack, black spruce, 1 Jack pine
Shrub Description	Bog birch and conifer regen; bog laurel and rosemary
Groundcover Description	Bog rosemary, Solomon seal, sphagnum, bluejoint, pitcher plant, cloudberry
Soils Description	Sphagnum at surface, black peat 0-12''; frost at 12''
Notes	No standing water but frozen layer saturated



Sample Location Waypoint 18

Survey Data	Observations
Cover Classification	Wetland Herb
Forest Description	None
Shrub Description	Sporadic bog birch around
Groundcover Description	Sedge spp., buck bean, horsetail
Soils Description	Sedge peat throughout; darker 0-6''; brown/tan 6-12''; frost at 12''
Notes	Water table around 6'' below surface



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Sample Location Waypoint 19

Survey Data	Observations
Cover Classification	Wetland Shrub – Mixedwood Forest
Forest Description	Shrubby mixedwood forest; black spruce, balsam poplar, young Jack pine
Shrub Description	Willow, bog birch, Jack pine, Labrador tea
Groundcover Description	Lichen, Labrador tea, bog rosemary, bearberry, andromeda
Soils Description	Dark brown peat 0-14''; frost at 14''
Notes	No water table encountered



Sample Location Waypoint 20

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Young coniferous forest with patches of bog birch; Jack pine, tamarack, black spruce
Shrub Description	Bog birch, conifer saplings, Labrador tea
Groundcover Description	Sedge spp., sphagnum
Soils Description	Black peat 0-6'', black/brown mixture 6-12''; frozen around 12''
Notes	No water table encountered



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Sample Location Waypoint 21

Survey Data	Observations
Cover Classification	Broadleaf Treed
Forest Description	Trembling aspen 75%; Balsam poplar 5-10%; willow and tamarack sporadic
Shrub Description	Willow sp. ~40%
Groundcover Description	Bluejoint regen, some willow, lots of small seedlings; sparse regen on centre line; dandelion at forest edge
Soils Description	Clay loam (6-8''); grey clay (8-24'')
Notes	3 samples taken; dark clay loam near surface, grey silty clay below, roots throughout; few stones at surface



Sample Location Waypoint 22

Survey Data	Observations
Cover Classification	Wetland Treed
Forest Description	Black spruce/tamarack forest cover, young
Shrub Description	Alder, poplar, tamarack, bog birch
Groundcover Description	Phragmites, sedge spp., raspberry, Labrador tea
Soils Description	Black peat 0-8''; frost at 8''; saturated but no water table
Notes	None



Sample Location Waypoint 23

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	No forest canopy; sporadic tamarack and black spruce
Shrub Description	Lots of bog birch, tamarack and poplar regen, willow
Groundcover Description	Sphagnum, Labrador tea, bog rosemary; brown sphagnum at surface in places
Soils Description	Black peat 0-6''; brown peat 6-8''; frost at 8''
Notes	Brown thrasher



Sample Location Waypoint 24

Survey Data	Observations
Cover Classification	Broadleaf Dense
Forest Description	Poplar stand – cleared; all trembling aspen and balsam poplar
Shrub Description	Shrub poor; some willow and poplar regen – very sparse
Groundcover Description	Rich groundcover; bluejoint, lily of the valley, strawberry, rose, sarsaparilla, current, gallium, starflower, palmate coltsfoot, honeysuckle, Solomon's seal, wintergreen, bishops cap, alder-leaved buckthorn
Soils Description	Clay loam 0-6"; greying clay 6-10"; 10-24" grey clay
Notes	No water table hit, no frost hit



Sample Location Waypoint 25

Survey Data	Observations
Cover Classification	Wetland Shrub
Forest Description	Sporadic poplar with lots of snags
Shrub Description	Willow; aspen regen
Groundcover Description	Bluejoint
Soils Description	Organic 0-4''; dark clay loam 4-12''; grey clay 12''+ very heavy
Notes	Quite a bit of Canada thistle right at the inlet



Sample Location Waypoint 26 – Lake St. Martin Outlet Channel Reach 3 (existing channel)

Survey Data	Observations
Cover Classification	N/A – Disturbed
Forest Description	No mature trees
Shrub Description	Minor deciduous regeneration – poplar
Groundcover Description	Sedge, clover, cattail, saltgrass
Soils Description	Exposed till
Notes	More regrowth and less erosion than Reach 1; lots of geese; less erosion; channel has not been operated.



APPENDIX 2 - Lake St. Martin Outlet Channel Field Survey Soil Sample Analysis

LRI Cover Class	Locations	Sampling Depth (cm)	pH	EC (mS/cm)	Phosphorous (mg/L)	Nitrate N (mg/L)	Organic Matter (%)	Texture / Soil Type
Exposed	26	0 – 15	8.4	0.167	0.89	0.24	81	Loamy till, with a mixture of coarse gravel
Wetland Herb	3, 14 , 15, 17 and 11	0 – 15	7.0 – 7.5	0.111 – 0.245	1.5 – 30	1.6 – 7.1	75 – 88	Organic
		15 – 30	7.0–7.5	0.061 – 0.096	1.5 – 10	2.0 – 3.5	84 – 87	Organic
Coniferous Dense	2	0 – 15	7	0.245	30	7.1	75	Organic
Coniferous Open	11 and 17	0 – 15	6.9 – 7.3	0.106 – 0.113	15 – 30	3.6 – 8.7	73 – 79	Organic
		15 – 30	7.1 – 7.3	0.111 – 0.311	11	3.8 – 8.2	72 – 78	Organic
Wetland Shrub	5, 13 and 20	0 – 15	7.6 – 8.0	0.124 – 0.280	11–12	2.3 – 15.0	75 – 79	Organic
		15 – 30	7.5 – 7.9	0.156 – 0.254	3.3 – 7.3	5.0 – 23.0	73 – 77	Organic
Wetland Treed	22	0 – 15	7.6	0.117	11	3	79	Organic
		15 – 30	8.2	0.262	22	0.58	4.6	N/A
Broadleaf Tree	4, 21 and 24	0 – 15	7.6 – 7.9	0.149 – 0.257	2.4 – 15	0.49 – 17.0	6.9 – 9.2	Organic – Mineral Clay
		15 – 30	7.8 – 8.2	0.220 – 0.755	3.1 – 9.8	0.58 – 0.84	2.8 – 4.6	Mineral Clay
		30 – 60	8.2 – 8.6	0.220 – 1.90	3.4 – 4.6	0.39 – 1.40	1.2 – 2.3	Mineral Clay

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APPENDIX 3 - Revegetation Trials Photo Log



Photo Array 1: Site reconnaissance – organic soils (peat) were located in multiple locations along Reach 1 along the forest edge; representative samples were collected and submitted for laboratory analysis; a suitable organics source was selected based on available quantity, soil quality, and proximity to a suitable trial location.



Photo Array 2: Trial Set-up (June 3rd and 4th, 2019) - Plots were decompacted to 0.30m using a pick axe; organics were dug, hauled and placed on appropriate sub-plots; organics were spread and blended into the decompacted till; animal exclusion measures were installed; grasses were seeded on following site preparation.

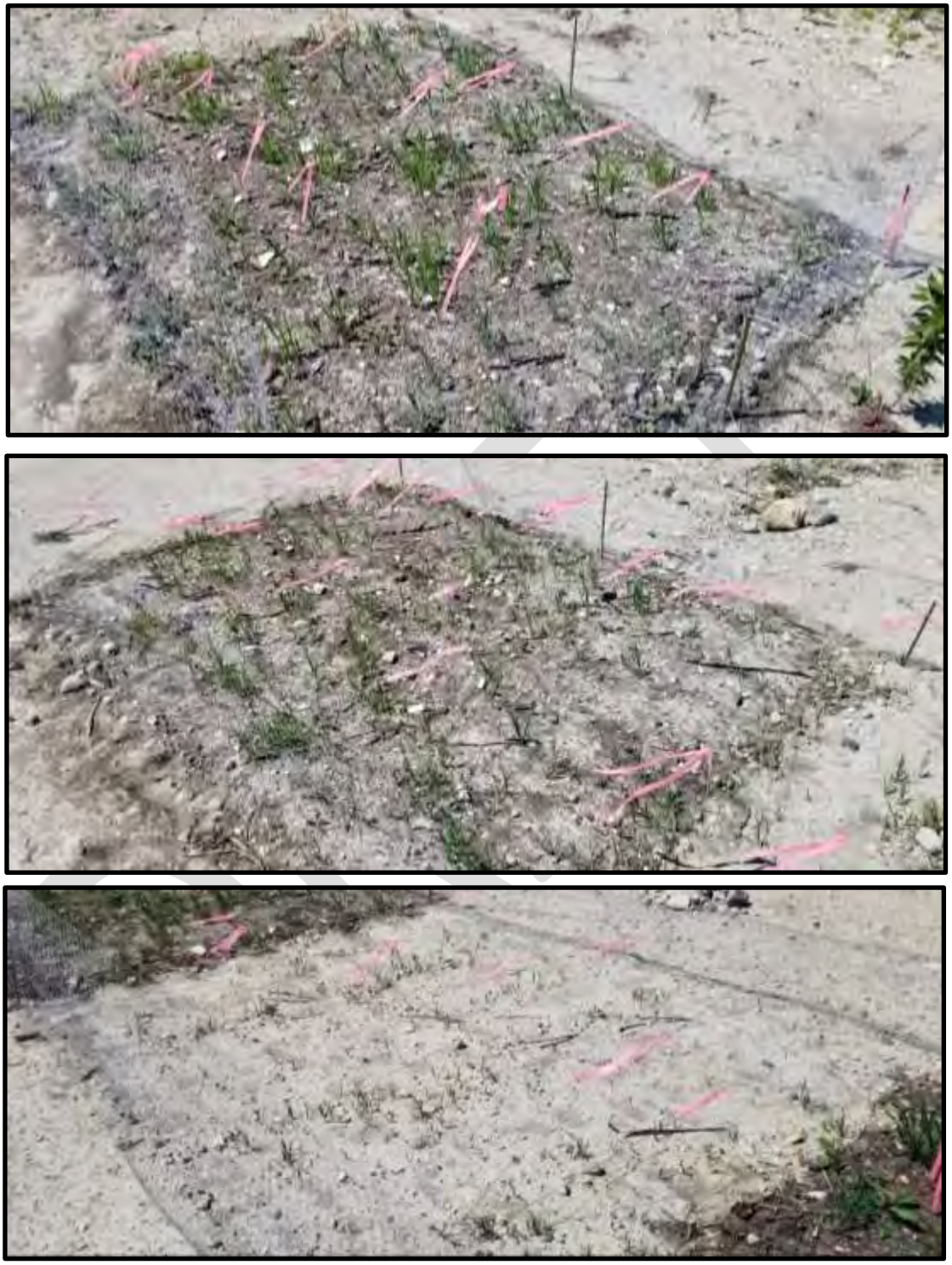


Photo Array 3: Site Inspection (July 10th, 2019) – Showing early summer plant growth in the 0.15 m (top), 0.075 m (middle), and 0 m (bottom) organics depth treatments – Note seedlings visible are oat nurse crop, at this point in the summer native grass seedlings are very small and difficult to pick out in these photographs.



Photo Array 4: Site Inspection – August 8th, 2019 – Showing summer plant growth – 0.15 m organics depth (top), 0.075 m organics depth (middle), 0 m organics applied (bottom).



Photo Array 5: Site Inspection – August 8th, 2019 – Showing relative grass growth between treatments (top) and native seedling health and vigour in 0.15 m depth of organics treatment (middle) and no organic amendment treatment (bottom).



Photo Array 6: Site Inspection (September 23rd, 2019) – Showing late summer plant growth – 0.15 m organics depth (top), 0.075 m organics depth (middle), 0 m organics applied (bottom).

APPENDIX 4 - end-of-season revegetation trials field data

Upper Slope Plot	Sample #	Oat Seedlings (#)	Total Native Grass Seedlings (#)	Native Grass Seedling Leaf Stage (avg.)	Meets Criteria for Successful Establishment (y/n)
15cm soil	**1**	4	4	>4	No
15cm soil	**2**	8	4	>4	No
15cm soil	**3**	6	7	>4	Yes
15cm soil	**4**	6	12	>4	Yes
15cm soil	**5**	5	11	>4	Yes
	avg	**5.8**	**7.6**	**>4**	**60%**
	stdev	**1.48**	**3.78**		
7.5cm soil	**1**	7	7	>4	Yes
7.5cm soil	**2**	9	13	>4	Yes
7.5cm soil	**3**	8	9	>4	Yes
7.5cm soil	**4**	5	12	3 to 4	Yes
7.5cm soil	**5**	7	10	>4	Yes
	avg	**7.2**	**10.2**	**>4**	**100%**
	stdev	**1.48**	**2.39**		
No soil	**1**	2	6	3 to 4	No
No soil	**2**	4	4	3	No
No soil	**3**	4	10	3	No
No soil	**4**	5	5	3	No
No soil	**5**	5	12	3 to 4	Yes
	avg	**4**	**7.4**	**<4**	**20%**
	stdev	**1.22**	**3.44**		

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Middle Plot	Sample #	Oat Seedlings (#)	Total Native Grass Seedlings (#)	Native Grass Seedling Leaf Stage (avg.)	Meets Criteria for Successful Establishment (y/n)
15cm soil	**1**	2	19	3 to 4	Yes
15cm soil	**2**	5	18	3 to 4	Yes
15cm soil	**3**	7	14	4 or >4	Yes
15cm soil	**4**	3	14	4 or >4	Yes
15cm soil	**5**	8	13	4 or >4	Yes
	avg	**5**	**15.6**	**4**	**100%**
	stdev	**2.55**	**2.70**		
7.5cm soil	**1**	3	15	4 or >4	No
7.5cm soil	**2**	5	17	>4	No
7.5cm soil	**3**	8	19	3 to 4	Yes
7.5cm soil	**4**	4	22	3 to 4	Yes
7.5cm soil	**5**	3	25	3 to 4	Yes
	avg	**4.6**	**19.6**	**4**	**60%**
	stdev	**2.07**	**3.97**		
No soil	**1**	4	16	2 to 3	No
No soil	**2**	11	8	2 to 4	No
No soil	**3**	4	15	3 to 5	Yes
No soil	**4**	11	12	2 to 4	Yes
No soil	**5**	9	18	2 to 4	No
	avg	**7.8**	**13.8**	**3**	**40%**
	stdev	**3.56**	**3.90**		

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Lower Slope Plot	Sample #	Oat Seedlings (#)	Total Native Grass Seedlings (#)	Native Grass Seedling Leaf Stage (avg.)	Meets Criteria for Successful Establishment (y/n)
15cm soil	**1**	4	10	>4	Yes
15cm soil	**2**	3	6	>4	Yes
15cm soil	**3**	4	9	>4	Yes
15cm soil	**4**	4	2	>4	No
15cm soil	**5**	5	7	>4	Yes
	avg	**4**	**6.8**	**>4**	**80%**
	stdev	**0.71**	**3.11**		
7.5cm soil	**1**	5	23	>4	Yes
7.5cm soil	**2**	6	15	>4	Yes
7.5cm soil	**3**	5	14	>4	Yes
7.5cm soil	**4**	7	15	4	Yes
7.5cm soil	**5**	5	4	4	No
	avg	**5.6**	**14.2**	**>4**	**80%**
	stdev	**0.89**	**6.76**		
No soil	**1**	3	4	3	No
No soil	**2**	4	5	3	No
No soil	**3**	4	4	3	No
No soil	**4**	4	6	4	No
No soil	**5**	4	8	4	No
	avg	**3.8**	**5.4**	**<4**	**0%**
	stdev	**0.45**	**1.67**		

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APPENDIX 3B

LSMOC Candidate Grass Species Attributes Tables

Table 3B-1: List of Commercially Available Seed Suitable to the Lake St. Martin Region

Scientific Name	Common Name	C3/C4*	Variety	Origin	Chemistry			Zone***			Growth Habit			Life History		Seral Stage			
																Perennial	Early	Mid	Late
Agrostis scabra	Rough hairgrass	C3	Common	Parkland Prairie	< 4	low	weakly acidic - weakly basic						●			●	●	●	
Andropogon gerardii	Big bluestem	C4	Bison	North Dakota	< 4	low	neutral - weakly basic				●		●			●		●	●
Astragalus canadensis	Canada milkvetch	C3	Common	Manitoba	N/A	none	weakly acidic - weakly basic				●					●	●	●	
Beckmannia syzigachne	Sloughgrass	C3	Common	Manitoba	N/A	medium	weakly acidic - weakly basic						●		●		●		
Bouteloua gracilis	Blue grama	C4	Badlands	North Dakota	< 4	none	neutral - weakly basic				●		●			●		●	●
Bromus anomalus	Nodding brome	C3	Common	Manitoba	N/A	low	weakly acidic - weakly basic						●			●	●	●	
Bromus ciliatus	Fringed brome	C3	Common	Manitoba	< 4	none	weakly acidic - weakly basic						●			●	●	●	
Deschampsia caespitosa	Tufted hairgrass	C3	Nortran	Alaska	N/A	low	highly acidic - weakly basic						●			●	●	●	●
Elymus canadensis	Canada wildrye	C3	Mandan	North Dakota	< 4	low	weakly acidic - weakly basic						●			●	●		
Elymus dasystachyum	Northern wheatgrass	C3	Polar	Western Prairies	< 8	low	weakly acidic - mod. basic			●		●				●		●	●
			Elbee	Saskatchewan	< 8	low	weakly acidic - mod. basic			●		●				●		●	●
Elymus innovatus	Hairy wildrye	C3	Common	Manitoba	< 4	none	weakly acidic - weakly basic				●					●	●	●	
Elymus trachycaulus* var. *subsecundus	Awned wheatgrass	C3	Spring	Southern Prairies	< 4	none	weakly acidic - weakly basic						●			●	●		
			Hillcrest	Alberta	< 4	none	weakly acidic - weakly basic						●			●	●		
Elymus trachycaulus* var. *trachycaulus	Slender wheatgrass	C3	Common	Saskatchewan	< 16	high	weakly acidic - strongly basic						●			●	●		
Elymus virginicum	Virginia wildrye	C3	Common	Minnesota	< 4	none	weakly acidic - weakly basic						●			●	●	●	
Glyceria grandis*	Tall manna grass	C3	Common	Manitoba	N/A	none	weakly acidic - mod. basic				●					●	●		
Juncus arcticus*	Alpine rush	C3	Common	Manitoba	N/A	medium	weakly acidic - strongly basic			●						●	●	●	●
Koeleria macrantha	June grass	C3	Common	Manitoba	< 4	none	neutral - weakly basic						●			●		●	●
Nassella viridula	Green needle grass	C3	Lodorm	North Dakota	< 4	none	neutral - weakly basic						●			●		●	●
			Mallard	Manitoba	< 4	none	neutral - weakly basic						●			●		●	●
Panicum virgatum	Switchgrass	C4	Dacotah	Manitoba	< 4	medium	neutral - weakly basic						●			●		●	●

Scientific Name	Common Name	C3/C4*	Variety	Origin	Chemistry			Zone***		Growth Habit				Life History		Seral Stage			
																Perennial	Early	Mid	Late
Pascopyron smithii	Western wheatgrass	C3	W.R. Poole	MB, SK, AB	< 16	high	weakly acidic - mod. basic			●		●				●	●	●	●
			Rodan	North Dakota	< 16	high	weakly acidic - mod. basic			●		●				●	●	●	●
Poa palustris	Fowl bluegrass	C3	Common	Manitoba	N/A	medium	mod. acidic - weakly basic						●			●		●	●
Puccinellia nuttalliana	Nuttall's alkali grass	C3	Common	Manitoba	< 33	high	weakly acidic - mod. basic						●			●		●	●
Schizachyrium scoparium	Little bluestem	C4	Badlands	North Dakota	< 4	none	neutral - weakly basic						●			●		●	●
Scholochloa festucacea*	Whitetop	C3	Common	Manitoba	N/A	low-medium	weakly acidic - weakly basic			●						●	●	●	●
Sparganium eurycarpum*	Bur reed	C3	Common	Manitoba	N/A	none	weakly acidic - weakly basic			●						●		●	●
Spartina pectinata*	Cord grass	C4	Red River	North Dakota	< 4	none	neutral - weakly basic			●	●	●				●		●	●

Notes:

* C3 denotes cool season and C4 denotes warm season.

** E.C. refers to electrical conductivity, used here as an indication of salt tolerance.

*** Indicates expected suitability for use in different active revegetation zones of the LSMOC ROW - final seed mixes to be determined in detailed design.

**** For consideration in ditches and drains.

Note: Commercial seed availability and quality (purity and germination) may vary from year to year.

Table 3B-2: Non-exhaustive List of Tame Grass Species Suitable For Use in Lake St. Martin Outlet Channel Revegetation

Scientific Name	Common Name*	C3/C4*	Chemistry			Zone			Growth Habit			Life History			Seral Stage		
			E.C. (dS m^{-1})**	Salinity Tolerance	pH Range	Upland Berm	Lower Slope	Rhizomatous	Creeping	Sod Forming	Bunch	Annual	Biennial	Perennial	Early	Mid	Late
Thinopyrum ponticum	Tall wheatgrass	C3	< 16	high	neutral - alkaline						●			●	●	●	
Dactylis glomeratus	Orchard grass	C3	4-8	low	mod. acidic - neutral						●			●	●		
Agrostis stolonifera	Redtop	C3	< 16	high	weakly acidic - strongly basic					●	●			●	●	●	●
Phleum pratense	Timothy	C3	< 4	low	mod. acidic - slightly basic						●			●	●	●	●
***Festuca* sp**	Fescues	C3	4-8	low	weakly acidic - strongly basic				●		●			●	●	●	●
Medicago sativa	Alfalfa	C3	4-8	low	neutral - alkaline						●			●	●		

Notes:

* C3 denote cool season species; C4 denotes warm season species.

** E.C. refers to electrical conductivity, used here as an indication of salt tolerance.

*** Indicates expected suitability for use in different active revegetation zones of the LSMOC ROW - final seed mixes to be determined in detailed design.

Note: Commercial seed availability and quality (purity and germination) may vary from year to year.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Agricultural Biosecurity Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

EXECUTIVE SUMMARY V

LIST OF ACRONYMS AND GLOSSARY OF TERMS VIII

Acronyms viii

Glossary of Terms ix

1.0 INTRODUCTION 1

2.0 BACKGROUND 3

2.1 Summary of Agricultural Land Use 3

2.2 Regulatory Requirements and Industry Guidelines 3

2.2.1 Federal Environmental Requirements and Guidelines 3

2.2.2 Provincial Regulatory Context and Guidelines 4

2.3 Related Project Reports and Management Plans 6

3.0 BIOSECURITY RISK ISSUES AND MECHANISMS, AND RISK MANAGEMENT 8

3.1 Biosecurity Risk Issues and Mechanisms 8

3.1.1 Cropland Biosecurity 8

3.1.2 Livestock Biosecurity 10

3.1.3 Biosecurity Risk Mechanisms 10

3.2 Biosecurity Management Strategies, Approaches, And Practices 12

3.2.1 Biosecurity Management Zones and Access Management 14

3.2.2 Biosecurity Risk Levels 19

3.2.3 Cleaning Practices 22

4.0 IMPLEMENTATION PLAN 27

4.1 Roles, Responsibilities and Communication 27

4.1.1 Roles and Responsibilities 27

4.1.2 Project Communication 30

4.2 Planning and Preparation 31

4.2.1 Contract/Contractor Specifications 31

4.2.2 Landowner Communication and Notification 31

4.2.3 Work Timing and Scheduling 31

4.2 Facilities and Equipment 32

4.2.1 Project Area Entry Checkpoint 32

4.2.2 Controlled Access Point Signage 32

4.2.3 Cleaning Areas and Stations 32

4.2.4 Cleaning Equipment 34

4.4 Worker Requirements 34

4.4.1 Worker Orientation 34

4.4.2 Worker Actions 35

4.4.3 Record Keeping 37

4.5 Contractor Reporting 38

4.6 Monitoring Program 38

4.7 Implementation Tasks by Project Phase 38

5.0 ADAPTIVE MANAGEMENT 42

6.0 REFERENCES 43

APPENDIX 1 44

APPENDIX 2 56

APPENDIX 3 64

List of Tables

Table 1: Summary of Project-Related Biosecurity Risk Mechanisms

Table 2: Risk Level and Required Action

Table 3: Roles and Responsibilities

Table 4: Implementation Tasks by Project Phase

Table 2-1:Designated Noxious Weeds in Manitoba (The Noxious Weeds Regulation M.R. 42/17)

List of Figures

Figure A: EMP Process

Figure 1: Three Key Strategies for Effective Biosecurity Management

Figure 2: Conceptual Diagrams of Controlled Access Point, Construction Access, and Point of Access

Figure 3: Proposed Site Access Roads for LMOC and LSMOC

Figure 4: Determination of Agricultural Biosecurity Risk Categories and Risk Levels

Figure 5: Conceptual Diagram of Rough/Mechanical Cleaning Area and Fine Cleaning Station

Figure 6: Conceptual Diagram of Location of Cleaning Area or Station on PDA

Figure 7: Project Organization Structure

Figure 1-1: Overview Map

Figure 2-1: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-2: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-3: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-4: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-5: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-6: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-7: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-8: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-9: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

Figure 2-10: Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Agricultural Biosecurity Management Plan (AgBMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.



Figure A: EMP Process

EXECUTIVE SUMMARY

This document presents the Agricultural Biosecurity Management Plan (AgBMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). The AgBMP was a commitment within the Project Environmental Impact Assessment (EIS) to address agricultural biosecurity risks to crop land and livestock operations resulting from Project activities, such as:

- Noxious weed spread to crop land.
- Soil-borne pathogen transfer to crop land.
- Disease transmission to livestock.

The AgBMP primarily pertains to the Lake Manitoba Outlet Channel (LMOC), municipal roads realignments and Provincial Road (PR) 239 realignment portions of the Project, as these portions of the Project traverse agricultural land use, including cropland, grazing land and livestock operations. It is developed to address Project activities during the construction and operation phases of the Project that have the potential to harm agricultural lands adjacent to and in proximity of the Project development area (PDA) in these portions of the Project. While the Lake St. Martin Outlet Channel (LSMOC) portion of the Project is currently characterized predominantly as natural vegetation and wetlands, it may be used in times of severe drought during operation for haying by private agricultural producers. If this becomes a permitted activity, it would also require measures to address biosecurity issues.

Generally, invasive agricultural pests (e.g., noxious weeds, pathogens) can pose a substantial risk to agricultural land and are costly to control and remove. Breaches in agricultural biosecurity can result in the introduction, transfer and/or transmission of invasive pests into agricultural regions, fields, or livestock operations. These breaches may cause harm to crop health and/or productivity in annual crop and hayland, and to livestock health and productivity, resulting in economic losses, and in severe cases, reductions in property values. Project activities have the potential to transfer soil, manure, and plant debris from the PDA to agricultural areas outside of the PDA. These materials may contain disease-causing pathogens, noxious weeds or other pests that may cause harm to agricultural land use and productivity.

Through this Plan, Manitoba Transportation and Infrastructure will address biosecurity concerns related to Project activities. This Plan includes:

- Background information, including a summary of agricultural land use in the Project area, regulatory context and industry guidelines and related Project management plans.
- A summary of biosecurity risk issues, risk mechanisms related to construction and operation activities, and risk levels to guide biosecurity management efforts.
- Required actions by Manitoba Transportation and Infrastructure and Project contractors to protect agricultural biosecurity.
- Identification of specific biosecurity risk areas within and adjacent to the PDA and controlled access points (CAP) where workers will enter and exit the PDA.
- An implementation plan to guide Manitoba Transportation and Infrastructure in implementing the biosecurity management plan for Project construction and operation, including roles and responsibilities, planning and preparation, facilities and equipment, worker requirements, record keeping and reporting, worker orientation, communication, monitoring, and implementation schedule.

Biosecurity management measures will be implemented to prevent, minimize, or control the potential for these mechanisms to occur as a result of Project activities.

During the construction phase:

- Measures to protect cropland biosecurity focus on preventing and minimizing the potential of soil and weed seed transfer to the PDA from agricultural areas outside of the region of the Project, and from the LMOC and realignment of PR 239 and municipal roads portions of the PDA to agricultural areas outside of the PDA.
- For livestock biosecurity, measures include minimizing the potential for manure transfer from the LMOC and PR 239 realignment portions of the PDA to agricultural areas outside of the PDA and preventing direct worker contact with livestock.
- During the construction phase, managed revegetation will occur within the PDA to minimize the potential for weed infestations. Revegetation plans for the PDA are presented in the Revegetation Management Plan (RVMP). The plan necessitates treatment of weed infestations prior to soil stockpiling, control of weeds on soil stockpiles, and timely and appropriate weed control response when noxious weeds or invasive weeds of agricultural concern are identified within the PDA following revegetation.

During the operation phase:

- The RVMP prescribes monitoring of vegetation establishment within the PDA for a three-year period following revegetation, including assessment of non-native species and noxious weeds, Ongoing monitoring of vegetation within the PDA is planned through the remainder of the operation phase, specifically to identify weed infestations.
- If haying within the PDA is a permitted activity, private landowners/producers will be expected to enter the PDA with machinery clean and free of loose soil and plant debris, and clean machinery of loose soil and plant debris prior to exiting the PDA. Private landowners/producers will be expected to enter into a lease agreement with Manitoba Transportation and Infrastructure for haying within the PDA. It is anticipated that these agreements will include these cleaning requirements expected of landowners/producers.

Effective agricultural biosecurity management is achieved through three key strategies: 1) prevent and avoid (e.g., single Project Area Entry Checkpoint, limiting access, identification of restricted areas), 2) minimize (e.g., cleaning vehicles, equipment and footwear that have accumulated soil, manure or plant debris) and 3) control (e.g., control weeds within the PDA). The AgBMP includes actions to operationalize these three strategies.

The AgBMP includes the need for identification of a single, controlled Project Area Entry Checkpoint into the Project area, Biosecurity Management Zones (biosecurity risk zones [BRZ], restricted access zones [RAZ]), and CAPs for construction access (CA) to Project work areas, which are critical to effective agricultural biosecurity management for the Project during construction. The Project Area Entry Checkpoint will provide a single, established location at which all incoming machinery must be checked for adequate cleanliness prior to entry into the Project area to access the PDA. Cleaning of vehicles, equipment and footwear that have accumulated soil, manure and/or plant debris prior to exiting the PDA is a key required action to minimize agricultural biosecurity risk during construction. Cleaning areas and cleaning stations will be established at CAPs to allow for effective cleaning to be conducted by field construction workers. Cleaning requirements are determined

by biosecurity risk levels, identified through a combination of: 1) the Risk Category assigned to each CAP (defined by the nature of the CA when exiting the PDA), and 2) the potential for vehicles, equipment or footwear to transfer soil, manure or plant debris from the PDA to agricultural areas outside of the PDA. Restricted access zones are areas which require special management and monitoring due to elevated biosecurity risks, and include manure impacted sites and areas of weed infestations.

An implementation plan is presented to assist Manitoba Transportation and Infrastructure and its contractors in planning and preparing for implementation of biosecurity management measures on the Project. The implementation plan includes the identification of roles and responsibilities, communication structure, planning and preparation information, facilities and equipment requirements, field worker requirements, contractor reporting expectations, monitoring program requirements and a summary of implementation tasks by Project phase.

Adaptive management is part of the follow-up process that provides a mechanism for continual improvement of the AgBMP. Specific aspects of the adaptive management program include delineating RAZ if weed infestations are identified through vegetation monitoring, updating Risk Categories at CAPs if necessitated by changes to Project access management, and using learnings from the biosecurity monitoring program to modify or change measures within the AgBMP.

Implementation and adherence to the AgBMP will effectively manage biosecurity issues and reduce the risk to agricultural biosecurity resulting from Project activities through construction and operation. Through adaptive management, improvement actions will be implemented to address deficiencies, if identified and as required.

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	percent
AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
BRZ	Biosecurity Risk Zone
CA	construction access
CAP	controlled access point
CEMP	Construction Environmental Management Program
CEnvPP	Construction Environmental Protection Plan
CFIA	Canadian Food Inspection Agency
EDRR	Early Detection and Rapid Response
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPP	Environmental Protection Plan
ISCM	Invasive Species Council of Manitoba
km	kilometre
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
OEMP	Operation Environmental Management Program
PDA	Project development area
PERs	Project Environmental Requirements
POA	point of access
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Outlet Channels Project
RAZ	restricted access zone
RM	Rural Municipality
RVMP	Revegetation Management Plan

Glossary of Terms

Agricultural biosecurity: Management practices to control the potential for introduction and/or minimize the potential to transfer or multiply pests in agricultural land and agricultural operations.

Agricultural Biosecurity Management Plan (AgBMP): The AgBMP for the Project, which includes a summary of regulatory requirements and guidelines, biosecurity risk issues, identification of risk management zones, and implementation plan components.

Borrow area zone: An area representing the originally anticipated extent of potential borrow area use at the time the effects assessment was completed. Subsequent engineering analysis has reduced the anticipated borrow area extent.

Contractor: Refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Contract Administrator: Refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Cropland biosecurity: Management practices to control the potential for introduction, and/or minimize the potential to transfer or transmit, pests and/or disease to crops and croplands.

Disease (agricultural): A condition that impairs normal functioning of an agricultural plant or animal.

Environmental Monitor: Refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee (EAC).

Invasive agricultural pest: A plant (weed), insect or pathogen that is not native or indigenous to an agricultural region or field, and whose introduction can adversely affect crop or livestock health and/or productivity and lead to economic harm.

Invasive weed (agricultural): A plant species that is not native or indigenous to an agricultural region or field, and whose introduction can adversely affect crop or livestock health and/or productivity and lead to economic harm. The Invasive Species Council of Manitoba (ISCM) provides lists of invasive plant species, some of which are of concern to agriculture, and direction on management, control and eradication (ISCM 2022).

Lake Manitoba Outlet Channel (LMOC): The proposed Lake Manitoba Outlet Channel, which will convey flood-level water from Lake Manitoba into Lake St. Martin. It forms a portion of the Lake Manitoba and Lake St. Martin Outlet Channels Project.

Livestock biosecurity: Management practices to control the potential for introduction, and/or minimize the potential to transfer or transmit, pests and/or disease to livestock and livestock operations.

Local assessment area (LAA): The local assessment area comprises an area including the Project development area (PDA) plus a 1 km buffer around the PDA, as identified in the Project Environmental Impact Statement (EIS). For the purposes of the Agricultural Biosecurity Management Plan (AgBMP) the LAA includes the Lake Manitoba Outlet Channel (LMOC) and the PR 239 realignment portions of the overall Project LAA.

Noxious weed (agricultural): A weed that is considered to be harmful to agricultural crops and cropland, and is designated as a noxious weed in Manitoba according to The Noxious Weeds Regulation (M.R. 42/17).

The Owner: Refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Pathogen (agricultural): A disease-causing agent (e.g., bacteria, viruses, fungi), which can transmit or transfer disease to agricultural plants (crops) or animals (livestock).

Pest (agricultural): A broad term encompassing organisms, including weeds, animals (e.g., insects, nematodes), and pathogens, that may cause harm to crops, croplands, livestock and/or livestock operations.

Project development area (PDA): For the purposes of the Agricultural Biosecurity Management Plan (AgBMP), the Project development area includes the Lake Manitoba Outlet Channel (LMOC) and the PR 239 realignment components of the Project.

PR 239 Realignment: The proposed realignment of a portion of Provincial Road 239, required to accommodate the Lake Manitoba Outlet Channel.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

1.0 INTRODUCTION

This document presents the Agricultural Biosecurity Management Plan (AgBMB) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been developed to address agricultural biosecurity risks to crop land and livestock operations resulting from Project activities. The AgBMP primarily pertains to the Lake Manitoba Outlet Channel (LMOC), municipal roads realignment and Provincial Road (PR) 239 realignment portions of the Project, as these portions of the Project traverse agricultural land use, including cropland, grazing land and livestock operations. It is developed to address Project activities during the construction and operation phases of the Project that have the potential to harm agricultural lands adjacent to and in proximity of the Project development area (PDA) in these portions of the Project. While the Lake St. Martin Outlet Channel (LSMOC) portion of the Project is currently characterized predominantly as natural vegetation and wetlands, it may be used during operation for haying by private agricultural producers in times of severe drought. If this becomes a permitted activity, it has the potential to harm the vegetation community within the LSMOC portion of the PDA and agricultural lands alike and would also require measures to address biosecurity issues. The AgBMP was a commitment made by Manitoba Transportation and Infrastructure within the Project Environmental Impact Assessment (EIS) to address these agricultural biosecurity risks.

Generally, invasive agricultural pests (i.e., plants, animals, and pathogens) pose a considerable risk to agricultural land and operations and are costly to control and remove. Breaches in agricultural biosecurity can result in the introduction, transfer and/or transmission of invasive agricultural pests into agricultural regions, cropping fields or livestock operations. These breaches may cause harm to crop health and/or productivity in annual crop and hayland, and to livestock health and productivity, resulting in economic losses, and in severe cases, reductions in property values.

The Project pathways of concern for biosecurity during construction are related to the transfer of materials that may contain disease-causing pathogens, and weeds or other pests that may cause harm to agricultural areas adjacent to the PDA, as well as to the PDA itself, and include:

- The transfer of soil, manure, and weeds from areas outside of the agricultural region surrounding the Project to agricultural areas local to the Project via vehicles and equipment incoming to the Project area.
- The transfer of soil, manure, and weeds from the PDA to adjacent agricultural land via vehicles, equipment or pedestrians exiting the PDA.
- Direct contact between workers and livestock.

During the operation of the Project the pathways of biosecurity concern are related to the transfer of noxious weeds or invasive agricultural plants to and from the PDA, including:

- Invasive spread of weeds from the PDA to adjacent agricultural cropland.
- Weed seed transfer to/from the PDA by privately-owned haying machinery and from the PDA to adjacent privately-owned agricultural operations in harvested hay, if haying is permitted activity within the PDA.

Through this Plan, Manitoba Transportation and Infrastructure will address biosecurity concerns related to Project activities. The AgBMP includes:

- Background information including a summary of agricultural land use in the Project area, regulatory context and industry guidelines and related Project management plans.
- A summary of biosecurity risk issues, mechanisms and levels and issues related to construction and operation activities.
- Required actions by Manitoba Transportation and Infrastructure and Contractors to protect agricultural biosecurity.
- Identification of specific biosecurity risk areas and CAPs.
- A guide for Manitoba Transportation and Infrastructure in implementation of the biosecurity management plan for Project construction and operation, including roles and responsibilities, planning and preparation, facilities and equipment, worker requirements, record keeping and reporting, worker orientation, communication, monitoring, and implementation schedule.

An overview of the location of the Project is provided in Figure 1-1 (Appendix 1).

2.0 BACKGROUND

2.1 Summary of Agricultural Land Use

Agricultural land use and production within the area of the LMOC and PR 239 realignment is characterized in the Project EIS. A summary of pertinent information is presented below.

Farming in the area surrounding the LMOC and PR 239 realignment is characterized as predominantly cattle and mixed farming operations, consisting of cattle production, forage for hay production, pastures for grazing and annual crop production. Annual cropping includes such crop types as oats, barley, canola, beans, and soybeans. Alfalfa and other forage species are baled for feeding cattle. Due to the prevalence of cattle production, manure application is a common practice in the LMOC and PR 239 realignment areas.

Agricultural crop type distribution within the LMOC and PR 239 realignment portions of the local assessment area (LAA), or an area within a 1 kilometre (km) buffer of the PDA of these components, was predominantly hay, pasture and grasses (43 percent [%] of the LAA) used to support livestock production, based on 2018 land use data (Manitoba Transportation and Infrastructure, 2020). Approximately 12% of the LAA was under annual crop production, predominantly canola, soybeans, and spring wheat. The remaining 45% of the LAA was considered non-agricultural and composed of forest and shrubland, wetland, open water, exposed/bare land and developed land.

Based on review of 2018 ortho-imagery for LMOC) and a road-side agricultural land use survey in August 2020, there are eight cattle feedlots within the LMOC and PR 239 realignment portions of the PDA or in proximity of CA with the potential to interact with Project activities. Of these cattle operations, two are located within the PDA and will be expropriated prior to the commencement of construction. A new cattle feedlot is proposed to be constructed east of the LMOC portion of the PDA; however, this operation is beyond the LAA and is not expected to directly interact with the Project.

The area traversed by the LSMOC is predominantly characterized as natural vegetation and wetlands, and there is no agricultural land use within or adjacent to the LSMOC portion of the PDA.

Areas of agricultural cropping and livestock operations are presented in Figure 1-1 (Appendix 1).

2.2 Regulatory Requirements and Industry Guidelines

2.2.1 Federal Environmental Requirements and Guidelines

There are currently no federal legislative requirements specifically pertaining to agricultural biosecurity issues related to infrastructure developments. Updates to this plan may be made based on any pertinent conditions in the Project's federal Decision Statement as part of the approvals under the *Canadian Environmental Assessment Act, 2012*.

The Canadian Food Inspection Agency (CFIA) provides some guidelines for agricultural biosecurity; however, these are generally focused on activities at the farm level and on the agricultural industry and do not provide specific guidance to the Project's interaction with agricultural biosecurity.

2.2.2 Provincial Regulatory Context and Guidelines

There are currently no provincial requirements under regulations associated with *The Environment Act* specifically pertaining to agricultural biosecurity issues related to infrastructure developments. Updates may be made to this plan based on any pertinent conditions in the Project's provincial licence as part of the approvals under *The Environment Act*.

With the exception of noxious weeds (Section 2.2.2.1), there is no other legislation directly governing biosecurity concerns (e.g., soil-borne pathogens and diseases, livestock disease) in Manitoba. However, Manitoba Agriculture has developed biosecurity guidelines and generalized protocols for crop production (Manitoba Agriculture 2020a) and livestock production (Manitoba Agriculture 2020b). These guidelines are discussed in Section 2.2.2.2.

2.2.2.1 Noxious Weeds Act and Noxious Weeds Regulation

Administered by Manitoba Agriculture, *The Noxious Weeds Act* presents the designation of noxious weeds that may adversely impact Manitoba's environment and economy, and outlines responsibilities to control or destroy such weeds (i.e., biosecurity). It addresses one component of agricultural biosecurity, the controlling and preventing of the spread of noxious weeds.

Non-native invasive plants are regulated under the Act. Ninety noxious weeds are currently listed in The *Noxious Weeds Regulation* (MR 42/17), including those that are a threat to agricultural and natural areas. The Act designates three tiers of noxious weeds:

- Tier 1 species are those that are considered to have the most potential for negative effects, although they may not yet be present in Manitoba. Under the Act, Tier 1 species must be destroyed or eradicated immediately upon discovery.
- Tier 2 species are already established in Manitoba and have been observed to spread easily. Tier 2 species infestations under five acres must be eradicated; whereas infestations larger than five acres must be controlled and kept from spreading.
- Tier 3 species are all other designated species that do not require immediate control unless the spread of the occurrence poses a threat to the economy, environment, or the well-being of residents. It should be noted that Tier 3 lists common and showy milkweed (*Asclepias syriaca* and *Asclepias speciosa*) that are native plant species and are only considered weeds in an agricultural context (i.e., agricultural crops and cropland).

The noxious weeds list for all of Manitoba is provided in Appendix 2.B.1. A summary of frequently asked questions and general information on control of noxious weeds provided by Manitoba Agriculture is presented in Appendix 2.B.2.

2.2.2.2 Provincial Guidelines

Cropland Biosecurity

Manitoba Agriculture has developed biosecurity guidelines and generalized protocols for crop production (Manitoba Agriculture 2020a; Appendix 2.A). These include a guideline for "Biosecurity Management on Agricultural Land for the Energy and Transportation Industries" in specific consideration of energy, construction, water management, transportation industry and municipal work on agricultural land (Manitoba Agriculture 2020c). The objective is to prevent the spread of soil-borne pests, such as diseases, weeds and nematodes in agricultural soils by limiting soil movement between fields and across rights of way. Guidance includes developing and implementing protocols to prevent pest movement and establishment to other fields and properties. Protocols can include:

- equipment cleaning between fields
- avoidance of equipment traffic on fields during wet conditions
- increased communication with clients on their expectations

The protocol includes a summary of methods (cleaning/washing techniques, exposure avoidance), cleaning locations and targeted activities, inspection and record keeping requirements and responsibilities. The protocol is found at the link below:

https://www.gov.mb.ca/agriculture/crops/biosecurity-energy-and-transportation.html

Livestock Biosecurity

General information on livestock biosecurity is presented by Manitoba Agriculture (Manitoba Agriculture 2020b). No specific protocols are available. General guidance indicates that vehicles and visitors are capable of transmitting disease to a livestock herd. While this method of disease transmission is not considered serious, any manure transferred (e.g., on vehicles, equipment, boots, clothing) from an unknown source could be a threat to livestock biosecurity. To protect livestock biosecurity, vehicles and visitors should be evaluated for biosecurity concerns, entry to operations should be controlled and protocols for all visitors should be developed. This general information is found at the link below:

https://www.gov.mb.ca/agriculture/animal-health-and-welfare/animal-health/biosecurity-in-livestock-production.html

2.2.2.3 Invasive Weeds (Unregulated)

Invasive weeds of agricultural concern are defined as plant species that are not native or indigenous to an agricultural region or field, and whose introduction can adversely affect crop or livestock health and/or productivity and lead to economic harm. While *The Noxious Weeds Act*, as described in Section 2.2.2, identifies noxious weeds and outlines responsibilities to control and destroy such weeds, there is potential for invasive species of agricultural concern which are not listed as noxious weeds. The Invasive Species Council of Manitoba (ICSM) provides information on invasive plant species in Manitoba, some of which are not listed as noxious weeds but are considered invasive weeds of concern for agricultural crop lands. Guidance on management and potential eradication of invasive weeds are provided by ICSM. This includes

the categorization of species into two Early Detection and Rapid Response (EDRR) categories, Category 1 and Category 2, with specific management guidance, and as 'Other Terrestrial Plant Species' for which specific management guidance is not provided.

2.3 Related Project Reports and Management Plans

There are other related Project reports that were used to inform the development of the AgBMP and management plans which are connected to the delivery of biosecurity management measures on the Project. These related reports and management plans are summarized below:

- Project EIS (Manitoba Transportation and Infrastructure 2020):
  - Potential effects to agricultural land use are evaluated in Chapter 9 – Socio-Economic Effects Assessment on Human Environment of the Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. Agricultural biosecurity issues in the area surrounding the Project, Project activities during construction and operation phases that have potential risk to biosecurity, and recommended mitigation measures were addressed in this section of the Project EIS. A key commitment made in the Project EIS was the development of this Plan (Section 9.2.4.3, p. 9.77) and the associated implementation of biosecurity measures to protect agricultural biosecurity in agricultural lands in proximity of the Project.
  - Locations of manure stockpiles associated with cattle feedlot operations within the PDA will be confirmed, and these stockpiles will be relocated to suitable locations outside of the PDA or disposed of at an approved landfill facility prior to construction (Section 6.3.4.3, p. 6.118; Section 9.2.4.3, p. 9.76; Section 9.2.8, p. 9.112-113). This will reduce the potential for construction activities to result in the spread of manure within the PDA and transfer of manure to agricultural areas outside of the PDA.
- Construction Environmental Management Program (CEMP) – the purpose of the CEMP is to provide guidance on how environmental issues will be addressed during construction, and how adverse effects will be mitigated. This Plan is one of the management plans included under the CEMP. Agricultural biosecurity requirements of Manitoba Transportation and Infrastructure and Contractor construction staff are also summarized in the Environmental Protection Plan (EPP) and Project Environmental Requirements (PERs), which are also components of the CEMP.
- Operation Environmental Management Program (OEMP) – the purpose of the OEMP is to provide guidance on how environmental issues will be addressed during operation, and how adverse effects will be mitigated. This includes the Revegetation Management Plan (RVMP), described in detail below, which provides for vegetation management within the PDA to minimize weed growth and the potential for noxious weeds or invasive plant transfer to agricultural land adjacent to the PDA.

- Lake Manitoba and Lake St. Martin Outlet Channels Project Access Management Plan (AMP) – the AMP provides a framework for access management for the Project. This provides the basis for access management planning and the identification of access management features pertinent to biosecurity management, including approved access routes from major transportation routes (i.e., provincial highways/roads or municipal grid roads) to the PDA (Section 3.2.1). This allows for the identification of CAPs for the purposes of biosecurity management. Access to the LMOC will be restricted and controlled through a limited number of CAPs. Access to the LSMOC will be via Idylwild Road, which will have a security gate in place following construction.
- Lake Manitoba and Lake St. Martin Outlet Channels Project RVMP - this revegetation plan provides for managed revegetation within the LMOC and LSMOC portions of the PDA during the construction phase of the Project, and monitoring of revegetation outcomes and for effects on vegetation through the construction and operation phases. The RVMP is included as a component of the CEMP and OEMP. The objectives of the RVMP are to establish self-sustaining permanent plant cover, provide erosion and sediment control, and control the spread of invasive plant species along the channel and into adjacent environments, including noxious weed and invasive agricultural plant spread into adjacent areas under agricultural land use. The AgBMP necessitates treatment of weed infestations prior to soil stockpiling, control of weeds on soil stockpiles, and timely and appropriate weed control response when noxious weeds and invasive plant species are identified following revegetation. The RVMP prescribes monitoring of vegetation establishment within the PDA for a three-year period, including assessment of noxious weeds and invasive plant species, and additional monitoring for weeds through the operation phase.
- Project Environmental Requirements (PERs) – the PERs form part of the CEMP and prescribe environmental management practices to be implemented during Project construction to reduce effects to the environment from construction activities.
- Project Construction Environmental Protection Plan (EPP) – the EPP includes a description of mitigation measures, including biosecurity management requirements pertinent to Contractor workers, such as restricted access zones (RAZs), and cleaning requirements. They include mapbooks, which will identify sites where specific types of mitigation are required, and support measures described in the PERs (Section 2.16).

3.0 BIOSECURITY RISK ISSUES AND MECHANISMS, AND RISK MANAGEMENT

This section provides a summary of the biosecurity program elements as Project-specific context (Section 3.1 Biosecurity Risk Issues and Mechanisms) to focus management actions and level of effort on potential risk areas and risk levels (Section 3.2 Biosecurity Management Strategies, Approaches, and Practices).

3.1 Biosecurity Risk Issues and Mechanisms

This section includes a brief Project-specific overview of biosecurity issues affecting croplands (Section 3.1.1) and livestock (Section 3.1.2) and presents a summary of biosecurity risk mechanisms (Section 3.1.3) that need to be addressed by the AgBMP.

3.1.1 Cropland Biosecurity

The CFIA (2020b) provides the following definitions for cropland biosecurity:

> *Crop biosecurity is a general description for a set of measures designed to protect Canada's plant resources from crop pests at the national, regional, and individual farm levels. A pest is considered anything that is injurious or potentially injurious, whether directly or indirectly, to plants, or to products or by-products of plants, and it includes any plant prescribed as a pest.*
> (CFIA 2020a; part A) Background)
>
> *Crop biosecurity prevents, minimizes and controls the introduction and spread of plant pests at the farm level. Pest problems can severely reduce the sustainability and profitability of the Canadian agricultural sector.* (CFIA 2020b; Crop Biosecurity)

Soil and plant debris transport is an important mechanism for the potential spread of weeds and soil-borne diseases to and from the PDA, and to agricultural fields in proximity to the PDA. There are two primary pathways of this transport:

- Machinery (vehicles and equipment) incoming to the Project provides a pathway of potential disease and weed transmission to all portions of the PDA, and to agricultural lands adjacent to the LMOC and PR 239 realignment portions of the PDA, from agricultural areas outside of the region surrounding the Project. Incoming machinery that was not properly cleaned following previous work in other agricultural areas provides a mechanism of potential transfer.
- Movement of equipment and workers on and off the LMOC and PR 239 realignment portions of the PDA during construction in cropland areas provides another potential pathway for disease and weed transmission to previously non-affected agricultural soils, compromising biosecurity for affected lands. There is potential for soil and plant debris to be transferred from the LMOC and PR 239 realignment portions of the PDA to areas outside of the PDA during the construction phase as a result of unclean construction equipment, other vehicles and people moving from the PDA and transiting through areas of agricultural crop production, including access roads and municipal roads.

The introduction of agricultural pests can have lasting adverse effects to production (reductions in yield and quality) and production cost (increased input and management costs). Diseases can spread between regions and fields by human-related means through transport of infested seed, soil, and crop residues, and within and between fields by natural means (e.g., wind, rain, water and soil erosion and insects).

Examples of two soil-borne pathogens verified in Manitoba are verticillium wilt (*Verticillium longisporum*; Manitoba Agriculture 2019c) and clubroot (*Plasmodiophora brassicae*; Manitoba Agriculture 2019c, d). Both can have deleterious effects on canola, a crop commonly grown in the Project area, and can be transferred in soil. Movement of infected soil on vehicles, equipment and pedestrian footwear is an important mechanism for transfer of these and other soil-borne pathogens.

Cattle production is common in the LMOC and PR 239 areas, and cattle feedlots are present within the LMOC portion of the PDA. While the livestock-related biosecurity concerns are discussed in Section 3.1.2, manure can be an issue for cropland biosecurity. Manure can contain weed seeds, so if manure is transferred from the PDA on vehicles or equipment, there is potential for weed transfer to croplands outside of the PDA.

Another biosecurity concern is related to management within the PDA. Weed growth within the PDA can be a source of weeds to adjacent agricultural land through various mechanisms of transfer including weeds spreading invasively, weed seeds blowing onto land, and birds and other wildlife transferring weed seeds. The following weeds were observed within, and in the vicinity of, the PDA during a reconnaissance field survey in August 2019 (RVMP):

- Noxious weeds (i.e., *Noxious Weeds Act* listed species), including Tier 1 (orange hawkweed [*Hieraciam aurantiacum*], Tier 2 (ox-eye daisy [*Leucanthemum vulgare*] and nodding thistle [*Carduus nutans*]) and Tier 3 (absinth [*Artemisia absinthium*], common burdock [*Arctium minus*], perennial sow thistle [*Sonchus arvensis*] and Canada thistle [*Circium arvense*]).
- No ISCM EDRR Category 1 listed species were identified. Nodding thistle and ox-eyed daisy (noted as Tier 2 noxious weeds, above) are considered EDRR Category 2 listed terrestrial species by ISCM. Prickly lettuce (*Lactuca serriola*) and scotch thistle (*Onopordum acanthium)* are listed as 'Other Terrestrial Invasive Plants' by ICSM and don't have specific management guidance as do the EDRR species.

Weed growth, noxious weed and invasive agricultural plant spread, and weed seed transfer can occur through construction and operation phases. However, a properly managed PDA should not be a source of noxious weeds or other invasive agricultural plants to agricultural land.

A potential land use within the PDA is haying suitable revegetated areas or cutting and baling vegetation for use as feed for livestock at farming operations in proximity of the PDA. Manitoba Transportation and Infrastructure has indicated that haying of the LMOC and LSMOC by private producers is a potential activity which would be considered during periods of drought, when producers may have limited hay supply for their livestock. Haying would be conducted by private landowners/producers under agreement with Manitoba Transportation and Infrastructure. Haying activities would consist of farm machinery accessing the PDA to cut and bale vegetation and remove bales from the PDA. Hay harvest typically occurs two to three times per season, depending on growing conditions and productivity. While haying of the PDA is considered of benefit to local producers, and generally beneficial to areas of upland vegetation suitable for haying within the PDA,

this activity comes with some biosecurity concerns requiring consideration. Haying within the PDA provides potential mechanisms for weed seed transfer to and from the PDA:

- From the PDA onto adjacent, privately-owned farming operations in harvested bales, and
- To and from the PDA, by machinery which is not adequately cleaned prior to entry to and exit from the PDA.

This potential land use within the PDA will be confirmed by Manitoba Transportation and Infrastructure at a future date.

3.1.2 Livestock Biosecurity

The CFIA provides the following definitions for livestock biosecurity (CFIA 2020c; What is Biosecurity in the Canadian Beef Cattle Industry?):

> *Those practices that prevent or mitigate disease from entering, spreading within, or being released from operations that may contain livestock.*
>
> *A broadly applied term encompassing the introduction, transmission, spread and/or existence of a range of pests, pathogens and other disease-causing agents, including toxins.*

Contact between workers or equipment and livestock and/or livestock manure is a vector for the transmission of various diseases (e.g., bovine tuberculosis). This is of particular concern when workers or equipment have recently been in contact with livestock within another farm or region. The introduction or spread of diseases can be devastating for livestock operations. This is especially the case for livestock operations with large numbers of animals contained close within common spaces (e.g., cattle feedlots). Workers should not come into close contact with livestock that may be in confined areas (e.g., cattle feedlots) or in open areas (e.g., grazing livestock).

The transfer of manure also has the potential to spread infectious diseases amongst livestock. As cattle feedlots and grazing lands are common throughout the LMOC area, measures need to be taken to avoid transferring manure to agricultural lands outside of the LMOC portion of the PDA.

3.1.3 Biosecurity Risk Mechanisms

A summary of biosecurity risk mechanisms is provided in Table 1. Biosecurity management measures will be implemented to prevent, minimize, or control the potential for these mechanisms to occur as a result of Project activities.

During the construction phase:

- Measures to protect cropland biosecurity focus on preventing and minimizing the potential of soil and weed transfer to the PDA from agricultural areas outside of the region of the Project, and from the LMOC and PR 239 realignment portions of the PDA to agricultural areas adjacent to these portions of the PDA.

- For livestock biosecurity, measures include minimizing the potential for manure transfer from the LMOC and PR 239 realignment portions of the PDA to agricultural areas outside of these portions of the PDA and preventing direct worker contact with livestock.
- During the construction phase, managed revegetation will occur within all portions of the PDA to minimize the potential for weed growth and infestations. Revegetation plans for the PDA are presented in the RVMP. The RVMP necessitates treatment of weed infestations prior to soil stockpiling, control of weeds on soil stockpiles, and timely and appropriate weed control response when noxious weeds or invasive plant species are identified within the PDA following revegetation.

During the operation phase:

- The RVMP prescribes monitoring of vegetation establishment within the PDA for a three-year period following revegetation, including assessment of noxious weeds and invasive plant species. Long-term monitoring of vegetation for weeds within the PDA is planned to be completed once per year and may be adjusted depending on the long-term site-specific effectiveness of revegetation.
- If haying within the PDA is a permitted activity, private landowners/producers will be expected to enter the PDA with machinery clean and free of loose soil and plant debris and will be expected to clean machinery of loose soil and plant debris prior to exiting the PDA. Private landowners/producers will be expected to enter into a lease agreement with Manitoba Transportation and Infrastructure for haying within the PDA. It is anticipated that these agreements will include these cleaning requirements expected of landowners/producers.

Table 1: Summary of Project-Related Biosecurity Risk Mechanisms

Project Phase	Risk Category	Risk Mechanism	Relevant PDA Components
Construction	Cropland	Soil/manure/weed-containing plant debris material transfer to the PDA on machinery incoming to the Project. Incoming machinery, if not properly cleaned following previous work, may transfer harmful materials from other agricultural regions to the PDA.	LMOC PR 239 LSMOC
	Cropland	Soil/manure/weed-containing plant debris material transfer to/from the PDA by machinery movement, namely loose material falling off vehicles and equipment after exiting the PDA and traveling on public roadways through adjacent areas of agricultural land use. This material can subsequently be transported into adjacent agricultural fields by wind or other traffic.	LMOC PR239

Project Phase	Risk Category	Risk Mechanism	Relevant PDA Components
Construction (cont'd)	Livestock	Direct contact between workers and livestock.	LMOC PR239
Operation	Cropland	Invasive agricultural plant/noxious weed transfer from the PDA to adjacent agricultural cropland.[1]	LMOC
	Cropland	Weed seed transfer to/from the PDA by privately-owned haying machinery and from the PDA to privately-owned agricultural operations on haying equipment and in harvested hay (if haying activity is permitted).[2]	LMOC LSMOC

Notes:

1. Weed management within the PDA, including invasive agricultural plant/noxious weed control and prevention of invasive agricultural plant/noxious weed spread from the PDA onto adjacent agricultural areas, is addressed in the revegetation plans for the LMOC.
2. Haying within the PDA by private landowners/producers may be permitted, in which case this will be considered a risk mechanism. This potential land use within the PDA will be confirmed by Manitoba Transportation and Infrastructure at a future date.

3.2 Biosecurity Management Strategies, Approaches, And Practices

There are three key strategies to an effective biosecurity management program: 1) prevent, 2) minimize, and 3) control. These strategies and associated tactics, achieved through planning and action, are summarized below:

- **Prevent** – the first line of defense against biosecurity concerns is to prevent the risk. The primary means of prevention is through avoidance. Avoidance requires an understanding of potential biosecurity risk issues and Project mechanisms of risk (Section 3.1), and actions to avoid the risk from occurring during Project activities. Avoidance tactics can include keeping activities and workers removed from biosecurity concerns (e.g., restricted or no-go areas, separation from livestock and livestock facilities), timing activities to reduce higher risk situations (e.g., wet soils), and limiting access to only required and established access routes and CAPs. The establishment of a single Project Area Entry Checkpoint provides a means to inspect vehicles and equipment incoming into the Project area to confirm they are clean prior to entering the Project area and PDA for work purposes. If vehicles and equipment are not considered to be adequately clean, they must be cleaned and disinfected prior to approval to proceed to Project work areas. This provides an important prevention and avoidance measure for the Project. Prevention and avoidance are largely the result of Project planning, involving defining risk management zones and implementing access management (Section 3.2.1).

- **Minimize** – the second line of defense against biosecurity concerns is to minimize risks, where risks are not preventable or avoidable. Cleaning vehicles, equipment and footwear is the key approach to minimizing biosecurity risks to croplands and livestock operations in proximity of the PDA. Vehicles, equipment, and pedestrian footwear must be clean prior to exiting the LMOC and PR 239 realignment portions of the PDA following work, as these are the portions of the PDA with adjacent agricultural land use. As land use within and adjacent to the LSMOC is predominantly natural vegetation and wetlands with no agricultural land uses, cleaning of machinery and footwear is not required during construction for the purposes of agricultural biosecurity. Risk levels, as described in Section 3.2.2, are assessed to guide cleaning requirements. Cleaning techniques involve cleaning the surface of vehicles, equipment and footwear that have been in contact and/or accumulated agricultural soil, manure, or plant debris. This includes tires, tracks, treads, undercarriages, and portions of equipment that are in contact with soil for earth moving, excavation, drilling, etc. Cleaning of vehicles, equipment and footwear will be conducted at cleaning areas and/or stations established at CAPs prior to exiting the PDA. Cleaning practices are discussed in Section 3.2.3.
- **Respond** – the last line of defense against biosecurity concerns is to respond to biosecurity issues through control measures when issues occur due to Project activities. Control measures may need to be implemented through the construction phase as a result of weed infestations or other unforeseen or unplanned events (i.e., accidents or malfunctions resulting in a biosecurity breach). Control measures are planned during the operation phase, involving weed control within the PDA should weed infestations occur and create a potential risk of invasive spread to adjacent agricultural lands.

The three key strategies are illustrated in Figure 1.

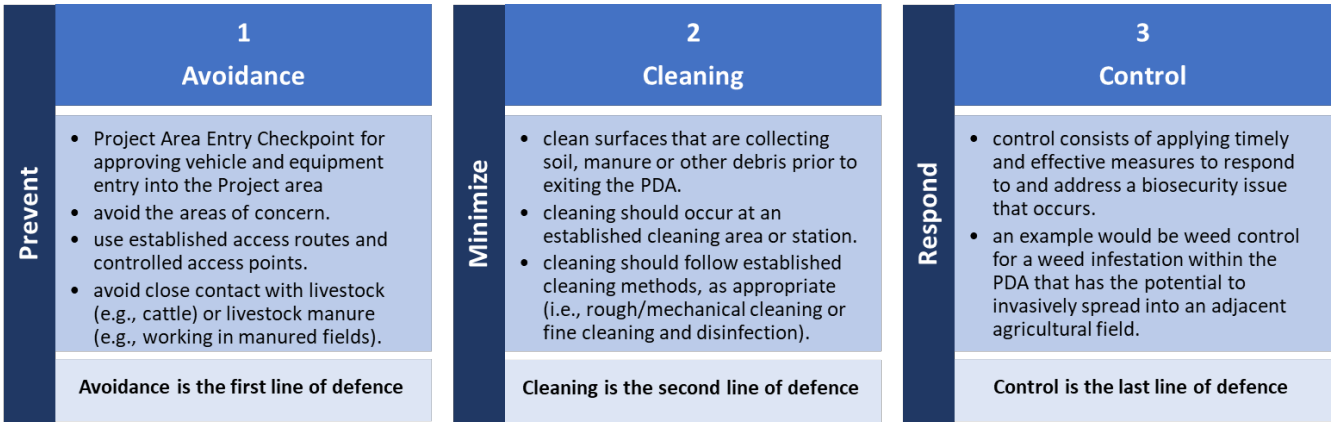


Figure 1: Three Key Strategies for Effective Biosecurity Management

3.2.1 Biosecurity Management Zones and Access Management

The identification of Biosecurity Management Zones (risk zones, restricted areas) and access management features are critical to effective agricultural biosecurity management for the Project. Access management features include a controlled checkpoint into the Project area, CAPs onto the LMOC and PR 239 realignment portions of the PDA, routes of access to the PDA access points, and a single access point and security gate for the LSMOC portion of the PDA These access management features and zones are summarized below:

- Project Area Entry Checkpoint – a single, established location at which incoming construction machinery must be checked for adequate cleanliness prior to entry into the Project area to access any portions of the PDA. Information on the Project Area Entry Checkpoint is described in Section 7.1 of the AMP. All incoming machinery must be checked-in and receive approval for entry prior to accessing the LMOC and PR 239 realignment portions of the PDA through a CAP (see below) or the LSMOC portion of the PDA through the security gate (see below).
- PDA access management features:
    - LMOC and PR 239:
        - Controlled Access Point– established locations at the edge of the PDA at which construction workers, vehicles and equipment can enter and exit the PDA. CAPs are located at various locations along the LMOC and PR 239 realignment portions of the PDA. Cleaning areas or stations will be established at CAPs and workers will have to adhere to cleaning requirements when exiting the PDA. Cleaning requirements are defined according to the biosecurity risk level (i.e., low risk, moderate risk, or high risk) determined by the combination of the potential to transfer soil, manure, or debris off the PDA and the nature of the CA from the PDA, as described in Section 3.2.2.
        - Construction access – approved routes to access CAPs along the edge of the PDA where CAPs are not located along major transportation routes (provincial highways/roads or municipal grid roads). In other words, where access to the PDA is directly from major transportation routes (provincial highways/roads or municipal grid roads) CA are not applicable or identified.
        - Point of Access (POA) – the starting POA to a CA route from a major transportation route (provincial highways/roads or municipal grid roads). Where access to the PDA is directly from major transportation routes (provincial highways/roads or municipal grid roads) POA are not applicable or identified.
    - LSMOC:
        - Security Gate – a security gate will be established at the beginning of the LSMOC access road located at the end of Idylwild Road (Figure 1-1, Appendix 1) following the completion of construction. This will provide access control to all vehicles and equipment entering and exiting the LSMOC portion of the PDA through the operation phase of the Project. As discussed above, all construction machinery incoming to the LSMOC portion of the PDA will have to be approved as adequately clean at the Project Area Entry Checkpoint prior to accessing the LSMOC portion of the PDA for construction. During operation, if haying of the LSMOC portion of the PDA is a permitted activity, the security gate may act as a CAP for private agricultural producers where haying machinery will be checked for cleanliness prior to entering the LSMOC portion of the PDA.

A conceptual diagram of a CAP, CA and POA in relation to the PDA and a major transportation route is presented in Figure 2.

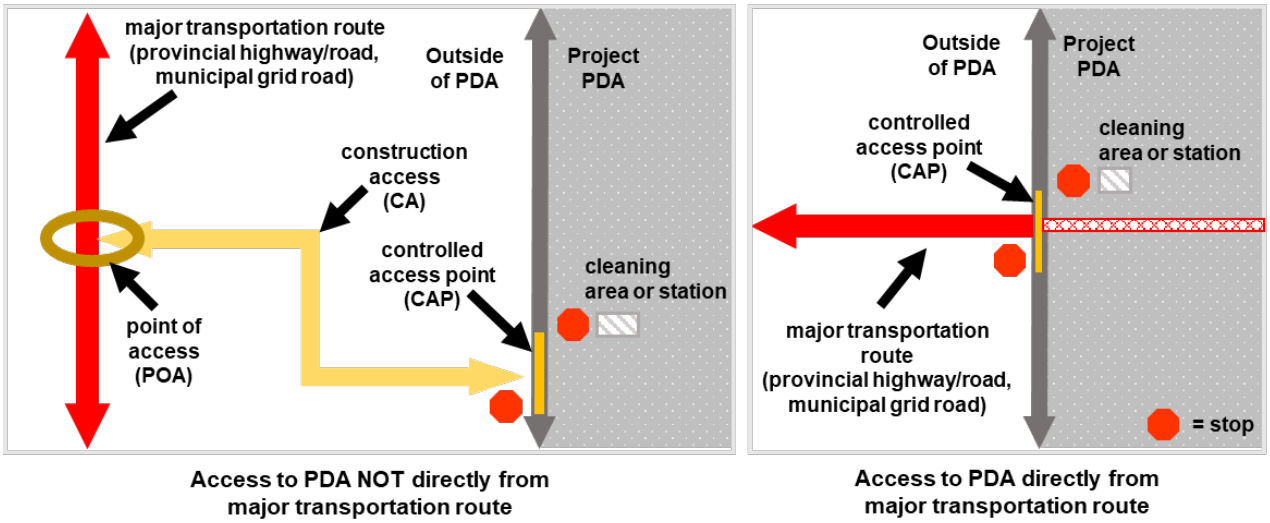


Figure 2: Conceptual Diagrams of Controlled Access Point, Construction Access, and Point of Access

Biosecurity Management Zones are defined in areas of agricultural land use adjacent to the PDA. As there is no agricultural land use adjacent to the LSMOC portion of the PDA these features are only relevant to the LMOC and PR 239 realignment portions of the PDA. Biosecurity Management Zones help define the level of biosecurity risk related to CA and construction activities. They include:

- Biosecurity Risk Zone – BRZs are areas of agricultural land, including annual crop land, hayland and pastures for livestock grazing, immediately adjacent to the LMOC and PR 239 realignment portions of the PDA, and located along access management routes. These represent areas of agricultural production that are potentially at risk from Project activities.
- Restricted Access Zone – RAZs are areas within and in proximity to the LMOC and PR 239 realignment portions of the PDA into which access by workers is restricted due to special biosecurity concerns. For RAZ located outside of the PDA, workers should avoid these areas when accessing the PDA. For RAZ located within the PDA, workers should not access these areas and Project activities should not be conducted within these areas without explicit permission from Manitoba Transportation and Infrastructure. Specific management plans will need to be developed to address the biosecurity concerns for RAZ within the PDA prior to access to these areas being permitted. Once the biosecurity concerns have been addressed and the biosecurity risks adequately managed, the RAZ designation can be removed by Manitoba Transportation and Infrastructure following which time these areas will be treated according to general biosecurity management plan requirements. Two RAZ categories are defined within the PDA, as follows:

- **Manure impacted site** - these areas have manure impacted soils and/or manure stockpiles as a result of the presence of cattle feedlots/operations. Two manure impacted site RAZs are identified within the LMOC PDA (Figures 2-1 to 2-10, Appendix 2). These are comprised of cattle feedlots/operations areas with potentially manure impacted soils and manure stockpiles. The following requirements pertain to these RAZs:
  - Workers should not access RAZs within the PDA without explicit permission from Manitoba Transportation and Infrastructure, and workers should not access the PDA through RAZs identified outside of the PDA.
  - Construction activities should not occur within manure impacted site RAZs located within the PDA until these areas are properly evaluated and adequately cleaned-up (i.e., manure stockpiles removed, and manure impacted soils evaluated and remediated).
  - Cleanup of these areas are described as a commitment in the PERs (Section 2.6.6), with mitigations described in the EPP and associated LMOC mapbooks.
  - Equipment, vehicles and workers are required to utilize fine cleaning and disinfection when exiting these RAZs prior to these sites being cleaned-up and deemed remediated.
  - Soils from these areas should not be excavated, moved or stockpiled in general soil stockpiles prior to the implementation of a site-specific management plan.
  - Once remediated and following approval by Manitoba Transportation and Infrastructure, these areas will no longer be considered RAZs and general biosecurity management measures will apply.
- **Weed infestations** – areas of known weed infestations (i.e., noxious weeds or invasive agricultural plant species) identified within the PDA through monitoring under the RVMP are considered a RAZ until they are effectively treated as outlined in the RVMP and no longer considered an area of weed infestation. There are currently no weed infestation RAZ identified within the PDA; however, these RAZs may be identified during construction and operation through the monitoring prescribed under the RVMP or other environmental monitoring activities. The following requirements pertain to these RAZs:
  - Workers should not access weed infestation RAZs within the PDA without explicit permission from Manitoba Transportation and Infrastructure.
  - Construction activities should not occur within weed infestation RAZs located within the PDA until weeds in these areas are adequately controlled or destroyed as described in the RVMP.
  - A site-specific management and monitoring plan should be developed and implemented to treat the weed infestation. Management measures should be appropriate to treat the site-specific weed infestation as outlined in the RVMP (i.e., destroy, control or prevent spread) according to the type of noxious weed and/or invasive species present. Management measures should also address specific requirements for work to be conducted within the RAZ (e.g., mowing, special construction activities, soil excavation, etc.). Monitoring should be implemented to confirm management measures have effectively treated the area such that it is no longer considered a weed infestation, at which point additional monitoring is not required.

- Until response measures effectively treat (i.e., control or destroy) the weed infestation, vehicles, equipment and workers conducting approved work within the RAZ (e.g., weed treatment, mowing) are required to utilize fine cleaning (disinfection not required) when exiting the RAZ.
- Soils from within these RAZs should not be excavated, moved or stockpiled prior to implementation of a site-specific management and monitoring plan.
- Mowing of these areas should not be conducted prior to implementation of a site-specific management and monitoring plan, described above, and if mowing is required, approved mowing of RAZ should only occur after mowing of areas not deemed a RAZ or having known weed concerns.
- Once the weed infestation is effectively treated, the weed infestation RAZ designation may be removed on approval by Manitoba Transportation and Infrastructure, following which time general construction activities may be undertaken in these areas and general biosecurity management measures under the will apply.

Biosecurity Management Zones, including BRZs and RAZs, are presented in the agricultural biosecurity map book in Figures 2-1 to 2-10 (Appendix 1). While manure impacted site RAZs are identified in Figure 1-1, weed infestation RAZs are to be identified through construction and operations phase monitoring activities to be completed under the RVMP.

Also presented in Figures 2-1 to 2-10 (Appendix 1) are preliminary locations for access management features including CAPs, CAs, and POAs. These locations have been informed by the proposed site access roads provided by Manitoba Transportation and Infrastructure and provided in Figure 3. As noted in Figure 3, access to LMOC is anticipated to be limited to existing municipal roads and existing provincial highways. Final locations of these features will be determined by the Contractor and will be approved by Manitoba Transportation and Infrastructure.

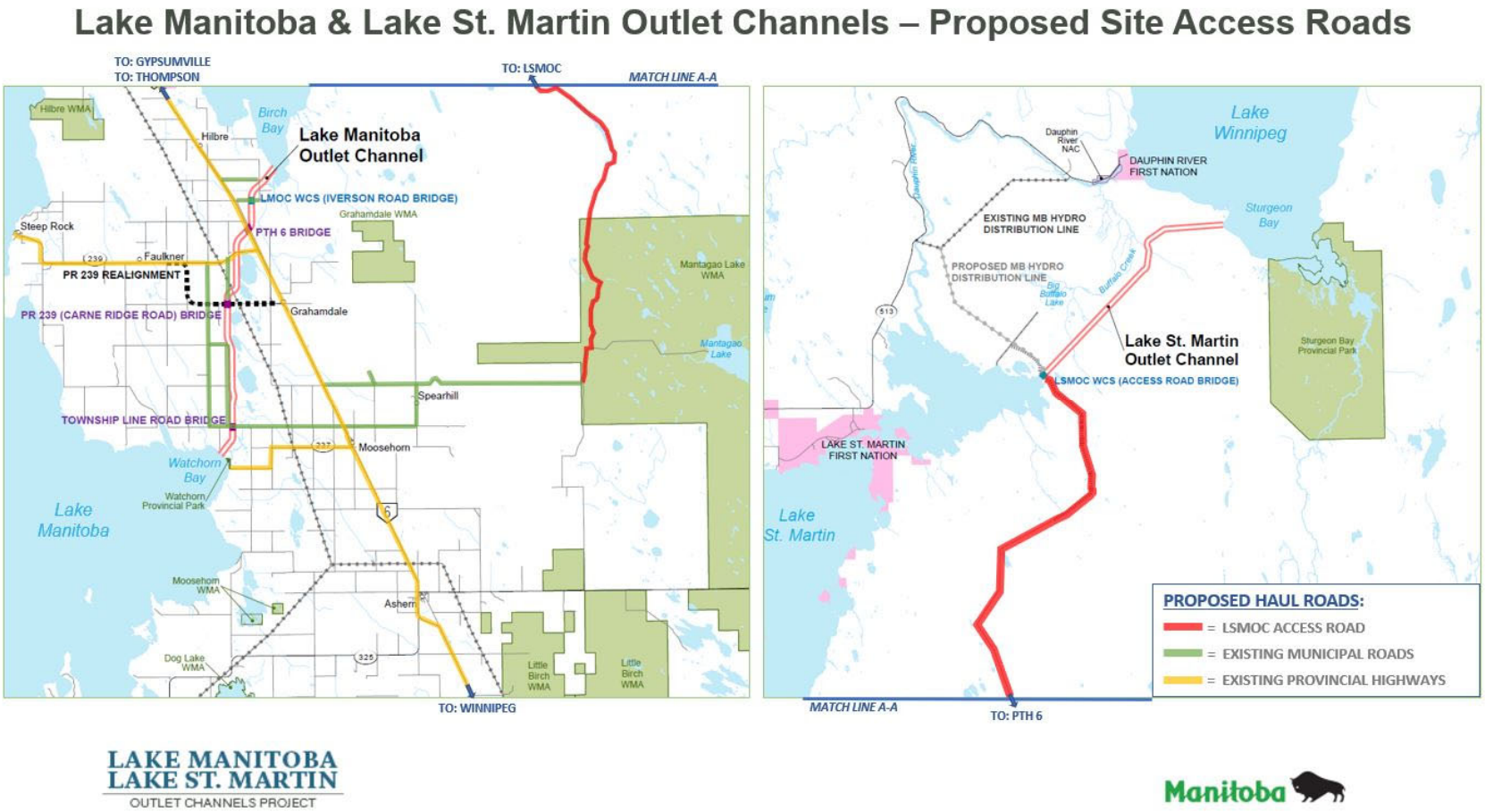


Figure 3: Proposed Site Access Roads for LMOC and LSMOC

The Project Construction Environmental Protection Plan (CEnvPP) will incorporate RAZs, CAPs, CAs and POAs, as these are important agricultural biosecurity management plan elements with associated management measures pertaining to construction activities.

3.2.2 Biosecurity Risk Levels

The identification of risk levels allows for management effort to be targeted appropriately to construction activities and areas of concern. Biosecurity risk levels are defined for the LMOC and PR 239 realignment portions of the PDA as these areas are within agricultural areas and have agricultural land use adjacent to the PDA. Two Risk Categories are defined to determine potential risk levels associated with a given CAP:

- Level 1 Risk Category – where CA on exit from the PDA is on established provincial highway/road or municipal grid road.
- Level 2 Risk Category – where CA on exit from the PDA is through areas of primary agricultural production (i.e., farmyards, livestock operations, cropping fields).

Risk levels are identified based on the Risk Category assigned to a CAP and on the potential for vehicles, equipment or footwear to transfer soil, manure or plant debris from the PDA to agricultural areas outside of the PDA. Risk levels include Low risk, Moderate risk and High risk, which are described in Table 2. Required cleaning actions associated with each risk level are also presented in Table 2. As summarized in the table, activities considered to have low risk level have no associated required action, while activities having a moderate or high risk, have required actions comprised of mechanical and fine cleaning, respectively. Cleaning methods are described in Section 3.2.3.1.

A decision flow process for determining the Risk Categories and levels is provided in Figure 4.

Based on the potential locations of CAPs, CAs and POAs presented in the map book in Figures 2-1 to 2-10 (Appendix 1), the assessed Risk Category at all potential CAPs is Level 1, resulting in the potential for risk levels of Low risk or Moderate risk. This assessment will be reviewed following the determination of final access routes and access points by the Contractor. However, at this time, POAs, CAs and CAPs are not anticipated to be established within areas of primary agricultural production (i.e., farmyards, livestock operations, cropping fields). As such, it is not anticipated that CAPs will be identified that will result in a Level 2 Risk Category determination, and, therefore, a risk level determination of High risk is not expected to occur on the Project.

Table 2: Risk Level and Required Action

Risk Level	Description of Risk Level	Required Action
Low risk	Activity is not resulting in soil disturbance and soil, manure or plant debris is not accumulating on vehicles, equipment, or footwear. The potential transfer of soil, manure, or plant debris from the PDA to agricultural areas outside of the PDA is unlikely.	No action is required if vehicle, equipment, and footwear checks for accumulation of soil, manure, or plant debris prior to leaving the PDA confirm no accumulation of these materials.

Risk Level	Description of Risk Level	Required Action
Moderate risk	Activity is resulting in soil disturbance and/or soil, manure or plant debris is accumulating on vehicles, equipment, or footwear in a manner that this material is at risk of falling or blowing off vehicles and/or equipment after exiting the PDA. Soil, manure and/or plant debris accumulations are loose and/or in accumulated masses (e.g., chunks, lumps) and are not firmly adhered or impacted to vehicles and/or equipment. There is the potential to transfer soil, manure, or plant debris from the PDA to agricultural areas outside of the PDA. Loose soil, manure or debris or accumulated masses of soil, manure or debris may fall off vehicles or equipment on roads and may be subsequently transferred into adjacent agricultural fields by other non-Project machinery or by the wind. The egress from the PDA is directly to a major transportation route (primary, secondary highway) or municipal road and not through an areas of primary agricultural land use, including farmyards, livestock operations, and cropping fields.	Rough/mechanical cleaning must be completed if vehicle, equipment, and footwear checks indicate accumulations of soil, manure or debris that are loose or in masses (lumps, chunks) that are at risk of falling or blowing off vehicles and/or equipment after exiting the PDA. Cleaning must be conducted until these accumulations are removed. In these instances, it is generally considered good practice to pressure wash vehicles and equipment at commercial wash facilities after exiting the PDA (even if rough/mechanical cleaning has been completed at the Project work area).
High risk	Activity is resulting in soil disturbance and/or soil, manure or plant debris is accumulating on vehicles, equipment, or footwear. There is the potential to transfer soil, manure, or plant debris from the PDA directly to agricultural operations outside of the PDA. The access management route from the PDA is through other areas of primary agricultural land use, including farmyards, livestock operations, cropping fields.	All affected equipment, vehicles, footwear, tools (i.e., those surface in contact with and accumulating soil, manure, or plant debris) must be fine cleaned and disinfected prior to leaving the PDA and transiting to agricultural operations outside of the PDA. Note: transit between the PDA and agricultural operations outside of the PDA is not planned or anticipated.

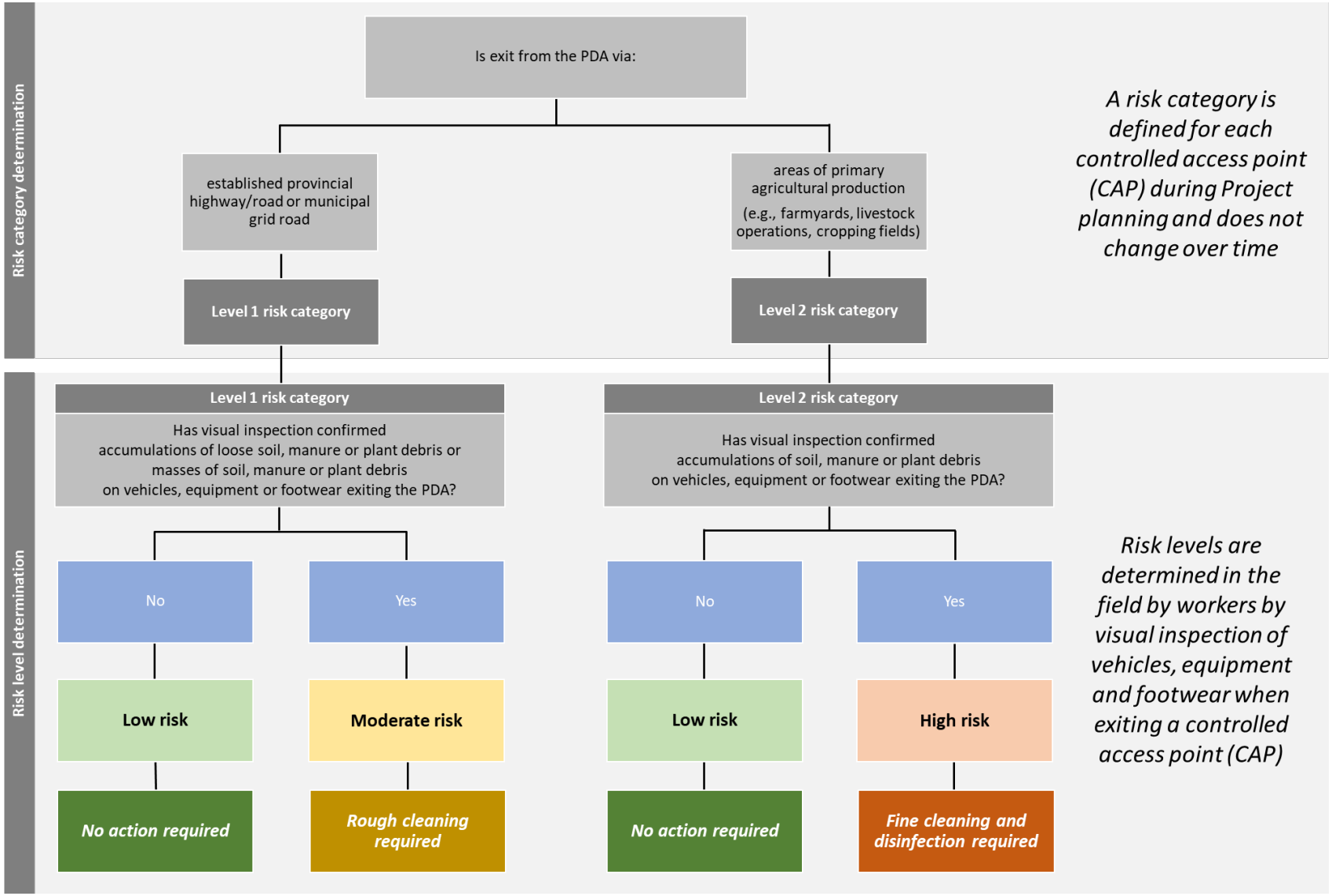


Figure 4: Determination of Agricultural Biosecurity Risk Categories and Risk Levels

3.2.3 Cleaning Practices

Cleaning practices are discussed below, including different types of cleaning methods for vehicles, equipment and footwear, and cleaning station and cleaning area requirements for the Project.

3.2.3.1 Cleaning Methods

There are two types of cleaning methods described below that provide different degrees of cleaning of vehicles, equipment and footwear – rough/mechanical cleaning and fine cleaning and disinfection. These are prescribed according to defined risk levels on the Project, as discussed below.

Rough/Mechanical Cleaning

Rough/mechanical cleaning is accomplished using hand tools (i.e., shovels, scrapers, brushes, and brooms, etc.) or compressed air, or a combination of these means, to physically remove loose and accumulated masses of soil, manure and/or plant debris from vehicles, equipment, and footwear.

Rough/mechanical cleaning is required in the following instances:

- Construction phase:
  - Exiting the LMOC and PR 239 realignment portions of the PDA - when a moderate risk level has been assessed when exiting the PDA. A moderate risk is assessed (as presented in Section 3.2.2) when the following criteria are met:
    1. Exiting the PDA at a CAP categorized as a Level 1 Risk Category (i.e., egress from the PDA is directly to a major transportation route [primary, secondary highway] or municipal road), and
    2. Soil, manure and/or plant debris has accumulated on vehicles, equipment, or footwear in a manner that this material is at risk of falling or blowing off vehicles and/or equipment after exiting the PDA. Soil, manure and/or plant debris accumulations are loose and/or in accumulated masses (e.g., chunks, lumps) and are not firmly adhered or impacted to vehicles and/or equipment.
- Operation phase
  - Haying of the PDA – if haying of the PDA by private landowners/producers is a permitted activity within the LMOC or LSMOC portions of the PDA, haying equipment must undergo a rough/mechanical cleaning prior to entry onto the PDA and prior to exit from the PDA. This will minimize the potential for weed transfer to and from the PDA and to and from private agricultural land as a result of this activity.
  - Accessing the LMOC and PR 239 realignment portions of the PDA for maintenance purposes – vehicles accessing the PDA for routine maintenance purposes must undergo inspection prior to exiting the PDA, and if soil or plant debris is collecting on vehicles, they must undergo a rough/mechanical cleaning prior to exit from the PDA to reduce the potential for transfer of soil or plant debris from the PDA to agricultural areas outside of the PDA.

Fine Cleaning and Disinfection

Fine cleaning is accomplished using a pressure washer to wash down vehicles and equipment. Footwear can be cleaned using rough cleaning or fine cleaning methods. Rough cleaning before fine cleaning can reduce fine cleaning efforts if a substantial amount of soil and other material has accumulated on vehicles or equipment. Disinfection is accomplished using a Manitoba Transportation and Infrastructure-approved disinfection solution (e.g., regulated, commercial disinfectant such as Virkon® or Prevail™) on surfaces that have already undergone fine cleaning. Disinfectants must be used according to industry and/or manufacturers guidelines; disposal is discussed in Section 3.2.3.2. All surfaces in contact with soil (e.g., tire treads, tracks) and any remaining soil on vehicle, equipment or footwear following cleaning must be adequately treated (i.e., thoroughly wetted) with disinfectant for effective disinfection.

Fine cleaning and disinfection are required in the following instances:

- Construction phase:
  - Vehicles and equipment incoming into the Project area - incoming construction machinery must be checked for adequate cleanliness prior to entry into the Project area to access any portions of the PDA. All incoming machinery must be checked-in at the Project Area Entry Checkpoint and receive approval for entry into the Project area. Vehicles or equipment that are deemed to not be adequately clean on arrival at the Project Area Entry Checkpoint must undergo a fine cleaning and disinfection prior to entering the Project area and accessing the PDA.
  - Exiting the LMOC and PR 239 realignment portions of the PDA - when a high-risk level has been assessed when exiting the PDA. A high risk is assessed (as presented in Section 3.2.2) when the following criteria are met:
    1. Exiting the PDA at a CAP categorized as a Level 2 Risk Category (i.e., the access management route from the PDA is through other areas of primary agricultural land use, including farmyards, livestock operations, cropping fields.), and
    2. Soil, manure and/or plant debris has accumulated on vehicles, equipment, or footwear exiting the PDA.
  - Exiting a RAZ – if completing approved activities within a RAZ, vehicles, equipment and footwear must undergo a fine cleaning prior to exiting a RAZ to access other areas of the PDA or to exit the PDA. Disinfection following fine cleaning is required at manure impacted soils RAZs, while disinfection is not required at weed infestation RAZs.

3.2.3.2 Cleaning Areas and Stations

Cleaning areas and/or stations will be established at CAPs where there is potential for a moderate or high biosecurity risk to occur, as defined in Table 2. Cleaning areas or stations will be established as appropriate relative to the biosecurity risk level, as follows:

- Rough/mechanical cleaning area – will accommodate rough/mechanical cleaning requirements, including an established zone for vehicle and equipment cleaning, and an area for soil and other material cleanings. Soil, manure, and plant debris cleanings will be temporarily managed on-site in a manner such that they are not prone to losses from the PDA (e.g., through erosion or runoff), and should be periodically (i.e., in the fall prior to freeze-up or more frequently if deemed necessary)

spread and incorporated within the PDA, added to existing soil spoil piles, or buried within the PDA with a minimum soil cover of 0.5 metres (m). Rough/mechanical cleaning areas will be established at CAPs where there is the potential for a Moderate risk (i.e., Level 1 Risk Category – CA from the PDA directly onto major transportation routes [provincial highways/roads, municipal grid roads]).

- Fine cleaning station – will accommodate fine cleaning and disinfection requirements, including an established zone with appropriate matting (i.e., wood or wood and steel "rig mats" or mats of other rigid materials sufficient to keep vehicles and equipment separated from the surficial soils) for vehicle and equipment cleaning, and a collection system for wash water. Soil, manure, and plant debris cleanings will be temporarily managed on-site in a manner such that they are not prone to losses from the PDA (e.g., through erosion or runoff). Cleanings and sediment from wash water collection systems should be periodically buried within the PDA at a minimum soil cover of 0.5 m. Fine cleaning stations will be established at CAPs where there is the potential for a High risk (i.e., Level 2 Risk Category – CA from the PDA through areas of primary agricultural production [farmyards, livestock operations, cropping fields]). In addition, fine cleaning stations will be established at RAZs, including those associated with manure impacted sites and weed infestations, for use when workers, vehicles and equipment are accessing these areas during approved activities (e.g., undertaking of soil clean-up and remediation or weed control activities).

Figure 5 provides a conceptual diagram of the potential layout and components for a rough/mechanical cleaning station and a fine cleaning station. At this time, it is anticipated that all CAPs will be assigned a Level Risk Category, as access routes and points (i.e., POAs, CAs and CAPs) are not anticipated to be established in areas of primary agricultural production (i.e., farmyards, livestock operations, cropping fields). As such, it is not anticipated that CAPs will be identified that will result in a Level 2 Risk Category determination, and, therefore, a risk level determination of High risk is not expected to occur on the Project. Subject to confirmation of final access route and access points determined by the Contractor, fine cleaning and disinfection and fine cleaning stations are not anticipated to be required at CAPs as there is not anticipated to be a high-risk level assessed on the Project. However, fine cleaning stations will be required to be established RAZs prior to the completion of manure and soil clean-up activities at manure impacted site RAZ and weed control and/or elimination activities at weed infestation RAZ.

Cleaning areas and stations should be set back from the main line of travel for accessing and exiting the PDA to prevent traffic interference and to avoid trafficking over soil and plant debris cleanings (Figure 6). Areas for cleaning stations need to be adequate to accommodate the construction vehicles and equipment being cleaned. Cleaning areas and stations should also be located on relatively high and dry land (i.e., not prone to flooding or runoff events), and sufficiently set back from drainage ditches and field edges, such that soil, manure and plant debris cleanings are not prone to loss from the PDA into these features. Figure 5 shows an example representation of the location of a cleaning area or station on the PDA, in relation to the main line of traffic accessing and exiting the PDA, and in relation to the edge of the PDA.

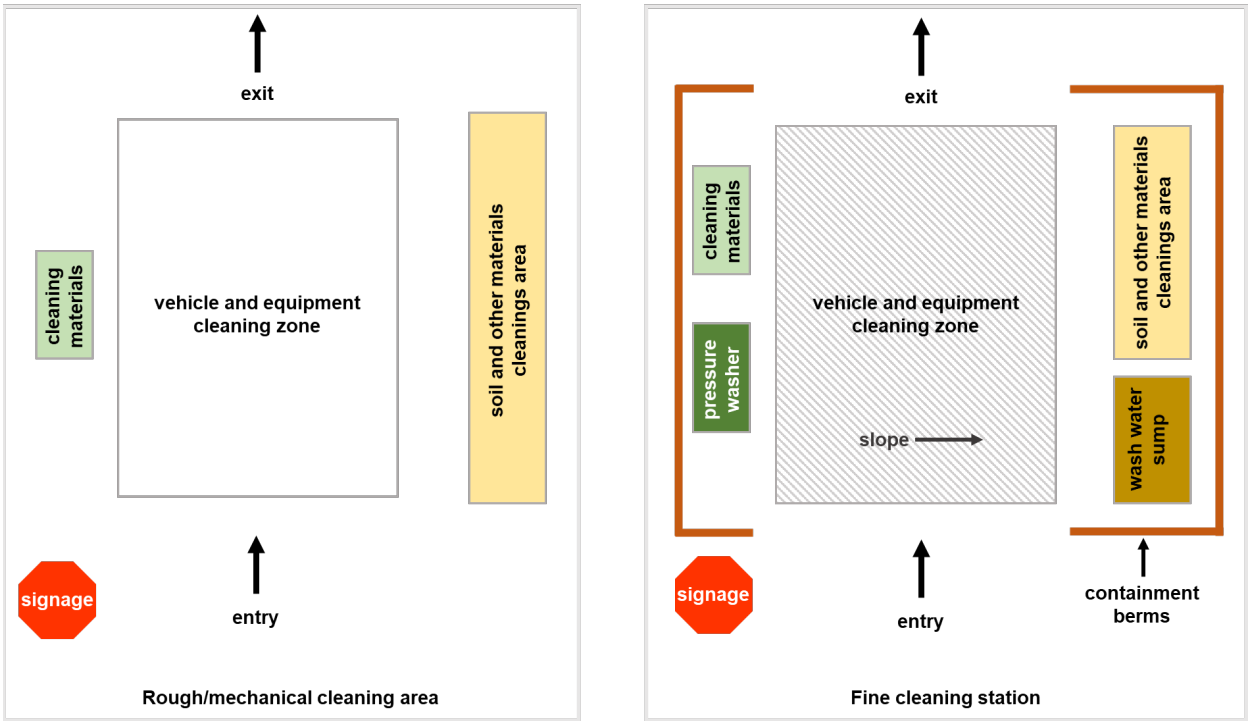


Figure 5: Conceptual Diagram of Rough/Mechanical Cleaning Area and Fine Cleaning Station

Cleaning area and station locations are displayed in Figures 2-1 to 2-10 (Appendix 1). Preliminary cleaning areas and station locations are included in Figures 2-1 to 2-10 but may be updated once access management features are confirmed in the AMP or by Contractors prior to construction, as discussed in Section 3.2.1. It is anticipated that rough/mechanical cleaning areas will be required at all CAPs into the LMOC and PR 239 realignment portions of the PDA as they are currently all anticipated to be considered Level 1 Risk Category with a potential moderate risk level. Fine cleaning stations will be required at identified RAZs, once access into these areas is determined.

Additional details on cleaning areas and stations to support implementation on the Project are presented in Section 4.3.2.

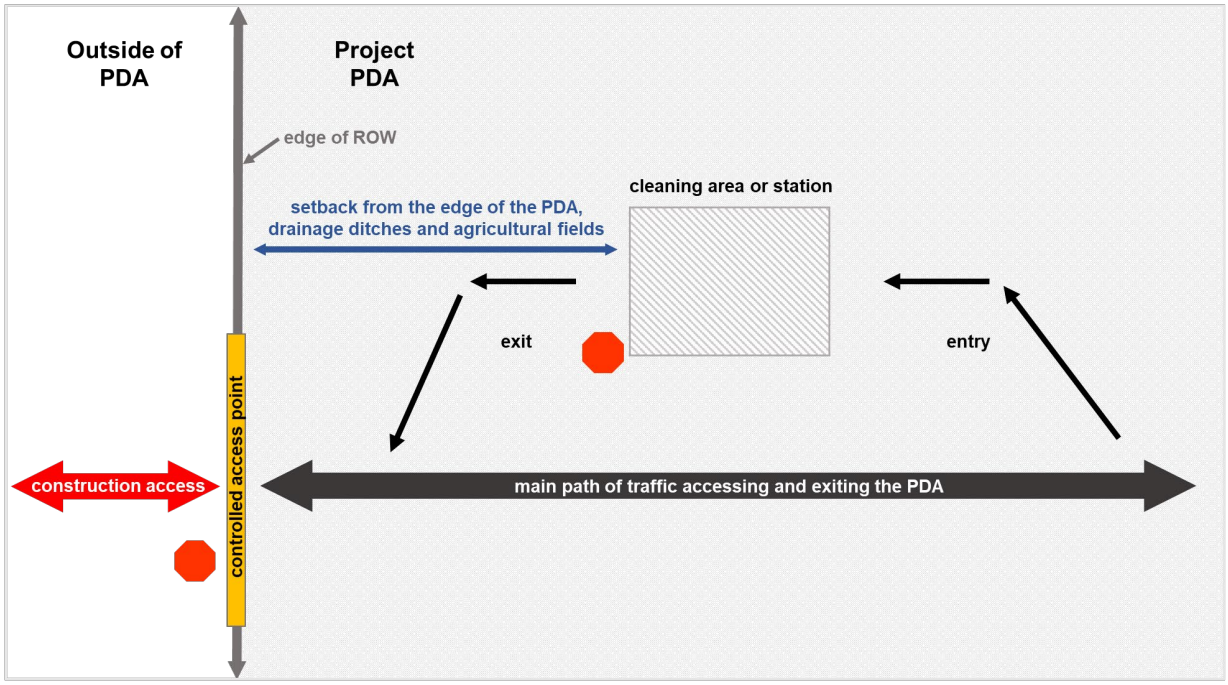


Figure 6: Conceptual Diagram of Location of Cleaning Area or Station on PDA

3.2.3.3 Frozen Ground Conditions

Ground conditions are variable throughout the year, but the ground is frozen through much of the year and during these conditions the risk associated with agricultural biosecurity is reduced. Frozen ground conditions are defined as ground that is frozen, or frozen and snow-covered, to the degree that soil, manure, and plant debris is not accumulating on vehicle, equipment, and footwear. During frozen ground conditions, cleaning is not required; however, if activities are causing soil disturbance (e.g., earth-moving, drilling, hydro-excavation/hydro-vacing), or are otherwise accumulating soil, manure or plant debris, frozen ground conditions are not applicable. In these instances, regular cleaning requirements apply for those vehicles, equipment and footwear accumulating soil, manure or plant debris when exiting the LMOC and PR 239 realignment portions of the PDA, even though the ground surface is considered frozen.

4.0 IMPLEMENTATION PLAN

This section provides a planning framework for Manitoba Transportation and Infrastructure and its Contractors to use for the implementation of the AgBMP for construction and operation of the Project.

4.1 Roles, Responsibilities and Communication

4.1.1 Roles and Responsibilities

Roles and responsibilities for Manitoba Transportation and Infrastructure, Contractors and biosecurity monitors are summarized in Table 3.

Table 3: Roles and Responsibilities

Organization	Role	Responsibility
Manitoba Transportation and Infrastructure (or its representative)	The Owner or Contract Administrator, or designate	• Confirm biosecurity management is implemented effectively and manage the biosecurity management plan through Project construction and operation phases • Provide for Contractor biosecurity management requirements in construction contract documents and specifications (e.g., required actions, signage, cleaning areas and/or stations) • Approve final locations of CAPs (anticipated to be determined by Contractors) and confirm associated biosecurity Risk Categories (i.e., Level 1 Risk Category or Level 2 Risk Category) • Lead and coordinate communication between internal staff, Contractors, biosecurity monitors and landowners • Conduct worker orientation (internal staff) • Confirm appropriate implementation of facilities (i.e., signage and cleaning areas and/or stations) and equipment (i.e., cleaning equipment) • Implement vegetation management and weed monitoring within the PDA through Project construction and operation phases (i.e., per requirements of the RVMP)

Organization	Role	Responsibility
Contractor(s)	Contractor	• Deliver requirements of the biosecurity management plan through the Project construction phase • Confirm staff working on the Project are adequately trained to follow the requirements of the biosecurity management plan, including determining biosecurity Risk Category at CAPs, inspecting vehicle/equipment for cleanliness prior to entering or exiting the PDA, completing required cleaning, and completing required record-keeping • Provide materials and establish biosecurity management facilities and equipment (i.e., signage and cleaning areas and/or stations) • Provide orientation to construction field workers such that they understand and are able to conduct biosecurity management requirements, including weed awareness and reporting requirements should weed infestations be encountered in work areas • Provide adequate equipment (i.e., cleaning equipment) to allow for workers to adhere to the AgBMP requirements • Provide field guidance (i.e., PERs and associated EPP map book; additional guidance, as required) to construction field workers • Document biosecurity management activities and issues and report to Manitoba Transportation and Infrastructure, as required • Implement improvements as identified in conjunction with Manitoba Transportation and Infrastructure through adaptive management • Development and submission of RAZ plan to Owner or Contract Administrator for review and approval

Organization	Role	Responsibility
Contractor(s) (cont'd)	Contractor (cont'd)	• Confirm and approve site-specific management and monitoring plans for RAZs (i.e., manure impacted sites, weed infestations), including specific requirements associated with these zones. In addition, approve activities within RAZ prior to completion of clean-up of manure impacted sites and control and/or elimination of weeds at weed infestation sites, and confirm fine cleaning and disinfection is completed prior to exit of vehicles, equipment and workers from RAZs. Following completion of adequate clean-up of manure impacted site RAZs and control or elimination of weeds from weed infestation RAZs, approve the removal of the RAZ designation for these areas, following which time general biosecurity requirements will apply.
Manitoba Transportation and Infrastructure or Contract administrator or designated third-party consultant	Inspector or Monitor	• Conduct field monitoring for implementation of facilities, including adequacy of signage (i.e., risk level category, direction to stop, inspect, vehicle/equipment, and clean, as required) at CAPs, and adequacy of cleaning areas and/or stations (e.g., adequate area established, area setback from edge of PDA, adequate cleaning equipment available, proper management of cleanings and wash water) • Conduct field monitoring for construction worker adherence to requirements of biosecurity management plan (i.e., stop at CAP, inspect vehicle/equipment, assess risk level, clean vehicle/equipment, as required, record activity) • Review biosecurity management plan reporting completed by contractor • Conduct monitoring reporting including identification of corrective actions (i.e., to achieve adherence to the AgBMP) and improvement actions (i.e., adaptive management)

4.1.2 Project Communication

Timely and effective communication among all organizations and staff involved in biosecurity management is critical to the successful implementation of the biosecurity management plan and ongoing biosecurity management. Communication will occur between Manitoba Transportation and Infrastructure, the Contract Administrator, the Contractor, and Inspector(s) on a regular and ongoing basis during the Project planning, as well as with Environmental Monitor during the construction phase. These communications will allow for effective planning and Plan implementation, and biosecurity monitoring throughout Project construction. The Project organization structure is provided in Figure 7.

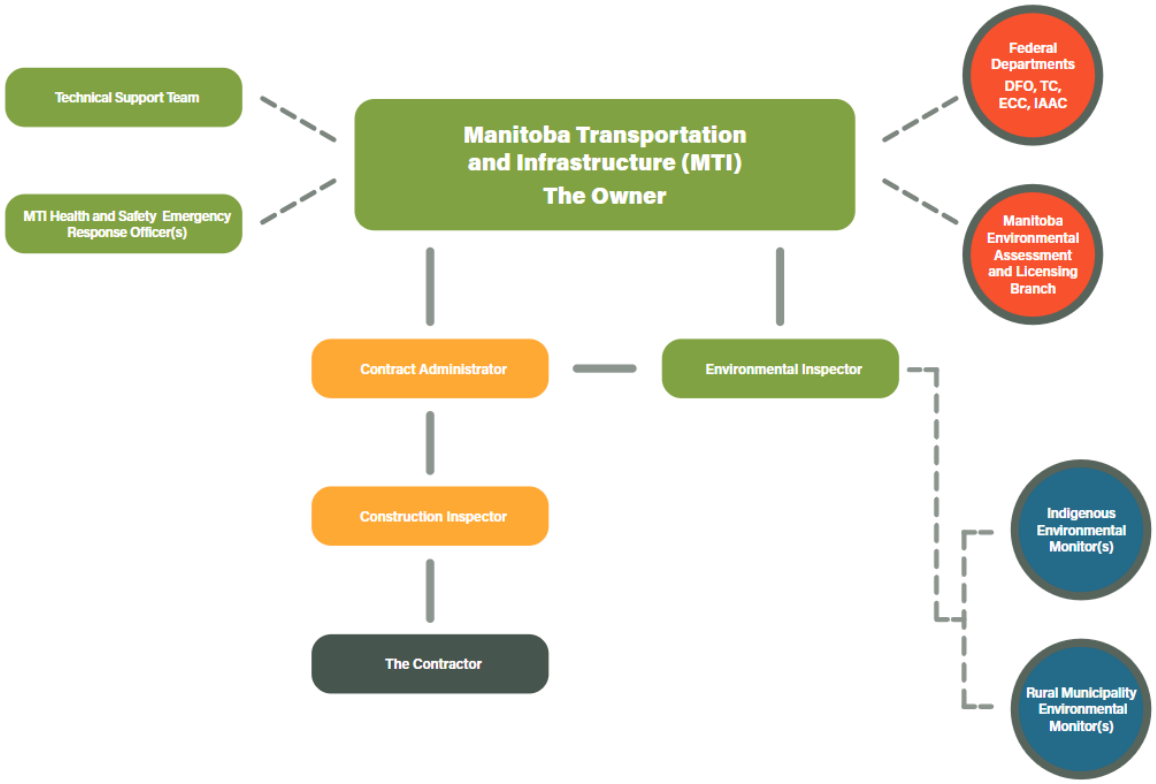


Figure 7: Project Organization Structure

4.2 Planning and Preparation

4.2.1 Contract/Contractor Specifications

Biosecurity management requirements for Contractors and their workers need to be provided in contract/Contractor specifications to support effective consideration and planning by Contractors for successful implementation of their portions of the biosecurity management plan. Contract/Contractor specifications should include the components listed below and detailed in subsequent sections:

- Facilities and equipment requirements – signage, cleaning areas and stations and cleaning equipment (see Section 4.3 for more information)
- Construction worker action requirements – orientation, required actions, record-keeping (see Section 4.4 for more information)
- Contractor reporting – required reporting on biosecurity management (see Section 4.5 for more information)

4.2.2 Landowner Communication and Notification

Manitoba Transportation and Infrastructure has been in communication with the rural municipality (RM) of Grahamdale, rights-holders, and other stakeholders, including local landowners, since 2013. Through open houses and other targeted engagement, stakeholders have been kept apprised of the Project planning as it progresses. Ongoing engagement prior to construction will provide a means for stakeholders to communicate with Manitoba Transportation and Infrastructure on Project plans, including biosecurity management.

Manitoba Transportation and Infrastructure will notify landowners in advance of construction activities that may have the potential to cause biosecurity concerns specific to an individual landowner's operation (e.g., travel required into or through private agricultural lands), if any. Manitoba Transportation and Infrastructure will work with landowners to address any related concerns in a timely manner. A Project Complaint Resolution Process has been established as a mechanism to formally document and address concerns.

4.2.3 Work Timing and Scheduling

Timing and scheduling of required tasks will be confirmed by Manitoba Transportation and Infrastructure and Contractors prior to the commencement of construction. A summary of implementation tasks is presented in relation to Project phases in Table 4 (Section 4.7). Tasks will be implemented as appropriate relative to sequencing of construction and construction contracts over the anticipated three-year construction period.

4.2 Facilities and Equipment

4.2.1 Project Area Entry Checkpoint

A single checkpoint will be established to allow for equipment inspections prior to entering into the Project area. The checkpoint will be staffed during Contractor mobilization periods when machinery is arriving to the Project. Vehicles and equipment are expected to arrive at the Project Area Entry Checkpoint in a clean condition, consistent with fine cleaning and disinfection as described in Section 3.2.3 and recommended by Manitoba Agriculture (2020c). Vehicles and equipment arriving in an unclean condition will not be permitted access into the Project area until they have been fine cleaned and disinfected.

4.2.2 Controlled Access Point Signage

Access to the LMOC portion of the PDA will be restricted and controlled through a limited number of CAPs on the west side of the PDA. Signage at CAPs will inform construction field workers of biosecurity management plan requirements. This will include the following:

1. Identification of biosecurity Risk Category (i.e., Level 1 Risk Category or Level 2 Risk Category)
2. Direction for workers to:
   a) Stop
   b) Inspect vehicle, equipment and footwear for accumulated soil, manure or plant material
   c) Assess risk level (i.e., for Level 1 Risk Category – Low risk or Moderate risk: for Level 2 Risk Category – Low risk or High risk))
   d) Complete cleaning if soil, manure, or plant material has accumulated on vehicle, equipment, or footwear, as follows:
      - If Level 1 Risk Category:
        - Rough/mechanical cleaning is required – complete rough cleaning until soil, manure or plant debris accumulations have been removed from the vehicle, equipment, or footwear
      - If Level 2 Risk Category:
        - Fine cleaning and disinfection are required - complete fine cleaning until soil, manure or plant debris has been removed from the vehicle, equipment, or footwear. Complete disinfection according to product manufacturer's directions.

4.2.3 Cleaning Areas and Stations

There are two types of cleaning areas or stations to be established at CAPs along the LMOC portion of the PDA:

1. Rough/mechanical cleaning area – will accommodate rough cleaning requirements at CAPs with a potential for up to a Moderate risk level only (i.e., CAPs defined as Level 1 Risk Category). Rough/mechanical cleaning areas will:
   - Be of adequate size/area to accommodate vehicles and equipment to be cleaned.

- Include a contained area for soil, manure and plant debris and other material cleanings. Soil, manure, and plant debris cleanings will be temporarily managed on-site in a manner such that they are not prone to losses from the PDA (e.g., through erosion or runoff), and should be periodically (i.e., in the fall prior to freeze-up or more frequently if deemed necessary) spread and incorporated within the PDA, added to existing soil spoil piles, or buried within the PDA.
- Be established on relative high ground with good drainage, in an area not prone to flooding or inundation.
- Be set back from the primary line of traffic through the CAP to avoid cross-contamination.
- Be set back from drainage ditches and agricultural field boundaries.
- Be maintained in good condition.
- Be stocked with dedicated rough/mechanical cleaning equipment, unless cleaning equipment is carried in individual vehicles and equipment (see Section 4.3.3).

2. Fine cleaning station – will accommodate fine cleaning and disinfection requirements at CAPs with a potential for up to a high-risk level (i.e., CAPs defined as Level 2 Risk Category) and at RAZs. Fine cleaning stations will:
   - Be of adequate size/area to accommodate vehicles and equipment to be cleaned.
   - Include area for soil, manure and plant debris and other material cleanings. Soil, manure, and plant debris cleanings will be temporarily managed on-site in a manner such that they are not prone to losses from the PDA (e.g., through erosion or runoff). Cleanings should be periodically buried within the PDA at a minimum soil cover of 0.5 m.
   - Include a collection and disposal system for wash water. As discussed in Section 3.2.3.2, wash water will be collected and disposed of in accordance with disinfectant manufacturer's directions, local by-laws and provincial regulations. Subject to approval by local authorities and provincial regulators, the use of an on-site sump for collection would allow for wash water to be collected and remain on-site, as well as for *in-situ* treatment. If this is a permitted collection and treatment option, the on-site collection will be managed such that collected wash water is not prone to running off the PDA (e.g., collected in *in-situ* sump and allowed to infiltrate into the soil without ponding or potential for overflow of the sump) or interception by shallow groundwater (e.g., high water table). Sediment from wash water collection systems should be periodically buried within the PDA at a minimum soil cover of 0.5 m.
   - Be established on relative high ground with good drainage, in an area not prone to flooding or inundation.
   - Be set back from the primary line of traffic through the CAP to avoid cross-contamination.
   - Be set back from drainage ditches and agricultural field boundaries.
   - Be maintained in good condition.
   - Be stocked with dedicated rough/mechanical cleaning equipment and fine cleaning equipment (see Section 4.3.3).
   - Be stocked with approved and active disinfectant.

Soil, manure, and plant debris cleanings will be managed on-site in a manner such that they are not prone to losses from the PDA (e.g., through erosion or runoff).

If fine cleaning is required, wash water will be collected and disposed of in accordance with disinfectant manufacturer's directions, local by-laws and provincial regulations. Subject to approval by local authorities and provincial regulators, the use of an on-site sump for collection may be used to allow for on-site collection and treatment of waste wash water.

4.2.4 Cleaning Equipment

The Contractor will provide cleaning equipment at each cleaning area and/or station as outlined below.

Rough/mechanical cleaning area

Rough/mechanical cleaning equipment must be adequate to complete soil removal and will be appropriate to the type of vehicle or equipment that needs to be cleaned. Cleaning equipment can be dedicated to a cleaning area or can be carried in individual vehicles and equipment. Rough/mechanical cleaning equipment will include:

- Shovels and scrapers
- Brushes
- Air compressor (optional)

Fine cleaning station

Fine cleaning and disinfection equipment should be dedicated to a cleaning station and will include:

- Shovels and scrapers
- Brushes
- Pressure washer
- Disinfectant equipment, consisting of a hand pressurized sprayer, or similar equipment, of adequate size and capacity to effectively treat vehicles and equipment to be disinfected
- Approved disinfectant, such as one to two percent bleach solution or a commercial product such as Virkon®. Propylene glycol or other suitable anti-freeze product would be required in the event that disinfection is required during freezing temperatures.

4.4 Worker Requirements

The following section summarizes construction worker responsibilities and requirements under the biosecurity management plan, including orientation, required actions while working on the Project and record-keeping. This applies to any and all workers conducting work within the LMOC or PR239 realignment portions of the Project, including contractors, contract administrators, inspectors and monitors.

4.4.1 Worker Orientation

All workers working within the LMOC or PR239 realignment portions of the PDA require biosecurity management orientation prior to working on the Project. Biosecurity program orientation will introduce workers to the biosecurity management plan and biosecurity issues related to Project construction activities and develop awareness of their roles and responsibilities under the AgBMP. Orientation needs to develop an

adequate understanding of biosecurity management requirements of all workers working on the LMOC and PR 239 realignment portions of the Project. Biosecurity orientation will be the responsibility of the Contractor(s) and it is assumed it will form part of overall Project-specific orientation.

Orientation will include the following components:

- Biosecurity issues overview
- Biosecurity management plan awareness
- Roles, responsibilities, and communications
- Access management plan, access routes and CAPs
- Cleaning stations and areas, tools, and methods
- Vehicle, equipment, and footwear inspection
- Record-keeping and reporting

In addition, Manitoba Transportation and Infrastructure Inspectors and Environmental Monitors (RM and Indigenous) working on the LMOC or PR 239 realignment portions for the Project will receive orientation on agricultural weed awareness. This orientation should include basic identification of weed infestations and awareness of noxious weeds and invasive weeds anticipated to be a concern on the Project. In addition, weed awareness orientation should include responsibilities to inform supervisors prior to undertaking work in an area if noxious weed or invasive agricultural plant infestations are encountered. It is anticipated that this orientation will add value to the identification of potential weed concerns on the Project.

4.4.2 Worker Actions

Actions by workers while accessing and exiting the LMOC or PR239 realignment portions of the PDA will ultimately determine the level of effectiveness of the biosecurity management plan, while inspection and monitoring will confirm worker conformance and effectiveness of the implemented plan. Biosecurity is a concern for worker activities in croplands and livestock areas during both construction and operation phases of the Project. Typical procedures for reducing soil transport, and disease and weed transmission, include the following for construction and operation phases of the Project.

Construction Phase

During the construction phase of the Project, any workers conducting work within the LMOC and PR239 realignment portions of the Project must:

- Proceed to the Project Area Entry Checkpoint when mobilizing machinery (vehicles or equipment) that will be used within the PDA. Workers must not bring machinery into the PDA without first having checked-in at the Project Areas Entry Checkpoint and received approval for entry into the PDA through a CAP
- Not work within the PDA without having completed the biosecurity orientation module of the required Project-specific orientation
- Avoid any designated RAZs unless explicit permission is received by Manitoba Transportation and Infrastructure

- Avoid livestock operations (i.e., cattle feedlots), areas of recently spread manure, and close contact with livestock (i.e., grazing animals)
- Access and exit the PDA using identified CAs and CAPs
- Confirm all vehicles and equipment arrive at the construction site clean and free of soil, manure or plant debris
- Prior to exiting the PDA at a CAP
    - Stop
    - Inspect vehicle, equipment and footwear for accumulated soil, manure or plant material
    - Assess risk level (i.e., for Level 1 Risk Category – Low risk or Moderate risk: for Level 2 Risk Category – Low Risk or High risk))
    - Complete cleaning, if required, as follows:
        - If Level 1 Risk Category:
            - If soil, manure, or plant material has not accumulated on vehicle, equipment, or footwear:
                - No cleaning required prior to exiting the PDA
            - If soil, manure, or plant material has accumulated on vehicle, equipment, or footwear in a manner that this material is at risk of falling or blowing off vehicles and/or equipment after exiting the PDA (i.e., soil, manure and/or plant debris accumulations are loose and/or in accumulated masses [e.g., chunks, lumps] and are not firmly adhered or impacted to vehicles and/or equipment):
                - Rough/mechanical cleaning is required – complete rough cleaning until soil, manure or plant debris has been removed from the vehicle, equipment, or footwear
        - If Level 2 Risk Category:
            - If soil, manure, or plant material has not accumulated on vehicle, equipment, or footwear:
                - No cleaning required prior to exiting the PDA
            - If soil, manure, or plant material has accumulated on vehicle, equipment, or footwear:
                - Fine cleaning and disinfection are required - complete fine cleaning until soil, manure or plant debris has been removed from the vehicle, equipment, or footwear. Complete disinfection according to product manufacturer's directions and confirm all surfaces in contact with soil (e.g., tire treads, tracks) and any remaining soil on vehicle, equipment or footwear following cleaning is adequately treated (i.e., thoroughly wetted) with disinfectant for effective disinfection.
- Confirm cleaning areas and stations and cleaning equipment are in good condition (i.e., organized, orderly, clean, functioning equipment in good repair, etc.). Communicate to supervisors if attention is required
- Communicate any biosecurity management issues to supervisors
- Record vehicle inspection and cleaning actions completed and submit to supervisors (see Section 4.4.3)
- Notify supervisors if weed infestations are identified within the PDA

During the construction phase of the Project, Contractors must:

- Control any weed infestations and control and/or eliminate noxious weeds and invasive agricultural plants within the LMOC portion of the PDA, as indicated in the RVMP for the LMOC PDA, and within the PR 239 realignment portion of the PDA according to Manitoba Transportation and Infrastructure standard operating procedures.

Operation Phase

During operation phase of the Project, any workers conducting work within the LMOC and PR239 realignment portions of the Project will:

- Notify supervisors if weed infestations or occurrences of noxious weeds or invasive agricultural plants are identified within the PDA

Vegetation monitoring within the LMOC portion of the PDA will conducted for a period of three years following the completion of construction and annually during operations as per the RVMP. This monitoring will include assessing the PDA for noxious weeds and invasive agricultural plants.

4.4.3 Record Keeping

Record keeping is a critical component of the AgBMP and will be used to document completion of required activities by workers. Record-keeping is to be completed daily by Contractors working at the Project Area Entry Checkpoint and within the PDA to document biosecurity management activities completed when entering and exiting through CAPs

Record keeping at the Project Area Entry Checkpoint includes:

- Machinery (vehicles and equipment) identification, date, and time of arrival to the PDA
- Outcomes of inspection of machinery for adequate cleanliness prior to entering the Project area (i.e., approval for entry into Project area for equipment that is deemed adequately clean)

Daily record keeping by construction workers includes:

- Inspection of vehicles and equipment for cleanliness prior to entering the PDA
- Cleaning of vehicles and equipment prior to entry onto the PDA, if required
- Inspection of vehicles and equipment for cleanliness prior to exiting the PDA
- Cleaning of vehicles and equipment prior to exiting the PDA, if required

Record-keeping will be documented on the Project-specific forms. Form templates are provided in Appendix 3 (i.e., Project Area Entry Checkpoint Log – Appendix 3.A, Weekly Vehicle and Equipment Cleaning Record – Appendix 3.B), or similar Contractor provided forms (paper or electronic) may be used subject to approval by Manitoba Transportation and Infrastructure. Daily records will be maintained for all vehicles and equipment arriving in the Project area, and those entering and exiting the PDA, and these records will be included in Contractor reporting (Section 4.5) and will be maintained for auditing purposes.

4.5 Contractor Reporting

Reporting will be conducted monthly by the Contractor to Manitoba Transportation and Infrastructure. Reporting will be conducted using a standardized reporting format to be developed or approved by Manitoba Transportation and Infrastructure. Reporting will include a summary of activities, compliance checks (e.g., signage and cleaning station adequacy), daily records, and recommended and/or implemented improvement actions (as identified by the Contractor or required by Manitoba Transportation and Infrastructure).

4.6 Monitoring Program

Third-party monitoring will be conducted on behalf of Manitoba Transportation and Infrastructure for the biosecurity management program. Monitoring will be completed to confirm Contractor adherence to requirements in the biosecurity management plan, including:

- Adequacy of facilities, including signage at CAPs informing workers to stop and check their vehicles and equipment, and informing workers of cleaning requirements, if required, and adequacy of cleaning areas and cleaning stations
- Adequacy of equipment, including cleaning equipment and supplies
- Worker actions, including adherence to vehicle and equipment cleanliness inspections before entering or exiting the PDA, adequate completion of cleaning activities, as required
- Record-keeping, namely confirming biosecurity management records are being adequately maintained.

It is anticipated that monitoring will occur periodically throughout the construction phase at a frequency to be determined by Manitoba Transportation and Infrastructure. Monitoring reporting will include findings of monitoring events, including a summary of compliance and deficiencies, and will identify recommendations for improvement actions for consideration by Manitoba Transportation and Infrastructure as part of the follow-up and adaptive management process.

4.7 Implementation Tasks by Project Phase

A summary of implementation tasks by Project phase is provided in Table 4 to help facilitate planning for implementation of the biosecurity management plan for Manitoba Transportation and Infrastructure, including tasks required prior to the commencement of construction of the LMOC and the PR 239 realignment. Construction of the LMOC and PR239 realignment portions of the Project is anticipated to be completed over a three-year period. Tasks will be implemented as appropriate relative to construction and construction contract sequencing through the construction period.

Table 4: Implementation Tasks by Project Phase

Task	Description	Responsibility	Project Phase
Preliminary identification of access routes, CAPs, and cleaning area and station locations (these may be refined during the contract tendering process)	Project Area Entry Checkpoint, access routes and CAPs will be confirmed to allow for finalization of Risk Category identification and cleaning area and station requirements at each CAP.	Manitoba Transportation and Infrastructure (with input from the RM of Grahamadale and others identified by Manitoba Transportation and Infrastructure)	Prior to commencement of construction
Contract specifications for tender package	Develop specifications for Contractor requirements under the biosecurity management plan (e.g., Project Area Entry Checkpoint, cleaning areas and stations, cleaning equipment, worker orientation, record-keeping, reporting) and/or include reference to this Plan as part of contract specifications.	Manitoba Transportation and Infrastructure	Prior to commencement of construction
Determination of final locations of access routes, CAPs, and cleaning station locations	Designated haul/access roads identified by Manitoba Transportation and Infrastructure with input from the RM of Grahamdale.	Manitoba Transportation and Infrastructure	Prior to commencement of construction phase
	Final locations for CA routes and CAPs will be confirmed by the Contractor(s) to allow for finalization of Risk Category identification, risk level determination, and cleaning area and station requirements at each CAP.	Contractor(s)	

Task	Description	Responsibility	Project Phase
Record-keeping and reporting templates	Develop standardized entry checkpoint and vehicle and equipment cleaning record-keeping templates for use by Contractors (Appendix 3).	Manitoba Transportation and Infrastructure	Prior to commencement of construction phase
	Develop monthly reporting templates for reporting summary of activities, compliance checks (e.g., signage and cleaning station adequacy), daily checkpoint and cleaning records, and recommended and/or implemented improvement actions.	Contractors	Prior to commencement of construction phase
Monitoring program development	Develop monitoring program to monitor Contractor adherence to biosecurity management plan requirements.	Manitoba Transportation and Infrastructure	Prior to commencement of construction phase
Orientation program development	A biosecurity management program orientation module will be developed to be delivered to all workers prior to working on the LMOC and PR 239 realignment portions of the PDA.	Manitoba Transportation and Infrastructure	Prior to commencement of construction phase

Task	Description	Responsibility	Project Phase
Worker orientation	Worker orientation on the biosecurity management plan requirements will be conducted for all workers prior to working on the LMOC and PR 239 realignment portions of the PDA. Orientation will be delivered by Manitoba Transportation and Infrastructure. Records of contractor worker completion of training will be maintained by the Contractor(s).	Manitoba Transportation and Infrastructure and Contractor(s)	Construction phase (ongoing, as required)
Construction phase biosecurity management, record-keeping, reporting and monitoring	Biosecurity management, record-keeping, reporting, and monitoring through the construction phase.	Contractor(s)	Construction phase
Construction phase biosecurity monitoring	Monitor construction worker adherence to biosecurity management requirements.	Manitoba Transportation and Infrastructure and Environmental Monitors	Construction phase
Operation phase biosecurity management	Biosecurity management through the operation phase. Agricultural producer adherence to requirements of haying leases, including equipment cleaning before entering and exiting the PDA, as required.	Manitoba Transportation and Infrastructure	Operations phase

5.0 ADAPTIVE MANAGEMENT

Adaptive management is part of the follow-up process that provides a mechanism for continual improvement of the AgBMP as new information becomes available through the biosecurity monitoring program or vegetation monitoring under the RVMP. An operational policy statement provides guidance on the use of adaptive management under the *Canadian Environmental Assessment Act* (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf). As presented in this statement:

> *"…adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project."*

Adaptive management under the AgBMP recognizes that Project conditions (e.g., access management) and environmental conditions (e.g., extreme weather, vegetation conditions within the PDA) are subject to change. These changes may necessitate modifications to the AgBMP if through monitoring and evaluation it is determined that mitigation needs to be modified or if new mitigation is required for effective mitigation of biosecurity concerns. Specific aspects of the adaptive management program for the AgBMP include:

- Identify and delineate RAZ if weed infestations (i.e., noxious weeds non-compliant with the *Noxious Weeds Act* or other agricultural invasive plant species deemed a concern, as described in the RVMP) are identified during construction or operations through vegetation and weed monitoring under the RVMP or other environmental monitoring activities. As documented in Section 3.2.1, RAZs require specific management and monitoring plans and will require biosecurity management measures tailored to the nature of the specific concern.
- Assign and/or update biosecurity Risk Categories at CAPs if Project access management changes relative to the assumptions within this Plan or if new Project access points are identified that are not addressed within the Biosecurity Management Plan mapbook provided in Figures 2-1 to 2-10.
- Use learnings from the agricultural biosecurity monitoring program to modify or change measures within the AgBMP for improved effectiveness, as appropriate.

6.0 REFERENCES

CFIA. 2020a. National Farm-Level Biosecurity Planning Guide - Proactive Management of Plant Resources. Canadian Food Inspection Agency. Available at: https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/biosecurity/guide/eng/1323477130171/1323477259986 [accessed May 2020].

CFIA. 2020b. Crop Biosecurity. Canadian Food Inspection Agency. Available at: https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/biosecurity/eng/1323475203667/1323475279124 [accessed May 2020].

CFIA. 2020c. Canadian Beef Cattle On-Farm Biosecurity Standard. Canadian Food Inspection Agency. Available at: https://www.inspection.gc.ca/animal-health/terrestrial-animals/biosecurity/standards-and-principles/beef-cattle/eng/1378825897354/1378825940112?chap=1 [accessed May 2020].

Invasive Species Council of Manitoba (ISCM), 2022. Alien plant and animal species that threaten Manitoba's ecological balance. Available at: http://invasivespeciesmanitoba.com/site/index.php?page=terrestrial-species. [accessed March 2022].

Manitoba Agriculture. 2020a. Biosecurity in crop production. Available at: https://www.manitoba.ca/agriculture/crops/biosecurity.html [accessed May 2020].

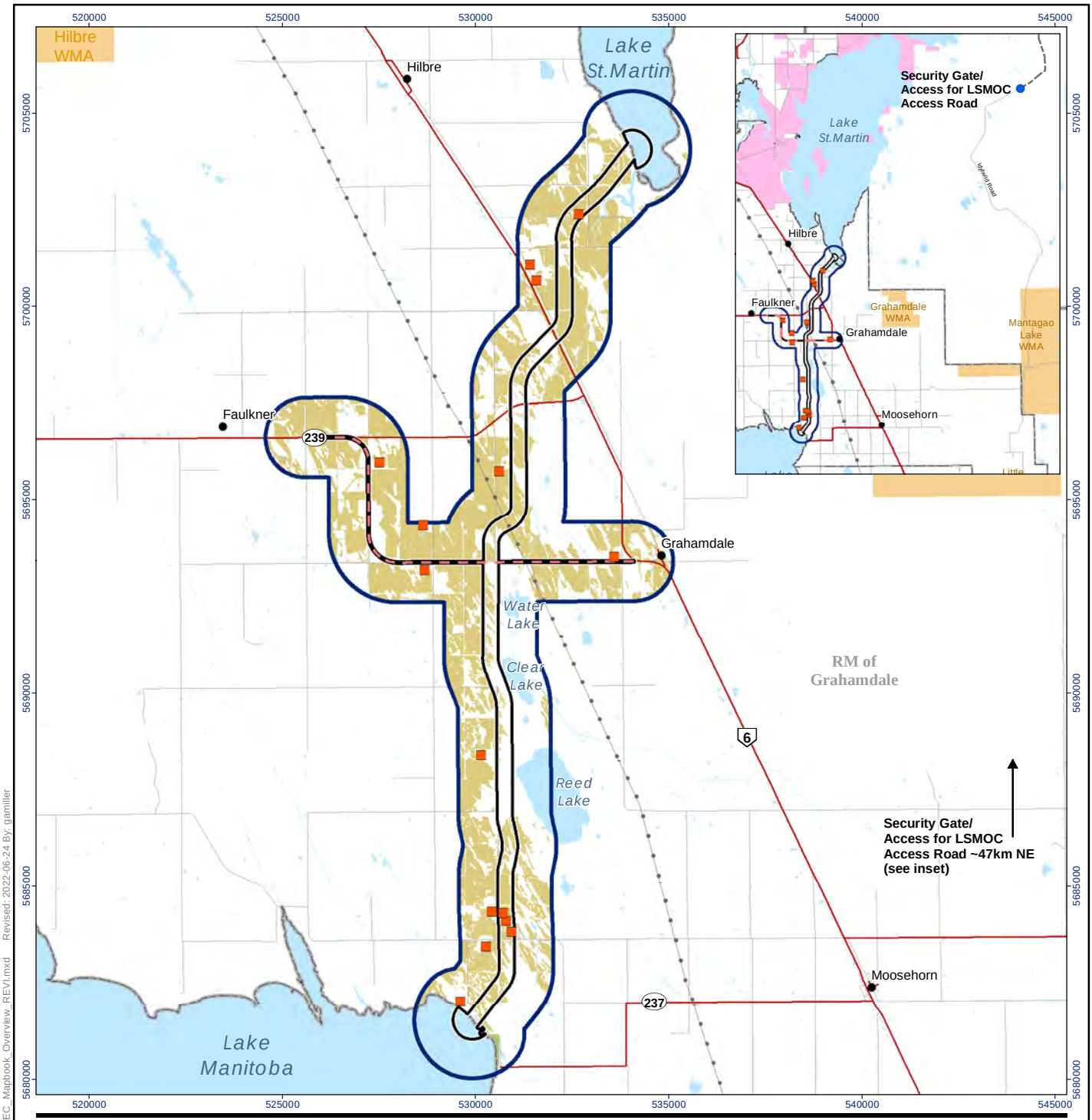
Manitoba Agriculture. 2020b. Biosecurity in Livestock Production. Available at: https://www.gov.mb.ca/agriculture/animal-health-and-welfare/animal-health/biosecurity-in-livestock-production.html [accessed May 2020].

Manitoba Agriculture. 2020c. Biosecurity Management on Agricultural Land for the Energy and Transportation Industries. Available at: https://www.manitoba.ca/agriculture/crops/biosecurity-energy-and-transportation.html [accessed May 2020].

Manitoba Agriculture. 2020d. Plant diseases. Accessed at: https://www.gov.mb.ca/agriculture/crops/plant-diseases/index.html [accessed May 2020].

APPENDIX 1

Maps





Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Stantec Consulting, AgriEarth Consulting, Manitoba Infrastructure

Legend

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Develoment Area (PDA)
- Proposed PR 239 Realignment
- LMOC/PR239 PDA 1km Buffer
- Livestock Operations
- Project Area Entry Checkpoint (Location to be Identified)

Agricultural Land Class

- Agricultural Cropping
- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Wildlife Management
- Provincial Park
- Rural Municipality

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(At original document size of 8.5x11)
1:750,000

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Lake Manitoba/Lake St.Martin Manitoba

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TR by DW on 2022-06-24

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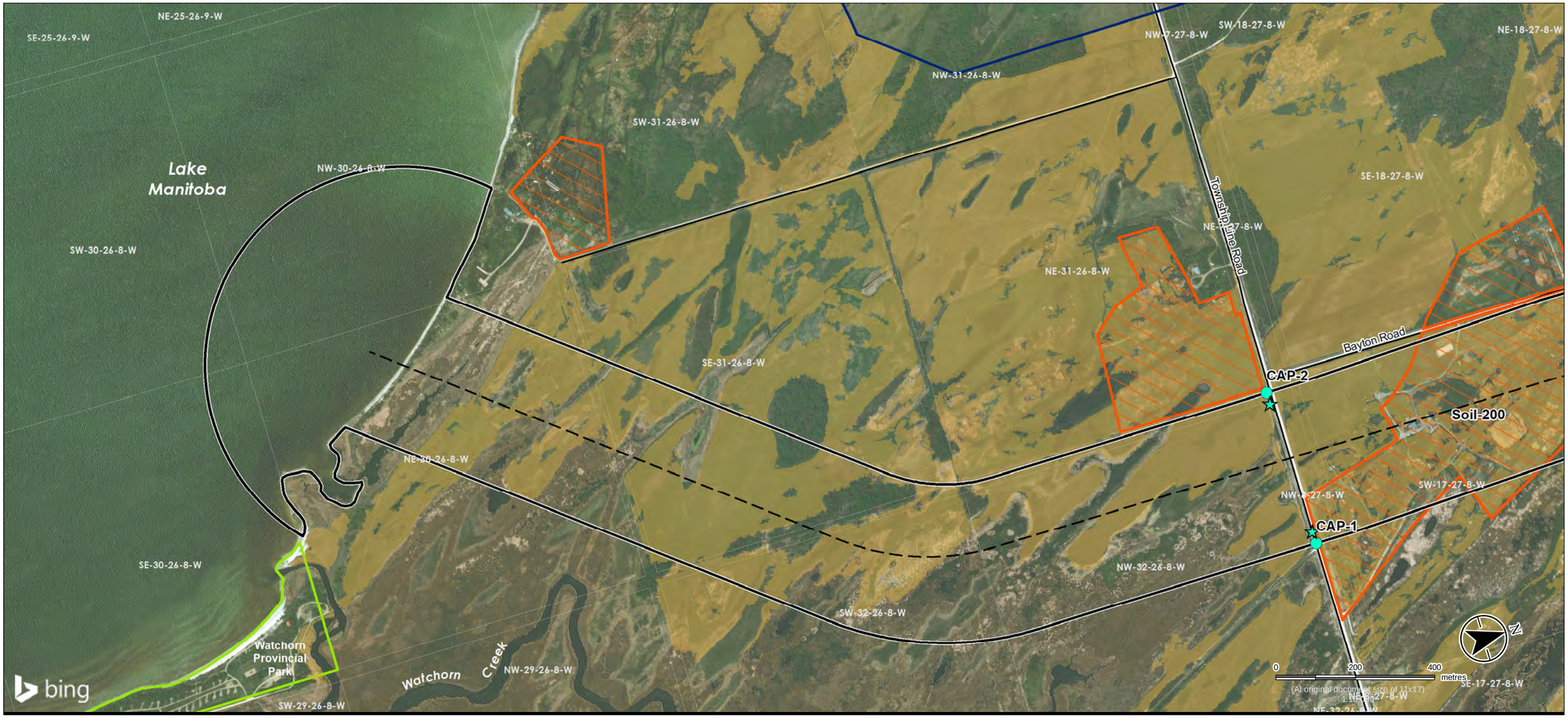
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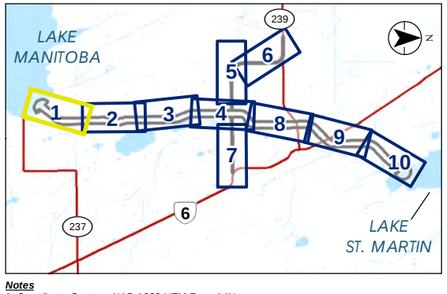
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Title
Overview Map

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- LMOC Approximate
- LMOC/PR239 PDA 1km Buffer
- Municipal Road
- Provincial Park
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
- Fine Cleaning Area

BIOSECURITY MANAGEMENT ZONES*

Biosecurity Risk Zone (BRZ)

- Agricultural Cropping (Annual Cropping, Hayland & Pasture)

Restricted Access Zone (RAZ)

- Manure Impacted Site
- Weed Infestations (to be identified through vegetation monitoring)

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Project Location
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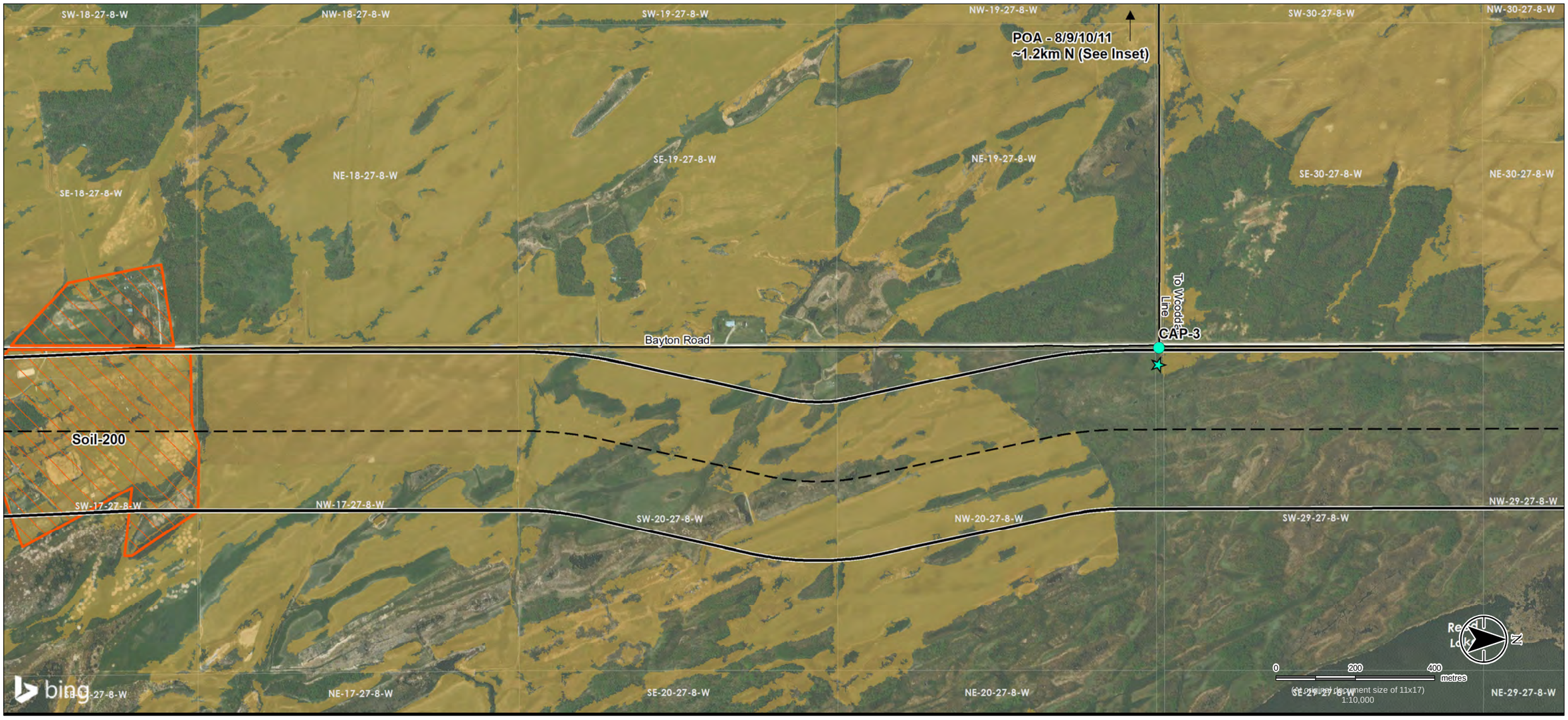
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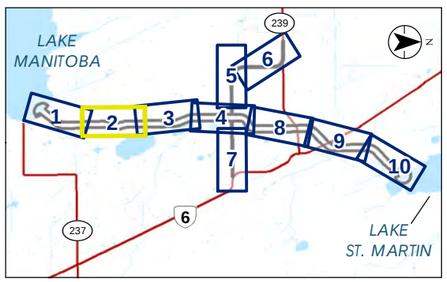
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2 - 1

Title
Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- LMOC Approximate Centerline
- LMOC/PR239 PDA 1km Buffer
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
- Fine Cleaning Area

BIOSECURITY MANAGEMENT ZONES*

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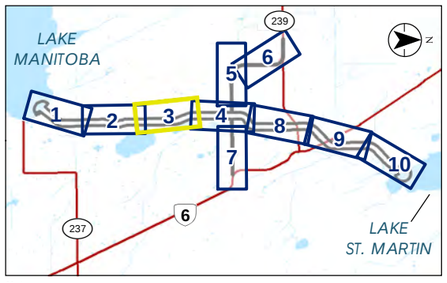
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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- LMOC Approximate
- LMOC/PR239 PDA 1km Buffer
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
- Fine Cleaning Area

BIOSECURITY MANAGEMENT ZONES*

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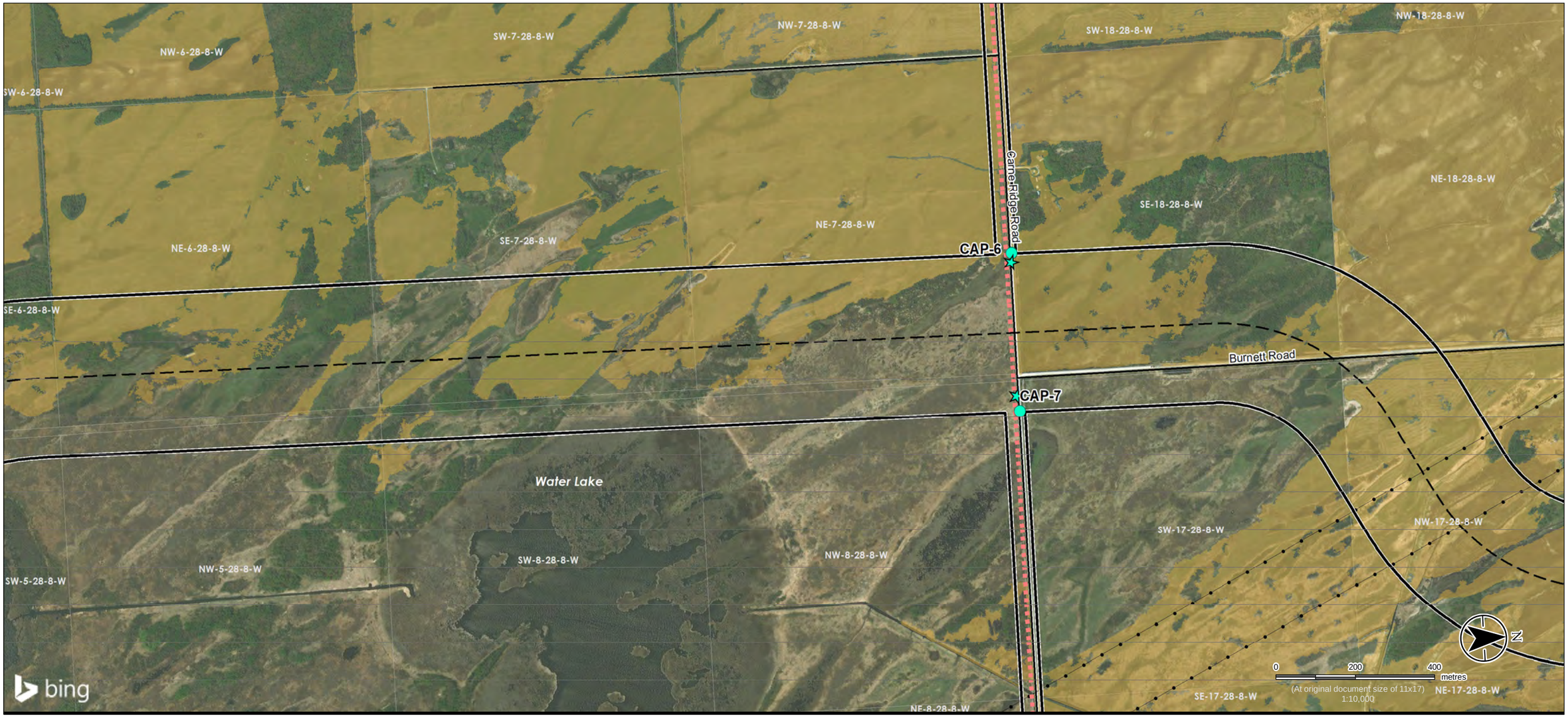
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Lake Manitoba and Lake St.Martin Outlet Channels Project

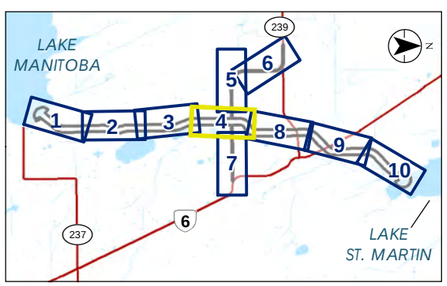
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Title
Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- LMOC Approximate
- Proposed PR239 Realignment
- LMOC/PR239 PDA 1km Buffer
- Existing Transmission Line
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
- Fine Cleaning Area

BIOSECURITY MANAGEMENT ZONES*

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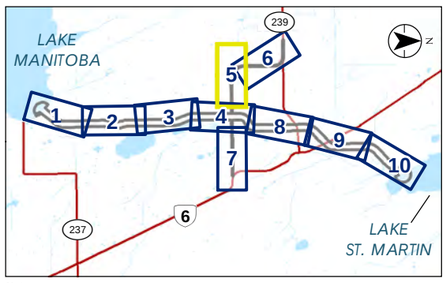
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Title
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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- Proposed PR239 Realignment
- LMOC/PR239 PDA 1km Buffer
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

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BIOSECURITY MANAGEMENT ZONES*

Biosecurity Risk Zone (BRZ)

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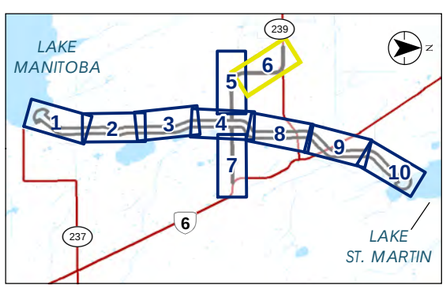
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Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- Proposed PR239 Realignment
- LMOC/PR239 PDA 1km Buffer
- Provincial Hwy (PTH/PR)
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

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BIOSECURITY MANAGEMENT ZONES*

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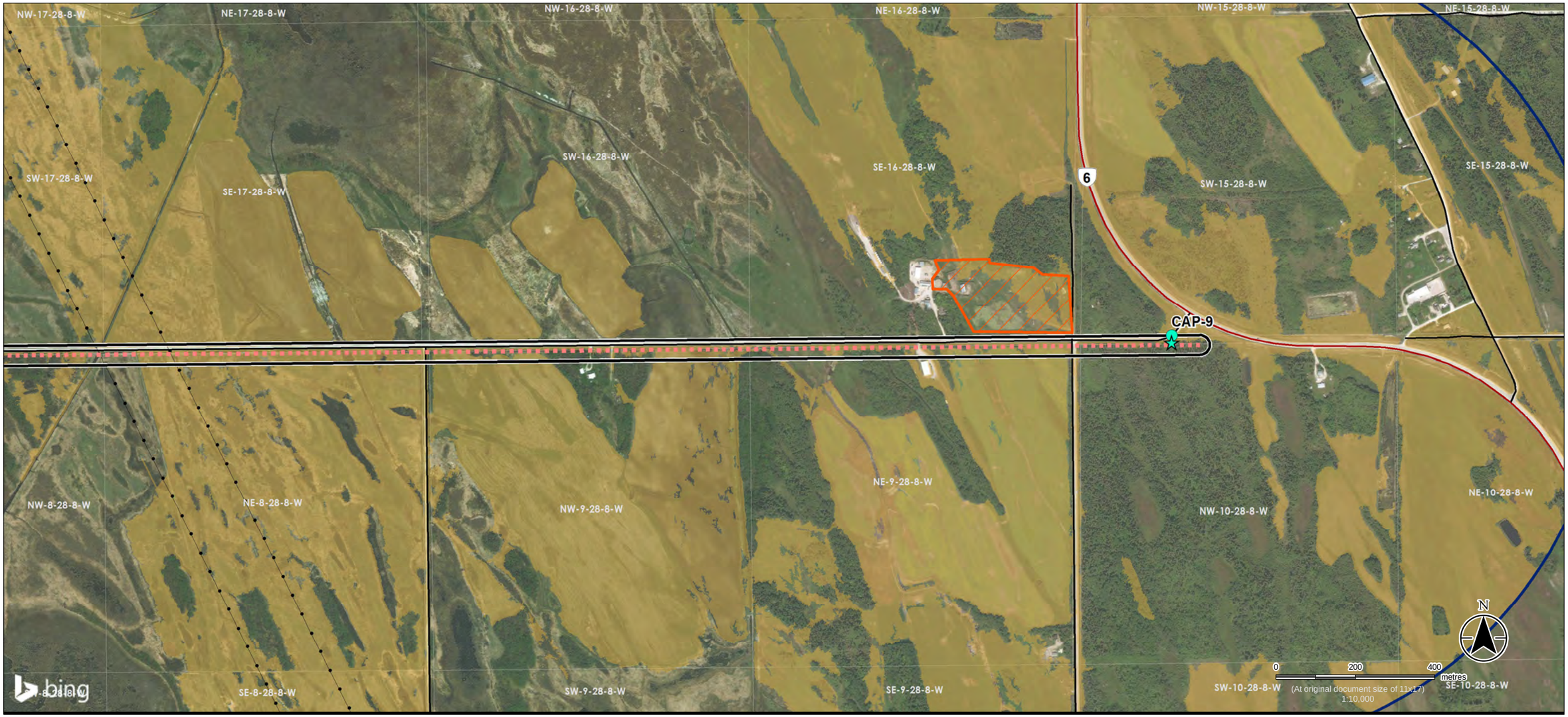
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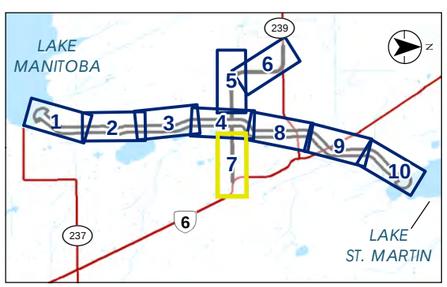
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Title
Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- Proposed PR239 Realignment
- LMOC/PR239 PDA 1km Buffer
- Existing Transmission Line
- Provincial Hwy (PTH/PR)
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
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BIOSECURITY MANAGEMENT ZONES*

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Manitoba

Stantec

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Project Location
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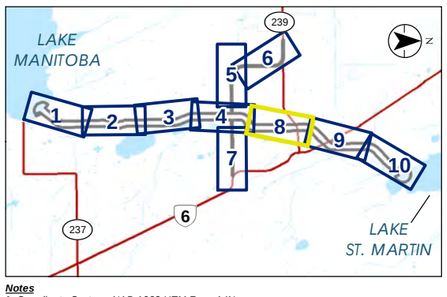
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Agriculture Biosecurity Management Plan - Lake Manitoba Outlet Channel and PR 239 Realignment

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LEGEND

- Lake Manitoba Outlet Channel (LMOC)/ PR 239 Realignment Project Development Area (PDA)
- LMOC Approximate
- LMOC/PR239 PDA 1km Buffer
- Existing Transmission Line
- Provincial Hwy (PTH/PR)
- Municipal Road
- Quarter Sections

ACCESS MANAGEMENT FEATURES*

- Construction Access (CA)
- Point of Access (POA)

Controlled Access Point

- Level 1 Risk Category - Low/Moderate Risk Level CAP
- Level 2 Risk Category - Low/High Risk Level CAP

Cleaning Areas and Stations

- Rough/Mechanical Cleaning Area
- Fine Cleaning Area

BIOSECURITY MANAGEMENT ZONES*

Biosecurity Risk Zone (BRZ)

- Agricultural Cropping (Annual Cropping, Hayland & Pasture)

Restricted Access Zone (RAZ)

- Manure Impacted Site
- Weed Infestations (to be identified through vegetation monitoring)

*The information presented for Access Management Features and Biosecurity Management Zones is considered preliminary in nature and subject to change as a result of ongoing Project access management planning and following determination of final locations of access routes and access points by the construction contractor(s).

Notes

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Manitoba
Stantec
agriearth consulting ltd

Project Location
Near Lake Manitoba & Lake St.Martin Manitoba

Prepared by GM on 2022-06-24
TR by DW on 2022-06-24

Client/Project
111475120 REVI

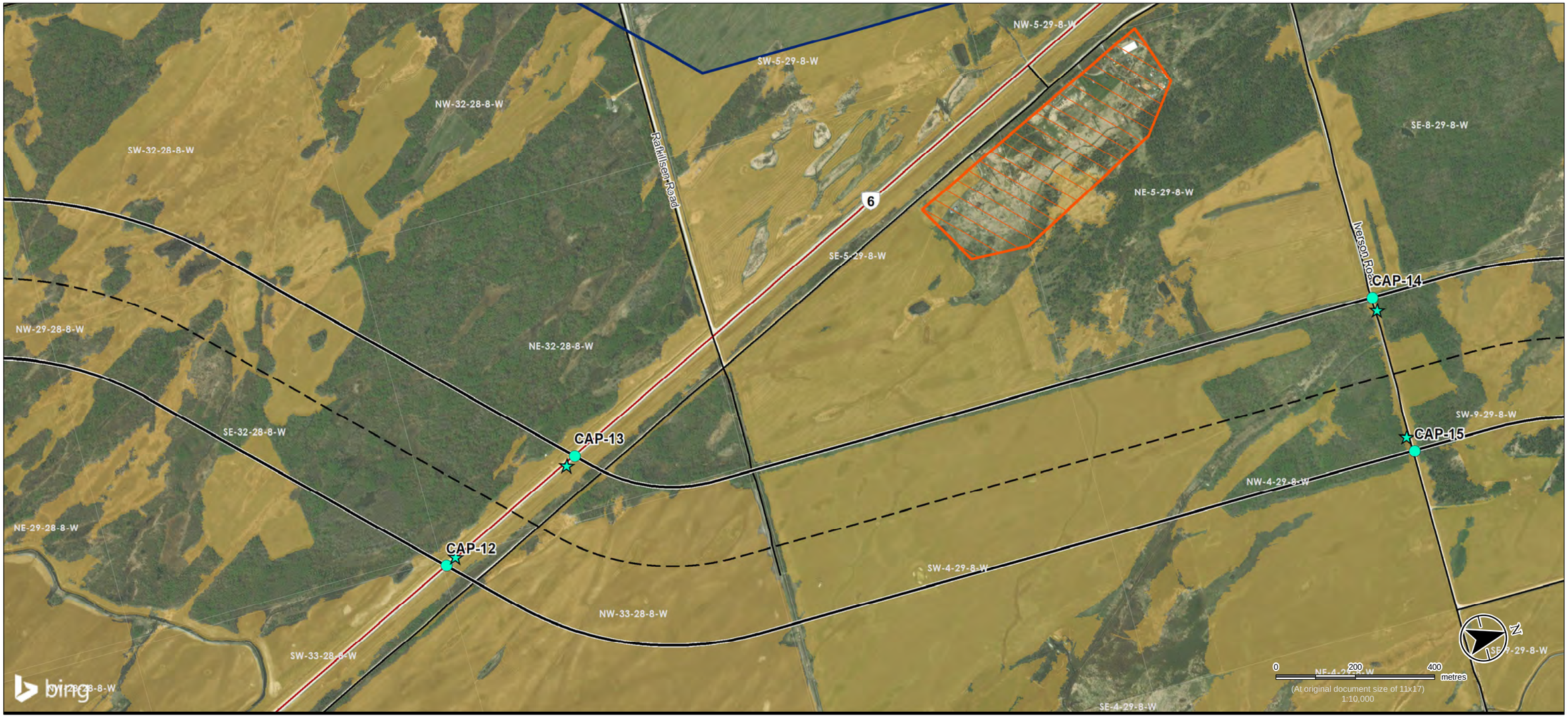
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Lake Manitoba and Lake St.Martin Outlet Channels Project

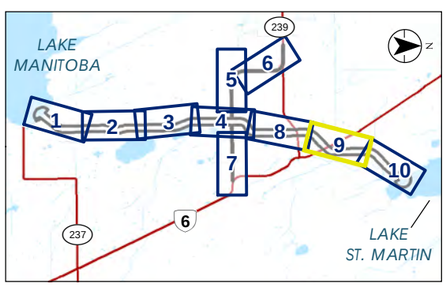
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2 - 8

Title
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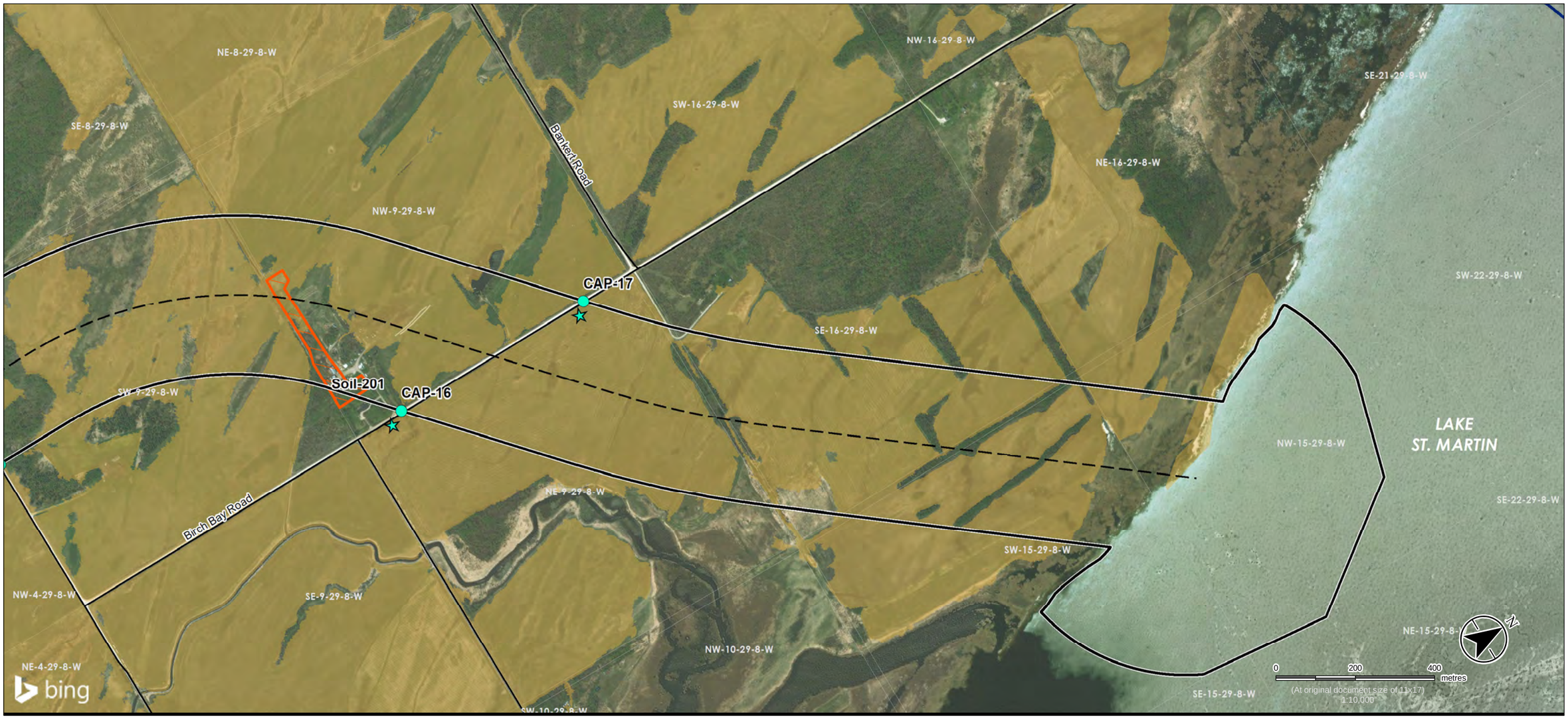
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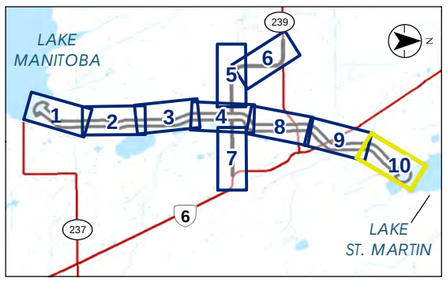
Figure No.
2 - 9

Title
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LEGEND

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Agricultural Biosecurity Management Plan -
Lake Manitoba and Lake St.Martin Outlet Channels Project

Figure No.
2 - 10

Title
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APPENDIX 2

Provincial Resources

2.A Biosecurity Factsheet

Biosecurity

Help protect the health of livestock and crops



New and existing pests and diseases can have a devastating impact on both our natural and agro-ecosystems. We can all take steps to limit human impact on the spread of noxious weeds, disease and insects.

The best defense to reduce pest and disease outbreaks is to set up good biosecurity measures.

Manitoba Agriculture continues to work with farmers, other government departments, Crown corporations, industry and outside agencies to develop and promote realistic and effective biosecurity protocols that protect agricultural crop, livestock and poultry farms.

Biosecurity protocols supported by Manitoba Agriculture have helped limit the impact of significant livestock diseases such as Porcine Epidemic Diarrhea and Avian Influenza and are important for reducing the impact of crop pests such as Bacterial Ring Rot, Clubroot and Verticillium Wilt.

Biosecurity guidelines

As farmers and the industry become more aware of the importance of biosecurity, many sectors have developed standards for farmers and service providers to use. It is essential for employees of government and non-government agencies to use effective biosecurity practices to protect the animals and crops they visit.

Biosecurity and pest management practices are designed to:

- **Prevent** – recognize potential pests and diseases and how and where they can enter a farm
- **Minimize** – reduce the spread or increase of pests or diseases currently on a farm
- **Control** – apply effective and timely measures
- **Communicate** – risks, strategies and protocols for specific pest and disease management

Farmers are responsible for their operations, but others working or visiting agricultural lands have responsibilities to limit the spread of noxious weeds, diseases and pests. Guidelines for both sectors are available online:

- Livestock: www.manitoba.ca/agriculture/animals/animal-health/biosecurity-in-livestock-production.html
- Crops: www.manitoba.ca/agriculture/crops/biosecurity.html

Staff across government have implemented biosecurity protocols to limit the spread of pests and diseases. Protocols are updated as new information becomes available.

For more information

- Livestock biosecurity: contact Manitoba Agriculture at 204-794-9816.
- Crop biosecurity: contact Manitoba Agriculture at 204-745-5660.

Manitoba

2.B Noxious Weeds Information (Manitoba Agriculture)

2.B.1 Noxious Weeds List

The noxious weeds list includes a list of weeds designated as Tier 1, Tier 2, and Tier 3 noxious weeds in Manitoba under the Declaration of Noxious Weeds in Manitoba under The Noxious Weeds Regulation (M.R. 42/17). The list was accessed May 2020 at: https://www.gov.mb.ca/agriculture/crops/weeds/declaration-of-noxious-weeds-in-mb.html

Table 2-1:Designated Noxious Weeds in Manitoba
(The Noxious Weeds Regulation M.R. 42/17)

Common Name	Scientific Name	Area for which Designation Applies
Designated Tier 1 Noxious Weeds		
Amaranth, Palmer	*Amaranthus palmeri*	Whole province
Bartsia, red	*Odontites vernus*	All areas of the province outside the Municipality of Bifrost-Riverton and the Rural Municipalities of Armstrong, Fisher, Gimli, Rockwood, St. Andrews and St. Clements
Crupina, common	*Crupina vulgaris*	Whole province
Cupgrass, wooly	*Eriochloa villosa*	Whole province
Goatgrass, jointed	*Aegilops cylindrica*	Whole province
Hawkweed, orange	*Hieracium aurantiacum*	Whole province
Hogweed, giant	*Heracleum mantegazzianum*	Whole province
Hound's-tongue	*Cynoglossum officinale*	Whole province
Knapweed, diffuse	*Centaurea diffusa*	Whole province
Knapweed, Russian	*Acroptilon repens*	Whole province
Knapweed, spotted	*Centaurea stoebe*	Whole province

Common Name	Scientific Name	Area for which Designation Applies
Knapweed, squarrose	*Centaurea virgata*	Whole province
Knotweed, Japanese	*Fallopian japonica*	Whole province
Mile-a-minute weed	*Persicaria perfoliata*	Whole province
Mustard, garlic	*Allaria petiolata*	Whole province
Patterson's curse	*Echium plantagineum*	Whole province
Pigweed, smooth	*Amaranthus hybridus*	Whole province
Saltcedar	*Tamarix ramosissima*	Whole province
Star-thistle, yellow	*Centaurea solstitialus*	Whole province
Tussock, serrated	*Nassella trichotoma*	Whole province
Waterhemp, tall	*Amaranthus tuberculatus*	Whole province
Designated Tier 2 Noxious Weeds		
Alyssum, hoary	*Berteroa incana*	Whole province
Baby's-breath	*Gypsophila paniculata*	Whole province
Bartsia, red	*Odontites vernus*	Municipality of Bifrost-Riverton and the Rural Municipalities of Armstrong, Fisher, Gimli, Rockwood, St. Andrews and St. Clements
Bouncingbet	*Saponaria officinalis*	Whole province
Brome, downy	*Bromus tectorum*	Whole province
Brome, Japanese	*Bromus japonicas*	Whole province
Campion, bladder	*Silene vulgaris*	Whole province
Chamomile, scentless	*Matricaria perforata*	Whole province

Common Name	Scientific Name	Area for which Designation Applies
Common reed, invasive	*Phragmites australis*	Whole province
Daisy, ox-eye	*Leucanthemum vulgare*	Whole province
Nutsedge, yellow	*Cyperus esculentus*	Whole province
Scabious, field	*Knautia arvensis*	Whole province
Spurge, Cypress	*Euphorbia cyparissias*	Whole province
Spurge, leafy	*Euphorbia esula*	Whole province
St. John's-wort	*Hypericum perforatum*	Whole province
Tansy, common	*Tanacetum vulgare*	Whole province
Thistle, nodding	*Carduus nutans*	Whole province
Toadflax, Dalmatian	*Linaria dalmatica*	Whole province
Designated Tier 3 Noxious Weeds		
Absinth	*Artemisia absinthium*	Whole province
Barberry	*Berberis vulgaris*	Whole province
Barley, foxtail	*Hordeum jubatum*	Whole province
Bellflower, creeping	*Campanula rapunculoides*	Whole province
Buckthorn, European	*Rhamnus cathartica*	Whole province
Burdock, common	*Arctium minus*	Whole province
Burdock, greater	*Arctium lappa*	Whole province
Burdock, woolly	*Arctium tomentosum*	Whole province
Campion, biennial	*Silene dioica*	Whole province
Catchfly, night-flowering	*Silene noctiflora*	Whole province

Common Name	Scientific Name	Area for which Designation Applies
Cleavers	*Gallium aparine*	Whole province
Cleavers, false	*Gallium spurium*	Whole province
Cockle, white	*Silene alba*	Whole province
Dandelion	*Taraxacum officinale*	Whole province
Dodder	genus *Cuscuta*	Whole province
Fleabane, Canada	*Conyza canadensis*	Whole province
Flixweed	*Descurainia sophia*	Whole province
Hawk's-beard, narrow-leaved	*Crepis tectorum*	Whole province
Hemlock, poison	*Conium maculatum*	Whole province
Hemp-nettle	*Galeopsis tetrahit*	Whole province
Hoary-cress	*Cardaria draba*	Whole province
Jimsonweed	*Datura stromonium*	Whole province
Kochia	*Kochia scoparia*	Whole province
Lamb's quarters	*Chenopodium album*	Whole province
Lettuce, prickly	*Lactuca serriola*	Whole province
Milkweed, common	*Asclepias syriaca*	Whole province
Milkweed, showy	*Aslepias speciosa*	Whole province
Mustard, wild	*Sinapis arvensis*	Whole province
Nightshade, American black	*Solanum americanum*	Whole province
Nightshade, cutleaf	*Solanum triflorum*	Whole province
Nightshade, hairy	*Solanum sarachoides*	Whole province

Common Name	Scientific Name	Area for which Designation Applies
Parsnip, wild	*Pastinaca sativa*	Whole province
Ragweed, common	*Ambrosia artemisiifolia*	Whole province
Ragweed, false	*Iva xanthifolia*	Whole province
Ragweed, giant	*Ambrosia trifida*	Whole province
Sow-thistle, annual	*Sonchus oleraceus*	Whole province
Sow-thistle, perennial	*Sonchus arvensis*	Whole province
Sow-thistle, spiny annual	*Sonchus asper*	Whole province
Stinkweed	*Thlaspi arvense*	Whole province
Stork's bill	*Erodium cicutarium*	Whole province
Thistle, bull	*Cirsium vulgare*	Whole province
Thistle, Canada	*Circium arvense*	Whole province
Thistle, Russian	*Salsola pestifer*	Whole province
Toadflax, yellow	*Linaria vulgaris*	Whole province
Water hemlock, bulb-bearing	*Cicuta bulbifera*	Whole province
Water hemlock, northern	*Cicuta virosa*	Whole province
Water hemlock, spotted	*Cicuta maculata*	Whole province
Water hemlock, western	*Cicuta douglasii*	Whole province
Whitetop, hairy	*Cardaria pubescens*	Whole province
Whitetop, lenspod	*Cardaria chalepensis*	Whole province

2.B.2 Manitoba Agriculture FAQs and Control of Noxious Weeds

The following document provides an FAQ and information on control of noxious weeds provided by Manitoba Agriculture. This was accessed at: https://www.gov.mb.ca/agriculture/crops/weeds/declaration-of-noxious-weeds-in-mb.html [May 2020].

Controlling Noxious Weeds

The Noxious Weeds Act (C.C.S.M. c. N110) sets out requirements regarding various control or destruction measures for different plants. It applies to anyone owning or occupying land in Manitoba on which the plant is located.

Is it a Noxious Weed?

The listing of noxious weeds is found in The Noxious Weeds Regulation (Man.Reg.42/17), which contains schedules that rank plants according to their threat levels and specifies the areas of the province to which these levels apply. A noxious weed means, a plant that is designated as a Tier 1, Tier 2 or Tier 3 noxious weed in the Noxious Weeds Regulations and includes the seed of a noxious weed, whether it is still attached to the noxious weed or is separate from it.

How are different Tiers of weeds managed?

The Act requires that Tier 1 weeds, considered a significant threat, must be eradicated without conditions. Tier 2 weeds must be managed according to the size of the infestation. Tier 3 weeds have to be controlled if the weed's uncontrolled growth or spread would have a negative impact on the economy, the environment or the well-being of residents near-by.

Who is responsible?

The control of noxious weeds is the responsibility of all landowners, including:

- Farmers: conventional & organic
- Construction
- Industry: Hydro, Oil & Gas, etc.
- Railways
- Governments: Municipal, Provincial & Federal
  - Rights-of-way, crown land, parks, etc.

The provincial mandate to control noxious weeds is provided through the Noxious Weeds Act, but the implementation of the Act is at the Municipal or Weed Control District Level. On an annual basis, each municipality or Weed Control District appoints a Weed Inspector or Supervisor whom is tasked with inspecting and enforcing the Noxious Weed Act. The Weed Inspector or Supervisor will work with landowners to develop control strategies on private lands for particularly invasive weeds such as leafy spurge. If necessary, Weed Inspector or Supervisor is authorized to regulate weed control under the authority of the Noxious Weeds Act.

How do I get a weed controlled?

To establish control of a Tier 3 noxious weed, a complaint should be lodged with the appropriate municipality or Weed Control District. At that point, an assessment of the concern can take place to establish if there is a negative affect. This would include the collection of the following information.

1. Photographs of the area (date on photos):
   a. A landscape photo with landmarks to help locate the area
   b. Close-up of weeds to confirm it is a Tier 3 weed
   c. Landscape shot of the total infestation
2. Documentation of the complaint filed (or in the event that the Weed Supervisor/ Inspector located the weed infestation on their own, feedback from a municipal or weed control board member and/or MB Weed Specialist)

APPENDIX 3

Record-Keeping Forms

3.A Project Area Entry Checkpoint Log

Project Area Entry Checkpoint Log
Agricultural Biosecurity Management Plan

DRAFT

LAKE MANITOBA
LAKE ST. MARTIN
OUTLET CHANNELS PROJECT

Date & Time		Vehicle or Equipment ID and Description				Cleanliness Inspection		Project Entry Approval		
Date	Time	Company	ID	License Plate (or "n/a")	Description	Cleanliness Inspection[1]	Cleaning Completed[2]	Entry approval[3]	Approver name	Approver initials
2021-12-30	12:30 PM	Construction Co.	No. 1234	ABC 123	Transport truck	C	NR	Approved	A. Smith	AS
2021-12-30	12:30 PM	Construction Co.	No. 9999	n/a	John Deere 300 Excavator	U	PW, D	Approved	A. Smith	AS

sample entries

Notes:

1. Cleanliness inspection:	C = adequately clean		U = unclean, additional cleaning required prior to entry to Project area
2. Cleaning completed:	NR = not required	PW = power washing	D = disinfect of all soil contact surfaces (treads,tracks,buckets,blades,augers, etc.)
3. Entry approval:	Approved - vehicle or equipment approved for entry into Project area		Not approved - vehicle or equipment not approved for entry into Project area

Manitoba

3.B Weekly Vehicle and Equipment Cleaning Record

Weekly Vehicle and Equipment Cleaning Record
Agricultural Biosecurity Management Plan

DRAFT

LAKE MANITOBA
LAKE ST. MARTIN
OUTLET CHANNELS PROJECT

Weekly period Date starting (Monday; dd-mm-yy): _____ Date ending (Friday; dd-mm-yy): _____

Vehicle/equipment info Vehicle/Equipment Type: _____ Vehicle/Equipment ID: _____

Date (dd-mm)	Controlled Access Point (CAP) ID	Controlled Access Point (CAP) Risk Category: 1=Level 1 Risk Category 2=Level 2 Risk Category	Entering the Project Development Area (PDA): Time	Vehicle/equipment inspection (mark with "x"): No soil/manure/plant debris accumulation	Vehicle/equipment inspection (mark with "x"): Soil/manure/plant debris accumulation on machinery	Cleaning completed (mark with "x"): No cleaning required	Cleaning completed (mark with "x"): Rough/mechanical cleaning (scraping, brushing)	Cleaning completed (mark with "x"): Fine cleaning (pressure washer) and disinfection	Exiting the Project Development Area (PDA): Time	Vehicle/equipment inspection (mark with "x"): No soil/manure/plant debris accumulation	Vehicle/equipment inspection (mark with "x"): Soil/manure/plant debris accumulation on machinery	Assessed risk level*: L=Low risk M=Moderate risk H=High risk	Cleaning completed (mark with "x"): No cleaning required	Cleaning completed (mark with "x"): Rough/mechanical cleaning (scraping, brushing)	Cleaning completed (mark with "x"): Fine cleaning (pressure washer) and disinfection	Initial complete

*Risk level is determined by:
1. risk category of the Controlled Access Point, and
2. cleanliness of vehicle/equipment entering/exiting the PDA

			2. Vehicle/equipment cleanliness inspection: Has soil, manure or plant material accumulated on vehicle, equipment or footwear? No	Yes
1. Risk category of the Controlled Access Point (CAP)	Level 1 Risk Category	Risk level	Low risk	Moderate risk
		Cleaning requirement	No cleaning is required	Rough/mechanical cleaning (brushing, scraping) is required until loose or clumped soil/manure/plant debris has been removed from the vehicle, equipment, or footwear
	Level 2 Risk Category	Risk level	Low risk	High risk
		Cleaning requirement	No cleaning is required	Fine cleaning (pressure washer) is required until all soil/manure/ plant debris has been removed from the vehicle, equipment, or footwear. Complete disinfection according to product directions.

Manitoba

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Dust Control Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Objective 1

1.2 Applicable Legislation and Reference Documents 1

1.3 Scope 2

1.4 Monitoring and Follow-up 2

1.4.1 Construction 2

1.4.2 Operation 5

2.0 SUBMISSION REQUIREMENTS 6

3.0 MATERIALS 7

3.1 Construction Areas, Roadways, and Parking Areas 7

3.1.1 Specification for Supply of Material 7

3.1.2 Chemical Requirements 7

3.2 Soil Stockpiles 7

4.0 EQUIPMENT 9

4.1 General 9

4.2 Equipment Used 9

5.0 APPLICATION OF SUPPRESSANT FOR DUST CONTROL 10

5.1 General Requirements 10

List of Tables

Table 1: Chemical Specification

List of Figures

Figure A: EMP Process

Figure 1: Proposed construction access and haul roads for the Project

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Dust Control Plan is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

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Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *The Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

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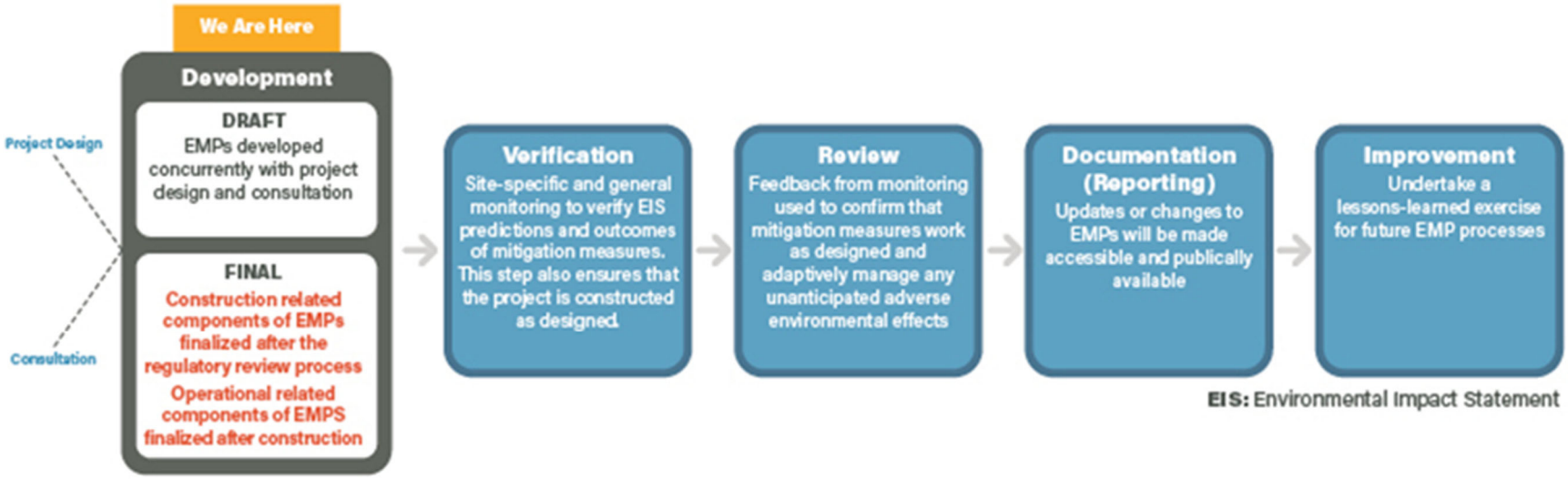


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

µg/m^3	micrograms per metre cubed
CAAQS	Canadian Ambient Air Quality Standards
$CaCl_2$	Calcium Chloride
CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
EIS	Environmental Impact Statement
EMP	Environmental Management Program
L	litres
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MAAQC	Manitoba Ambient Air Quality Criteria
$MgCl_2$	Magnesium Chloride
OEMP	Operation Environmental Management Program
PDA	Project development area
PER	Project Environmental Requirements
$PM_{2.5}$	particulate matter 2.5 micrometers or less in diameter
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
TSP	total suspended particulate

Glossary of Terms

Calcium chloride: Is an inorganic compound, a white coloured crystalline salt with the chemical formula $CaCl_2$ that is a solid at room temperature, highly soluble in water and used as a dust suppressant.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Magnesium chloride: Is an inorganic compound, a white coloured crystalline salt with the chemical formula $MgCl_2$ that is a solid at room temperature, highly soluble in water and used as a dust suppressant.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Specific gravity: Is the ratio of the density of a substance to the density of a given reference material. Specific gravity for solids and liquids is nearly always measured with respect to water at its densest; for gases, the reference is air at room temperature.

Suppressant (dust): A substance which acts to suppress or restrain something (dust).

1.0 INTRODUCTION

1.1 Objective

Manitoba Transportation and Infrastructure has developed a series of environmental management plans and monitoring plans as part of the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). These plans are developed to provide mitigation measures and Best Management Practices to be applied during Project planning, construction, and operation and maintenance activities to reduce or avoid potential adverse effects. The plans outline monitoring activities that will be undertaken to document environmental conditions, guide mitigation and adaptive management measures, and undertake Project activities such that they are carried out in compliance with applicable environmental legislation and licensing requirements and have considered and incorporated input received from Indigenous communities and other Project stakeholders.

The requirements for dust suppression are discussed in Section 2.7 of the Project Environmental Requirements (PERs). The Dust Control Plan, which is a component of the overall Project EMP, addresses visual and instrumentation monitoring for dust and the dust suppressant requirements for the Project construction and operation activities to adhere to Manitoba Transportation and Infrastructure's dust control specifications. The plan describes monitoring, the products to use, and the methods of their application to minimize and mitigate effects from increased dust levels, in particular when in proximity to residences. Mitigation measures will be revised as required to meet specific site conditions. Potential activities that could generate dust were discussed in the Environmental Impact Statement and include areas of excavation and material stockpiles, construction of Provincial Road (PR) 239, and transportation of materials along gravel access roads. Once constructed PR 239 will be paved and will no longer be a material source of dust.

1.2 Applicable Legislation and Reference Documents

Federal and provincial legislation and applicable reference documents will be followed by Contractors while controlling dust. All relevant plans, such as the PERs and management plans, will be among the information that is referenced in the tender document(s) to be provided to prospective Contractor(s). Key reference documents are as follows:

- PERs Section 2.7 Dust Suppression.
- Manitoba Infrastructure. February 2019. Specifications for the Approval, Supply and Application of Dust Control. Specification No. 1280
- Manitoba Infrastructure. June 2000. Specification for Dust Control. Specification No.220ASTM D 98 – Standard Specification for Calcium Chloride
- ASTM D 1293 – Standard Test Methods for pH of Water
- ASTM D 1429 – Standard Test Methods for Specific Gravity of Water and Brine
- ASTM E 449 – Standard Test Methods for Analysis of Calcium Chloride
- Pulp and Paper Association of Canada Standard H1 – Determination of Solids Content of Pulp and Paper Mill Effluents

- Standard Methods for the Examination of Water and Wastewater, 3120 – Metals by Plasma Emission Spectroscopy
- Manitoba Environment, Climate and Parks Manitoba Ambient Air Quality Criteria (MAAQC)
- Canadian Ambient Air Quality Standards (CAAQS)

1.3 Scope

This plan covers the requirements and application of dust suppressants and other mitigation measures used for dust control and stabilization. The Dust Control Plan also includes measures for monitoring of dust and air quality.

1.4 Monitoring and Follow-up

1.4.1 Construction

In accordance with standard construction practices, visual inspections for dust or potential for dust generation and ambient air quality monitoring will be conducted to determine where and when dust control needs to be applied to avoid or minimize dust generation. Areas or activities identified as potential sources of dust generation will be watered, as required to prevent generation of dust when there is a potential human receptor. The on-site personnel, which may include the Contractor, Contract Administrator, Manitoba Transportation and Infrastructure Construction Inspector or designated alternate, will be responsible for the visual and ambient air quality monitoring of dust conditions on PR 239, designated haul or access roads (Figure 1), and all areas where construction activities will take place in proximity to human receptors. In accordance with the Manitoba Transportation and Infrastructure construction contracts, a monitor will be onsite at all times during construction to confirm that appropriate dust controls are implemented in accordance with this plan. Dust control will be a discussion topic of biweekly construction meetings initiated by Manitoba Transportation and Infrastructure Inspector or designated alternate to routinely report and address concerns or deficiencies in the environmental management measures and follow-up on direction provided to take appropriate and timely corrective action.

In addition to visual monitoring, ambient air quality monitoring for particulate matter 2.5 micrometers or less in diameter ($PM_{2.5}$) and total suspended particulate (TSP) will be implemented at a representative location that coincides with greatest number of proximate residents and sensitive receptors near construction activities. The air monitoring program results will facilitate the timely application of additional mitigation measures for fugitive dust should excessive particulate matter concentrations be measured.

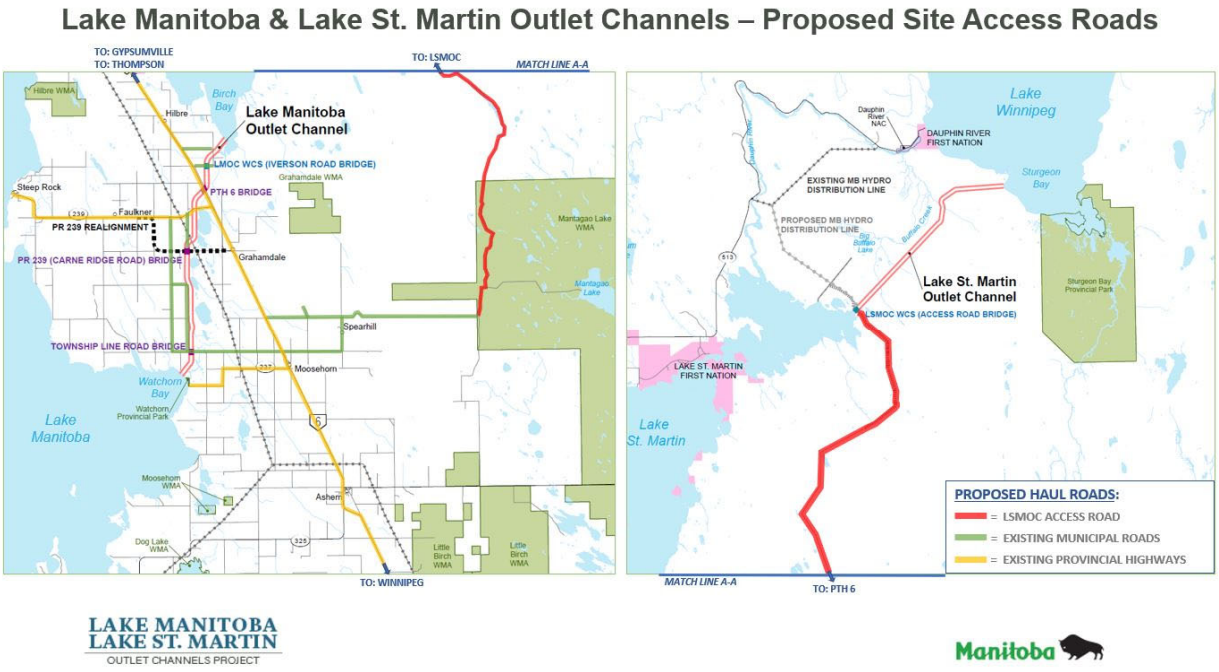


Figure 1: Proposed construction access and haul roads for the Project

Manitoba Transportation and Infrastructure proposes to conduct air quality monitoring for $PM_{2.5}$ and TSP at a location near the Project development area (PDA) and residences along PR 239 during periods with construction activity associated with the Lake Manitoba Outlet Channel (LMOC) and PR 239 realignment. The specific monitoring location will be determined based on year-round access to the site for deployment, monthly calibration and maintenance, other site visits as needed, access to reliable electrical power that will be relatively uninterrupted during construction, site security, and regulatory air monitoring siting guidance. The selected instrument may vary depending upon the availability of electrical power or potentially the need to rely upon solar or battery power. Candidate instruments include the E-BAM Portable Environmental Beta-Attenuation Mass Monitor, the DustTrak Environmental Monitor, Thermo Scientific ADR1500, or GRIMM Aerosol Environmental Dust Monitor (EDM164). Monitoring equipment would also be equipped with meteorological sensors to measure meteorological parameters (e.g., winds and temperature). The stations will be outfitted with equipment to collect and store the monitoring data and transmit it via the local cellular phone network for long-term storage. Monitoring equipment will be deployed, operated, and maintained as per manufacturer recommendations.

The monitoring data will be reviewed daily to identify if concentrations exceed trigger levels, the MAAQC, or the CAAQS. The proposed trigger levels are 2/3 of 24-hour Maximum Acceptable Level 24-hour average $PM_{2.5}$ and 24-hour average TSP MAAQC equal to 20 micrograms per metre (m) cubed ($\mu g/m^3$) and 80 $\mu g/m^3$, respectively.

If the $PM_{2.5}$ or TSP concentrations are higher than the proposed trigger limits, this will provide an initial warning that mitigation of fugitive dust may be required. Concentrations greater than the trigger levels will be investigated to determine possible causes of elevated particulate matter concentrations. If they are associated with the Project activities, Manitoba Transportation and Infrastructure can determine the appropriate mitigation measures to apply to lower the particulate emissions. The proposed 2/3 of the MAAQC for $PM_{2.5}$ is less than the CAAQS and is an adequate trigger for both the MAAQC and CAAQS.

If measured TSP or $PM_{2.5}$ concentrations are above the MAAQC, the concentration measurements and instruments will be reviewed to determine whether measurement error exists (i.e., confirm that the measurements are valid). If exceedances are verified, then Manitoba Transportation and Infrastructure will investigate to determine possible causes of elevated particulate matter concentrations and determine the appropriate adaptive mitigation. Recent construction activities will be reviewed to determine which activities may have contributed to measured TSP and $PM_{2.5}$ concentrations. If ground-level $PM_{2.5}$ and TSP concentrations are greater than the MAAQC and are associated with the Project, additional mitigation to reduce dust emissions will be implemented. This mitigation may include increased watering of access roads, the spraying of acceptable dust control chemicals, stabilizing soil stockpiles, silt fencing, or the suspension of certain construction activities at the site.

The monitoring instruments may be relocated during the Project to accommodate construction requirements, changes to the Project, consultation with stakeholders or regulators, or based on observations made in the field during construction or Project operations. These locations should be periodically reviewed to check that they are correctly placed to protect human health and inform adaptive dust control efforts. Additional monitoring stations may be added to the program as needed.

A daily log of visual dust monitoring and meteorological condition observations will be recorded for the primary access roads and active construction areas. The combination of instrument-based particulate monitoring and visual dust observations will be used to verify the effectiveness of dust control and identify areas of meteorological conditions that result in insufficient mitigation. An adaptive management approach will be implemented to continuously review the effectiveness of the mitigation, and adapt mitigation as necessary, based upon both visual monitoring, $PM_{2.5}$ and TSP monitoring, and meteorological conditions. Monitoring and meteorological records will be reviewed periodically to determine if management actions and mitigations are appropriate.

A summary report will be prepared each time there is an air quality event that requires investigation. This will document the conditions leading up to the event, any mitigation actions taken to reduce the effects on ambient air quality, determination of the source of the emissions causing the event where possible, and any other relevant information.

1.4.2 Operation

To determine when dust control needs to be applied Manitoba Transportation and Infrastructure or a designated alternate will be responsible for visually monitoring dust conditions in areas associated with the Project operations and maintenance activities. As the relocated PR239 will be paved, it will not be a material source of dust emissions once construction is complete. Municipal roads which had been used as designated haul and access roads during Project construction would return to the care and control of the RM of Grahamdale and would no longer be maintained by Manitoba Transportation and Infrastructure. Manitoba Transportation and Infrastructure's standard practices for application of dust control on PRs in the region will determine whether and where to apply dust suppressant. PR 239 will not require application of dust suppressants as it will be paved. Manitoba Transportation and Infrastructure has developed a draft Complaint Resolution Process (CRP) intended to collect, respond to, and resolve any Project-related complaints, including dust concerns.

2.0 SUBMISSION REQUIREMENTS

The following will be submitted to Manitoba Transportation and Infrastructure or a designated representative with a request to approve the dust suppressant:

- The name of the material.
- The name of the manufacturer or supplier.
- The manufacturer's guidelines and recommendations for application rates that meet or exceed the performance of calcium chloride ($CaCl_2$) or magnesium chloride ($MgCl_2$).

3.0 MATERIALS

3.1 Construction Areas, Roadways, and Parking Areas

Only water or approved dust suppressants shall be used for dust control, with water being the preferred material. The use of waste petroleum or petroleum by-products as dust suppressants is not allowed. The following chemicals may be specified:

- 38% Liquid Calcium/Magnesium Chloride ($Ca/MgCl_2$)
- 35% Liquid $Ca/MgCl_2$
- 34% Liquid $Ca/MgCl_2$
- 30% Liquid $Ca/MgCl_2$
- 77% Flake $Ca/MgCl_2$
- 32.6% Liquid $MgCl_2$
- 30.3% Liquid $MgCl_2$
- 28% Liquid $MgCl_2$
- Lignosulfonate-Solution (Liquid)
- Lignosulfonate – Solution & Carbohydrates (Liquid)

3.1.1 Specification for Supply of Material

The chemicals shall comply with the requirements of Table 1.

3.1.2 Chemical Requirements

Liquid $Ca/MgCl_2$ shall be composed of $CaCl_2$ or a combination of $CaCl_2$ and $MgCl_2$. The quantity of chloride chemicals shall be calculated to achieve a strength equivalency of 77% pure flake $CaCl_2$. Water used in the solution shall be free of contaminants that could adversely affect either field material performance or the environment.

3.2 Soil Stockpiles

Where appropriate, water or tarps will be utilized to prevent excess dust originating from soil stockpiles. Soil stockpiles are not expected to be significant sources of dust.

Table 1: Chemical Specification

Requirements	Chemical									Test Method[1]
	$Ca/MgCl_2$ Liquid				$Ca/MgCl_2$ Flake	$MgCl_2$ Liquid			Lignosulfonate (Liquid)	
Minimum Concentration Percentage (by mass)[2]	38%	35%	34%	30%	77%	32.6%	30.3%	28%		ICP-AES as described in "Standard Methods for the examination of Water and Wastewater" Sec. 3120, APHA-AWWA-WEF
Gradation (Percent Passing)					9.5 mm – 100% 4.75 mm – 80 to 100%					ASTM D98
Minimum Percentage of Total Solids (by mass)									27%	Canadian Pulp and Paper Association Standard Method H.1
Product Specific Gravity	1.38	1.35	1.35	1.30		1.30	1.28	1.125		ASTM D-1429
pH									3-8	ASTM D-1293
Equivalency %	88	98	100	118		88	100	108		

Notes:
1. All Test Methods refer to the current version.
2. Alkali Chloride determination, as required for Minimum Concentration analysis, is calculated by use of ASTM E449.

4.0 EQUIPMENT

4.1 General

Application equipment shall be capable of distributing the dust suppressant in a uniform manner at an application rate specified by the manufacturer or Manitoba Transportation and Infrastructure.

4.2 Equipment Used

Pressure distributors shall be propelled by a power unit capable of accurately maintaining any speed required for spraying and shall be provided with the following minimum equipment:

- A pump capable of developing a constant uniform pressure in the spray manifold to sustain the required application.
- A pressure gauge indicating the pressure within the spray bar graduated in increments of 15 kilopascals or less and visible to the operator.
- A rear mounted spray bar having a cab-activated positive and instant shut off that can be set at variable heights parallel to the surface and to any spraying width from 1 to 3 metres (m) to spray any portion of the roadway surface, including the shoulders.
- The spray bar nozzles shall be:
  - All the same manufacture and size.
  - Clean and good working condition.
  - Designed and set to facilitate uniform fan shaped spray without atomization.
- A strainer installed in the feed system to prevent clogging of the spray bar nozzles.
- A device or method that allows the operator to determine the volume remaining in the tank to an accuracy of 200 litres (L).
- Splash guards or other approved devices for shoulder spraying that shall permit spraying immediately adjacent to the roadway without over-spraying the road surface.
- A system (e.g., meter, GPS device, ground speed sensors, or calibration charts) that allows the operator to determine the rate of application with accuracy while spreading the dust suppressant.

The application rate per kilometer shall be confirmed by running 250 m test sections in the presence of the Contract Administrator, Construction Inspector or a designated alternate by Manitoba Transportation and Infrastructure.

5.0 APPLICATION OF SUPPRESSANT FOR DUST CONTROL

5.1 General Requirements

Water should be applied on the surface of the road before applying the dust suppressant. Steps shall be taken as necessary to control dust resulting from operations or by traffic such that it does not:

- Affect traffic.
- Enter surface waters by ensuring that at 50 m from a water crossing the machinery applying the dust suppressant only passes on the middle between two narrow lanes.
- Escape beyond the right-of-way to cause a nuisance to residents, businesses, or utilities by ensuring an overpass in the middle of two lanes, thus leaving a certain margin of area not covered by the dust suppressant on both sides of the road.

Dust suppressant shall be applied when the speed of winds does not exceed 15 to 20 kilometres per hour to make sure to avoid ponding, runoff, drifting, and tracking of the material beyond the area of application. Carefully monitor the application rate of all dust suppressants so that adequate coverage occurs without pooling or runoff of products. The amount of dust suppressant applied should not exceed the minimum amount required to effectively suppress dust.

The suppressant application shall not proceed during periods of rain when the surface is in a saturated condition or on areas of ponded water or roads that are subject to flooding. The surface needs to be dry for the suppressants to be effective. Thus, when there is a high probability forecast for precipitation, only use water as a suppressant to prevent the loss of dust suppressant from the intended area of application. Areas receiving rainfall within 6 hours of application may require reapplication of the dust suppressant.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Heritage Resources Protection Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

EXECUTIVE SUMMARY V

LIST OF ACRONYMS AND GLOSSARY OF TERMS VIII

Acronyms viii

Glossary of Terms ix

1.0 INTRODUCTION 1

2.0 PURPOSE AND OBJECTIVES 3

3.0 HERITAGE RESOURCES DEFINITIONS 4

4.0 PROJECT ROLES AND RESPONSIBILITIES 5

5.0 HERITAGE RESOURCES PROTECTION MEASURES 7

5.1 Managing Known Heritage Resources of the Project 7

5.1.1 Heritage Sensitive Areas 7

5.1.2 Known Heritage Sites within the PDA 8

5.1.3 Culturally Important Areas 8

5.2 Procedures for Chance Find Heritage Resources 9

5.3 Additional Procedures for Specific Chance Find Heritage Resources 10

5.3.1 Human Remains 10

5.3.2 Animal Remains 12

5.3.3 Artifacts: Stone Tools, Lithics, and Pottery 13

5.3.4 Artifacts: Historic Objects 14

5.3.5 Features: Hearths and Stained Soils 14

5.3.6 Features: Stone Configurations 15

5.3.7 Features: Petroglyphs and Pictographs 15

5.3.8 Features: Historic Buildings or Structures 16
5.3.9 Cultural Use Areas 16
6.0 REPORTING AND CLOSURE 18
7.0 REFERENCES 19

List of Figures

Figure A: EMP Process

Figure 1: Project Area

Figure 2: Construction Organization Chart for the Project

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Heritage Resources Protection Plan (HRPP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

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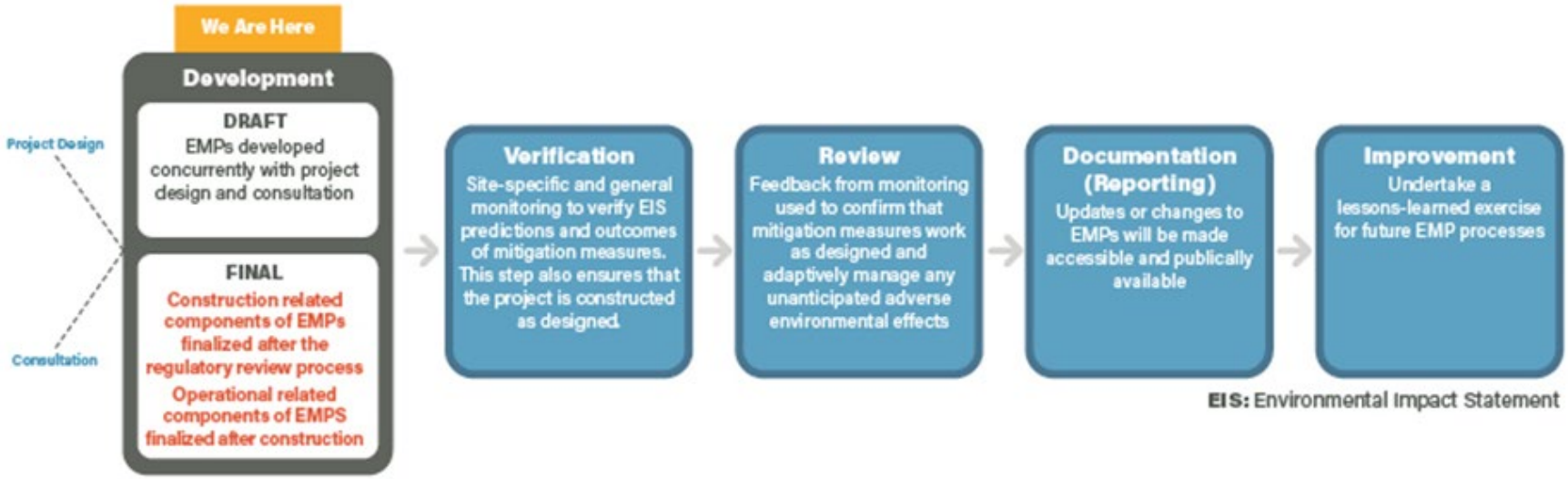


Figure A: EMP Process

EXECUTIVE SUMMARY

The Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project) is a proposed permanent flood control mitigation project to alleviate flooding in the Lake St. Martin area of Manitoba. The Project involves the construction of two new water diversion channels. The LMOC is approximately 24.1 kilometres (km) long with a channel inlet positioned at Watchorn Bay on Lake Manitoba and an outlet positioned at Birch Bay on Lake St. Martin. The LSMOC is approximately 23.8 km long with a channel inlet positioned at the east end of Lake St. Martin and an outlet positioned south of Willow Point in Sturgeon Bay on Lake Winnipeg. The Project development area (PDA) for both channels is approximately 400 metres (m) wide. Associated works and activities for the Project include temporary construction camps and staging areas, temporary access routes, realignment of existing drainage infrastructure, measures to divert surface water and groundwater, and erosion and sediment control.

An Environmental Management Program (EMP) Framework program has been developed to provide a structure that facilitates the management, monitoring, and mitigation of potential environmental effects during the construction and operating phases of the Project. Environmental Protection Plans (EPP) are a component of the EMP Framework that provides site-specific, detailed protection measures to be followed to minimize these potential effects during and after Project construction.

The protection of heritage resources constitutes one aspect of the EMP. Heritage resources are protected under Manitoba's *Heritage Resources Act* (1986) and are managed by the Historic Resources Branch (HRB) under the Ministry of Sport, Culture, and Heritage. A HRPP has been developed to provide for this protection. The objective of the HRPP is to provide for two facets of heritage protection:

1. the protection of previously known heritage resources; and
2. the protection of heritage resources and human remains should they be unearthed or discovered during the construction and operating phases of the Project.

This HRPP also describes the roles and responsibilities of Manitoba Transportation and Infrastructure and its Contractors towards heritage protection throughout the life of the Project.

This HRPP includes a system to manage known heritage resources within the Project. Known heritage resources fall under three classifications: 1) Heritage Sensitive Areas (HSA); 2) Known Heritage Resources; and 3) Culturally Important Areas.

1. HSAs are those portions of the PDA in which pre-construction desktop screening and subsequent field assessments suggest a high potential for archaeological materials. Trained Inspectors and/or Monitors will take extra measures to inspect soil layers within HSAs and enact the Chance Find Procedure if heritage resources are encountered.
2. **Known Heritage Resources** are heritage sites within the PDA that were identified during the pre-construction Heritage Resources Impact Assessment (HRIA). All heritage sites will be mitigated during pre-construction to a level that satisfies the requirements of HRB and the *Heritage Resources Act*. However, some sites may hold the potential to contain additional archaeological materials that were not recovered pre-construction. Most known heritage sites in the PDA will be treated as HSAs

(above), in which a trained Inspector and/or Monitor will take extra measures to inspect soil layers and enact the Chance Find Procedure if heritage resources are encountered. For a known heritage site in which HRB requires an Archaeologist to be present for heritage monitoring, the Archaeologist will take the extra measures to inspect soil layers and manage any heritage resources that may be exposed during construction.

3. **Culturally Important Areas (CIA)** are locations within the PDA that hold historic, social, economic, and/or spiritual value to the inhabitants of the Project local and regional assessment areas (LAA and RAA). Inspectors and/or Monitors will take extra measures to identify cultural resources in the CIA, document potential impacts to a CIA, and enact the Chance Find procedure if cultural resources are encountered or impacted.

This HRPP also includes **Procedures for Chance Find Heritage Resources**, a system to manage heritage resources that are unearthed or discovered during the construction and operating phases of the Project. The following describes the general procedures that will be followed if heritage resources are encountered during construction activities for the Project.

1. All construction activities at the location of the find will cease immediately. An immediate work-stop buffer zone will be enacted around the find.
2. All heritage resource items will be left in the same position in which they were noted or discovered.
3. The Inspector (or their delegate) will enact the Chance Find Procedure.
4. A buffer zone will be erected around the find at a minimum of 50 m in radius. The zone must be established with a highly visible physical barrier. No construction activities will take place within the buffer zone.
5. The Inspector will contact an Archaeologist. The Inspector will supply information about the find to the Archaeologist, who will then determine the significance of the find and the appropriate next steps in procedure.
6. The Archaeologist will work with HRB to determine if additional measures are required for the find.
7. The Archaeologist will conduct or oversee others who will conduct activities relating to any additional measures as required. These activities may include salvage archaeology, mitigation strategies, and/or on-going monitoring and supervision of the removal of soils associated with the site until the Archaeologist is satisfied that the heritage resource is no longer endangered by the construction activity.
8. Once HRB (and/or other parties as outlined in agreements with Manitoba Transportation and Infrastructure) is satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.

This HRPP also outlines additional procedures that must be followed for specific heritage resources. These include:

- Human remains
- Hearths and stained soils
- Stone Configurations
- Petroglyphs and Pictographs; and
- Cultural Use Areas

Activities relating to heritage resources that occur during the Project must be documented by a qualified professional archaeologist holding a valid heritage permit. The heritage permit requires the archaeologist to submit a detailed report to the HRB on behalf of Manitoba Transportation and Infrastructure outlining construction activities and their impacts on heritage resources, the procedures that were followed as laid out by this HRPP, and recommendations for site treatment and protection in relation to future development.

The statements made in this Executive Summary are subject to WSP Canada Group Limited's Standard Limitations found in the HRPP report and should be read in its entirety with the remainder of the HRPP report.

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

CEMP	Construction Environmental Management Program
CHRPP	Culture and Heritage Resources Protection Plan
CIA	Culturally Important Area
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Process
EPP	Environmental Protection Plan
ESS	Environmentally Sensitive Site
HRB	Historic Resources Branch
HRIA	Heritage Resources Impact Assessment
HRPP	Heritage Resources Protection Plan
HSA	Heritage Sensitive Area
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
OEMP	Operation Environmental Management Program
PDA	Project development area
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RAA	Regional Assessment Area
RCMP	Royal Canadian Mounted Police
RM	Rural Municipality

Glossary of Terms

Animal Remains: The remains of animal bodies, often recovered in skeletal form.

Artifact: Any object manufactures, used, moved, or modified by human beings.

Cairn: A cluster or pile of stones, often built to mark trails, burial sites, or food or tool caches.

Chance Find: A heritage resource (including human remains) that is unearthed or discovered during the construction and operating phases of a project.

Contractor: Refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation, or maintenance activities, and includes all subcontractors and affiliates.

Culturally Important Area: Locations within the Project that hold historic, social, economic, and/or spiritual value to the inhabitants of the LAA and RAA.

Cultural Use Area: An area that exhibits evidence of past cultural activities, such as culturally modified trees or ceremonial sites.

Environmental Monitor: Refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Erratic: A rock or boulder that is different from the surrounding rock, often deposited through glacial or hydrological action.

Feature: a non-portable object or alteration to the landscape that has cultural significance.

Forensic: Relating to a crime.

Funerary Object: Artifacts that have been buried with an individual.

Hearth: The physical remains of a firepit.

Heritage Resource: The physical remains of past cultural groups.

Heritage Resources Protection Plan: The managing document plan detailing the methods and procedures of heritage resource protection for the Project.

Heritage Sensitive Area: Locations within the Project in which there is a high potential for archaeological materials.

Heritage Site: The specific location in which a cluster of heritage resources in a direct temporal and spatial relationship are documented.

Historic artifact: An artifact identified as belonging to the time period after European contact, ranging from the early Fur Trade Period (late 17th Century) to the mid-20th Century.

Historic feature: A building or structure identified as belonging to the time period after European contact, ranging from the early Fur Trade Period (late 17th Century) to the mid-20th Century.

Human remains: The remains of human bodies, often recovered in skeletal form.

Inspector: Refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Lithic debitage: Stone debris created and left over from the manufacture of stone tools.

Owner: Refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction, and operation.

Petroglyph: A figure or scene inscribed onto a rock surface by grinding, pecking, or incising.

Pictograph: A figure or scene painted on a rock surface.

Pottery: Storage vessels fashioned from fired clay.

Pre-Contact Period: The period of time in Canadian human history before the arrival of Europeans. In Manitoba this is generally considered to range from 13,000 years before present to the late 17th Century.

Stone Configuration: Features constructed of cobbles and boulders in a meaningful way.

1.0 INTRODUCTION

Manitoba Transportation and Infrastructure is in the process of seeking environmental approvals for the Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project). The Project involves the construction of two new water diversion channels as a permanent flood control mitigation system to alleviate flooding in the Lake St. Martin area of Manitoba (Figure 1). The LMOC will connect Lake Manitoba with Lake St. Martin. The LMOC is approximately 24.1 kilometres (km) long with a channel inlet positioned at Watchorn Bay on Lake Manitoba and an outlet positioned at Birch Bay on Lake St. Martin. The LMOC includes a water control structure and three road bridges. The LSMOC will connect Lake St. Martin to Lake Winnipeg. The LSMOC is approximately 23.8 km long with a channel inlet positioned at the east end of Lake St. Martin and an outlet positioned south of Willow Point in Sturgeon Bay on Lake Winnipeg. The LSMOC includes a combined bridge/water control structure and multiple drop structures. The PDA for both channels is approximately 400 metres (m) wide. Associated works and activities for the Project include temporary construction camps and staging areas, temporary access routes, realignment of existing drainage infrastructure, measures to divert surface water and groundwater, and erosion and sediment control.

An Environmental Management Program (EMP) has been developed to manage, monitor, and mitigate potential environmental effects during the construction and operating phases of the Project and is being shared with regulators, Indigenous rights-holders, and stakeholders for input prior to finalization. An Environmental Protection Plan, complete with mapbooks of the PDA is being developed and will provide site-specific detailed protection measures to be followed to minimize potential effects to environmentally sensitive sites (ESS). ESS are locations, features, areas, activities, or facilities that were identified to be ecologically, socially, economically, culturally, or spiritually important or sensitive to disturbance and require protection during construction of the Project. The determination of ESS will include the consideration of Indigenous traditional knowledge.

The protection of heritage resources constitutes one aspect of the EMP. A HRPP has been developed by WSP Canada Inc. for Manitoba Transportation and Infrastructure to provide for this protection. The details and procedures found within the following pages provide for two facets of heritage protection: 1) the protection of previously known heritage resources; and 2) the protection of heritage resources and human remains should they be unearthed or discovered during the construction and operating phases of the Project. The HRPP also provides for CIAs.

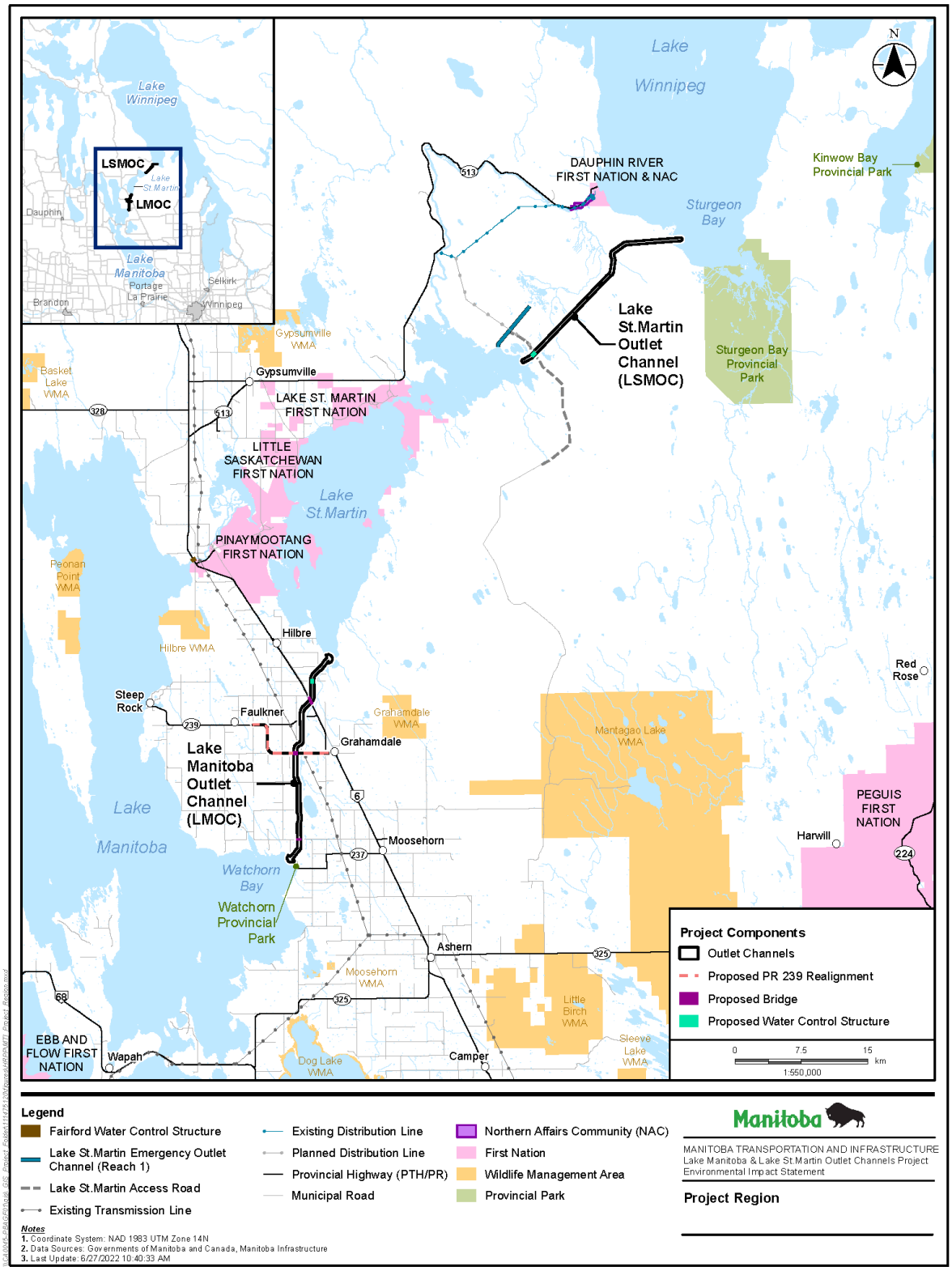


Figure 1: Project Area

2.0 PURPOSE AND OBJECTIVES

Heritage Resources are protected under Manitoba's *Heritage Resources Act* (1986). Found Human Remains, including partial remains and teeth, are protected under Manitoba's *Heritage Resources Act* (1986) and *The Policy Concerning the Reporting, Exhumation and Reburial of Found Human Remains* (1987). Heritage Resources in Manitoba are managed by the HRB under the Manitoba Ministry of Sport, Culture, and Heritage. This HRPP does not replace provincial legislation. Rather, the HRPP is a guideline written in accordance with provincial legislation and underlines the need to understand the protective measures that are based on provincial legislation. This document, therefore, should be considered as a heritage resource protection plan that advises practical responses to legislation, regulations, licenses, permits, standards, conditions, contracts, agreements, designs, and specifications for specific situations at specific work locations.

Ownership of all heritage objects found within Manitoba rests with the Province of Manitoba. All heritage resources are protected under the *Heritage Act*. Deliberate destruction or disturbance of heritage resources is an offence under the Act.

The HRPP is designed to demonstrate and document due diligence. In this context, due diligence involves taking all reasonable, practical steps to protect heritage resources which may be unearthed or discovered during the construction phase of the Project regardless of cultural affiliation. The objectives and direction of this document stem from the Project EIS, which included a recommendation for a Culture and Heritage Resources Protection Plan (CHRPP) to be instated during the construction phase of the Project. The Project EIS provided an outline for a CHRPP and included the following measures (MI 2020):

- The HRB will be informed immediately if any heritage resources, or objects thought to be heritage resources, are discovered during site preparation and construction.
- Protective barriers will be placed around heritage resource sites that are inadvertently found during construction if required so that the area can be protected while work proceeds.
- All heritage resources discovered during site preparation and construction will be left in their original position until HRB is contacted and provides instruction.
- Orientation for Project staff working in construction areas will include heritage resource awareness and training including the nature of heritage resources and the management of any resources encountered.
- Orientation information will include typical heritage resource materials and reporting procedures.
- The Contractor will report heritage resource materials immediately to the Construction Supervisor and will cease construction activities in the immediate vicinity until the Project Archaeologist is contacted and prescribes instruction.
- The CHRPP will be adhered to during construction and operations phases of the Project.

This HRPP has been prepared to meet the measures listed above and is concerned with heritage resources and/or found human remains that are found on lands associated with the Project. Information regarding heritage resources and/or found human remains will be submitted to the HRB as per the terms of the *Heritage Resources Act* (1986) and to Manitoba Transportation and Infrastructure as per the terms of the HRPP. In addition, any heritage resources and/or human remains that are accidently discovered by Project workers outside the PDA but are carrying out Project-related activities will also be subject to the same conditions of documentation as described herein.

3.0 HERITAGE RESOURCES DEFINITIONS

The following information on heritage resources is included in this HRPP to aid the understanding of identification of such resources by non-heritage specialists during the construction and operating phases of the Project.

Heritage resources are the physical remains of past culture groups. They are non-renewable forms of human art, workmanship or use that have been modified by or left behind due to human activities. This includes plant and animal remnants. The Manitoba *Heritage Resources Act* (1986) defines "Heritage Resources" as:

1. a heritage site.
2. a heritage object; and
3. any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, cultural, natural, scientific, or aesthetic features, and may be in the form of sites or objects or a combination thereof.

There are two types of heritage resources: (1) artifacts and (2) features.

1. Heritage artifacts are any object manufactures, used, moved, or modified by human beings. An artifact may be as small as a single stone flake (the by-product of stone tool production) or as large as a canoe. Other types of artifacts can include lithic tools, butchered animal bones, and Pre-Contact ceramics (pottery), as well as materials from the historic period including gun flints and parts, nails, ceramics, bottle glass and beads.
2. Features are *in situ* (in place) objects or alterations to the landscape that are non-portable: meaning they cannot be easily removed from their original location. Examples of features include petroforms (stones that have been placed in a shape or design, such as effigy of an animal, medicine wheel or thunderbird nest); pictographs (paintings on rock faces); or cairns (clusters of stones often used as way markers or could represent a burial site or food cache).

Heritage Site is the specific location in which a cluster of heritage resources in a direct temporal and spatial relationship are documented.

Chance Find is a heritage resource (including human remains) that are unearthed or discovered during the construction and operating phases of the Project.

4.0 PROJECT ROLES AND RESPONSIBILITIES

The Project is a sizeable endeavor and will involve Contractors, Inspectors, Contract Administrators, Monitors, and technical support teams, overseen by various levels of management. Figure 2 outlines the organizational structure of the Project. In this structure, the Owner (Manitoba Transportation and Infrastructure) is responsible for overseeing the Project site. Under the Owner, the workforce is divided into Contract Administrators, Construction Inspectors, Environmental Inspector's, and Environmental Monitors. Each plays a vital role in the protection and management of heritage resources.

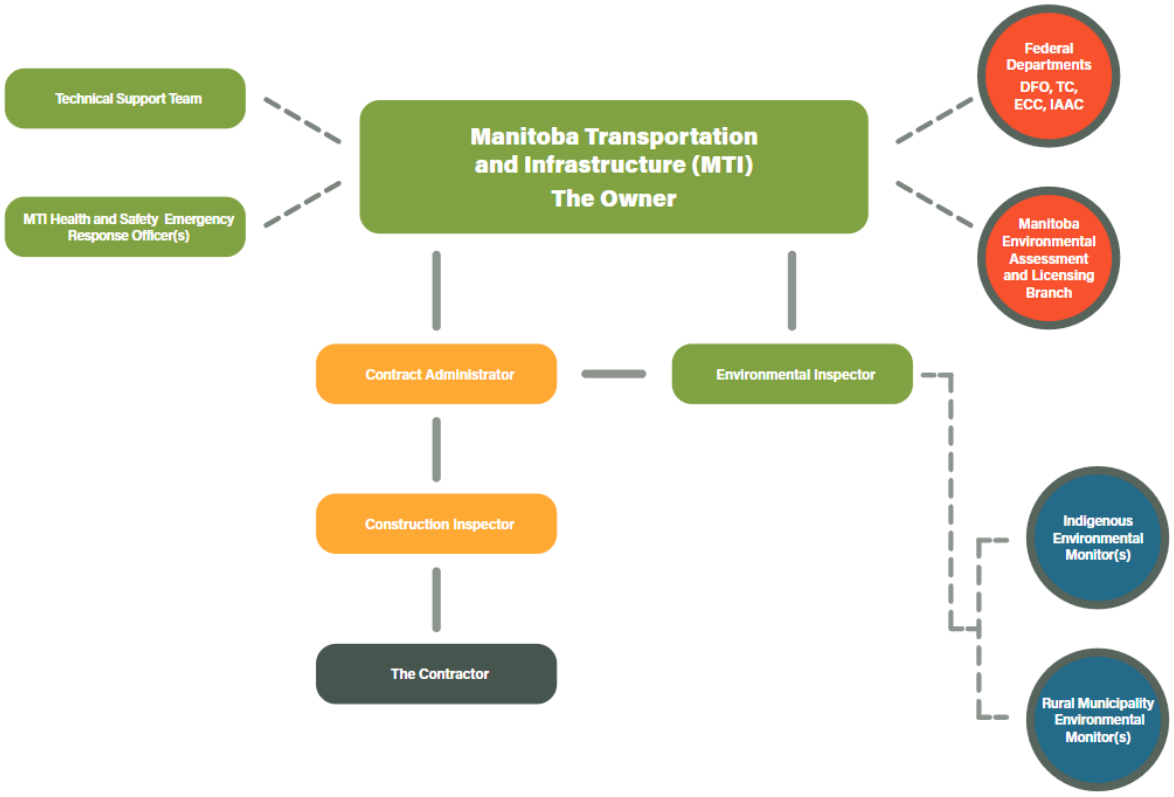


Figure 2: Construction Organization Chart for the Project

Only an archaeologist (hereafter the Project Archaeologist) as assigned by Manitoba Transportation and Infrastructure will have the authority to handle and remove artifacts found within the Project footprint under a valid heritage permit. The Project Archaeologist will be on-site in those areas and situations as dictated in Section 5. It is the responsibility of the workers as well as trained Inspectors and Monitors on site to identify and protect heritage resources. The front lines of heritage management are the trained Inspectors, Environmental Monitors and Contractors. It is important that all workers that fall under these categories be able to identify important heritage resources and be aware of the protocols regarding the protection of; or removal of and handling of artifacts (see Section 5.2 below). Heritage resources may be found in many different locations of the Project and may be difficult to identify during active construction. Heritage resources training will be provided prior to construction to aid in the ability to recognize heritage resources that are uncovered during construction (see Section 7.0 of the CEMP, which outlines training and orientation information). It is important to note that this training will only be on a basic level; they are not expected to act as Project Archaeologists when a potential heritage resource is encountered. Workers will be required to point out potential heritage resources during construction, but the Project Archaeologist will determine if the find is indeed a heritage resource.

Manitoba Transportation and Infrastructure, as the Owner, is responsible for ensuring that environmental issues, including heritage resources, are observed, and reported and will be on site during active construction. If an Inspector, Monitor or Contractor identifies a potential heritage resource, they will contact the Owner or designated alternate. The information will be shared with the environment and construction teams according to the organizational structure in Figure 2. Manitoba Transportation and Infrastructure, or designated alternate will then enact the Chance Find Procedure.

If a Contractor identifies a potential heritage resource, they will notify the Contract Administrator and/or Manitoba Transportation and Infrastructure. Manitoba Transportation and Infrastructure will communicate findings to relevant personnel and will enact the Chance Find Procedure.

5.0 HERITAGE RESOURCES PROTECTION MEASURES

The following sections outline the protection measures that have been put in place for all heritage resources associated with the Project. Section 5.1 describes how known heritage resources will be managed during the construction and operation phases of the Project. Sections 5.2 and 5.3 outline the procedures that will be followed in the event of a Chance Find.

5.1 Managing Known Heritage Resources of the Project

As stated in the Section 1, this document provides for two facets of heritage protection: 1) the protection of previously known heritage resources; and 2) the protection of heritage resources and human remains should they be unearthed or discovered during the construction and operating phases of the Project. This section deals with the former, providing information and guidelines on heritage resources related to the Project as established by pre-construction heritage investigations and Indigenous rights-holder consultations.

Known information about heritage resources within the PDA fall under three classifications:

1. HSAs;
2. Known Heritage Resources; and
3. CIAs

The information found in each of these classifications was gathered during the pre-construction phase of the Project, and in turn influenced the specific strategies and measures to be followed during the construction and operating phases of the Project. The specific data that falls under each classification will be found in the EPP.

5.1.1 Heritage Sensitive Areas

HSAs are those portions of the PDA in which pre-construction desktop screening and subsequent field assessments suggest a high potential for archaeological materials. This high likelihood is based on an interpretation of topographic data with an archaeological focus, including the type of landform, the landform's relationship to the surrounding area, its proximity to major water sources, and its cultural and/or historical context. This data informed the predictive modeling on which the desktop screening was based. The results of the HRIA fieldwork then further refined this classification.

Portions of the PDA classified as HSAs during the desktop screening process were investigated during the pre-construction HRIA. Some HSAs were found to contain heritage resources. Certain HSAs in which heritage resources were not found during the HRIA may still be considered to contain a high potential for archaeological material, as the lack of known heritage resources does not necessarily eliminate the likelihood that heritage resources may exist in these areas. While archaeological materials are not expected to be encountered in such areas, Manitoba Transportation and Infrastructure is advised that even the most

thorough archaeological study may not identify all archaeological materials that may be present. Thus, HSAs may still require additional inspection measures during the construction phase of the Project.

An HSA will be identified in the EPP as being an ESS. In the case of the HSA, the sensitivity is towards potential heritage resources. The EPP will highlight the location of the ESS within the PDA, identify the potential effects construction may have, and outline specific Contractor protocols to follow when working within the ESS. Project Archaeologists are not required to be on site for heritage monitoring when construction activities occur within the HSA ESS. However, trained Inspectors and/or Monitors will take extra measures to inspect soil layers within the ESS and enact the Chance Find procedure if heritage resources are encountered (see Section 5.2).

5.1.2 Known Heritage Sites within the PDA

Known heritage sites within the PDA were identified during the pre-construction HRIA. All heritage sites must be mitigated to a level that satisfies the requirements of HRB and the *Heritage Resources Act* before construction in the area can proceed. However, some sites may hold the potential to contain additional archaeological materials that were not recovered in the pre-construction surveys. The location of a known heritage site will be classified in the EPP as an ESS in the same manner as an HSA, in order to acknowledge that potential for more archaeological material.

The EPP will highlight the location of the heritage site within the PDA, identify potential effects construction may have, and outline specific Contractor protocols to follow when working within the ESS. For an ESS in which a Project Archaeologist is required to be present for heritage monitoring as directed by HRB, the Project Archaeologist will take the extra measures to inspect and provide direction for the excavation by mechanical means. For the remaining known heritage sites, the trained Inspectors and/or Monitors will take extra measures to inspect soil layers within the ESS and enact the Chance Find procedure if heritage resources are encountered (see Section 5.2).

5.1.3 Culturally Important Areas

CIAs are locations within the PDA that hold historic, social, economic, and/or spiritual value to the inhabitants of the Project LAA and RAA. Examples of CIAs may include burial sites, sacred sites, ceremonial sites, specific berry or plant foraging areas, or specific hunting locations. The CIAs were identified during the pre-construction HRIA and is ongoing through rights-holder and stakeholder engagement. The location of a CIA will be classified in the EPP as an ESS without detailing sensitive information to maintain confidentiality. In the case of a CIA, the sensitivity is towards cultural resources.

The EPP will highlight the location of the ESS within the PDA, identify potential impacts construction may have, and outline specific Contractor protocols to follow when working within the CIA ESS. Trained Inspectors and/or Monitors will take extra measures to identify cultural resources in the CIA ESS, document any potential impacts to a CIA, and enact the Chance Find procedure if cultural resources are encountered or impacted (see Section 5.2).

5.2 Procedures for Chance Find Heritage Resources

As noted in Section 3, a Chance Find is a heritage resource (including human remains) that are unearthed or discovered during the construction and operating phases of the Project. It is possible for Chance Finds to occur during any phase of the Project and in any location within the PDA, even in areas that were considered a low probability for heritage resources during the pre-construction HRIA.

All workers on the Project should be aware of the protocols regarding the protection of; or removal of; and handling of artifacts. However, only the Project Archaeologist has the authority to handle and remove artifacts. When there is no Project Archaeologist on site, the Inspector will inform the team of the situation and Manitoba Transportation and Infrastructure will enact the Chance Find procedures, which may involve bringing the Project Archaeologist on site.

The following describes the procedures that will be followed if heritage resources are encountered during construction activities for the Project.

1. All construction activities at the location of the find will cease immediately. An immediate work-stop buffer zone will be enacted around the find.
2. All heritage resource items will be left in the same position in which they were noted or discovered.
3. If a Contractor is the first to identify the find, they will notify the Inspector or Contract Administrator, who will then contact the Manitoba Transportation and Infrastructure.
4. If a trained Inspector or Monitor is the first to identify the find, they will notify Manitoba Transportation and Infrastructure directly.
5. Manitoba Transportation and Infrastructure will enact the Chance Find Procedure.
6. A buffer zone will be erected around the find at a minimum of 50 m in radius. The zone must be established with a highly visible physical barrier. No construction activities will take place within the buffer zone. This buffer zone may be expanded or contracted at any time during the procedures below.
7. The initial physical barrier may be composed of wooden stakes with either the top 30 centimetres of each stake spray painted green or wrapped with green flagging, placed at a minimum of 10 m apart. All construction workers must adhere to the established boundaries and stay outside of the buffer zone.
8. The trained Inspector or Monitor will gather as much information about the find as possible to provide the Project Archaeologist with a complete picture of the situation that will aid in determining the significance of the find. These data should include the find's location, description, condition, and type of activity that led to it being found. The Inspector or Monitor should also take detailed notes, Global Positioning System (GPS) coordinates, and photos of the find.
9. Manitoba Transportation and Infrastructure will contact the Project Archaeologist. In certain situations, an off-site delegate or Contract Administrator may have to be the one to contact the Project Archaeologist.

10. Manitoba Transportation and Infrastructure, or a delegate, will supply information about the find to the Project Archaeologist, who will then determine the significance of the find and the appropriate next steps in procedure. (See special procedures for specific types of heritage resource below).
    a. In certain circumstances the Project Archaeologist may determine it necessary to establish a more permanent, stable, or noticeable barrier around the heritage resource. In this event, the wooden staking will be replaced with snow fencing held with metal posts as directed by the Manitoba Transportation and Infrastructure Construction Supervisor.
11. If the Project Archaeologist deemed it necessary, the Project Archaeologist will come to site and conduct an investigation of the find based on professional guidelines. In this event, the Project Archaeologist will notify HRB of the find and obtain the required heritage permits for the investigation.
12. The Project Archaeologist will document the find with notes, photographs and recording of the GPS coordinates. Artifacts will be collected according to professional guidelines.
13. The Project Archaeologist will work with HRB to determine if additional measures are required for the find.
14. The Project Archaeologist will conduct or oversee others who will conduct activities relating to any additional measures as required. These activities may include salvage archaeology, mitigation strategies, and/or on-going monitoring and supervision of the removal of soils associated with the site until the Project Archaeologist is satisfied that the heritage resource is no longer endangered by the construction activity.
15. Once HRB (and/or other parties as outlined below) is satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.

5.3 Additional Procedures for Specific Chance Find Heritage Resources

The following sections detail the types of heritage resources that may be encountered during construction activities of the Project. The general procedures above must be followed; however, for each type listed below, the additional procedures must be enacted.

5.3.1 Human Remains

Description

Humans Remains, as defined by *The Heritage Resources Act*, Section 43(1), are “remains of human bodies that in the opinion of the minister have heritage significance and that are situated or discovered outside a recognized cemetery or burial ground in respect of which there is some manner of identifying the persons buried therein.” For practical purposes, human remains refer to the remains of human bodies, often recovered in skeletal form. This may range from a single bone or tooth to complete skeletons. It may be difficult to identify bone as human rather than animal. It is always best to err on the side of caution, assume the bone is human remains, and treat the find accordingly. The policies in which the Government of Manitoba protects, and preserves found human remains are stated and described in the *Province of*

Manitoba Policy Concerning the Reporting, Exhumation, and Reburial of Found Human Remains (1987). The procedures described below are governed by this document.

Any human bone uncovered during construction must be treated with the utmost respect. No human remains will be disturbed or removed from their original resting place unless the action is necessary, unavoidable, and done at the direction of qualified personnel. No photographs or video recordings will be taken of the human remains unless directed by the Project Archaeologist, HRB, or the Royal Canadian Mounted Police (RCMP).

Funerary objects may also be found alongside human remains. Funerary objects are artifacts (such as clothing, cloth, pouches, stone tools, jewelry, special rocks, etc.) that have been buried with the individual. Funerary objects are considered sacred and must be treated with the same respect as the human remains and must not be separated from the human remains except by qualified personnel.

Additional Procedures

1. Steps 1 through 10 of the Procedures for Chance Find Heritage Resources (Section 5.2 above) will be followed. These tasks include immediate work stoppage in a 50 m radius from the find, the establishment of a physical buffer zone, and the enactment of the Chance Find Procedure by Manitoba Transportation and Infrastructure.
2. All human remains and associated funerary goods will be left in the same position in which they were noted or discovered. The sole exception is if the human remains are found inside an excavator bucket that has not been dumped. In this case, the construction crew may empty the bucket by laying a tarp down on the ground immediately adjacent to the excavator (and within the 50 m buffer zone) and carefully empty the contents of the bucket onto the tarp.
3. A tarp will be placed overtop the remains to protect it from sight and the elements. The tarp must be secured only on the edges.
4. All heavy equipment will vacate the area within the 50 m, with spotters taking care to avoid any other potential bone or artifacts in the vicinity.
5. In the case of human remains, a more permanent buffer than wooden staking is required. Once the heavy equipment has vacated the 50 m area, snow fencing (or a similar barrier) must be erected.
6. After the erection of the barrier / snow fencing, all construction workers, Contractors, and members of the public must remain outside of the buffer unless directed by Manitoba Transportation and Infrastructure at the direction of Project Archaeologist, HRB, or the RCMP. All activity concerning the human remains must be conducted as much as possible out of sight of casual viewers.
7. Manitoba Transportation and Infrastructure will contact the Project Archaeologist, who will contact HRB. The Project Archaeologist and/or HRB will determine if the remains are human or non-human. The determination may be made from off-site based on supplied evidence or may require an on-site visit for verification.
8. If the Project Archaeologist is off-site, a trained Inspector or Monitor may be asked to perform certain tasks to assist the Project Archaeologist in determining the significance of the find. These tasks may include photographing the remains, the site area, the funerary objects, or soils and soil discolorations. These tasks must only be done if directed by the Project Archaeologist and/or HRB.

9. If the skeletal remains are identified as human, then the HRB will immediately contact the RCMP. Proper jurisdiction will be determined by the RCMP and HRB. If the remains are identified as animal, the appropriate procedures will be followed (see Section 5.3.2, Animal Remains).
10. The RCMP will determine if the remains are forensic (i.e., relating to a crime).
11. If the remains are determined to be forensic, or cannot be immediately classified as non-forensic, then the RCMP will have jurisdiction over the area and the custody and recovery of the remains.
12. If the RCMP determines the remains are non-forensic, then HRB will have jurisdiction over the area and the custody and recovery of the remains.
13. HRB will work with Manitoba Transportation and Infrastructure to contact relevant parties of the find and take any appropriate action that was previously agreed upon with said parties.
14. HRB will determine if the removal of the human remains is necessary. HRB will lead the exhumation of the remains or may delegate the Project Archaeologist to conduct the exhumation.
15. If the Project Archaeologist leads the exhumation, all proper permits will be acquired, and proper exhumation procedures will be followed. Standard guidelines for reporting will also be followed.
16. Technical reports submitted and approved by Manitoba Transportation and Infrastructure and HRB will be shared with relevant parties, as part of legislative requirements and contractual agreements.
17. Once HRB and other relevant parties are satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.
18. All visitors to the site must adhere to Project Risk and Safety Plan.
19. The situation may also arise in which the Project Archaeologist, during the investigation of a general Chance Find Heritage Resource, unearths human remains. In this situation, the Procedure for Human Remains will be immediately enacted for the entire heritage site.

5.3.2 Animal Remains

Description

Animal remains refer to the remains of animal bodies, often recovered in skeletal form. This may range from a single bone or tooth to complete skeletons. Animal remains may exist within the PDA for natural or cultural reasons. Natural reasons include situations in which an animal died naturally or was killed by other animals. In such cases the animal remains are not usually considered a heritage resource. Cultural reasons involve human activity. Such activity includes hunting, butchering, transporting, or otherwise modifying animal remains. Animal remains that are associated with human activity may be considered heritage resource.

It may be difficult to distinguish between animal bone and human bone. If a bone cannot be clearly identified as animal rather than human, it is always best to err on the side of caution. The find should be treated as human remains, and the procedures in Section 5.3.1 should be followed until the find is proven otherwise.

Additional Procedures

1. Steps 1 through 10 of the Procedures for Chance Find Heritage Resources (Section 5.2) will be followed. These tasks include immediate work stoppage in a 50 m radius from the find, the establishment of a physical buffer zone, and the enactment of the Chance Find Procedure by the Inspector.
2. If the find is possibly human, then Steps 1 through 7 of the Procedures for Human Remains (Section 5.3.1) will be followed. These tasks include the establishment of a snow fence buffer. The Project Archaeologist and/or HRB will determine if the remains are human or non-human.
3. If the find is determined to be human, then the Procedures for Human Remains (Section 5.3.1) will continued to be followed.
4. If the find is determined to be non-human, the procedures below will be followed.
5. If the find is definitely non-human, the Project Archaeologist will then determine if the find is considered a heritage resource. If deemed necessary, the Project Archaeologist will come to site and conduct an investigation of the find based on professional guidelines. In this event, the Project Archaeologist will notify HRB of the find (if they were not already part of the investigation) and obtain the required heritage permits for the investigation.
6. The Project Archaeologist will document the find with notes, photographs and recording of GPS coordinates. Artifacts will be collected according to professional guidelines.
7. The Project Archaeologist will work with HRB to determine if additional measures are required for the find.
8. The Project Archaeologist will conduct or oversee others who will conduct activities relating to any additional measures as required. These activities may include salvage archaeology, mitigation strategies, and/or on-going monitoring and supervision of the removal of soils associated with the site until the Project Archaeologist is satisfied that the heritage resource is no longer endangered by the construction activity.
9. Once HRB (and/or other parties as outlined below) is satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.

5.3.3 Artifacts: Stone Tools, Lithics, and Pottery

Description

Common Pre-Contact artifacts recovered from heritage sites include stone tools, lithic debitage, and ceramic pottery. Tools fashioned from stone could take the form of spear and dart points, arrowheads, knives, scrapers, hammers, and adzes. The tools may as a large as a person's forearm or as small as a thumbnail. They may be found complete or as only as fragments. Lithic debitage is the stone debris created and left over from the manufacture of stone tools. This material can also vary greatly in size; some stone flakes can be smaller than a pea. Pre-Contact pottery is the remains of storage vessels fashioned from fired clay. Vessels may be found complete or in small fragments.

Additional Procedures

The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects. If evidence is found during the investigation that any of these heritage objects may be a funerary object, or associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

5.3.4 Artifacts: Historic Objects

Description

Artifacts deemed historic may date from as far back as the early Fur Trade Period (late 17th Century) and as recent as the mid-20th Century. Historic artifacts are often found along old trails or near fur trade posts or old cabin sites. Common fur trade era historic artifacts (circa 1650-1850) include gun flints and musket balls, blown glass bottles, earthenware ceramics, glass beads, bone buttons, and handmade nails. Common later historic artifacts (circa 1850-1940) include cartridge shell casings, molded or machine-made bottles, transfer-print ceramics, hole-in-top tin cans, metal buttons, and machine-cut nails. The items may be found complete or only as fragments.

Additional Procedures

The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects. If evidence is found during the investigation that any of these heritage objects may be a funerary object, or associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

5.3.5 Features: Hearths and Stained Soils

Description

Unusual soil staining could represent several cultural features. The most common is a hearth. A hearth is the physical remains of a firepit. Common characteristics of a hearth include white and grey ash, blackened earth, presence of charcoal, and the presence of burnt or calcined (white) bone fragments. The hearth may, but not always, be well-defined with a ring of stones. The hearth may also contain a large amount of stones within the pit.

Red or yellow soil staining may represent ochre, a mineral with special significance to Indigenous peoples. Dark black greasy soil may represent the remains of organic material. If this soil is found to be associated with cultural activity, it may represent a kill site or butchering site. Unusual staining could also indicate the presence of a burial.

Additional Procedures

1. The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects.

2. In addition to those procedures, the feature must be covered with a tarp to protect it from the elements. The tarp must be secured only on the edges.
3. If evidence is found during the investigation that the stained soil may be associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

5.3.6 Features: Stone Configurations

Description

Stone configurations are features that are constructed of cobbles and boulders in a meaningful way. Stone configurations may have been built as trail markers, caches, ceremonial sites, dwelling foundations or rings, and burials or memorials. A common stone configuration is a cairn: a cluster or pile of stones that may be covering a burial site or a cache of food or tools. Indigenous peoples also made use of naturally occurring stone features. In these instances, the feature is not modified in any way by humans but was used as a marker or a ceremonial centre and may be considered sacred. One such feature is an erratic, a rock or boulder, usually very large, that is different from the surrounding rock, often deposited through glacial or hydrological action.

Additional Procedures

The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects. If evidence is found during the investigation that the stone feature may be associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

5.3.7 Features: Petroglyphs and Pictographs

Description

A petroglyph is a figure or scene inscribed onto a rock surface by grinding, pecking, or incising. A pictograph is a figure or scene painted on the rock the surface. Both features may be considered sacred.

Additional Procedures

1. The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects.
2. In addition to those procedures, the feature must be covered with a tarp to protect it from sight and the elements. The tarp must be secured only on the edges. If the location or position of the feature makes this task difficult, then the Project Archaeologist and/or HRB will decide on the best available technique.
3. If evidence is found during the investigation that the feature may be associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

4. As these features may hold sacred cultural significance, HRB will work with Manitoba Transportation and Infrastructure to contact relevant parties of the find and take any appropriate action that was previously agreed upon with said parties.
5. Technical reports submitted and approved by Manitoba Transportation and Infrastructure and HRB will be shared with relevant parties, as part of legislative requirements and contractual agreements.
6. Once HRB and other relevant parties are satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.
7. All visitors to the site must adhere to Project safety rules and regulations.

5.3.8 Features: Historic Buildings or Structures

Description

Buildings or structures deemed historic may date from as far back as the early Fur Trade Period (late 17th Century) and as recent as the mid-20th Century. Historic features can be made of wood or stone and could be found in various stages of declining condition. Historic features could include fur trade buildings or old cabin sites.

Additional Procedures

The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects. If evidence is found during the investigation that the feature may be associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.

5.3.9 Cultural Use Areas

Description

Cultural Use Areas are those areas that exhibit evidence of past cultural activities. They may not be considered archaeological but are often still considered a heritage resource. Common evidence for Cultural Use Areas includes culturally modified trees and brightly coloured cloth hung in trees.

Additional Procedures

1. The general Procedures for Chance Find Heritage Resources outlined in Section 5.2 will adequately address the concerns associated with these heritage objects.
2. If evidence is found during the investigation that the feature may be associated with a burial or human remains, then the Procedure for Human Remains (Section 5.3.1) will be immediately enacted for the entire heritage site.
3. As these features may hold sacred cultural significance, HRB will work with Manitoba Transportation and Infrastructure to contact relevant parties of the find and take any appropriate action that was previously agreed upon with said parties.
4. Technical reports submitted and approved by Manitoba Transportation and Infrastructure and HRB will be shared with relevant parties, as part of legislative requirements and contractual agreements.

5. Once HRB and other relevant parties are satisfied with the outcome of the investigation, construction activities can commence in the find area unless alternate measures have been established.
6. All visitors to the site must adhere to Project safety rules and regulations.

6.0 REPORTING AND CLOSURE

Activities relating to heritage resources that occur during the Project must be documented by a qualified Professional Archaeologist. To document the work, the archaeologist must hold a valid HRB heritage permit. As a condition for holding a heritage permit, the archaeologist must submit a detailed report to the HRB on behalf of Manitoba Transportation and Infrastructure, outlining construction activities and their impacts on heritage resources, the procedures that were followed as laid out by this HRPP, and recommendations for site treatment and protection in relation to future development.

7.0 REFERENCES

Government of Manitoba. 1986. Heritage Resources Act. Winnipeg.

Government of Manitoba. 1987. The Province of Manitoba Policy Concerning the Reporting, Exhumation, and Reburial of Found Human Remains. Winnipeg.

MI (Manitoba Infrastructure) 2020. Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. March 9, 2020.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Site Decommissioning Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Applicable Legislation and Reference Documents 1

1.2 Occupational Safety, Health and Risk Management 2

1.3 Project Schedule 2

2.0 COMMUNICATION 3

2.1 Contact Persons 3

2.2 Reporting 4

3.0 CONSTRUCTION 5

3.1 Designated Areas 5

3.2 Access Roads 7

3.3 Quarry Areas 7

4.0 OPERATION 9

List of Figures

Figure A: EMP Process

Figure 1: Access Roads within the LSMOC Right-of-Way

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Site Decommissioning Plan is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations.

The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

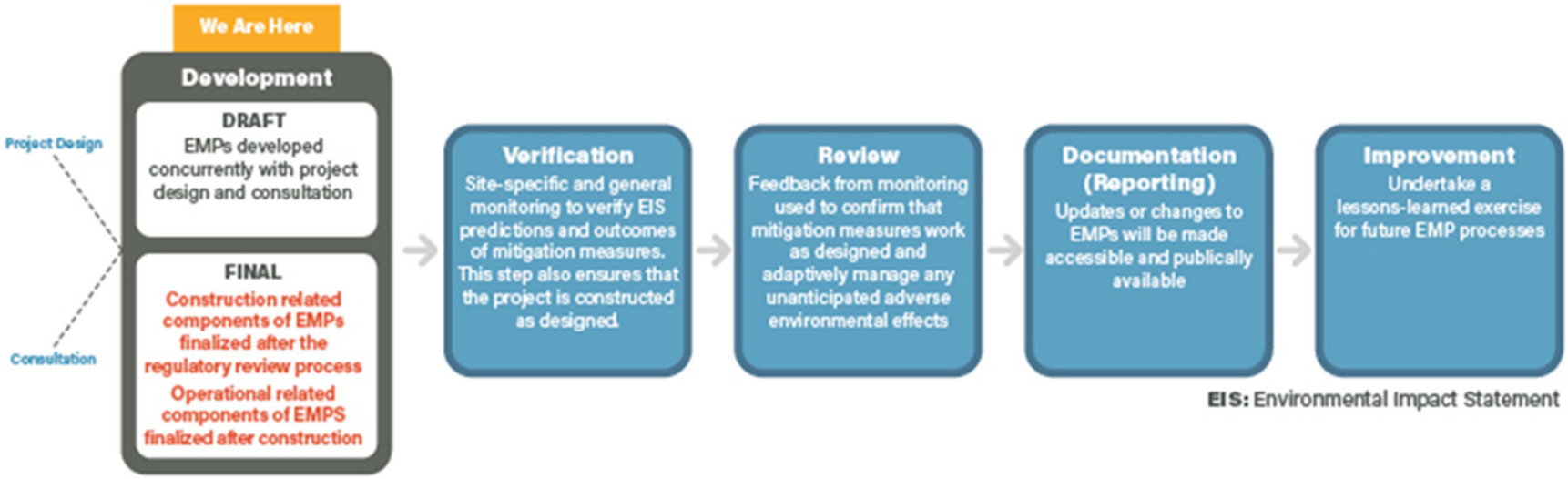


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AMP	Access Management Plan
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
OEMP	Operation Environmental Management Program
PER	Project Environmental Requirements
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project
QMP	Quarry Management Plan
RM	Rural Municipality
SWMP	Surface Water Management Plan

Glossary of Terms

Casual Quarry Permit: An annual permit issued for the production of a specified quantity of Crown quarry mineral (*Quarry Minerals Regulation* 1992).

Contractor: Refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Designated Area(s): Refers to specific sites that have been identified for a specific purpose which requires special approvals and/or careful documentation, maintenance, and decommissioning.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the project to support the structural design of the bridge or structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Inspector: Refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase of the design process typically supports the pre-construction engagement and consultation process with the public and rights-holders, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Rights-holders: Include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Technical Support Team: Refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure to provide specialized technical support services for Project construction, maintenance or operation. Specialized support may include, but is not limited to: design, contracting, contract disputes, auditing, inspections, construction methods and sequencing.

The Owner: Refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting or blasting.

Quarry Lease: Refers to a 10-year lease granted by the Crown with the exclusive rights to excavate quarry minerals (e.g., sand, gravel, clay, shale, gypsum, peat, salt, rock or stone).

1.0 INTRODUCTION

The Site Decommissioning Plan is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project). It describes the activities that are required to address Section 2.1.5 of the Project Environmental Requirements (PERs), which discusses site decommissioning. The purpose of the Site Decommissioning Plan is to describe the processes and environmental requirements for the removal and closure of temporary designated areas, temporary access roads and quarry areas required during construction or operation of the Project.

The Site Decommissioning Plan does not discuss decommissioning of the permanent Project components such as the channels and ancillary structures required for on-going operation. As noted in Volume 1, Section 3.3.3 of the Project Environmental Impact Statement (EIS), decommissioning of the Project is not anticipated; however, should portions of the Project require decommissioning in the future, these activities will be undertaken in accordance with applicable guidelines and regulations at that time.

The Site Decommissioning Plan addresses any temporary facilities and structures that are not needed for future maintenance activities. These will be decommissioned and reclaimed by the Contractor following the construction phase and are detailed in this Site Decommissioning Plan.

The Site Decommissioning Plan is organized into three main sections, which address the following:

- Communication from Manitoba Transportation and Infrastructure to contractors, rights-holders and residents of nearby communities.
- Decommissioning measures to be implemented during construction.
- Processes to be implemented during operation and maintenance.

1.1 Applicable Legislation and Reference Documents

As indicated, the key reference document for site decommissioning is the PERs, and particularly the following sections:

- Designated Areas and Access (Section 2.1)
- Erosion and Sediment Control (Section 2.3)
- Working Within or Near Surface Water (Section 2.5)
- Machinery, Fuel Storage, Materials Handling and Storage, Spill Response and Remediation (Section 2.6)
- Dust Suppression (Section 2.7)
- Noise and Noise Limitations (Section 2.9)
- Wildlife and Species of Conservation Concern (Section 2.11)
- Wildfires (Section 2.12)
- Heritage Resources (Section 2.13)
- Quarries and Borrow (Section 2.14)
- Site Decommissioning (Section 2.15)

- Revegetation and Vegetation Maintenance (Section 2.16)
- Planned and Unplanned Shutdowns (Section 2.17)

Federal and provincial legislation and applicable reference documents will be followed by Contractors during the decommissioning of infrastructure and associated temporary works during the Project. Appendix 1 of the Construction Environmental Management Program (CEMP) outlines key legislation and supporting documents to be followed, as required, for temporary works that will be decommissioned. There is no intent to decommission any permanent works; however, in the event that may occur, applicable legislations and regulations would apply at that time.

1.2 Occupational Safety, Health and Risk Management

Occupational safety, health and risk management are issues that apply to all Manitoba Transportation and Infrastructure facilities and operations, employees, contractors, and visitors. Effectively managing risks to the safety, health and well-being of employees, visitors and the public arising out of the work activities performed by or on behalf of the Department is an important priority. The Site Decommissioning Plan will contribute to the safety of Manitoba Transportation and Infrastructure employees, contractors, visitors and the public in adherence to *The Workplace Safety and Health Act* and its associated regulations so they are not adversely affected by Project construction or operations.

1.3 Project Schedule

A schedule outlining the physical activities required for completion of the Project leading up to operation is being developed as part of the Detailed Design stage. Construction is currently anticipated to occur over approximately two and half to three years followed by an additional one to two years for site clean-up, surveying and environmental offset works following the major construction works. Decommissioning of the channels and ancillary structures required for on-going operation is not anticipated as these would be permanent infrastructure. However, any temporary facilities and structures that are not needed for future maintenance activities will be decommissioned and reclaimed by the Contractor following the construction phase.

2.0 COMMUNICATION

Effective public education and communication about the Project is an important priority to the successful achievement of the objectives of the Site Decommissioning Plan. The education and communication approach for the construction and operations phases of the Project is intended to:

- Promote safety for all and to maintain an understanding among all identified rights-holders, stakeholders, and the public-at-large regarding the decommissioning measures being implemented and maintained, and the rationale for doing so.
- Provide clear information as to how the Site Decommissioning Plan will be implemented, as detailed in Section 3.0.

Ongoing communications with respect to the Site Decommissioning Plan will include information such as:

- Changes to schedule for certain Project components and closure of temporary construction work areas, temporary access roads, and temporary facilities.
- Manitoba Transportation and Infrastructure's commitment to working with stakeholders, the public and rights-holders to mitigate disruptions in areas for specific land and resource use and providing timely communication about Project activities and about possible restrictions.

During the construction and decommissioning period of temporary works, Manitoba Transportation and Infrastructure will maintain communication with rights-holders and local residents. Information will be distributed through established public communication platforms, such as Manitoba Transportation and Infrastructure's Project Website, monthly newsletters and other media used to enable effective and timely delivery to affected or interested parties. Regular construction and construction activity updates will also be provided to the Environmental Advisory Committee (EAC) at regular frequency. Additionally, Manitoba Transportation and Infrastructure has developed a draft Complaint Resolution Process (CRP) intended to collect, respond to, and resolve any Project-related complaints.

2.1 Contact Persons

Manitoba Transportation and Infrastructure, as the Owner, is responsible for implementing, monitoring and amending the environmental aspects of the Project. The overall Project organization structure is outlined in Section 2.2 of the EMP Framework. The Manitoba Transportation and Infrastructure Inspectors will monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction, operation and/or maintenance activities and associated works for the Project, and will oversee daily activities. These individuals will be supported by advice from a Manitoba Transportation and Infrastructure technical support team comprised of off-site environmental and design personnel. Manitoba Transportation and Infrastructure will coordinate information sharing between on-site activities and off-site support teams.

Throughout the construction phase, Manitoba Transportation and Infrastructure will be the main contact for communications between the construction team and rights-holders and local residents. Manitoba Transportation and Infrastructure will be responsible for maintaining regular communications and will facilitate communication between the construction site staff and the local communities, including keeping the EAC apprised of Project activities.

The Contractor is responsible for informing Manitoba Transportation and Infrastructure of their schedule to perform construction-related activities and when decommissioning of temporary construction works would begin. Prior to decommissioning, and as required, Manitoba Transportation and Infrastructure will provide rights-holders and members of local communities with information about any Project activities and restrictions that will be put in place for overall public safety. Manitoba Transportation and Infrastructure will work collaboratively on measures to address community concerns.

If decommissioning of Project-related infrastructure is required during the operations phase, Manitoba Transportation and Infrastructure will provide timely communication to stakeholders, the public, and rights-holders about Project activities and restrictions that may be put in place for overall public safety on an as-needed basis.

2.2 Reporting

Upon completion of any decommissioning works the Contractor is responsible for ensuring the work is documented and reported to Manitoba Transportation and Infrastructure. If any soil sampling or remediation activities are required, all third-party reporting completed by Environmental Consultants should be included in the report submission. Reporting should generally include:

- Location of site.
- Description of decommissioning activities.
- Mitigation measures required for construction activities.
- Environmental monitoring plans and activities required for reclamation.
- Records of actions taken to address environmental incidents such as accidents, spills, leaks, and releases, the reporting and clean-up procedures used.
- Third-party reporting for any required environmental sampling or remediation activities.

3.0 CONSTRUCTION

As detailed in the Project EIS, the construction activities and accommodations required for the Project include, but are not limited to, temporary construction camps, waste disposal, temporary work areas, laydown areas and other ancillary infrastructure such as temporary construction access roads. The construction phase also includes transporting equipment, vehicles, machinery, construction materials and supplies to the Project site, as well as the preparation of equipment marshalling areas. Existing licensed and permitted quarry and borrow areas will be used as required and may remain after Project construction. Temporary facilities and work areas that will not be needed for future maintenance activities will be decommissioned and reclaimed at the end of the construction phase.

Site decommissioning requirements are described in Section 2.1.5 of the PERs. Quarry decommissioning requirements are described in Section 3.5 of the Quarry Management Plan (QMP). The Contractor will be responsible for decommissioning construction components as detailed in the following sections.

3.1 Designated Areas

Proposed Designated Areas required to complete components of the Project will be submitted by the Contractor for review and acceptance by the Engineer prior to the development and commencement of work. The Contractor is responsible for decommissioning and restoring the Designated Areas not required for on-going maintenance. Decommissioning of Designated Areas, temporary facilities and work areas, shall be conducted in accordance with applicable legislation, regulations, permits, approvals, authorizations or licenses. Temporary facilities and work areas that will not be needed for future maintenance activities will be decommissioned and reclaimed following the construction phase by the Contractor.

As described in the PERs (Section 2.1), Designated Areas include, but are not limited to the following:

- Laydown and Staging Area(s)
- Waste Storage Area(s)
- Fuel Storage and Refueling Area(s)
- Equipment Servicing Area(s)
- Work Camp(s)
- Parking Area(s)
- Cement Batch Plant(s)
- Quarry and Borrow Sites
- Cement Washout Area(s)
- Other Designated Areas (as required by Manitoba Transportation and Infrastructure)

During decommissioning of the Designated Areas, the Contractor is required to complete the following:

- Dismantle and/or remove buildings, outbuildings, above-ground storage tanks and associated infrastructure.
    - Dismantling of buildings will include disconnecting services such as potable water and septic holding tanks and removal of associated infrastructure.
    - Dismantling electrical and telephone services including removal of overhead lines, poles and transformers.
- Remove and clear non-hazardous debris, construction waste and solid waste to existing permitted waste disposal sites in accordance with the Contractor's Waste Management Plan.
    - Removal of hazardous materials will be handled by licensed contractors and in accordance with specific legislation and the Waste Management Plan.
- Collect soil samples in areas with fuel storage or refueling, hazardous substance handling or vehicle or heavy equipment parking.
    - Should soil concentrations result in exceedances above applicable criteria the area will be fully remediated (i.e., below Canadian Council of Ministers of the Environment [CCME] guidelines).
- Collect soil samples in areas that were used for cement/concrete washout.
    - Should soil concentrations result in exceedances above applicable criteria the area will be fully remediated (i.e., below CCME guidelines).
- Level areas to natural or pre-existing grade and slope and restore to original condition, where possible.
- Provide signage and flag persons at the site as part of the decommissioning and reclamation activities if the activities pose a risk to the safety of local residents.
- Redistribute topsoil and other organic materials to encourage natural vegetation and regeneration.
- Re-seed, as required, following the Revegetation Management Plan developed for the Project.
    - Should re-seeding be required, and when conditions permit, re-seeding should be completed following grading, capping and trimming operations. If conditions do not permit re-seeding immediately, the Contractor is responsible to re-seed the next growing season. Seeding operations should not be carried out during high wind events, snow cover, ice conditions or in standing water.

Decommissioning of Designated Areas will also follow the details outlined in the following topic specific EMP plans (as applicable): Access Management Plan (AMP), Dust Control Plan, Surface Water Management Plan (SWMP), CEMP (for waste management and hazardous materials management), and QMP.

3.2 Access Roads

Temporary construction roads within the right-of-way for the Project that are not required for the operation and maintenance phases will require removal (Figure 1). The Contractor is responsible for leveling the roads to the natural or pre-existing grade and slope and restoring the site to original conditions, where possible. Any granular material will require stripping and removal from the site. Temporary construction roads will be contoured, de-compacted and trimmed to encourage natural vegetation. If the public will be affected during the decommissioning of any temporary construction roads the Contractor will require signage or flag persons to support the health and safety of workers and residents in the area.

Any existing or constructed roads that are required as part of the Project that will be used during the operation and maintenance phases of the project are not required to be decommissioned.

3.3 Quarry Areas

Reclamation of quarry and borrow areas will occur following the completion of construction if the sites are no longer needed for operation and maintenance. The remediation and reclamation of quarry and borrow areas will follow those measures in place at the time of remediation/decommissioning and in full compliance with legislation and regulatory standards as detailed in the QMP.

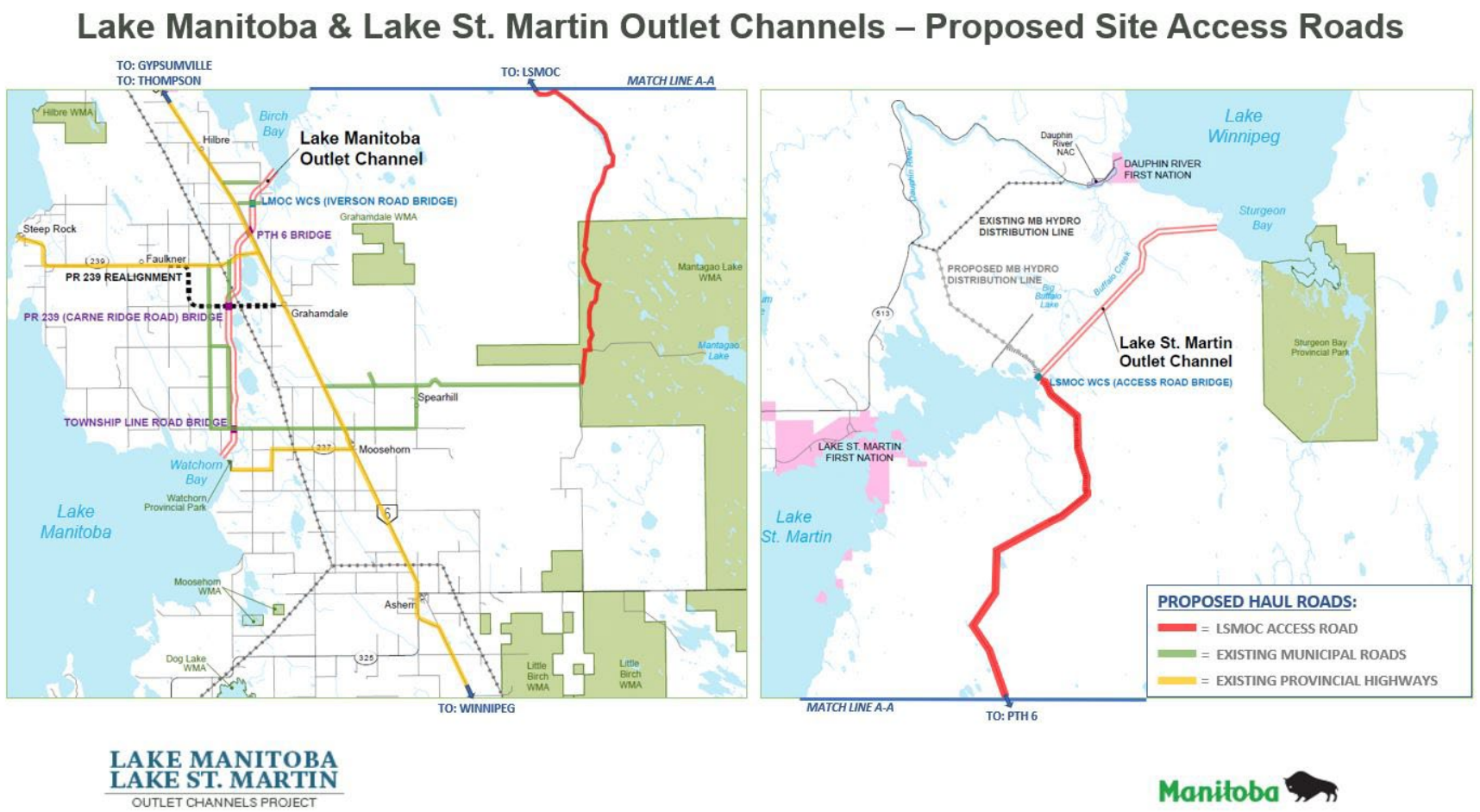


Figure 1: Access Roads within the LSMOC Right-of-Way

4.0 OPERATION

As stated in the Project EIS, the operation phase of the Project is expected to be indefinite. The Project components will be permanent infrastructure, will be maintained and not be decommissioned. Major maintenance or upgrade activities that require designated areas, construction of temporary construction roads or use of a quarry or borrow areas will be required to follow decommissioning details outlined in Sections 3.1, 3.2 and 3.3.

As indicated, if decommissioning of the proposed Project is required at a future date, a decommissioning plan consistent with the environmental conditions and regulatory requirements at that time would be developed for federal and provincial review prior to implementation.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Operation Environmental Management Program

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Licensing and Authorization 2

1.2 Project Description 2

1.3 Applicable / Related Documentation 5

2.0 PRIMARY RESPONSIBILITIES 6

2.1 Contract Administrator 8

2.2 Contractor 8

3.0 KEY ACTIVITIES AND POTENTIAL ENVIRONMENTAL EFFECTS 10

3.1 Regular and Ongoing Maintenance 10

3.1.1 Cleaning / General Upkeep 10

3.1.2 Mechanical Equipment Maintenance 11

3.1.3 Road Maintenance and Snow Clearing 11

3.1.4 Removal of Debris in Channel 11

3.1.5 Removal of Wastewater from Septic System 12

3.1.6 Installation and Removal of Navigational Boom / Buoys 12

3.2 Earthwork Repairs 12

3.3 Vegetation Maintenance 13

3.3.1 Maintaining Success of Re-Vegetation 13

3.3.2 Control of Nuisance Vegetation and Noxious Weeds in Channel and Outside Drains 13

3.4 Operating WCSs to Convey Flood Waters 14

3.5 Additional Potential Environmental Effects 14

4.0 ENVIRONMENTAL MANAGEMENT AND PROTECTION 16

4.1 Atmospheric Environment 16

4.2 Soil 17

4.3 Groundwater 17

4.3.1 Regional Groundwater Description 17

4.3.2 Potential Effects on Groundwater During Operation 18

4.3.3 Management Measures 19

4.4 Surface Water 20

4.5 Ice 21

4.6 Erosion and Sediment Control 21

4.7 Fisheries and Aquatic Ecosystem 23

4.8 Vegetation 25

4.9 Wildlife 26

4.9.1 Loss of Habitat or Disturbance to Wildlife During Operation 26

4.9.2 Disturbance During Maintenance Activities 26

4.9.3 Wildlife Interaction with Vehicles 27

4.9.4 Increase of Hunting Pressure 27

4.10 Land and Resource Use 27

4.11 Heritage Resources 27

4.12 Materials and Waste Management 28

4.13 Emergency Spill Response and Reporting Procedures 29

4.14 Fire Prevention and Response Procedure 30

5.0 COMMUNICATION 32

5.1 Public Advisement of Operation 32

5.2 Communication During Onsite Inspections and Maintenance 32

5.3 Environmental Concerns 32

6.0 TRAINING AND AWARENESS 33

7.0 MONITORING 34

7.1 Monitoring 34

7.2 Reporting 35

APPENDIX 1 37

APPENDIX 2 46

List of Tables

Table 1-1: Applicable Federal and Provincial Legislation

List of Figures

Figure A: EMP Process

Figure 1: LMOC Location

Figure 2: LSMOC Location

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Operation Environmental Management Program (OEMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under The Environment Act, the federal Decision Statement issued under the Canadian Environmental Act 2012, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of The Environmental Act provincial licence, Canadian Environmental Assessment Act 2012 federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

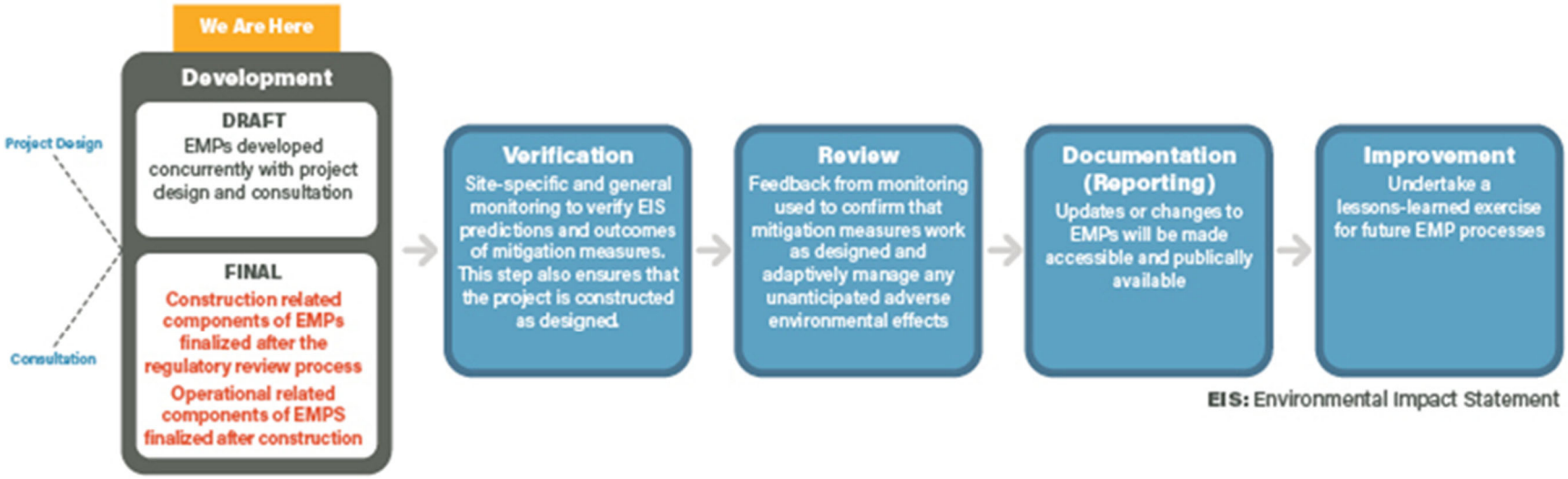


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AEMP	Aquatic Effects Monitoring Plan
AMP	Access Management Plan
BMP	Best Management Practices
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
DFO	Fisheries and Oceans Canada
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ERP	Emergency Response Procedures
GWMP	Groundwater Management Plan
HRPP	Heritage Resources Protection Plan
IMP	Ice Management Plan
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MECP	Manitoba Environment, Climate and Parks
O&M	Operation and Maintenance Manual
OEMP	Operation Environmental Management Program
PDA	Project development area
PER	Project Environmental Requirements
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan

SMP	Sediment Management Plan
SOCC	species of conservation concern
SWMP	Surface Water Management Plan
WCS	water control structure
WHMIS	Workplace Hazardous Materials Information System
WMP	Wildlife Monitoring Plan

Glossary of Terms

Aquatic biota: Organisms temporarily or permanently living or found in water.

Aquatic ecosystem: All living organisms in an area of a lake, river, wetland or other waters and the non-living components of the environment upon which they depend, as well as all their interactions, both among living and non-living components.

Aquifer: A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

Aquitard: A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.

Artesian aquifer: A body of rock or sediment containing groundwater that is under greater than hydrostatic pressure: that is a confined aquifer. When an artesian aquifer is penetrated by a well, the water level will rise above the top of the aquifer; a flowing artesian well is when the water level will rise above ground surface.

Baseflow: The portion of the streamflow that is sustained between precipitation events, fed to streams by delayed pathways.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Biodegradable: A substance or object capable of being decomposed by bacteria or other living organisms.

Carbonates: A rock made up primarily of carbonate minerals (minerals containing the CO3 anionic structure). Examples include: limestone, dolostone, and marble (metamorphosed limestone or dolomite) are the most commonly encountered carbonate rocks.

Carbonate aquifer: See Aquifer; see Carbonates. Refers to an aquifer comprised of a carbonate bedrock.

Cofferdam: An enclosure, usually only partially obstructing a river, from which water is pumped to expose the bottom to permit construction.

Confined aquifer: An aquifer that is bounded above and below by formations of distinctly lower permeability than that of the aquifer itself. An aquifer containing confined ground water. See artesian.

Contract Administrator: refers to the individuals, entities or groups delegated by Manitoba Transportation and Infrastructure to provide professional Engineering and Consulting Services for the Permanent Outlet Channels Project. This includes oversight of construction and maintenance contracts and operations; review of contractor submittals, plans and proposals for compliance with Project commitments and restrictions and making recommendation for acceptance or rejection of such plans by the Owner; and monitoring, inspecting, documenting and enforcing compliance with contractual and regulatory requirements.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Deleterious substance: A substance which, if administered, would likely cause bodily injury. In terms of the *Fisheries Act*: "Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or (b) any water that contains a substance in such quantity or concentration, or that has been so treated processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water".

Depressurization: Action of decreasing hydrostatic pressure. Active depressurization involves the use of pumps. Passive depressurization does not involve the use of pump, but rather uses a relation between hydrostatic pressure elevation and topographic elevation.

Detailed Design: The Project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental and traffic control aspects of the Project to support the structural design of the bridge or structure.

Dewatering: Removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dolomite: A sedimentary rock composed mostly of dolomite [CaMg (CO3)2] which often forms from limestone as the calcium is partly replaced by magnesium, usually as water solutions move through the limestone.

Domestic well: A water well used to supply water for the domestic needs of an individual residence or systems of four or fewer service connections.

Entrainment: Fish (larval or adult) that are carried on a current and cannot escape; at weirs or hydroelectric dams often refers to entrainment over or through the man-made structure (e.g., powerhouse flow).

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Flowing well: A well that has a static water level above the gradient ground surface (where water pressure in an aquifer causes water level to rise above the ground surface).

Glaciolacustrine: Pertaining to, derived from, or deposited in glacial lakes; especially said of the deposits and landforms composed of suspended material brought by meltwater streams flowing into lakes bordering the glacier, such as deltas, kame deltas, and varved sediments.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Groundwater quality: Refers to the chemical composition of groundwater and its suitability for various uses. Varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current land use practices that may contribute anthropogenic effects.

Groundwater recharge: The natural or intentional infiltration of surface water into the zone of saturation. Groundwater recharge occurs either naturally as the net gain from precipitation, or artificially as the result of human influence.

Inspector: refers to the individuals or designated representatives delegated by Manitoba Transportation and Infrastructure to monitor, inspect, document, and enforce compliance with contractual and regulatory requirements associated with the construction and/or maintenance activities and associated works for the Project.

Aquatic Invasive species: Aquatic or plant species that are growing outside the country or region of origin and outcompeting or replacing native species.

Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Piezometric head/pressure: A measurement at a discrete location expressing the potentiometric surface which is an imaginary surface representing the pressure of groundwater in an aquifer that is defined by the level to which water will rise in a well.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase is the design process

typically supports the pre-construction engagement and consultation process with the public and Indigenous groups, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Quarry: An open excavation or pit from which stone, gravel or sand is obtained by digging, cutting or blasting.

Quarry Permit: A permit issued for the production of a specified quantity of Crown quarry mineral (Quarry Minerals Regulation 1992).

Recharge: Water added to an aquifer or the process of adding water to an aquifer.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under Section 35 of the Constitution Act 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

Riparian vegetation: Vegetation growing along the banks of rivers and streams, at the interface between water and land.

Riprap: A stone covering used to protect soil or surface bedrock from erosion by water or the elements.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Species of conservation concern: Species that are tracked either federally (*Species at Risk Act*, Committee on the Status of Endangered Wildlife in Canada), or provincially (*The Endangered Species and Ecosystems Act* and Manitoba Conservation Data Centre), and are considered rare or at risk of extinction.

Suspended sediment: Particulate matter that is held in the water column due to movement of the water.

Technical Support Team: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure to provide specialized technical support services for Project construction, maintenance or operation. Specialized support may include, but is not limited to design, contracting, contract disputes, auditing, inspections, construction methods and sequencing

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Turbidity: A measure of the relative clarity of water.

Water table: The upper surface of the zone of saturation in an unconfined aquifer.

Wetted width: The width of a stream fully covered by water.

Wetland: Refers to:

> (a) a marsh, bog, fen, swamp or ponded shallow water, and
>
> (b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

1.0 INTRODUCTION

The Operation Environmental Management Program (OEMP) has been prepared as part of the design, tendering and contract administration of the Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) for Manitoba Transportation and Infrastructure. This OEMP has been prepared based on industry standard practices and the description provided in Section 3.7 of the Project Environmental Impact Statement (EIS) for the Project. Contractors required to support activities related to Lake Manitoba Outlet Channel (LMOC) or the Lake St. Martin Outlet Channel (LSMOC) substantial repairs of supporting infrastructure will be required to abide by the procedures and measures identified within this OEMP.

During the operation and maintenance phase (post-construction), the LMOC and LSMOC will be in a stand-by status (gates closed) during periods of non-flood conditions. Maintenance activities on channel and water control structure (WCS) infrastructure, in accordance with the Operation and Maintenance Manual (O&M Manual), will be completed during these stand-by periods. These maintenance activities, as well as general operation activities, have potential to result in adverse effects on the environment.

The purpose of the OEMP is to describe the environmental management processes and measures that will be implemented to minimize environmental effects during operation (gates open or gates closed) of the LMOC and LSMOC and from required maintenance. The OEMP describes Manitoba Transportation and Infrastructure's commitment to protection of the environment and compliance with the various federal and provincial environmental regulatory requirements and promotes Best Management Practices (BMP) for environmental protection. It organizes the various mechanisms required to confirm that the environmental management measures are executed, monitored, evaluated for effectiveness and that any required information is reported to Manitoba Transportation and Infrastructure for adjustments. The OEMP describes the responsibilities of the various parties involved, provides a summary of potential activities related to the operation phase of the LMOC and LSMOC and the subsequent potential environmental effects, and discusses the applicable environmental management measures, monitoring and reporting procedures.

The environmental management measures described herein, and in the specific or targeted management plans, are derived from Manitoba Transportation and Infrastructure's corporate, environmental and safety policies, Manitoba Transportation and Infrastructure's Project Environmental Requirements (PER) and environmental protection plans and incorporate other BMPs. Many of the topic specific management plans are interrelated and rely on each other for management and monitoring aspects. These topic specific management plans will also include references to other documents that will be developed to support the topic further.

This OEMP is a preliminary version based on the current stage of design and will be expanded and updated during the detailed design, tender, and construction phases of the Project. The updates and finalization of the OEMP will reflect the construction and as-built information, requirements of the environmental approvals, permits and licenses, input from the O&M Manual, and other applicable documentation. The OEMP is a living document that will be reviewed and updated by Manitoba Transportation and Infrastructure on a regular basis as the Project is operated.

1.1 Licensing and Authorization

The proposed Project is a designated project under the *Canadian Environmental Assessment Act*, 2012 (CEAA, 2012), and therefore requires an Environmental Assessment. Pursuant to Section 15(d) of the CEAA, 2012, the Impact Assessment Agency of Canada is the authority responsible for federal review of the proposed Project under this act and issued Guidelines for the Preparation of an EIS for the Project. Other key federal legislation, under which approvals may be required, includes the *Fisheries Act*, *Canadian Navigable Waters Act*, *Migratory Birds Convention Act* and *Species at Risk Act*.

The proposed Project is considered a 'Class 3' development under the *Classes of Development Regulation* (164/88) of *The Environment Act* (Manitoba) and therefore requires an *Environment Act* Licence. Manitoba Environment, Climate and Parks' (MECP) Environmental Approvals Branch is the authority responsible for provincial review of the proposed Project and provided EIS Guidelines for the Project. In addition to addressing the EIS Guidelines, provincial permits related to operation of the Project will be required under several acts to address various Project activities, such as *The Mines and Minerals Act* (maintaining quarries for maintenance activities, as required), and *The Dangerous Goods Handling and Transportation Act* (petroleum storage tanks). Federal and provincial legislation relevant to the proposed Project is summarized in Appendix 1.

1.2 Project Description

The Project will consist of the LMOC, the LSMOC and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure. A detailed description is provided in the EMP Framework document. The Project location is shown on Figure 1 and Figure 2.

The LMOC is located within the Rural Municipality (RM) of Grahamdale in Manitoba's Interlake Region, approximately 220 kilometres (km) northwest of the City of Winnipeg. It will run from Watchorn Bay on Lake Manitoba northeast to Birch Bay on Lake St. Martin and will primarily be located on private agricultural lands that will be purchased. There are more than 60 residences within 3.0 km of the LMOC, the nearest of which is approximately 0.5 km from the proposed channel. The communities of Moosehorn and Pinaymootang First Nation (FN) are located approximately 10.9 km and 9.3 km respectively, from the LMOC. The channel intersects portions of 26-8-W1, 27-8-W1, 28-8-W1, and 29-8-W1. The approximate UTM coordinates (North American Datum 1983) Zone 14 U are 5681518 N 529841 E for the inlet and 5704032 N 534074 E for the outlet.

The LSMOC is located approximately 220 km northwest of the City of Winnipeg in Manitoba's Interlake Region between the northeastern most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg. This area is currently considered semi-remote as road access is seasonal, with the nearest permanent residence located approximately 6.1 km from the channel in Dauphin River FN. Dauphin River FN and Lake St. Martin FN reserve boundaries are located approximately 4.6 km and 12.0 km respectively, from the LSMOC. The LSMOC will occur entirely within Crown land, which is located within the area covered by Treaty No. 2. The channel intersects portions of 32-5-W1, 32-6-W1, 33-5-W1 and 34-4-W1. The approximate UTM coordinates (North American Datum 1983) Zone 14 U are 5738284 N 557122 E for the inlet and 5751400 N 572725 E for the outlet.

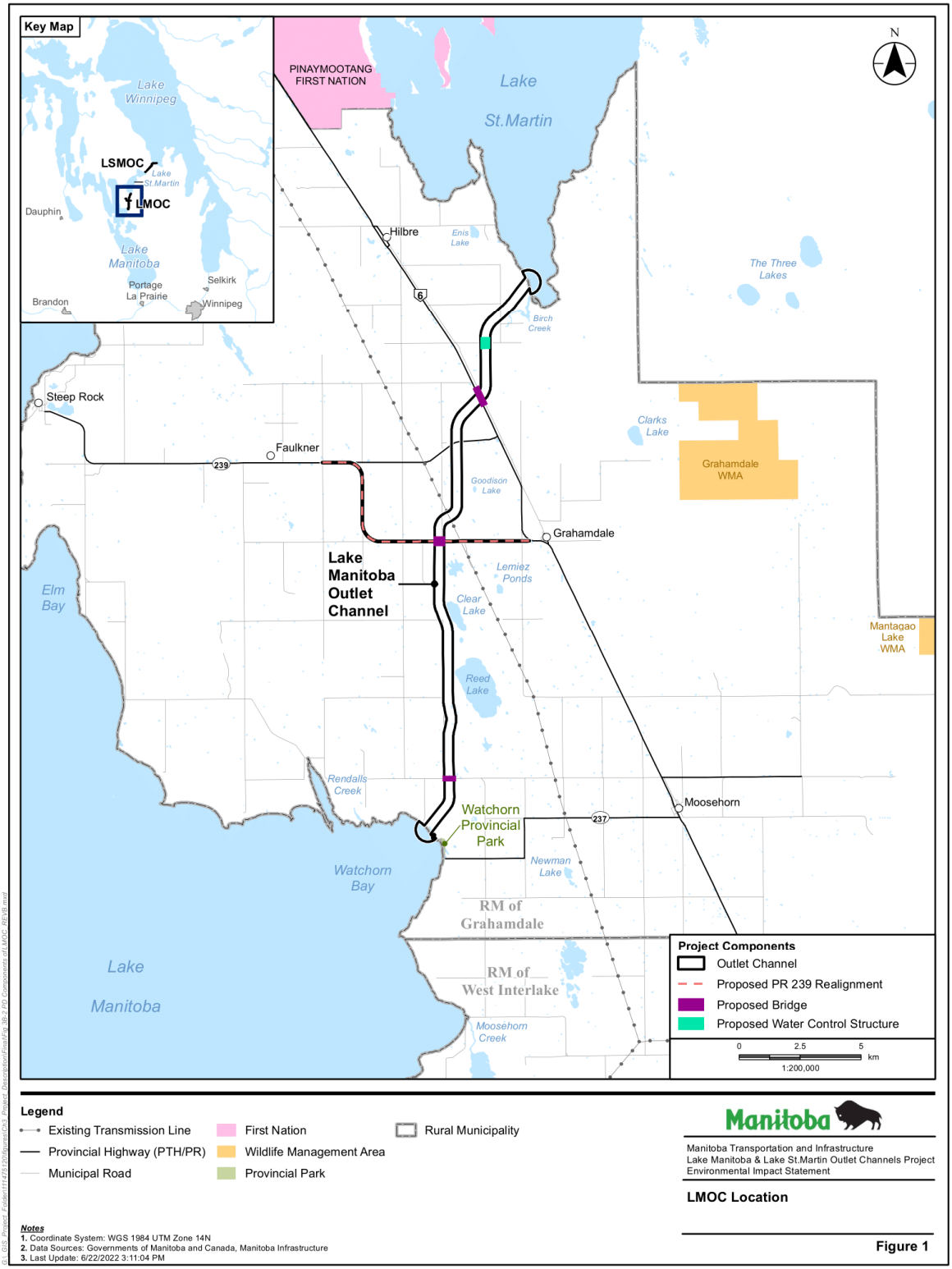


Figure 1: LMOC Location

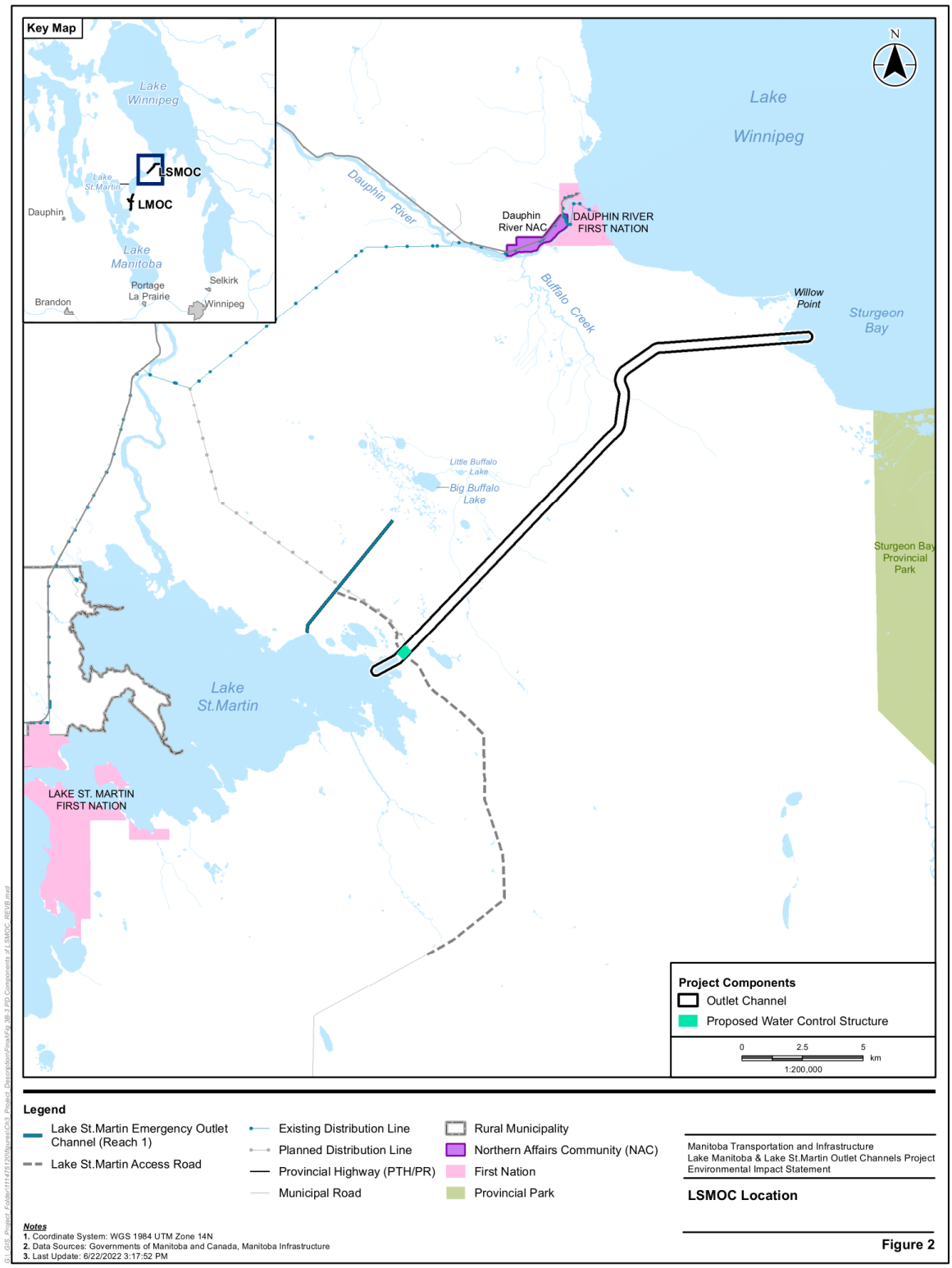


Figure 2: LSMOC Location

1.3 Applicable / Related Documentation

The OEMP is supported by several specific or targeted management plans that have been submitted as separate documents, with the exception of Waste Management, Hazardous Materials Management and Emergency Response which are described in greater detail within this document. As listed in Section 3.7.2 of the Project EIS these targeted management plans include:

- Management Plans:
  - Project Environmental Requirements;
  - Access Management Plan (AMP);
  - Quarry Management Plan;
  - Sediment Management Plan (SMP);
  - Surface Water Management Plan (SWMP);
  - Groundwater Management Plan (GWMP);
  - Revegetation Management Plan (RVMP);
  - Agricultural Biosecurity Management Plan;
  - Dust Control Plan (DCP);
  - Waste Management Plan;
  - Hazardous Materials Management Plan;
  - Emergency Response Procedures (ERP);
  - Ice Management Plan (IMP);
  - Heritage Resources Protection Plan (HRPP);
  - Complaint Resolution Process, and
  - Site Decommissioning Plan.
- Monitoring Plans:
  - Inspection and compliance monitoring (part of the SWMP, SMP and GWMP)
  - Aquatic Effects Monitoring Plan (AEMP)
  - Wildlife Monitoring Plan (WMP)
  - Wetland Monitoring Plan

In addition to the specific management plans, O&M Manuals for the LMOC and LSMOC will be developed that will detail the technical aspects of the required activities, as well as Project-specific restrictions respecting how such work is to be completed. The Operating Guidelines for the Project, the OEMP, and associated management plans will help guide the manner to which the outlet channels are operated and maintained.

2.0 PRIMARY RESPONSIBILITIES

All parties involved in this Project need to be aware of their responsibilities so that the OEMP is effectively and efficiently implemented and therefore, maximize environmental protection at the Project site. The primary responsibilities of the various parties are listed in the following sections; however, these roles and responsibilities will be verified and modified as required when construction is nearing completion. Operation of the Project is governed in part by the regulatory conditions described in Section 1.3, when received, which defines Manitoba Transportation and Infrastructure as being responsible for the construction, maintenance and operation of the Project and other environmental approvals, when received.

Manitoba Transportation and Infrastructure will be the overall Owner, responsible for implementing, monitoring and amending the environmental aspects of the Project. As the proponent and owner of the Project, Manitoba Transportation and Infrastructure will be responsible for ensuring that the appropriate environmental protection measures, including BMPs, are adhered to during activities related to operation of the Project. To help avoid and control communicable diseases (including COVID-19) within its work-places and worker accommodations, Manitoba Transportation and Infrastructure will adhere to Manitoba Public Health Orders. Manitoba Transportation and Infrastructure will be responsible for providing relevant plans, such as the PERs and management plans, to Manitoba Transportation and Infrastructure's operation and maintenance personnel and any prospective Consultants and Contractors that will be working on site once the LMOC and LSMOC projects are established and operational.

The Owner, or a designated alternate, will coordinate with on-site personnel (Manitoba Transportation and Infrastructure personnel or Consultant/Contractor). The Owner and/or designated alternate will be supported by advice from a Manitoba Transportation and Infrastructure Technical Support Team comprised of environmental, health and safety, and design personnel. The Owner will coordinate information sharing between on-site activities and off-site support teams. The Owner, with the support of the Technical Support Team, will also have the following responsibilities under the OEMP:

- Liaise with the Federal Responsible Authorities and Manitoba Regulators concerning authorization requirements, monitoring and follow-up.
- Maintain a *Water Rights Act* authorization from Manitoba Water Stewardship for the purpose of removing water from groundwater monitoring wells and for water use at the WCS.
- Maintain a *Water Rights Act* authorization from Manitoba Water Stewardship for operation of the LMOC and LSMOC WCS and Channel.
- Attain a Live Fish Handling Permit in the event that fish salvage activities are required during operation.
- Provide approval, based on discussions with Manitoba Transportation and Infrastructure Environment, in cases where a Consultant / Contractor suggests methods to achieve a particular goal or objective that differ from those stated in applicable documentation.

Should infrastructure maintenance be required, as the Owner, Manitoba Transportation and Infrastructure will utilize a similar framework to that employed during the construction phase, with Contract Administrators, Inspectors and Contractors (as required or applicable). Manitoba Transportation and Infrastructure will coordinate information sharing between on-site activities and off-site support teams. Manitoba Transportation and Infrastructure, as the Owner, will have the following responsibilities:

- Inspect for compliance with the requirements outlined in permits and/or authorization associated with the Project.
- Inform the Technical Support Team and Contractor of appropriate environmental requirements and provide them a copy of relevant permits / authorizations.
- Inspection and maintenance of ancillary structures, including vegetation management.
- Check that site specific plans outlined by a maintenance Contractor are appropriate and environmentally responsible.
- Monitor maintenance work sites and equipment and document to verify that the PERs, environmental specifications and environmental management measures (e.g., containment, spill response) are implemented and that the site is maintained in accordance with the Contract Documents.
- Meet with maintenance Contractors accessing the site and request that regular updates be provided regarding progress on the environmental components of the maintenance work.
- Initiate and hold meetings as required to advise the maintenance Contractor of deficiencies in the environmental management measures, to address the deficiencies, and direct the Contractor to take appropriate and timely corrective action.
- Liaise with the Contractor and Technical Support Team regarding deficiencies in the environmental management measures implemented, contract documents or in other environmental matters that involve the Contractor.
- In cases of recognized non-compliance with the legal requirements, or where a Contractor fails to take appropriate timely measures to protect the environment, or fails to correct recurring deficiencies, direct the responsible party to suspend work until the appropriate measures have been met, and immediately contact the necessary regulators.

Manitoba Transportation and Infrastructure is responsible for operation of the WCS and ancillary structures (e.g., bridges, booms and buoys) associated with the LMOC and LSMOC. This responsibility includes:

- Pre-flood inspection of each WCS and preparation of each WCS for onset of spring flood flows and for overwintering.
- Operation of WCS systems and components including raising and lowering the gates of the WCS.
- Notifying the public and implementing safety measures during WCS operation.

2.1 Contract Administrator

Upon completion of the LMOC and LSMOC construction contracts, Contract Administrator responsibilities may fall to Manitoba Transportation and Infrastructure or a designated alternative.

The Contract Administrator will perform the following functions to manage environmental protection during the administration of the contract:

- Be familiar with the appropriate environmental requirements applicable to maintenance of the Project.
- Where applicable, review the Contractor's pre-work submittals to determine if they are appropriate for the anticipated site conditions.
- Liaise with Manitoba Transportation and Infrastructure to address concerns with the proposed contractor submittals (as required).
- Assist with monitoring the work site to confirm the Contractor implements environmental management measures and maintains the site in accordance with the Contract Documents.
- Forward required reports received from the Contractor to the Owner.
- While on site, notify the Owner of recognized non-compliance with the legal requirements or where the Contractor fails to take appropriate timely measures to protect the environment or fails to correct recurring deficiencies, so that the Owner can determine the need and/or extent of cessation of work associated with the particular incident. The Contract Administrator will issue an immediate cease work order in the event of a non-compliance that will have an immediate and severe effect on the environment.
- Immediately notify the Manitoba Transportation and Infrastructure Technical Support Team of orders to suspend work, or of environmental incidents, complaints or enquiries.

2.2 Contractor

Manitoba Transportation and Infrastructure will likely tender substantial maintenance and repair works to Contractors. Project Contractors will be responsible for implementing environmental management measures required to conduct maintenance activities for the continued operation of the Project. To manage environmental protection during operation and maintenance activities, Contractors will perform the following functions:

- Obtain relevant permits (as required) to conduct their work (e.g., Crown Lands work permits, quarry permits, etc.). Environmental permits or approvals obtained by the Contractor and any amendments will be identified and submitted to the Contract Administrator for compliance and record keeping purposes.
- Provide training for staff and confirm Subcontractors are trained and empowered to identify, address and report potential environmental problems. Training and orientation sessions will be documented, and copies provided to the Contract Administrator to document compliance with the Project EIS
- Confirm that Subcontractors are familiar and comply with the related Contract Documents.
- Confirm adherence to environmental permits.

- Implement the environmental management measures, maintain environmental control and protection devices, and monitor the site for the effectiveness of the environmental management measures in accordance with the related Contract Documents and documentation requirements.
- Maintain a record file at the site in which relevant information relating to materials handling, spills, leaks, releases, and the implementation and adjustment of the environmental management measures is documented. Relevant information and/or significant events are to be documented and provided to the Contract Administrator in a timely fashion.
- Immediately report environmental incidents (e.g., spills, species at risk, nuisance wildlife, aquatic invasive species, wildfires) to the Owner, Contract Administrator, or Inspector so that the proper authorities can be notified and provide a copy of the incident report to the Owner, Contract Administrator and/or Inspector (as appropriate). The Contractor will also be responsible for meeting reporting requirements for permits they hold.
- Take action when it is identified that a violation of environmental regulation or a considerable impact to the environment will occur, such as work shut down, in consultation with the Contract Administrator, Inspector and/or Owner.
- Attend meetings initiated by the Contract Administrator or Owner to address concerns or deficiencies in the environmental management measures and follow-up on direction provided to take appropriate and timely corrective action.
- Requests for a change in environmental management measures initiated by the Contractor will be forwarded to the Contract Administrator for review and recommendation, and submitted to Manitoba Transportation and Infrastructure for consideration and approval relative to Project requirements and approval conditions.

3.0 KEY ACTIVITIES AND POTENTIAL ENVIRONMENTAL EFFECTS

Activities associated with operation and maintenance of the LMOC and LSMOC and related infrastructure (access roads, drainage control structures, etc.) will be described in the O&M manuals for each channel that will be developed upon completion of the construction phase of the Project. The activities listed below have potential to cause adverse environmental effects or are required to maintain established environmental measures for the Project. Corresponding mitigation measures for potential adverse environmental effects are described in Section 4.0 Environmental Management and Protection.

- Regular and ongoing maintenance:
  - Cleaning / general upkeep;
  - Mechanical equipment maintenance;
  - Road maintenance and snow clearing;
  - Removal of debris in channel;
  - Removal of wastewater from the LSMOC WCS septic system; and
  - Installation and removal of navigational booms / buoys.
- Earthwork repairs (erosion and sedimentation).
- Vegetation maintenance:
  - Maintaining success of re-vegetation;
  - Controlling nuisance vegetation and noxious weeds in channel and outside drains; and
- Operating the LMOC and LSMOC to convey flood waters.

3.1 Regular and Ongoing Maintenance

3.1.1 Cleaning / General Upkeep

To maintain the aesthetic conditions of the Project, some general cleaning and upkeep will be required. This may include:

- Upkeep of signage
  - Signage may fall or be removed by recreational users of the Project study area.
- Removal of illegal dumping
  - If materials are deposited on site by recreational users of the Project study area, these materials should be removed from site.
- General maintenance
  - Materials brought on site should be stored neatly.
  - Waste generated should be removed from site as this could attract wildlife.
  - Waste shall be disposed of at an approved and appropriate facility.
- Removal of graffiti
  - If graffiti occurs on structures related to the Project, it should be removed or covered.

3.1.2 Mechanical Equipment Maintenance

Mechanical components such as the WCS gates, hoists, ancillary buildings, and electrical systems, and gated culverts / flap gates, will require maintenance at periodic intervals. Potential adverse environmental effects associated with mechanical equipment maintenance are generally focused on soil compaction, contamination of soil and surface water from leaks and spills associated with vehicles used during maintenance activities, spills associated with onsite maintenance / repair of vehicles/construction equipment.

3.1.3 Road Maintenance and Snow Clearing

Access for the Project will use the existing Provincial and Municipal road network, which will be maintained by the respective responsible parties. However, maintenance and snow clearing may be required for access to specific areas along the channels.

Potential adverse environmental effects associated with maintaining access include impacts to groundcover vegetation during snow clearing, increased dust generation during road repair, soil compaction, contamination of soil and surface water from leaks and spills associated with vehicles used during maintenance activities, spills associated with onsite maintenance / repair of vehicles / construction equipment.

3.1.4 Removal of Debris in Channel

Large debris (natural woody debris, manufactured materials) may be carried with flood waters into the LMOC and/or LSMOC during periods where the WCS is opened / conveying flood water through the channel. Conveyance of flood water could also result in buildup of sediment within sections of the channel, particularly on the upstream side of drop structures within the LSMOC. During stand-by periods where the gates are closed, there is a potential for beavers to build dams and / lodges. Debris in the channel could impact conveyance of flows and would have to be removed. Clearing debris may result in:

- Disruption and destruction of fish from direct disturbance of material being removed and surrounding sediment.
- Sedimentation into the channels from work carried out along the side slopes.
- Contamination to soil and surface water from leaks and spills associated with vehicles use.

Mitigation measures to address these potential effects are described throughout Section 4.0.

3.1.5 Removal of Wastewater from Septic System

The LSMOC WCS will have a septic holding tank to collect wastewater, which will need to be emptied periodically during the operation and maintenance phase. The wastewater will be pumped from the holding tank in the ground into holding tanks on the back of transport vehicles and removed offsite by way of the access road. The routine maintenance activity of wastewater removal from the LSMOC septic tank could potentially result in:

- Contamination of soil and surface water from leaks and releases of septic / wastewater during pumping of holding tanks, or accidental release during transport offsite.
- Contamination to soil and surface water from leaks and spills associated with vehicles use.

Mitigation measures to address these potential effects are described in Sections 4.2 and 4.4.

3.1.6 Installation and Removal of Navigational Boom / Buoys

The inlet and outlet designs will include navigation safety measures such as warning signage and safety booms and buoys to delineate the regions of increased water velocities and to notify water users. It is anticipated that a boat will be used for the maintenance activity of inspecting and installation and removal, if required, of navigation safety booms and buoys.

Operation of a boat has the potential to adversely affect surface water quality associated with an accidental spill or leak of fuel and may facilitate conveyance of invasive or undesirable aquatic species, (zebra mussel, spiny water flea and toxic algae). Mitigation measures to address these potential effects are described in Sections 4.4 and 4.6, respectively. Additionally, operation of a boat is a worker health and safety concern. Conditions at the inlet or outlet prior to operation may present challenges for buoy or boom installation (e.g., ice conditions), which will be considered further at Detailed Design. A public safety assessment in accordance with the Canadian Dam Association Guidelines for Public Safety Around Dams will be undertaken at the Detailed Design stage to confirm and finalize all safety requirements that are required for the Project.

3.2 Earthwork Repairs

Extended operation of the channels during flood events and intense storm events has the potential to erode the side slopes of the channels and impact the rock structures (e.g., jetties, drop structures, riprap placement). This erosion could lead to sedimentation within the channels and downstream into Lake St. Martin and Lake Winnipeg. If channel and outlet damage is discovered to earthworks or rock structures during visual inspections of the inlet, these areas would be repaired by Manitoba Transportation and Infrastructure or a Contractor. The potential adverse effects related to earthwork and drop structure repair include:

- Disruption of fish at the inlet, within the channel and at the outlet from direct disturbance of material being removed and surrounding sediment.
- Sedimentation into inlet, channel, and outlet from work carried out along the side slopes.
- Contamination to soil and surface water from leaks and spills associated with vehicle and equipment use.
- Damage to channel/side slope integrity from wildlife (e.g., muskrat or beaver).

Mitigation measures to address these potential effects are described throughout Section 4.0.

3.3 Vegetation Maintenance

3.3.1 Maintaining Success of Re-Vegetation

Groundcover vegetation along / within the channels, including along the spoil piles, outside drains, and dikes, is a design criterion included to provide protection against erosion and sedimentation. Maintaining an established vegetation cover will ultimately limit deposition of sediment into the receiving waters in Lake St. Martin and Lake Winnipeg. Vegetation management will include inspection of the re-vegetation success in the first few years after completion of the construction phase, with maintenance activities in areas where erosion might be present, as described in the RVMP. Even when the channels are in standby (gates closed), precipitation has the potential to scour the channel banks leading to rills and valleys removing the vegetation. Operating the channels to convey flood waters has the potential to affect survival of vegetative groundcover, and scour / remove isolated areas along the channel. The potential adverse effects related to inspection and repairs of vegetation cover include:

- Sedimentation into channel from working along the side slopes.
- Contamination to soil and surface water from leaks and spills associated with vehicle and equipment use.

Mitigation measures to address these potential effects are described throughout Section 4.0.

3.3.2 Control of Nuisance Vegetation and Noxious Weeds in Channel and Outside Drains

Vegetation management will be required to control nuisance vegetation that can impact conveyance of flows through the channel and outside drains, and to control noxious weeds throughout the LMOC and LSMOC right-of-way (ROW). Vegetation management throughout operation of the channels will include monitoring and maintenance activities as described in the RVMP, to manage the presence and extent of noxious weeds as defined under *The Noxious Weeds Act*. Management of nuisance vegetation and control of noxious weeds through either herbicide or mechanical control (mowing / tilling) will be required on an as-needed / where-needed basis. Either the herbicide or mechanical control methods will require equipment on site that has the potential to result in increased compaction of soils and potential for leaks and spills that could impact soil quality and subsequent surface water quality in local creeks and downstream receiving waters. If herbicides / pesticides are used, there is a potential for adverse environmental effects to humans during application, storage and handling as these products may contain hazardous materials. As well, if herbicide / pesticides are not used appropriately, there is potential for these products to have an adverse effect on surface water quality and subsequently on aquatic biota within the channels, outside drains, proximal creeks, Lake St. Martin and Lake Winnipeg. Mitigation measures to address these potential effects are described throughout Section 4.0.

3.4 Operating WCSs to Convey Flood Waters

The Project EIS identified several potential adverse environmental effects related to operating the LMOC and LSMOC to convey flood waters through the channels. Some of the more notable of these potential adverse biophysical and socioeconomic environmental effects include:

- Stranding of fish and fish mortality in the LSMOC.
- Movement of suspended sediment-laden water into downstream receiving waters.
- Movement of bedload at the outlets and into Birch Bay and Sturgeon Bay.
- Groundwater-surface water interaction.
- Risk to human health and safety from increase in flows through channel.
- Risk to wildlife from increase in flows through channel.

3.5 Additional Potential Environmental Effects

This OEMP is a living document that will be updated as Project phases progress and will incorporate additional environmental effects and mitigation measures identified when additional public and Indigenous input is obtained and licensing and approval conditions are received. Additional potential adverse environmental effects related to operation and maintenance activities based on information that was included in the Project EIS are summarized as follows:

- Fugitive dust will be emitted from surface disturbance activities. Vehicle or maintenance equipment usage for maintenance operations would be a source of greenhouse gas and particulate emissions that will adversely affect the local air quality. Maintenance activities will also result in temporary and localized increased noise from heavy machinery and ambient light levels from portable lighting.
- There is a risk of deleterious substances during maintenance affecting the soil quality, seeping into the groundwater, or entering the surrounding waterbodies and negatively influencing terrestrial and aquatic species and habitat. Possible sources include fuel spills or releases from equipment operation, during refueling or improper storage and handling of fuel. Additionally, hazardous material spills may occur as the result of improper handling, use, or storage of these materials on-site and while being transported to site.
- The channels will result in changes to the existing groundwater conditions within the perched peat (around LSMOC), overburden clay/till, and confined bedrock aquifer piezometric pressure conditions along the channels. Potential effects will include changes in groundwater flows and levels and potentially quality through interaction with surface water. These conditions will persist during operation and maintenance and conveyance of flows through the channels during operation, which will increase the potential for groundwater surface water interaction.
- Clearing, excavation and other operation and maintenance activities could result in the release and transport of sediment and/or debris to waterways. Erosion due to precipitation and runoff can introduce sediment to the downstream receiving waterbodies, particularly at Birch Bay and Sturgeon Bay (outlet structures), which can negatively affect fish and fish habitat. Further, maintenance of the inlet and outlet and dredging of the lake beds (if required) has the potential to disturb and re-suspend sediment in Lake Manitoba (LMOC inlet), Lake St. Martin (LMOC outlet and LSMOC inlet) and Lake Winnipeg (LSMOC outlet).

- Operation of the channels will result in potential change in flow patterns of the Fairford River, Dauphin River and at the inlets and outlets resulting in potential impacts to fish passage.
- Fish health and mortality could potentially be affected during maintenance activities within or near water through the potential release of deleterious substances to streams and lakes adjacent to or downstream of the channels.
- The maintenance activities may facilitate conveyance of invasive or undesirable aquatic species, (zebra mussel, spiny water flea and toxic algae). For equipment used during in-water work, aquatic invasive species could be transported into the Project when equipment is initially brought to site, or from downstream to upstream locations once on site. The introduction and spread of invasive species can reduce the diversity and populations of native species and can modify habitat.
- During operation and maintenance activities, there is potential for increased wildlife mortality risk. Ground-nesting birds and species with decreased mobility (i.e., amphibians, small mammals) are most susceptible to direct mortality during maintenance activities such as removal of vegetative groundcover, reshaping and repairing of earthworks, excavating / dredging of channel.
- Increased traffic during maintenance activities has the potential to result in increased mortality risk to wildlife, including migratory birds, due to potential vehicle collisions.
- Maintenance activities have the potential to affect a change in wildlife movement by creating physical and sensory (noise, vibration, and light) barriers. During maintenance activities, noise and activity associated with heavy equipment and personnel is anticipated to deter wildlife for the short-term.
- Operation of the LSMOC will potentially impact traditional use areas for hunting, trapping, fishing, and gathering.
- Ground-disturbing maintenance activities, such as vegetation clearing and excavation in areas not disturbed during construction, have the potential to interact with heritage resources by subsurface disturbance and alteration of the horizontal and vertical locations of intact archaeological features or objects contained therein. This in turn has the potential to affect cultural and spiritual sites and sacred areas.
- Due to the potential storage of combustible materials or wastes, operation of internal combustion engines (e.g., vehicles, heavy equipment) and the presence of workers during maintenance activities, brush and wildfires could be ignited. In particular, the accumulation of slash during vegetation maintenance can contribute material for wildfires and hot combustion engines on vehicles driving over dry grass or fields can cause wildfires. An accidental fire could adversely affect air quality, vegetation, wildlife, land and resource use, infrastructure and services, economy, and human health.

The mitigation measures to address these potential effects are outlined in Section 4.0 of this OEMP with additional details provided in the various topic specific management plans.

4.0 ENVIRONMENTAL MANAGEMENT AND PROTECTION

The environmental management and protection measures described in the following sections are proposed to mitigate potential temporary and/or permanent impacts resulting from the operation and maintenance phase of this Project. Additional detail on mitigation measures that will be followed are provided in the various environmental management plans associated with the potential effect, e.g., SWMP and IMP. The manner to which these management and protection measures will be employed will be facilitated through the outcomes of inspections and monitoring outlined in Section 6.0. These management and protection measures are consistent with and augment the PERs.

4.1 Atmospheric Environment

As noted in the Project EIS, the effects on air quality during the Project operation and maintenance activities are expected to be lower in magnitude, duration, and extent than during the construction phase due to the reduced use of vehicles and equipment and the limited extent and infrequent nature of the activities.

Dust can be generated during operation and maintenance activities through driving on roads, road maintenance, earthwork and rock structure repair, and removal of materials from quarries, as required. Increased dust is not a concern during winter construction activities. Any activities that could generate dust that occur during non-frozen conditions will be conducted by methods that minimize the raising of dust. Manitoba Transportation and Infrastructure, or the Contractor completing the maintenance work, will implement dust control practices, as described in the Dust Control Plan, during activities such as excavation, and transporting of materials, to mitigate the generation of dust and other particulate matter. Vehicles used to haul materials to or from the work site will have the load covered with a tarpaulin cover during transport to minimize dust and prevent material from falling out. Material stockpiles or spoil piles prone to wind erosion will be maintained as to minimize release of particulate matter or dust. This will include, but is not limited to, covering or stabilization of material stockpiled at the work site as required. If required, the application of dust suppressants, preferably water, will be limited to the roadways, driveways or designated areas used for substantial maintenance and repair works. The amount of dust suppressant applied should not exceed the minimum amount required to effectively suppress dust and will be visually monitored to confirm excess does not pool or run-off and impact adjacent waterbodies.

To mitigate impacts to ambient air quality and reduce increased greenhouse gases associated with maintenance vehicle emissions, engines and exhaust systems will be properly maintained, vehicle idling times and cold starts will be reduced to the extent possible.

Due to the remote location of the LSMOC, there are no nearby residents that will be affected by the increased noise associated with heavy machinery and equipment during maintenance activities. However, the LMOC is located in a developed area such that nearby residents may be affected by the increased noise associated with heavy machinery and equipment during maintenance activities. In recognition of this, machinery and factory-supplied noise-abatement equipment (e.g., mufflers) will be maintained in good

working order and machinery idling will be minimized. Additionally, Manitoba Transportation and Infrastructure will implement a management process based on response to noise complaints (see Complaint Resolution Plan). Measures for mitigating the potential effects of noise and other sensory disturbance on wildlife are described in Section 4.8.

4.2 Soil

Soil quality in the Project development area (PDA) may be adversely affected during operation and maintenance from leaks and accidental spills or release of fuels or other hazardous substances. Mitigation to avert impacts to soil quality includes preventing leaks, spills, and releases by providing secondary containment for fuel and hazardous material storage, requiring drip trays for equipment, refuel and conduct maintenance only in designated areas and in accordance with the PERs, provide spill clean-up equipment and materials, and provide an emergency (spill) response plan. As well, speed limits will be abided by when hauling material to and from the Project site to avoid spills related to vehicular accidents. If a spill should occur, Manitoba Transportation and Infrastructure or the Contractor conducting the work would be responsible to provide notification within 24 hours and contaminated soil will be appropriately disposed of at a licensed facility or stored in a designated storage area to prevent secondary contamination. Quantities of hazardous materials removed will be recorded (e.g., weigh bills) and provided to Manitoba Transportation and Infrastructure. More details on measures to protect against and clean-up the potential accidental discharge of contaminants such as fuel, hazardous materials, hazardous waste and non-hazardous waste are discussed in Sections 4.11 and 4.12 of this OEMP.

Most maintenance activities will occur on previously constructed / disturbed ground with the possible exception of the development of new quarry areas, if required. Quarrying activity will result in the loss of soil and use of heavy equipment can result in soil compaction. Efforts will be made to avoid causing ruts and disturbing soil. Mitigation to avert impact include avoid working in area when ground is wet, if possible.

4.3 Groundwater

4.3.1 Regional Groundwater Description

LMOC

A confined carbonate bedrock aquifer (commonly referred to in Manitoba as the “Carbonate Aquifer System”) is present in the area of the LMOC, which is overlain by 5 metres (m) to 18 m of till. Artesian pressures are present in the vicinity of the LMOC, with piezometric heads that can typically be up to 5 m above the ground surface. The bedrock aquifer is recharged via rainfall and snowmelt regionally. Groundwater recharge areas local to the LMOC are from upland areas as well as from local recharge zones to the east and west of the LMOC. Groundwater flow in the carbonate aquifer is interpreted to be from the LMOC area towards Lake Manitoba and Lake St. Martin.

LSMOC

Two distinct groundwater systems are known to be present within the region of the LSMOC, within the upper saturated peat and the lower confined carbonate bedrock aquifer. The upper, saturated peat unit is perched above the clays (where present) and underlying till units. The peat is recharged directly from surface rainfall and snowmelt and the flows within the peat will be locally controlled. The water table within the peat is at or near ground surface, with an overall hydraulic gradient, including surficial flow, to the east. Glaciolacustrine clays/clay tills, and silt tills form a low permeability aquitard between the perched peat groundwater flow system, and the underlying confined carbonate bedrock aquifer system. Aside from regional surface water drainage patterns, the low permeability nature of the aquitard is a key element in maintaining perched water levels in the surficial peat and confined head in the bedrock aquifer and overlying silt till. The lower, confined bedrock aquifer is comprised of a Paleozoic rock sequence commonly referred to in Manitoba as the Carbonate Aquifer System. This aquifer system is isolated from the peat unit by the upper clay zone and underling tills.

The confined bedrock aquifer is recharged via rainfall and snowmelt regionally. Groundwater recharge areas local to the LSMOC are located on topographically high ground areas with thin sediment cover south of Lake St. Martin, and also to the southwest at the Lake St. Martin Narrows where there are bedrock outcrops at ground surface. There are several artesian groundwater spring sites in the vicinity of the LSMOC. These are important because they provide a natural pressure relief of the bedrock aquifer system in the region of the LSMOC. The groundwater flow system is interpreted to be bound by discharge to naturally occurring spring sites, to Lake St. Martin, and to Lake Winnipeg. Groundwater is also likely to discharge into the Dauphin River to the northwest and to the Mantagao River to the east.

4.3.2 Potential Effects on Groundwater During Operation

Operation of the channels will result in potential changes to the existing groundwater conditions within the perched peat (LSMOC only), overburden clay/till, and confined bedrock aquifer piezometric pressure conditions along the channels. These will include water level (pressure) changes in aquifers, potential water quality changes, and changes in the relationship of the groundwater aquifer discharge to the surface water system. In areas where the bedrock aquifer pressures are elevated relative to the thickness of the confining till aquitard units and weight of water above, there is a risk of basal heave/hydraulic fracturing of the till. This would induce a connection of the bedrock aquifer to discharge at the base of the excavation, possibly producing some uncontrolled groundwater discharge into the channel.

For the LSMOC, infiltration of surface water during operation of the channel may cause local and short-lived water quality or possibly bacteriological degradation of the regional bedrock aquifer resource near the channel. However, there are no nearby domestic well users that would be affected and the overall hydraulic gradient is to the east northeast, with discharge to existing artesian spring sites, and ultimately into Lake Winnipeg. For the LMOC, the high piezometric pressure in the aquifer would protect against aquifer contamination during all phases of operation.

4.3.3 Management Measures

Groundwater management measures that will be implemented to mitigate or protect against impacts to groundwater or from groundwater during operation and maintenance of the channels are detailed in the GWMP.

Aquifer depressurization is required to reduce the risk of post-construction basal heave and slope instability within the LMOC. A long-term passive depressurization system is planned along the LMOC that will release groundwater from the confined aquifer into the channel, thereby reducing the groundwater pressure head in the LMOC area. This system would remain under artesian pressure and therefore flow upward year-round and will act as a discharge zone for the aquifer. The positive pressure in the aquifer depressurization system would protect against aquifer contamination.

The zone of influence of the LMOC depressurization system will expand over a limited distance and domestic water supply well pressure, as well as flowing well (artesian-dependent) operation, will be affected in this area. While most domestic water supply wells are drilled to an elevation deep enough into the bedrock that the water will remain in the well, pumping will be required to mitigate the loss of artesian pressure for flowing well operations.

Passive sub drains are planned to lower piezometric pressures beneath the base of the LSMOC WCS to protect against uplift. Additionally, to mitigate the potential for surface water infiltration to the bedrock aquifer the LSMOC is designed to minimize the difference between the operating (staged) channel water level, and the piezometric surface in the underlying bedrock aquifer.

Groundwater quality in the Project area may also be adversely affected during operation and maintenance from leaks and accidental spills or release of fuels or other hazardous substances. Mitigation to prevent leaks, spills and releases include providing secondary containment for fuel and hazardous material storage, requiring drip trays for equipment, refuel and conduct maintenance only in designated areas and in accordance with the PERs, provide spill clean-up equipment and materials, and provide an emergency (spill) response plan. If a spill should occur, Manitoba Transportation and Infrastructure or the Contractor doing the work would be responsible to provide notification within 24 hours, and to document the event with an incident report. Specific measures to address the potential contamination of groundwater from hazardous materials and waste are discussed in Sections 4.11 and 4.12 of this OEMP.

A long-term groundwater monitoring plan, beyond the 2-year post-construction monitoring period, has been developed, based on the Project monitoring data and an assessment of Project effects. The plan includes monitoring the effect of the channel on groundwater quality and water levels during channel operation with gates open and gates closed. On-site and regional monitoring of the effects of any long-term passive aquifer depressurization system (such as proposed at the WCS) is also be included in the plan. Manitoba Transportation and Infrastructure will take appropriate action with respect to adaptive management procedures identified through the monitoring process and as outlined in the GWMP.

4.4 Surface Water

While the channels will alter the route and timing for the passage of high flows from Lake Manitoba to Lake St. Martin and to Sturgeon Bay (Lake Winnipeg), it does not change the overall composition or volume of water entering or leaving the system as these flows would ultimately reach Lake Winnipeg through the Fairford River and Dauphin River without the operation of the channels. Operation of the channels is expected to have a negligible effect on Lake Winnipeg water levels (refer to Project EIS Chapter 6). Surface water management measures that will be implemented to manage local drainage are detailed in the SWMP.

Operation of the channels will potentially result in changes to localized sediment and debris transport impacting local water quality and also potentially changing regional water levels in Lake Manitoba, Lake St. Martin and Lake Winnipeg. Surface water management measures that will be implemented to mitigate the potential transport and deposition of sediments beyond areas disturbed during maintenance of the channels are detailed in the SWMP. Erosion and sediment control measures will be implemented during maintenance activities, or as required, to prevent the introduction of sediment, as summarized in Section 4.5 and detailed in the SMP. Measures that will be implemented to mitigate potential impacts to the environment or public and worker safety related to material entering, within or exiting the channels, including floating or submerged (e.g., driftwood, plants), are detailed in Sections 3.1.4, and 4.6 of this plan. Surface water quality along the channels will be monitored for two years post-construction by Manitoba Transportation and Infrastructure or their designated representative, as described in Section 7.1. While these surface water sampling events are occurring during the operation phase of the program, they are designed to monitor potential effects post-construction and not the effects related to operating the channels. Additional surface water quality monitoring during operation will be completed as part of the AEMP to assess effects of water quality changes on fish and fish habitat.

Surface water quality in the PDA may be adversely affected during maintenance and operation activities from leaks and accidental spills or release of fuels or other hazardous substances. Mitigation to avert impacts to surface water quality includes preventing leaks, spills and releases by providing secondary containment for fuel and hazardous material storage, requiring drip trays for equipment, refuel and conduct maintenance only in designated areas (located an appropriate distance from any surface water) and in accordance with the PERs, provide spill clean-up equipment and materials, and provide an emergency (spill) response plan. If a spill should occur, Manitoba Transportation and Infrastructure or the Contractor doing the work would be responsible to provide notification within 24 hours, and to document the event with an incident report. Measures to protect against and clean-up the potential accidental discharge of contaminants such as fuel, hazardous materials, hazardous waste and non-hazardous waste are discussed in Sections 4.10 and 4.11 of this OEMP.

4.5 Ice

Although the outlet channels will be used primarily during the spring and summer to reduce damages of open water flooding, the channels are designed to permit operation in the winter months as well. Winter operation of the outlet channels will be considered to reduce water levels in the lakes following a large flood the previous spring/summer, or to pre-emptively lower lake levels to prepare for a large flood in the subsequent spring. In years when winter operation is required, the LMOC and LSMOC will be operated in a manner to reduce the severity of ice formations within the outlet channels. Conditions in the outlet channels will be monitored during winter operation to identify the development of adverse ice conditions (e.g., ice jams) and inform operational adjustments (i.e., flow reduction) to maintain safe freeboard on the channel dikes. Operation of the outlet channels during the winter will alter the local flow patterns in the vicinity of the inlets and outlets, which could result in locally thinner ice covers compared to when the channels are not operated.

In general, the magnitude of the potential changes to ice processes in regional waterways (i.e., Dauphin River and Fairford River) is predicted to be low to negligible. Therefore, no special ice management practices are anticipated to be required outside of the LMOC and LSMOC. Management of ice processes, both in the channels and in the connected flow system, will be considered during winter operation of the outlet channels in accordance with the IMP.

4.6 Erosion and Sediment Control

Operation and maintenance activities that will require temporary erosion and sediment control include, but are not limited to, earthworks repairs, rock structure repairs, revegetation, road repairs, and excavation of sediment / debris management. Erosion and sediment control measures for the mitigation and management of potential erosion during channel maintenance activities, and to minimize adverse, sediment related, effects to the receiving waters are detailed in the SMP. Measures include, but are not limited to, rock riprap, erosion control blankets, check dams, straw waddles, silt fences, floating silt barriers (turbidity curtain) and sediment ponds. If erosion control blankets are used the product shall be 100 percent biodegradable, composed of natural fibers including netting, filling and thread. These temporary management practices are in addition to the permanent design mitigation that was built into the inlet, channel, and outlet. Establishing the vegetation cover within the channel and outside drains at the end of the construction phase and any subsequent maintenance activities will provide permanent mitigation against potential erosion and sedimentation from flooding and heavy precipitation.

Sedimentation from the erosion of exposed soils can negatively influence fish and fish habitat. To mitigate this effect, Manitoba Transportation and Infrastructure or the Contractor shall install effective erosion and sediment control measures in accordance with the SMP, Contract Documents and Manitoba Transportation and Infrastructure's PER prior to commencing work and manage water runoff during maintenance activities to prevent undesirable soil movement or soil releases and discharges to a waterbody. Contractor requirements for environmental protection are based on best management practices in the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, the PERs developed by Manitoba Transportation and Infrastructure and Manitoba Transportation and Infrastructure's Manual of Erosion and

Sedimentation Control During Highway Construction. Erosion and sediment control measures shall be maintained in disturbed sites until soils have stabilized and revegetation of disturbed areas is achieved. Necessary repairs and adjustments to erosion and sediment control measures shall be made immediately so that measures are effective in controlling erosion and sedimentation.

For minor maintenance works requiring management of sediments, water would likely be discharged to an area with established vegetation. However, if de-watering is required to conduct a major maintenance activity, sediment ponds will be constructed as part of the water management plans. In these instances, discharge from maintenance activities will be diverted into a sediment pond to allow suspended material to settle out before the water re-enters a natural waterbody. Pump discharge points will be lined with clean rock or other acceptable flow dissipating applications to prevent erosion and the release of suspended sediments. Manitoba Transportation and Infrastructure or the Contractor will take the necessary precautions to prevent contaminants (including sediments) from entering Lake St. Martin, Lake Winnipeg, or the creeks adjacent the LSMOC.

If in-water work is required, turbidity curtains may be required to isolate / control sediment movement from the work area. The turbidity curtain will be of geotextile and manufactured to suit site conditions, including a continuous floating top, and a continuous heavy weight sewn into the bottom. The turbidity curtain will be installed beyond the extents of the maintenance activities. The use and installation of a turbidity curtain should be directed by the Inspector in accordance with acceptable BMPs.

Providing for the success of the long-term management practices, such as maintaining the vegetation cover, is fundamental toward minimizing the erosion potential over the long-term operation and maintenance of the Project. Operation of the LMOC and LSMOC, as discussed in Section 4.7, may result in impacts to the cover vegetation along the channel side slopes, which could leave them vulnerable to erosion. Monitoring will be completed as described in the RVMP to assess the level of disturbance to vegetation and evidence of erosion following channel operation and to identify the need for corrective actions. Thresholds for remedial activities will depend on both the extent of vegetation dieback as well as the risks associated with erosion. Remedial approaches and methods in relation to thresholds are described in the RVMP. Corrective actions would generally include repairing areas of erosion, weed management and infill seeding, as required, following changes in water levels in the channel from operation.

Specific maintenance activities and field conditions may have unique requirements to control erosion and sediment concerns. As such, it is important to maintain an adaptive management approach to erosion and sediment control. Adaptive management procedures for the SMP will focus on the key objectives of reducing the potential for wind and runoff induced erosion and eliminating or controlling the amount of sediment that can enter channel, outside drains, proximal creeks, Lake Manitoba, Lake St. Martin, and Lake Winnipeg in order to maintain water quality goals. A water quality monitoring program will be developed, as part of the SWMP and AEMP, to assess any changes in water quality that may result from operation and maintenance activities and the effectiveness of proposed mitigation. Periodic inspections or progress updates may change or alter the need for erosion and sediment control measures during each maintenance activity.

4.7 Fisheries and Aquatic Ecosystem

Operation of the channels has potential to alter fish habitat through movement and deposition of sediment into Birch Bay (Lake St. Martin) and Sturgeon Bay (Lake Winnipeg) and through changes in the flow patterns of the Fairford River, Dauphin River and the inlet and outlet of the channels. When the channels are initially operated or wetted, fish will be able to access the channels. The inlet and outlet have been designed to limit scour of sediment and entrainment of fish, eggs, and sediment in the outflow.

While not a concern with the LMOC where fish are anticipated to egress the channel, operation of the LSMOC has potential to strand fish and fish eggs within the channel when the WCS gates are closed. To minimize effects to fish and fish habitat the LSMOC was designed to allow downstream movement of fish throughout the open-water season and provide baseflow depths sufficient to prevent freezing to bottom, such that the LSMOC will sustain fish even when the channel is not in operation. While some stranding of individual fish and eggs is unavoidable, the effects of stranding to the populations of local fish species are expected to be low. Operational procedures will be followed for closing the WCS gates to allow for gradual reduction in flows within the LSMOC to avoid the extent of potential fish stranding. As part of the AEMP, potential egg deposition below the most downstream drop structure will be monitored during operation, if eggs are found then an appropriate water management plan for the duration of egg incubation will be developed in consultation with Fisheries and Oceans Canada (DFO).

In addition to operation effects, maintenance activities such as cleaning debris and/or excess vegetation from the channels and the outside drains will potentially impact fish and fish habitat. These maintenance activities will be required to maintain conveyance of flows and will result in alteration of the substrate and flows. The navigation safety boom surrounding the inlet will help to manage and collect debris before it enters the channels. Debris captured by the boom will need to be removed periodically as it accumulates, likely using a boat. To reduce the potential for debris accumulation within the LSMOC outlet area from littoral drift during non-operation of the channel, rock jetties will be constructed at the outlet. Debris that does accumulate within either channel would be manually removed from the channel slopes after the flood waters have receded.

A detailed description of the Project and potential effects will be provided in a submission to DFO to obtain the required *Fisheries Act* authorization for the Project prior to construction. Therefore, no specific authorization conditions have been received to date; however, once received they will be incorporated into the final OEMP. Standard advice typically issued with a Project authorization would still be applicable for reducing potential effects during operation and maintenance of the channels. Environmental measures likely to be expressed by DFO, some of which are contained within the PERs, may include the following:

- Work will be conducted in adherence to DFO authorization(s).
- Follow DFO's Manitoba Restricted Activity Timing Windowsfor the protection of Fish and Fish Habitat for instream work, as practical, particularly for instream work required "in-the-wet".
- Comply with the Manitoba Aquatic Invasive Species regulations to reduce the risk of increasing dispersal of invasive aquatic species. Heavy machinery will be required to be cleaned and disinfected prior to arriving on site and before moving between work areas at different lakes and drainages (if working upstream from Lake Winnipeg to Lake St. Martin or from Lake St. Martin to Lake Manitoba).

- Activities related to the Project will be undertaken in accordance with the "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat" (https://www.gov.mb.ca/fish-wildlife/pubs/fish_wildlife/fish/sguide.pdf) and in consideration of the Fish Swimming Performance User Guide, 2016 (http://www.fishprotectiontools.ca/userguide.html) and provincial fisheries objectives.
- Appropriate precautions will be taken so that potential deleterious substances (such as fuel, hydraulic fluids, oil, or sediment) do not enter a waterbody. Equipment operating near a waterbody is to be free of external fluid leaks, grease, oil and mud and the cleaning, fueling and servicing of equipment will be conducted in a manner to prevent the entry of deleterious substances into the surface water.
- Removal of riparian vegetation will be kept to a minimum to help maintain the stability of waterbody banks. The area over which vegetation in riparian vegetation areas is removed will affect no more than one third (1/3) of the total woody vegetation in the ROW within 30 m of the ordinary high-water mark of a waterbody. Clearing within 30 m of a waterbody will be done by hand and vegetative root masses found within the waterbody banks will remain undisturbed unless specified in the Contract Documents.
- Implementation of erosion and sediment control measures as appropriate in compliance with Contract Documents in order to prevent the entry of sediment in waterbodies. Suitable temporary and long-term erosion control measures will be installed where required so that disturbed areas are not subject to erosion prior to the establishment of vegetation. These measures are to be inspected regularly to confirm that they are functioning properly until vegetation is reestablished and necessary repairs or adjustments will be made if damage is discovered or if these measures are not effective in controlling erosion and sedimentation.
- If maintenance of rock structures is required in the inlet and outlet of the LSMOC, these areas will be isolated from the adjoining waterbody using appropriate methods (turbidity curtain, temporary cofferdam, etc.).
- If required, de-watering of a cofferdam area will be pumped to a settling basin or filtering system protected with flow dissipating applications and then discharged onto the riprap shoreline prior to re-entering the waterbody. Alternatively, the dewatering could be pumped through dense terrestrial vegetation a sufficient distance from the waterbody to allow sediment deposition prior to discharge water reaching a waterbody.
- Live fish or mussels salvaged within a de-watering area will be transferred to the natural waterbody which it was from.
- Implement measures for materials handling, waste handling and disposal, and fuel handling and storage in designated areas located a minimum of 100 m from a waterbody and with secondary containment.
- Implement an ERP for spills, including educating the workforce and maintaining accessible spill control and clean-up equipment.

4.8 Vegetation

It is not expected that additional clearing activities will be required during the operation and maintenance phase of the Project. In the event that earthworks repair is required, there will be some disturbance to the revegetated areas along the LMOC and LSMOC alignment and supporting earthwork (outside drains, dikes, etc.) that was reclaimed immediately following the construction phase. Mitigation to reduce the adverse effects from maintenance repairs to earthworks and clearing of vegetation includes restricting clearing and grubbing to the isolated areas that require repair. The Contractor will not remove vegetation or excavate outside the limits of construction and staging areas without written authorization from Manitoba Transportation and Infrastructure or the Contract Administrator.

Clearing and grubbing activities will, whenever possible, occur during either dry or frozen conditions to limit impact to surrounding soil and vegetation. A 30 m setback will be applied to known occurrences of provincially listed species of conservation concern (SOCC), where avoidance of SOCC is not possible; however, construction in sensitive areas will be restricted to the winter months (outside of the growing season). Topsoil (i.e., the organic layer) will be salvaged and temporarily stockpiled to be replaced in support of re-vegetation as described in the RVMP. As a component of the SMP areas disturbed during maintenance activities will be re-vegetated. Where seeding is not required, temporary site locations will be left in a manner that promotes natural re-vegetation of the site.

Control of nuisance vegetation within the channels and outside drains will be required as a standard maintenance activity to retain appropriate conveyance of flows. Non-native invasive plant species, regulated in Manitoba by *The Noxious Weeds Act*, will also have to be controlled within the PDA. The need for vegetation management will be determined based on the results of monitoring completed in accordance with the RVMP. Management of nuisance vegetation and control of noxious weeds would involve either herbicide or mechanical control (mowing / tilling) or a combination of both methods.

Maintenance activities such as excavation, transportation of materials and blasting will result in increased fugitive dust, which can settle on vegetation in the study area resulting in impaired growth and development. It is anticipated that potential increased dust during operation and maintenance would be much less that what would be observed during construction activities. Mitigation measures to control dust are outlined in Section 4.1 and described in the Dust Control Plan.

Operation of the channels may result in impacts to the cover vegetation along the channel side slopes. Many factors will influence the effect of operation on cover vegetation, including timing, magnitude, and duration of flooding, as well as effects due to ice scour, erosion, and sediment deposition. Loss of vegetation would be greater in the early years post construction when vegetation is establishing or if the channel is operated for a prolonged period. Monitoring will be completed as described in the RVMP to assess the level of disturbance to vegetation and to identify the need for corrective actions. Thresholds for remedial revegetation activities will depend on both the extent of vegetation dieback as well as the risks associated with erosion. Remedial approaches and methods in relation to thresholds are described in the RVMP. Corrective actions would generally include repairing areas of erosion, weed management and infill seeding, as required, following changes in water levels in the channel from operation.

4.9 Wildlife

4.9.1 Loss of Habitat or Disturbance to Wildlife During Operation

Operation of the channels may result in temporary disturbance of wildlife and wildlife habitat, as the water levels increase along the channel banks. While local populations of some common wildlife may be disturbed during an operation event, particularly burrowing animals and ground-nesting species, there is sufficient habitat surrounding the channels to support these species. The potential to restore wildlife habitat in appropriate areas along the LMOC includes measures such as red-headed woodpecker snag and/or nest box installation and replacing coarse woody debris and planting shrubs to enhance eastern-whip-poor-will habitat.

Once the construction phase is complete and the channels enter operation phase, the water level maintained in the channels could limit some movement by wildlife species; however, most wildlife species are capable of crossing static or slow-moving water. During flood conditions, when the channels are conveying flow (gates opened), the increased depth, wetted width, and flow within the channels has the potential to increase this effect on wildlife movement. Mitigation for this effect will include monitoring and reporting of any wildlife interaction encountered when on site, as outlined in the WMP.

4.9.2 Disturbance During Maintenance Activities

It is not expected that additional clearing activities will be required during the operation and maintenance phase of the Project. In the event that earthworks repair is required however, there will be some disturbance to the revegetated areas along the LMOC and LSMOC alignment and supporting earthwork (outside drains, dikes, etc.) that was reclaimed immediately following the construction phase. Mitigation to reduce the disturbance to wildlife habitat from maintenance repairs to earthworks and clearing of vegetation includes restricting clearing and grubbing to the isolated areas that require repair. Tree and brush clearing, if required, will not be conducted between April 1 and August 30 of any year unless absolutely required for an emergency and otherwise approved by Manitoba Transportation and Infrastructure. While rarely used, if clearing needs to be conducted for an emergency during this breeding period or other critical nesting periods, a qualified biologist shall conduct a nest survey to identify if active nests are present. Likewise, in the event that quarry or borrow sites need to be reinstated for maintenance materials during the breeding bird window, the surveys to determine presence or absence of nests will need to be conducted by a qualified biologist. If nests are discovered, work will be suspended and the EAO will be contacted.

There is potential for sensory disturbance to wildlife species (noise, presence of people and equipment) in the event of earthwork repairs and during clearing of debris and excess vegetation within the channels and outside drains. While sensory barriers to wildlife movement will be temporary during maintenance, the adversity will be mitigated by ensuring that equipment supplied for use on the Project is effectively “sound-reduced” by means of proper silencers, mufflers, acoustic linings, acoustic shields or acoustic sheds. Night lighting, if required, will be directed downward to reduce light disturbance to wildlife.

4.9.3 Wildlife Interaction with Vehicles

To reduce wildlife mortality associated with vehicle-wildlife collisions, vehicle speed will not exceed posted speed limits and wildlife warning signs will be installed where appropriate. Project-related vehicle-wildlife collisions will be tracked as part of the WMP. Manitoba Transportation and Infrastructure or Contractors for maintenance work will be required to keep worksites clean with food, garbage or waste that may attract wildlife stored and disposed of in an appropriate manner so that problem wildlife attractants are not created. Nuisance wildlife will be immediately reported to the Natural Resources Officer and the Contract Administrator.

4.9.4 Increase of Hunting Pressure

During operation and maintenance, the channels, outside drains and access roads have the potential to increase predator and hunter/trapper efficiency by providing access along a continuous linear corridor. Prey species encountering these linear corridors will be at greater risk to predation. Mitigation measures will be implemented to limit public access to the ROWs for the channels through use of gates or other barriers and signage will be posted to indicate limited access.

4.10 Land and Resource Use

Details related to access to the channels for land and resource use is described in the AMP. Generally, public access to both the LMOC and LSMOC will be restricted.

A gate will be placed near the end of the pre-existing forestry road (Idylwild Road) However, the Idylwild Road will remain available to local resources users Signage will be posted to indicate only permitted access as described in the AMP.

4.11 Heritage Resources

As an outcome of the Heritage Resource Impact Assessment conducted, a HRPP has been prepared specifically to deal with potential effects to heritage resources. It outlines measures to mitigate effects to cultural and heritage resources. It is unlikely that maintenance and operations activities will encounter heritage resources that were not encountered previously during construction of the Project. However, in the event that heritage resources, or objects thought to be heritage resources, are discovered during operation and maintenance, the Historic Resources Branch (of the Manitoba Sport, Culture and Heritage Department) will be informed immediately. If a heritage resource is encountered, the activities in the immediate vicinity will cease, protective barriers will be placed around the potential heritage resource site, and the discovered heritage resources will remain in place until an archaeologist is contacted and prescribes instruction.

The current Project design and routing of the channels was influenced by the Indigenous engagement and consultation process to limit effects and concerns that were expressed in relation to changes to cultural and spiritual sites and sacred areas. Detailed recording and mapping of spiritual or cultural sites will be developed by Manitoba Transportation and Infrastructure in partnership with rights-holders, leading to a decision made about the relative importance of the site and potential mitigations strategies.

4.12 Materials and Waste Management

Operation and maintenance activities will require construction materials to be delivered to and stored at various locations along the channels and/or access roads, as required. Leaks and accidental spills or release of fuels or other hazardous substances related to operation and maintenance activities has been anticipated. The Manitoba Transportation and Infrastructure Emergency Spill Response and Reporting Procedures covers the transportation, use, storage and transfer of hydraulic fluid, other mechanical lubricants, petroleum fuels, antifreeze and herbicides. To prevent potential environmental accidents and contain potential spills, hazardous materials will be transported, stored, and handled as recommended by the suppliers and/or manufacturers, and in compliance with applicable federal, provincial, or municipal regulations. Dangerous goods/hazardous wastes are identified by and will be handled according to *The Dangerous Goods Handling and Transportation Act* and Regulations. Manitoba Transportation and Infrastructure or the maintenance Contractor will have on-site staff that are trained and certified in the handling of the dangerous/hazardous goods being utilized on site.

When required on site during operation and maintenance, fuel storage will be in compliance with the *Manitoba Storage and Handling of Petroleum Products and Allied Products Regulation* 188/2001. Fuel stored in drums or containers of 230 litres or less will comply with the requirements of the Manitoba Fire Code. Designated area(s) will be established for fuel storage, hazardous materials handling and storage, equipment cleaning, refueling and servicing. Designated areas will be located at least 100 m from a waterbody or wetland and will be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection. Dedicated petroleum storage areas will provide additional spill containment (impervious liner and berms). Only above ground storage tanks will be used for the storage of bulk petroleum products. The tanks will be equipped with overfill protection and spill containment consisting of perimeter dikes or secondary containment in the tank design.

Equipment maintenance and inspections are a key component to preventing small leaks from contaminating the waters and riparian areas associated with a project. This is particularly important for equipment working temporarily over the wetted area or within close proximity to Lake Manitoba, Lake St. Martin, Lake Winnipeg or other waterbodies. Maintenance equipment will arrive on site in a clean condition and will be kept in good working order free of external fluid leaks, grease and oil. Equipment working at a maintenance activity will be inspected daily for small leaks. Machinery that is found to be leaking fuel, oil or other fluids will be moved off the work site immediately for repair. When equipment is stationary for extended periods of time within the work area drip trays will be installed to contain potential leaks. For mobile equipment on site, drip trays should be readily available, and used as needed. Implementation of these measures will be documented in reports, as described in Section 7.2.

Manitoba Transportation and Infrastructure or the maintenance Contractor will conduct day-to-day operations in such a manner as to avoid creating conditions that will be detrimental to the surrounding area. Different waste streams will not be mixed, and waste materials and refuse will be removed and disposed of promptly in a manner that will not contaminate the surrounding area. Effort will be made to prevent debris from falling into, or accumulating on, ground surfaces or into the waterway at and in the immediate vicinity of the Project. Areas requiring maintenance will be kept clean and orderly during and at completion of the

activity. At no time during operation and maintenance activities will domestic solid, demolition or construction waste be permitted to accumulate for more than one day at a location on the work site, other than at a dedicated temporary waste storage site. These waste materials will be recycled to a degree that is economically and practically feasible or disposed of at a Waste Disposal Ground operating under the authority of a permit issued pursuant to *Manitoba Waste Disposal Grounds Regulation* 150/91. Sewage and seepage from on-site sanitary facilities, will be disposed of at a local licensed facility and in accordance with the *Manitoba Onsite Wastewater Management Systems Regulation* 83/2003.

Dangerous goods/hazardous waste storage areas will be located at least 100 m away from the high-water line of the nearest water body and be contained within a diked area or another form of secondary containment. Liquid wastes or fuels will not be permitted to be deposited upon the ground. When equipment servicing requires the drainage or pumping of lubricating oils, or other fluids from the equipment, a groundsheet of suitable material and size will be spread on the ground to catch fluids in the event of a leak or spill. Bulk waste oil will be stored in aboveground oil tanks, which will have secondary containment and a weatherproof cover. Waste oil will be recycled by a reputable recycling agency. Used oil filters will be drained, placed into suitable storage containers, and disposed of at approved facilities. Empty containers from equipment refueling and servicing will be removed to a licensed disposal site. Disposal of dangerous/ hazardous wastes will be at approved hazardous waste facilities.

4.13 Emergency Spill Response and Reporting Procedures

The ERPs refer to spills, accidents, or malfunctions involving the release of fuels, dangerous goods or hazardous materials/waste. Due care and caution will be taken to prevent spills during operation and maintenance activities. In the event of a release the maintenance Contractor doing the work will follow their own spill response plans, which will have been reviewed and approved by Manitoba Transportation and Infrastructure as part of their contracts. Manitoba Transportation and Infrastructure has developed PERs, which Contractors will have to adhere to, that describe measures to address accidents and spills, including reporting, cleanup, compliance training, inspection, and enforcement. An updated list of key contacts and telephone numbers for reporting spills, accidents or malfunctions will be kept on site. A Workplace Hazardous Materials Information System (WHMIS) file will be maintained on site for the hazardous materials at the work area. Prior to commencement of the work, Safety Data Sheets will be submitted to the Contract Administrator for hazardous materials to be used on site. The Contractor will provide training for staff and confirm Subcontractors are trained and empowered to identify, address, and report potential environmental problems.

Spills will be contained and cleaned up immediately by on-site personnel in accordance with the approved on-site emergency response and containment plan. In the event that petroleum products (e.g., fuel or oil) spill or leak at the work site, the source of the spill should be stopped by shutting down equipment, closing valves and pumps, or plugging hoses. If possible, the spilling or dripping materials should be contained by a spill pan and diking around the spill to prevent it from entering the drainage system. These mitigation procedures should be conducted by the operator(s) that identified/were involved in the spill or leak. Any pooled liquids should be recovered by placing in appropriate drums for temporary storage and disposal by approved agencies. The residual liquids will be cleaned up using absorbent pads and contaminated soil

and/or materials must be removed immediately and transported to an approved location for disposal. In the event that a petroleum product enters a natural waterbody (e.g., equipment leaks while conducting in-stream works in, or while working along the periphery of Lake Manitoba, Lake St. Martin and Lake Winnipeg), the appropriate spill kit resources must be implemented immediately.

The maintenance Contractor will immediately report any reportable spills to MECP 's Accident Reporting Line at (204) 944-4888 pursuant to *Manitoba Environmental Accident Reporting Regulation* 439/87. The Contractor will report spills and how they were managed to Manitoba Transportation and Infrastructure within 24 hours, whether it was necessary to report the spill to MECP or not. A follow-up report will be provided to the Director of MECP, at their request, for any reportable environmental accident outlining the causes(s) and proposed corrective action to prevent reoccurrence. This follow-up report will also be provided to other regulators, as required, such as DFO for example to adhere to the *Fisheries Act* Section 38(5) Duty to Notify – Deleterious Substance.

An adequate supply of suitable absorbent material and other supplies and equipment necessary to immediately cleanup inadvertent spills will be available on site during any maintenance activity, including an emergency spill kit for in-water use. Each machine working on site will also have a spill kit. Spill kits should contain at a minimum absorbent material, high density polystyrene groundsheets and absorbent oil booms when working near water. Storage and disposal of residual material from spill cleanup must be done in an environmentally safe manner and in accordance with applicable regulations. The EAO will inspect storage areas to confirm requirements are being met.

4.14 Fire Prevention and Response Procedure

Wildfires can be a threat to people, property and activities. Advance planning, preparation and the implementation of safety measures is required to effectively respond to wildfires when they do occur. The Manitoba Emergency Plan (https://www.manitoba.ca/emo/provincial/mep.html) provides information on prevention and mitigation, preparedness, response and recovery in relation to fires. Manitoba Transportation and Infrastructure has developed PERs, which maintenance Contractors will have to adhere to, that describe measures to address burning and brush disposal. On-site operation and maintenance personnel will be trained in fire prevention, including proper disposal of hot or burning material and designated smoking areas. An evacuation and emergency preparedness plan addressing wildfires will be implemented and submitted by the Contractor prior to commencing maintenance activity.

Fire prevention, at its most basic, is based upon the principle of keeping fuel sources, oxygen sources and ignition sources separate. Fire prevention starts with good housekeeping, such that materials are stored in the right place and do not accidentally spill and cause fire. A primary zone will be established around longer-term temporary structures associated with maintenance activities. Flammable materials such as leaves, brush, dead limbs, and fallen trees will be cleared from the area regularly. Exhaust and engine systems of equipment and vehicles will be in good working condition and free of dried grass and other combustibles. Fire extinguishers will be available in heavy and light equipment and in equipment storage facilities and offices for fighting fires.

Reasonable steps will be taken to prevent a fire from burning out of control or spreading from the channels and associated infrastructure areas. It is unlikely that open fires will be required within the PDA during operation and maintenance activities. Regardless, no fires will be started without first taking sufficient precautions to keep the fire under control. Burning or smoldering matter will not be placed where it may cause a fire to spread. Fires will be completely extinguished after burning and will be monitored so that no hot spots remain. Open fires are prohibited from April 1st to November 15th annually. In the event that burning is required during that period, an application for a burning permit will be submitted for approval to MECP and the conditions imposed by the burning permit will be adhered to.

In the event that a wildfire occurs, it will be immediately reported to Manitoba Transportation and Infrastructureand to MECP at 1-800-782-0076. All related maintenance activities in the vicinity of a wildfire will cease until advised by the site supervisor that it is safe to resume operations. Additionally, reasonable attempts will be made to extinguish the wildfire with available equipment, services and labor made available at the disposal of an officer for the purposes of wildfire protection operations.

5.0 COMMUNICATION

5.1 Public Advisement of Operation

Manitoba Transportation and Infrastructure will provide notifications on relevant information related to this plan as a part of ongoing engagement processes for the Project. Communication protocols will be developed with input from rights holders and stakeholders for the operations phase.

Prior to operating the LMOC and LSMOC to convey flood waters, public notifications will be issued to advise of the potential risk to public safety. An initial communication will be issued that indicates the proposed date to begin opening the gates within the LMOC and LSMOC and to provide website information as to where further information will be made available. Any federal or provincial regulators that require notification as a commitment of Project-related licensing, authorizations or approvals will be included in the initial communication. Any news releases and or public communications will be the responsibility of, and to be conducted solely by, Manitoba Transportation and Infrastructure. Specific details on the responsibility and methods for communication with public / government authorities will be described in the O&M Manual.

5.2 Communication During Onsite Inspections and Maintenance

During maintenance activities, Manitoba Transportation and Infrastructurepersonnel will attend a ‘pre-job’ briefing prior to the first day that workers and/or Contractors commence work on site. The meeting is intended to review the activities that will be conducted and to express any potential health, safety, and environmental issues related to the proposed work.

Personnel working on the site will maintain daily communication to confirm safety and environmental protocols are adhered to during onsite operation and maintenance activities. Daily and weekly documentation will be maintained by on site personnel and forwarded to Manitoba Transportation and Infrastructureat an appropriate frequency (daily / weekly), as is applicable.

5.3 Environmental Concerns

The primary line of communication to right’s holders, the public and stakeholders will be through the Owner, in addition to Project development and monitoring reports provided on the Manitoba Transportation and Infrastructure Project website. Environmental concerns will be identified by Manitoba Transportation and Infrastructure or reported by the Contractor conducting maintenance activities. If the Contractor is working under a Contract Administrator, then communication and follow-up information will be directed through the Contract Administrator. If an environmental incident/accident occurs, the Contractor will report it immediately. If an environmental incident results in a “reportable” spill, the Contractor / Contract Administrator (as applicable) will contact MECP’s Accident Reporting Line at (204) 944-4888.

Should the public have concerns about the Project, these can be raised to Manitoba Transportation and Infrastructure by use of the Complaint Resolution Process.

6.0 TRAINING AND AWARENESS

Manitoba Transportation and Infrastructure and the Contractor will be expected to provide mandatory training and awareness sessions for their workforce and Subcontractors prior to the start of any operation or maintenance activity, and to new personnel before they begin work. Employees involved in the storage, handling and use of dangerous goods and fuels will have WHMIS and spill prevention and response training. Additionally, if herbicides are used, they will be applied by trained personnel who meet provincial licensing requirements. The training and orientation sessions will be documented and issued to Manitoba Transportation and Infrastructure for their records and submission to regulators, where required.

The purposes of the training and orientation sessions are to confirm that on-site personnel are aware of and understand the environmental provisions of the contract documents including relevant drawings, specifications and Contractor submittals and updates. Orientation should include contents of this OEMP to confirm that environmental protection measures are followed. Topics of importance to be discussed with workers/Subcontractors include:

- What is a spill or discharge.
- What to do if there is a spill in water or on land.
- What spills are reportable and within what time frame.
- Fire prevention and response.
- What is a heritage resource and how to manage resources encountered.

The Contractor will submit the planned frequency and records of these meetings. However, this information will likely be presented during the weekly Project/maintenance meetings and the daily safety meetings that are held before each shift. The Contractor will maintain access to environmental provisions of the contract documents including relevant drawings, specifications and Contractor submittals and updates, in a location and manner accessible to employees, Subcontractors and agents.

7.0 MONITORING

Monitoring and reporting will be completed to verify that the environmental management measures outlined in this OEMP and the supporting topic-specific management plans are being implemented, maintained and are effective in mitigating the adverse environmental effects of the Project. Additionally, it allows these measures to be adapted where necessary, and to anticipate any potential unforeseen adverse environmental effects. Manitoba Transportation and Infrastructure , the Contract Administrators, and the Contractor(s) all have responsibilities for monitoring and reporting, as previously outlined in Section 2.0. More details characterizing the monitoring and follow-up are described in the EMP Framework.

Upon completion of the contract, Contract Administrator responsibilities will fall under future contracts between Manitoba Transportation and Infrastructure and Engineering Service Providers for upkeep, maintenance and other activities related to the operational phase of the Project.

7.1 Monitoring

Monitoring includes surveillance to document progress in operation and maintenance activities, identification of problems, issues and concerns, and environmental effects not predicted in the Project EIS. Throughout operation and maintenance of the channels, Manitoba Transportation and Infrastructure will monitor on-site activities to confirm adherence to, and the effectiveness of, environmental management measures outlined in this OEMP and the supporting topic specific management plans. There will also be monitoring of surface water quality, groundwater levels and quality, fish and fish habitat, vegetation, wildlife, land and resource use and heritage resources throughout operation of the Project where required to fulfill conditions of environmental approvals. Any lessons learned through ongoing data collection and monitoring programs will be used, if/where applicable, to adjust measures, address unanticipated effects, or improve subsequent rounds of monitoring, to the extent feasible.

Manitoba Transportation and Infrastructure, or their designated representative, will be conducting groundwater and surface water monitoring for two years beginning at the end of the construction phase following commissioning of the channels to monitor any post-construction effects from the Project. The program, as described in the SWMP and GWMP, is established to monitor only the post-construction effects related to construction of the Project.

An operation monitoring program extending beyond the initial two years post-commissioning will be developed. It will include sampling events during and following gate operation as well as during extended periods with no gate operation as required to support licensing / permits / authorizations for the Project. The frequency of events and the parameters being monitored will be informed by conditions of Project approval as well as results of the construction and post-commissioning monitoring and be modified to suit the program. Further, monitoring and sampling related to operation of the Project would require increased frequency of events, particularly for monitoring of Total Suspended Solids / Turbidity in surface water during the first month that the WCS is conveying flood water through the channels. Additional, albeit limited sampling may be required in the months that follow through to closure of the gates.

7.2 Reporting

Record keeping includes maintaining files and documentation related to environmental management measures and associated monitoring and reporting. During operation, Manitoba Transportation and Infrastructure will record water levels, gate settings and estimated flows. It is anticipated that these records would be provided by Manitoba Transportation and Infrastructure in an annual report along with other potential reporting requirements specified in the permits, approvals and authorizations for the Project.

For operation and maintenance activities copies of permits, approvals, or other authorizations required for the work to proceed will be retained on site while work is underway. Manitoba Transportation and Infrastructure will also be responsible for maintaining these records at an offsite location as there will be limited access to the onsite facilities.

A Contractor assigned work on the Project for ancillary construction, operation and maintenance activities will maintain a record of file while onsite. The record file at the site will include relevant information relating to materials handling, spills, leaks, releases, and the implementation and adjustment of the environmental protection measures. The Contractor will be required to maintain a copy of these records for a minimum of 5 years after contract closeout. Relevant information and/or significant events are to be documented and provided to Manitoba Transportation and Infrastructure in a timely fashion. Records would include, but are not limited to:

- Accidents, spills, leaks, and releases and the reporting and clean-up procedures used.
- Reviews, improvements and adjustments to the environmental protection measures.
- Details of environmental training sessions, including the schedule of these sessions and the names of participants.
- A full inventory of dangerous goods brought onto the site.
- A full inventory of hazardous wastes encountered on the site.
- Records of waste hauled from the site for disposal, including the location, name and description of the disposal facility and waybills/manifests.
- Records of material hauled from the site for recycling, including the location, name and description of the person or facility the material was delivered to.
- Records of fuel transported and stored at the site.
- Records of equipment inspections and maintenance.
- Records of public complaints.
- Records of actions taken to remove deleterious substances and debris from waterbodies.
- Records of annual use of pesticides.
- Wildlife encounters and/or management measures employed.

If a compliance / enforcement order is issued from a regulatory authority directly to the Contractor, the Contractor will notify Manitoba Transportation and Infrastructure in writing and provide copies of the correspondence between the regulator and the Contractors as there may be implications to Environmental Assessment reporting requirements. The Contractor will provide Manitoba Transportation and Infrastructure with the identity of knowledgeable individual(s) who will act as the on-site emergency response

coordinator(s) with the authority to redirect personnel to respond to a spill or environmental emergency. Additionally, the Contractor will provide the identity of an environmental coordinator capable of redirecting work to address non-compliance issues. As a general requirement, all work will be photo-documented, and notification of the work will be provided to Manitoba Transportation and Infrastructure on a monthly basis for record keeping purposes.

Manitoba Transportation and Infrastructure, or a designated representative, will inspect the site on a weekly basis during operation and maintenance activities to confirm mitigation methods outlined in this OEMP are, when applicable, adhered to. Any request for a change in environmental management measures or contract restrictions initiated by the Contractor will be submitted Manitoba Transportation and Infrastructure. The EAO will complete a Weekly Environmental Inspection Form (Appendix 2) during their site visits. The form will summarize information including, but not limited to:

- Description and status of construction activities.
- Description and status of environmental protection measures (in particular erosion and sediment control).
- Deficiencies, issues or complaints and the corrective action to be taken.
- Environmental incident(s) reported and corrective action implemented.
- Summaries of onsite correspondence.
- Site photos documenting observations.

If an environmental incident/accident occurs, a separate Environmental Incident/Accident Report Form (Appendix 2) will be filled out by the Contractor with assistance from the EAO, which describes the incident, lists the individuals involved, and details the cause of the incident and corrective actions taken to prevent the incident from occurring in the future. The EAO will maintain an Environmental Incidents Running Record Form (Appendix 2) that identifies each incident and identifies “when” the actions were taken to clean up and or prevent the incident from occurring in the future.

In the event of a reportable spill, the EAO will immediately report to the proper authorities, and provide a copy of the incident report to the Owner. As noted in Section 4.12, a follow-up report will be provided to the Director of MECP, at their request, for any reportable spill outlining the cause(s) and proposed corrective action to prevent reoccurrence. There are also regulatory reporting obligations when hazardous substances are transported to or from the site and/or stored on site.

APPENDIX 1

Applicable Federal and Provincial Legislation

Table 1-1: Applicable Federal and Provincial Legislation

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Federal Legislation		
Canadian Environmental Assessment Act, 2012, SC 2012, c 19, s 52	• Physical Activities, Regulations Designating, SOR/2012-147. • Prescribed Information for the Description of a Designated Project Regulations, SOR/2012-148.	• Identifies requirements and provides guidance for environmental assessments of designated projects. • Project requires environmental assessment and approval.
Canada Water Act, RSC 1985, c C-11	• Management of water resources including conservation and utilization of water resources, and provides guidelines for Canadian drinking water quality.	• Protection of water resources, including water quality.
Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33, s 64, shed 1)	• Provides a series of regulations for toxic substances.	• The potential risks of environmental pollutants and toxic substances are evaluated under this Act that addresses pollution prevention and the protection of the environment (Environment Canada) and human health (Health Canada) to contribute to sustainable development.
Explosives Act, RSC 1985, c E-17	• Explosives Regulations 2013, SOR/2013-211.	• Legislates and regulates the manufacturing, testing, acquisition, possession, sale, storage, transportation, importation and exportation of explosives. • Blasting activities, explosives storage and transport will need to be licenced.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Federal Sustainable Development Act, S.C. 2008, c. 33	• The Governor in Council may make regulations for the purpose of achieving any of the goals of this Act.	• An Act to require the development and implementation of a Federal Sustainable Development Strategy and the development of goals and targets with respect to sustainable development in Canada, and to make consequential amendments to another Act.
Fisheries Act, RSC 1985, c F-14	• Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations, SOR/2013-191. • Paragraph 36(3) Prohibits deposition of a deleterious substance of any type in water frequented by fish or in any place where the deleterious substance may enter the water, except those authorized by regulation. • Aquatic Invasive Species Reg. SOR/2015-121.	• Protects fish (as defined by the Act) from serious harm. Identifies general prohibitions, fisheries protections and pollution prevention, as well as requirements for authorization of works which may cause serious harm to fish prior to construction. • Protects against introductions of pollutants or high levels of sediment that could be deleterious to fish. • Lists invasive species that are prohibited and controlled. Identifies activities and regulatory tools to prevent the introduction of aquatic invasive species into Canadian waters and to control and manage their establishment and spread, once introduced.
Migratory Birds Convention Act, 1994, SC 1994, c 22	• Migratory Birds Regulations, CRC, c 1035.	• To protect and conserve designated migratory birds and their nests.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Navigation Protection Act, RSC 1985, c N-22	• Navigable Waters Bridges Regs. CRC, c 1231. • Navigable Waters Works Regs. CRC, c 1232.	• Protection of the right to navigation on navigable and scheduled waterways. Identifies prohibitions for the construction, placement, alteration, repair, reconstruction, removal or decommissioning or works in, on, over, under, through or across scheduled navigable water. Identifies requirements for authorization of works, and the potential for opting in for works at non-scheduled waters prior to construction. • MI will opt-in and obtain Transport Canada Authorization.
Species at Risk Act, SC 2002, c 29	• N/A	• Prohibits killing, harming or harassing endangered or threatened species at risk, provides for plans and strategies to enable the recovery and management of endangered, threatened or extirpated species, prohibits destruction of critical habitat, and allows for the management of species of special concern to prevent them from becoming endangered or threatened.
Transportation of Dangerous Goods Act, 1992, SC 1992, c 34	• Transportation of Dangerous Goods Regulations, SOR/2008-34.	• Defines methods for handling, containment and transportation of substances that could cause damage to personal safety or the environment.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Provincial Legislation		
The Environment Act, C.C.S.M. c. E125	• Classes of Development Reg. 164/88. • Environment Act Fees Reg.168/96. • Licensing Procedures Reg. 163/88. • Notice and Reporting Reg. 126/2010. • Onsite Wastewater Management Systems Reg. 83/2003.	• Classifies developments and identifies requirements for provincial licencing and environmental assessment. • Defines the application fees. • Defines information required to apply for licensing under The Environment Act. • Defines requirements regarding the notice of a licensing decision and reporting of releases to the environment. • Defines proper construction and disposal for onsite water management systems.
The Crown Lands Act, C.C.S.M. c. C340	• Crown Lands Fees Regulation 130/91. • Vehicle Use on Crown Lands Resource Roads Regulation 145/91.	• Identifies requirement for and issuance of leases, permits, easements and rights-of-way for specified works on provincial Crown lands. Work permits will be required.
The Dangerous Goods Handling and Transportation Act, C.C.S.M. c. D12	• Dangerous Goods Handling and Transportation Fees Reg. 164/2001. • Dangerous Goods Handling and Transportation Reg. 55/2003. • Environmental Accident Reporting Reg. 439/87. • Hazardous Waste Reg. 195/2015. • Storage and Handling of Petroleum Products and Allied Products Reg.188/2001.	• Identifies requirements for handling, containment and transportation of substances that could cause damage to personal safety or the environment. • Outlines reporting requirements in the case of an accidental spill. • Defines categories of hazardous wastes and registration of generators of hazardous waste. • Outlines requirements of storage systems for petroleum products.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Endangered Species and Ecosystems Act, C.C.S.M. c. E111	• Threatened, Endangered and Extirpated Species Reg. 25/98.	• Regulates the protection of Manitoba's threatened and endangered species. Conserves and protects threatened and endangered ecosystems in Manitoba and promotes their recovery.
The Fires Prevention and Emergency Response Act C.C.S.M. c. F80	• N/A	• Any activities associated with combustible materials. • Provides for control of activities regarding the prevention, detection and extinguishment of fires. Work camp occupancy permit required.
The Groundwater and Water Well Act *C.C.S.M. c. G110*	• Groundwater and Water Well (General Matters) Regulation 214/2015. • Well Standards Regulation 215/2015.	• The purpose of this Act is: ○ to provide for the protection and stewardship of Manitoba's aquifers and groundwater; ○ to ensure that the construction, maintenance and sealing of wells and test holes meet standards that protect; ○ the environmental quality of Manitoba's aquifers and groundwater, and human health and safety; ○ to provide for the collection and sharing of well, aquifer and groundwater information to better understand, manage, conserve, protect, develop and use Manitoba's aquifers and groundwater.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Heritage Resources Act, C.C.S.M. c. H39.1	• Heritage Resources Forms Regulation 99/86. • Heritage Objects Designation Regulation 160/89. • Heritage Sites Designation Regulation 122/88R.	• Designates heritage sites and identifies protections for heritage resources and heritage resource sites, including the requirement to conduct a Heritage Resource Impact Assessment (HRIA). A permit is required for the HRIA.
The Highway Traffic Act, SM 1985-86, c. 3	• Designated Construction Zones Regulation 145/2014.	• Provides guidelines and requirements for vehicles and driving on Manitoba highways.
The Mines and Minerals Act, C.C.S.M. c. M162	• Quarry Minerals Regulation, 1992, Reg.65/92. • Drilling Regulation, 1992, Reg. 63/92.	• Identifies and outlines requirements for sustainable development of mineral product exploration and production, including quarrying, in Manitoba. Quarry permits will be required.
The Noxious Weeds Act, C.C.S.M. c. N110	• Noxious Weeds Reg. 35/96.	• Identifies noxious weeds that may adversely impact Manitoba's environment or economy, outlines responsibilities to control or destroy such weeds and prohibits their spread during construction works.
The Public Health Act, P210	• N/A	• Relates to the preservation of health including conditions that may contaminate or pollute air, food or water. • Food handling permit is required for construction camps if they have kitchen facilities.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Climate and Green Plan Implementation Act	• N/A	• Provides a framework through which the government develops a plan to reduce greenhouse gas emissions, address the effects of climate change, promote sustainable development and protect Manitoba's water resources and natural areas.
The Water Protection Act, C.C.S.M. c. W65	• Aquatic Invasive Species Regulation 173/2015. • Nutrient Management Regulation 62/2008.	• Provides protection and stewardship of Manitoba's water resources and aquatic ecosystems.
The Water Resources Administration Act, C.C.S.M. c. W70	• N/A	• Outlines a framework for the use and administration of water control works, including requirements and processes for approval of operating guidelines.
The Water Resources Conservation Act *C.C.S.M. c. W72*	• Water Resources Conservation Regulation 179/2010.	• Provides for the conservation and protection of Manitoba's water resources, and of the ecosystems associated with and reliant upon those water resources.
The Water Rights Act, C.C.S.M. c. W80	• Water Rights Regulation 126/87.	• Identifies rights and use of water in Manitoba and prohibitions against diversion of water or operation of water works and sets requirements for permitting and protections of aquatic ecosystems. Permits may be required for drainage works.
The Wildfires Act, C.C.S.M. c. W128	• Burning Permit Areas Regulation 242/97.	• Outlines wildfire controls, duties and prohibitions. A permit is required to burn clearing debris.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Wildlife Act, C.C.S.M. c. W130	• General Hunting Regulation, Reg. 351/87. • Hunting Areas and Zones Regulation, Reg. 220/86. • Trapping Area and Zones Regulation, Reg. 149/2001. • Wildlife Protection Regulation, Reg. 85/2003.	• Designates provincial wildlife lands, regulates licenced harvest of wildlife, and identifies other protections for wildlife in Manitoba.
The Workplace Safety and Health Act, C.C.S.M. c. W210	• Workplace Safety and Health Regulation 217/2006. • Operation of Mines Regulation 212/2011.	• Outlines safety related duties in the workplace and identifies measures to ensure that safe work practices are being followed to protect health and safety of workers.

APPENDIX 2

Environmental Inspection Forms

(These will be included once developed during Detailed Design)

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Ice Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Purpose and Scope 1

1.2 Objective 3

2.0 ICE MANAGEMENT WITHIN OUTLET CHANNELS 4

2.1 Operation of Outlet Channels Following Winter Non-Operation 4

2.2 Winter Operation of Outlet Channels 5

2.2.1 Ice Conditions in LMOC 5

2.2.2 Ice Conditions in LSMOC 6

2.2.3 Ice Conditions at Channel Inlets 6

2.2.4 Ice Conditions at Channel Outlets 6

3.0 ICE MANAGEMENT IN PROJECT-AFFECTED FLOW SYSTEM ... 9

3.1 Existing River Ice Processes 9

3.1.1 Fairford River 9

3.1.2 Dauphin River 9

3.2 Potential Project Effects 10

4.0 ADAPTIVE MANAGEMENT AND MONITORING 12

4.1 General 12

4.2 Follow up Response 13

List of Figures

Figure A: EMP Process

Figure 1: Project Area

Figure 2: Locations of Potential Thin Lake Ice

DISCLAIMER

This document was developed to support the Channel Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders, and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from engagement and consultation, the Environmental Assessment process, Project planning activities and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans leading up to and after the start of construction will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Ice Management Plan (IMP) is one component of the overall Environmental Management Program (EMP) framework which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of *The Environment Act* provincial licence and *The Canadian Environmental Act 2012* Decision Statement, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied, as described further in individual environmental management and monitoring plans. Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the Committee will coordinate Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on the structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring plans, sharing plan specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders

and stakeholders would be informed and could provide meaningful input into Project planning. The draft EMP plans and questionnaires are also posted on the Project website for public review and comment at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html. Feedback and recommendations received were used to update the plans.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* licence, *The Canadian Environmental Assessment Act 2012* Decision Statement Conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance and in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

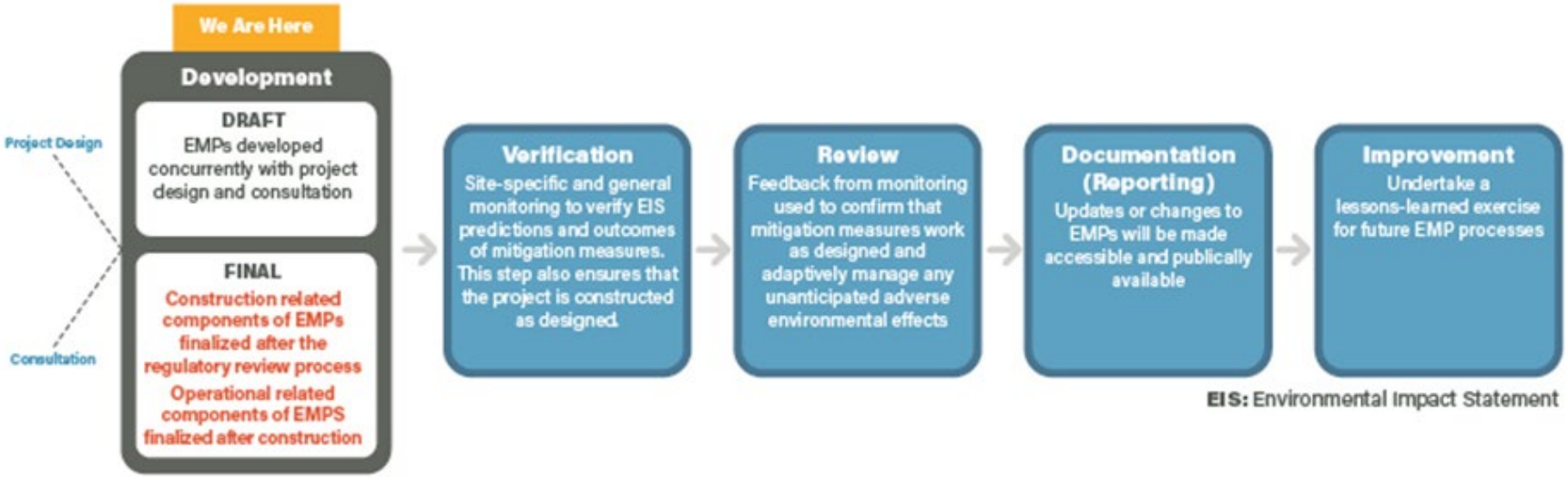


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	percent
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
EIS	Environmental Impact Statement
EMP	Environmental Management Program
FRWCS	Fairford River Water Control Structure
IMP	Ice Management Plan
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
mm	millimetre
OEMP	Operation Environmental Management Program
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
TC	Transport Canada
WCS	water control structure

Glossary of Terms

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation, or maintenance activities, and includes all subcontractors and affiliates.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental, and traffic control aspects of the project to support the structural design of the bridge or structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Frazil Ice: Small discs of ice ranging in size from less than 0.1 mm to a few mm, formed in turbulent water.

Hanging Ice Dam: Ice accumulation created by the deposition of entrained ice on the underside of an ice cover.

Ice Jam: Generic term referring to the accumulation of ice fragments in a watercourse that restricts flow and causes staging of water levels upstream.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase in the design process typically supports the pre-construction engagement and consultation process with the public and rights-holders, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Rights-holders: include First Nations, Metis communities and other Indigenous groups who hold Aboriginal or Treaty rights that are protected under section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing, or gathering rights.

1.0 INTRODUCTION

1.1 Purpose and Scope

The Ice Management Plan (IMP) is a component of Manitoba Transportation and Infrastructure's overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project ("the Project"). The EMP consists of a series of monitoring and management plans being developed to provide mitigation measures and Best Management Practices for Project construction, operation and maintenance activities to reduce or avoid potential adverse effects. The plans outline monitoring activities that will be undertaken to document environmental conditions, guide mitigation and adaptive management measures, and undertake Project activities such that they are carried out in compliance with applicable environmental legislation and licensing requirements. They have considered and incorporated input received from rights-holders and other Project stakeholders.

The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

The Project will provide additional outlets to release water from Lake Manitoba and Lake St. Martin. Operation of the outlet channels will result in changes to the regional flow system, including changes to lake water levels and changes to flows in the connecting rivers. The location of the proposed outlet channels in relation to the regional flow system is shown in Figure 1.

Although the outlet channels will be used primarily during the spring and summer to reduce damage caused by open water flooding, the channels are designed to permit operation in the winter months as well. Winter operation of the outlet channels will be considered to reduce water levels in the lakes following a large flood in the previous spring/summer, or to pre-emptively lower lake levels to prepare for a large flood in the subsequent spring as stipulated in the Operating Guidelines for the Project. Based on a simulation of historic (1915-2017) conditions from, it is estimated that for the 103-year period of record the LMOC and LSMOC would be operated in 33 years (32.0%), with winter operation occurring in 12 of those years (11.7 % of record, or 36.4% of operating years). It is recognized that this percentage would be increased based on climate change predictions since there is more volume of water in the system and therefore it takes longer to lower the lake level. Management of ice processes, both in the channels and in the connected flow system, will be considered during winter operation of the outlet channels.

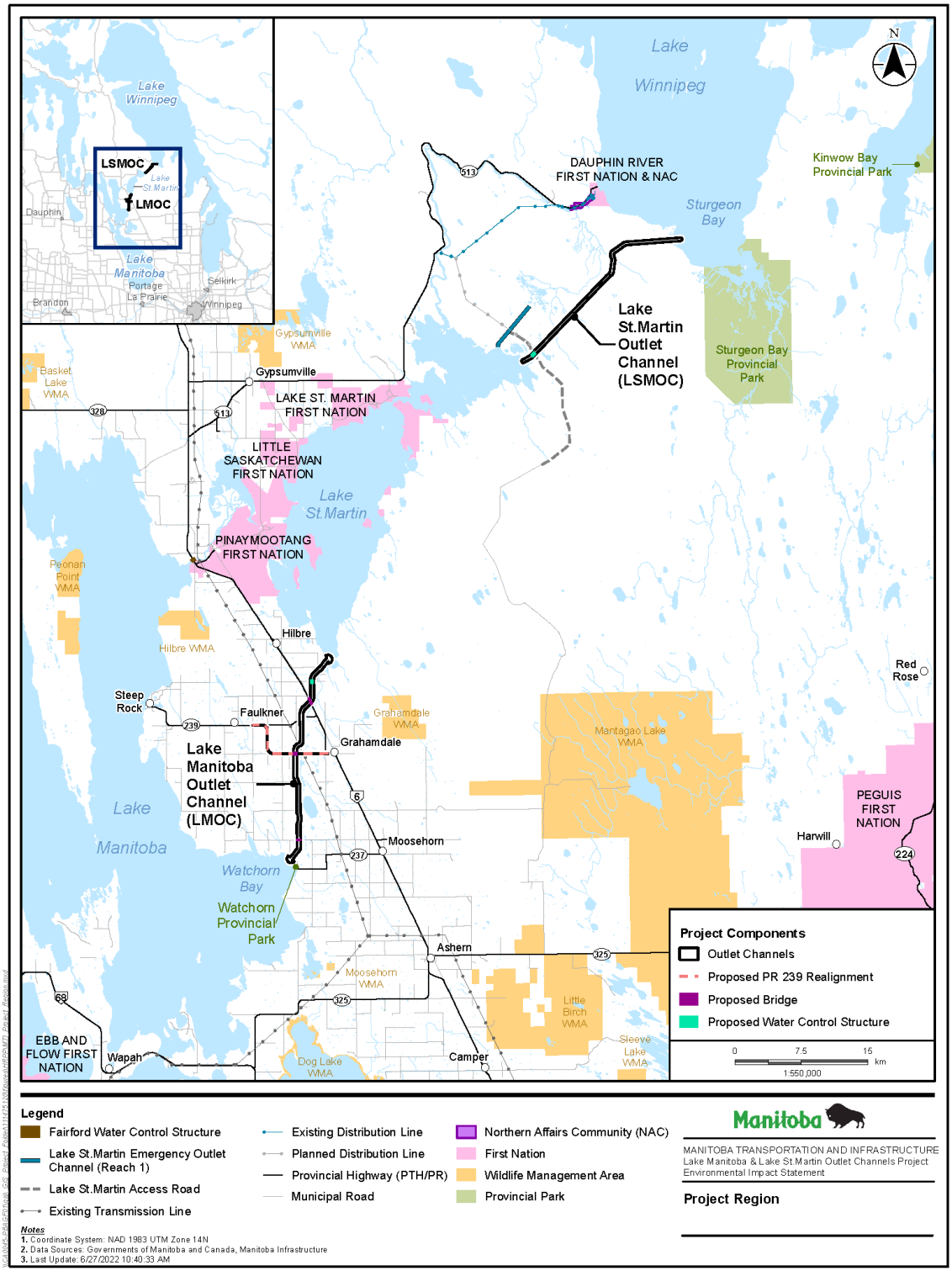


Figure 1: Project Area

1.2 Objective

The objective of the IMP is to manage hazards related to ice during operation of the outlet channels in consideration of public and worker safety and environmental impacts. Potential ice hazards include river ice jams (within the outlet channels and in Project-affected rivers) and variations in lake ice thicknesses. The IMP is a component of the Operation Environmental Management Program (OEMP).

2.0 ICE MANAGEMENT WITHIN OUTLET CHANNELS

Ice management within the outlet channels is important to minimize the risk of adverse ice conditions within the channels (e.g., ice jams), which could potentially lead to reduced freeboard on the channel dikes and a reduction in winter discharge capacity. Unpredictable ice processes could also cause damage to channel components such as drop structures and the water control structure (WCS). The following sections describe how ice will be managed in the LSMOC and LMOC.

2.1 Operation of Outlet Channels Following Winter Non-Operation

In years when the LMOC and LSMOC are not operated in the winter (i.e., WCS gates are closed), thermal ice covers will form in the channels. Depending on winter air temperatures, the ice thickness will range from approximately 0.6-1.2 metres (m). In accordance with the Operating Guidelines developed for the Project, the WCS gates will not typically be initially opened during the period where there is a solid ice cover in the channels (approximately December 1 to April 30).

Prior to normal spring operation, an observational survey of the outlet channels will be conducted to assess ice conditions. The survey may involve an initial monitoring phase where satellite-telemetered cameras mounted on the WCS would provide daily images of ice conditions to assess pre-breakup. Manitoba Transportation and Infrastructure Regional Operations staff would drive the dikes to assess ice conditions along the channels to carry out an ice condition assessment once degradation is observed. If conditions necessitate, a drone would be deployed to provide coverage of inaccessible areas. If required, Manitoba Transportation and Infrastructure can task RADARSAT satellite imagery to provide images of ice conditions. The ice condition assessment would only be carried out in years where operation in early spring is considered. It is anticipated that in most years that the cameras would confirm ice degradation prior to operation. Once the channels are observed to be free of ice (or substantial deterioration of the ice cover has occurred), spring operation of the outlet channels will commence.

In extreme cases where there is a risk of severe flooding the following spring, operation (opening) of the WCS gates will be considered even if a solid ice cover still exists within the outlet channels. Such operations will require careful adjustments of the gates and continuous monitoring; flow in the outlet channels would be gradually increased and ice conditions in the channels would be monitored concurrently for signs of undesirable changes in ice conditions. If the ice cover is observed to be breaking up uncontrollably and/or if ice jams form in the channel, the WCS gates would be lowered to reduce flow into the channels and prevent potential overtopping of the channel dikes or banks from the flow constriction caused by the ice jam. The broken ice pieces could also cause damage to bridge piers or drop structures as they are transported downstream.

2.2 Winter Operation of Outlet Channels

In years with significant spring/summer floods, the outlet channels may continue to be operated through the winter, in accordance with the Operating Guidelines, to continue reducing water levels in Lake Manitoba and Lake St. Martin. As mentioned previously, in years where the outlet channels operate, it is estimated that the LMOC and LSMOC would continue to be operated in approximately 12 % of the winter periods. During operation of the channels, communication processes will be managed by the Manitoba Transportation and Infrastructure according to existing protocols for other flood control infrastructure (e.g., Fairford River Water Control Structure [FRWCS], Shellmouth Dam, Portage Diversion, and Red River Floodway). This involves a combination of press releases, forecasts and reports by the Hydrologic Forecasting Center, and real time operation/monitoring data on Manitoba Transportation and Infrastructure's website.

In general, lake inflows and water levels are lower during the winter season and thus potential maximum flows in the outlet channels are less during this time than during an open water flood. In addition to lake level considerations in controlling the flows in each of the outlet channels, ice processes within the channels must be considered. The WCS will have heated vertical gates that can be operated throughout the winter.

2.2.1 Ice Conditions in LMOC

The WCS of the LMOC is located near the downstream end of the channel, approximately 3 kilometres (km) upstream of the outlet to Lake St. Martin. In winters when the WCS gates remain closed and only the riparian flow is released, the LMOC will form a uniform thermal ice cover. Should winter operation be required (as dictated by the threshold lake levels defined in the Operating Guidelines), the LMOC will be operated to mitigate potential negative impacts of ice formation in the channel. Based on the assessment monitoring described previously, at the onset of freeze-up the WCS gates will be operated to temporarily reduce or stop flow in the LMOC. The reduction in water velocity afforded by this will promote the rapid formation of a stable ice cover in the channel. Once formed, the ice cover will insulate the water surface, and reduce the volume of frazil ice produced (frazil ice refers to small discs of ice ranging in size from less than 0.1 millimetres (mm) to a few mm, formed in turbulent water). This will limit the severity of ice accumulation in the channel and avoid the formation of a hanging ice dam at the outlet in Lake St. Martin. Depending on the hydraulic and meteorological conditions, the stable ice cover may form thermally or through the accumulation of ice pans at the surface. Once a stable ice cover has formed, the WCS gates would be fully opened to allow the channel to operate at maximum capacity in accordance with the Operating Guidelines. The flow will be increased gradually, and in steps to limit the risk of mechanical breakup of the ice cover. Ice conditions in the LMOC will be monitored to minimize the chance of ice cover instabilities.

In the event of unforeseen ice conditions in the LMOC during winter operation (e.g., development of an ice jam), the WCS gates will be lowered to reduce the flow in the channel. If required, equipment such as tracked excavators with extended reach will be mobilized to help remove ice jam blockages if forecasted flood conditions necessitate the continued operation of the LMOC.

2.2.2 Ice Conditions in LSMOC

The WCS of the LSMOC is located at the upstream end, near the inlet in Lake St. Martin. In winters when the WCS gates remain closed and only the riparian flow is released, the LSMOC will form a uniform thermal ice cover.

Similar to the LMOC, in years when gated operations are required, the LSMOC WCS will be operated to limit winter flows to promote the formation of a stable ice cover in the channel, thereby reducing the volume of frazil ice produced. This will limit the severity of ice accumulations on the drop structures and will inhibit the formation of a hanging dam at the outlet in Lake Winnipeg.

During operation, depending on the hydraulic and meteorological conditions, the stable ice cover may form thermally or through the accumulation of ice pans at the surface. As indicated, observational monitoring of ice conditions and dike freeboard will be conducted regularly during winter operation of the LSMOC. It is anticipated that monitoring of ice conditions will occur more frequently during the first few winter operations of the LSMOC (i.e., daily to weekly) to document and understand the ice conditions. Monitoring frequency may be adjusted in subsequent years to be commensurate with patterns in the observed ice conditions. If unforeseen ice conditions develop in the outlet channel (i.e., ice jams or excessive accumulation of ice on the drop structure crests) causing reduced freeboard on channel dikes, the WCS gates will be lowered to reduce flow in the LSMOC and maintain safe freeboard. Equipment such as long-reach excavators will be used, if necessary, to assist in clearing ice jams if forecasted flood conditions necessitate the continued operation of the LSMOC at higher flows.

2.2.3 Ice Conditions at Channel Inlets

Operation of the outlet channels during the winter will alter the local flow patterns in the lakes near the inlets. Higher water velocities through the inlets will result in sustained open water and/or thinner ice covers compared to when the channels are not operated.

2.2.4 Ice Conditions at Channel Outlets

Winter operation of the outlet channels will alter local flow patterns at the channel outlets in Lake St. Martin and Lake Winnipeg.

As described in Section 2.2.1, when winter operation is required, the LMOC WCS will be operated to promote the development of a stable ice cover over its full length, which will limit the volume of frazil ice produced and transported into Lake St. Martin. The channel immediately downstream of the WCS will remain open for a short distance due to local high velocities and turbulence leaving the WCS. The remainder of the downstream channel is expected to develop a stable ice cover that will transition to a lake ice cover near the channel outlet in Lake St. Martin. The lake ice cover in the vicinity of the outlet will be thinner due to the local changes to water velocities resulting from operation of the LMOC.

When operated at higher flows, the LSMOC may not form a stable ice cover over its entire length (some reaches between drop structures may have a stable ice cover while others may not). Frazil ice will continue to be produced in the open water areas, and the ice will be transported downstream to Lake Winnipeg. The entrained frazil slush and ice pans will deposit under the thermal lake ice cover on Lake Winnipeg, creating a hanging dam. This type of ice formation occurs naturally each year at the outlet of the Dauphin River to Lake Winnipeg. As the hanging dam grows, the water level in the outlet and in the channel immediately upstream will rise. Water levels upstream of the final drop structure will not be directly affected by the hanging dam. Monitoring of ice processes in the LSMOC during winter operation will therefore also include observations of the hanging dam formation at the outlet. In the event that the hanging dam conditions become severe, and the channel dikes are at risk of overtopping, flow in the LSMOC will be reduced to form a stable ice cover in the LSMOC and cut off the supply of ice to the hanging dam. The flow would not be reduced below the riparian flow required to maintain adequate dissolved oxygen concentrations for aquatic organisms (as discussed in Section 2.2.2). If a hanging dam does not form, the lake ice cover in the vicinity of the outlet will be thinner due to the local changes to water velocities resulting from operation of the LSMOC.

Signage indicating potential areas of thin ice will be displayed at the LMOC and LSMOC outlet areas in accordance with TC requirements. Figure 2 shows the approximate extents of the areas of thin lake ice cover resulting from outlet channel operation. Figure 2 also indicates an area in the Lake St. Martin Narrows that could experience changes in freeze-up patterns (discussed later in Section 3.2).

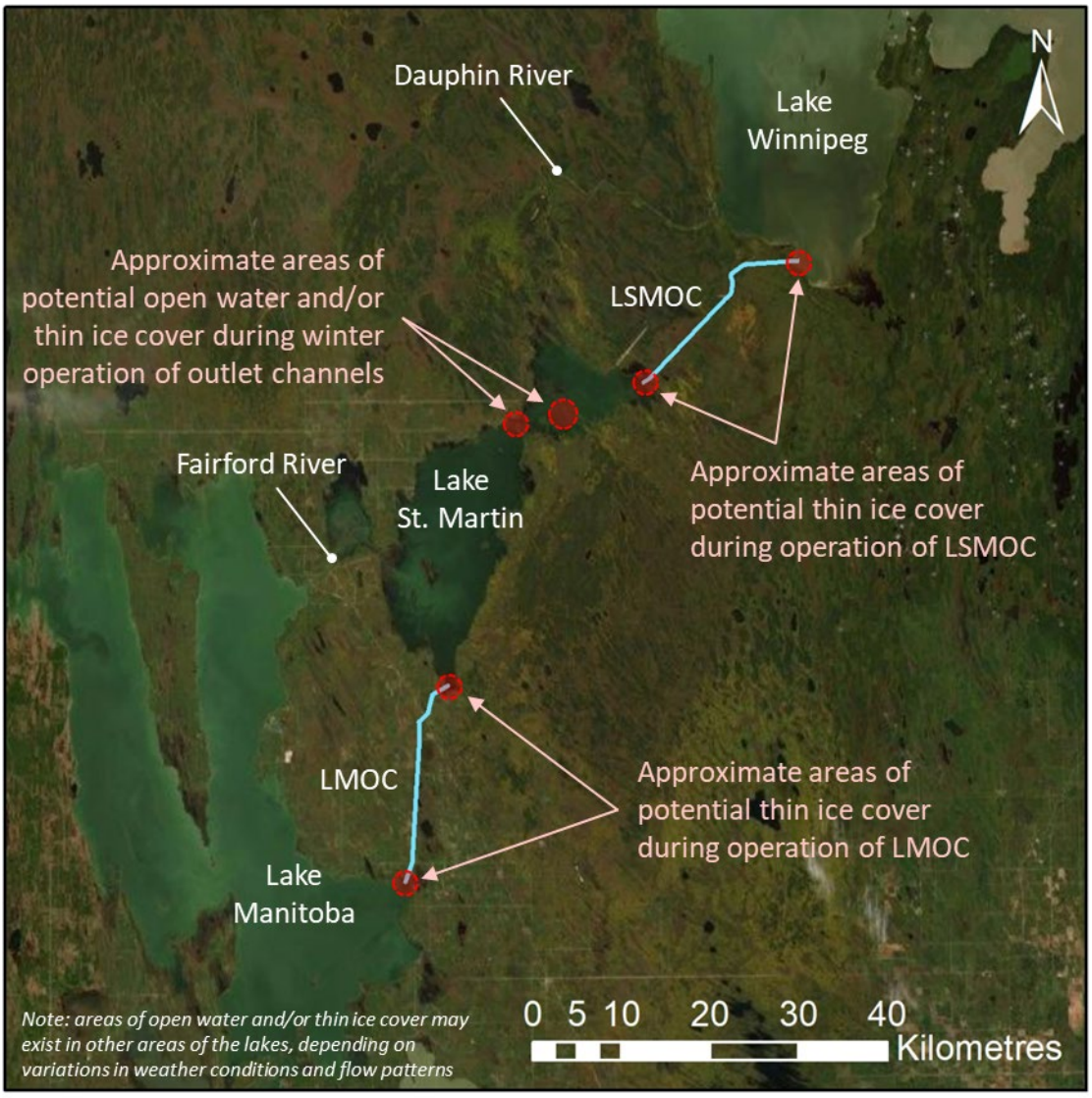


Figure 2: Locations of Potential Thin Lake Ice

3.0 ICE MANAGEMENT IN PROJECT-AFFECTED FLOW SYSTEM

Outflows from Lake Manitoba and Lake St. Martin are currently conveyed solely by the Fairford River and Dauphin River, respectively. Descriptions of the existing river ice conditions and anticipated effects of the Project are provided in the following sections.

3.1 Existing River Ice Processes

3.1.1 Fairford River

The Fairford River runs from the northeast end of Lake Manitoba, through Lake Pineimuta, to Lake St. Martin. The primary flow path is approximately 17 km long, but the river branches into multiple smaller reaches in the delta region through Lake Pineimuta. The FRWCS regulates outflow from Lake Manitoba. The outflows from the FRWCS are normally limited in magnitude in the winter to promote the formation of a stable ice cover in the Fairford River and reduce the severity of frazil ice formation in the Dauphin River downstream. Under these low flow conditions, ice formations on the river both upstream and downstream of the FRWCS do not substantially influence the outflow capacity from the lake.

Most of Lake Pineimuta typically freezes over with a thermally grown ice cover early in the winter. The two channels of the Fairford River take longer to develop an ice cover and may remain open through most of the winter in some years. Border ice may bridge across the river at certain locations, initiating ice covers at various points along the river. An ice front also progresses upstream from the thermal ice cover on Lake St. Martin. Throughout the winter, the ice coverage can change quite drastically as the various ice covers advance and retreat in response to flow conditions and air temperatures. The area upstream of the FRWCS in Lake Manitoba takes longer to freeze over due to the higher water velocities, and often does not completely freeze over throughout the entire winter.

3.1.2 Dauphin River

The Dauphin River is approximately 52 km long, running from the north basin of Lake St. Martin to Lake Winnipeg. Flow in the Dauphin River is not directly regulated but is influenced by operation of the FRWCS.

The ice processes in the Dauphin River are notably different in the upper, low gradient reach compared to the lower, high gradient reach. During winter, water flowing out of Lake St. Martin and into the Dauphin River cools and forms frazil ice. The shallow depth of Lake St. Martin reduces the residual heat capacity of the lake water, allowing ice to begin to form in the river within a few hundred metres of the lake. The frazil ice volume increases in the downstream direction, and the frazil slush forms competent ice pans which are transported downstream with the flow. Border ice forms in the lower velocity regions near the banks and in the side channels of the upper reach.

Approximately 11 km from Lake Winnipeg, the river gradient increases abruptly. The fast-moving water in this reach limits the extent of border ice growth and frazil pans are transported downstream with the flow to Lake Winnipeg. A thermal ice cover grows in Lake Winnipeg early in the winter. Incoming frazil pans and slush can be swept under the lake ice cover or may juxtapose against the lake ice cover depending on the hydraulic conditions at the outlet. During higher flows, the frazil pans are typically swept under the lake ice cover and are transported further into the lake where they are eventually deposited. This forms a hanging dam and causes the upstream water levels to gradually increase. Eventually, the staging of water allows incoming frazil pans to juxtapose against the lake ice cover and the leading edge of the cover begins to progress upstream.

Due to the high gradient of the lower reach, the ice cover typically experiences several consolidation events as it advances upstream; this refers to the collapse and mechanical thickening of the ice cover in response to the external forces of gravity and water shear which grow as the cover lengthens. The thickness and roughness of the consolidated cover can raise water levels by several metres (as much as 3-5 m in some areas).

When the ice front progresses to the upper reach, it generally advances much faster via juxtaposition and surface packing of the ice pans. Some mechanical thickening of the cover in the upstream reach can occur, but not nearly to the same extent as in the lower reach. Provincial Road 513 has been flooded in the past due to ice-affected staging in the upper reach. If the flow is sufficiently low, border ice may completely bridge across sections of the upper reach early in the winter, which cuts off the ice supply to downstream and can also insulate the water flowing in the river. Consequently, ice cover in the lower reach takes longer to form.

Once an ice cover forms, open water leads typically develop as the flowing water erodes the ice along preferential flow paths. As air temperatures rise in the spring, additional open water leads form and grow in size as the ice cover decays and melts.

3.2 Potential Project Effects

As documented in Volume 2, Section 6.4.7 of the Project EIS, changes to regional flow patterns from Lake Manitoba to Lake Winnipeg in the post-Project environment were quantified using a water balance model. The general effect of the Project is a reduction in the frequency of high winter flows on the Fairford and Dauphin rivers. The Project is predicted to have a negligible effect on the frequency of low flow events.

The Lake St. Martin Narrows typically does not freeze over completely in the winter in the existing environment; open water leads remain in the constriction where water velocities are highest. Winter operation of the outlet channels would increase flow through the system and could cause some increase in the size of the open water leads that remain through the Lake St. Martin Narrows over the winter (see Figure 2).

In general, the magnitude of the potential changes to ice processes in regional waterways (i.e., Dauphin River and Fairford River) is predicted to be low to negligible. Therefore, no specific ice management practices are anticipated to be required outside of the LMOC and LSMOC. As noted in Section 2.2, operation of the outlet channels could be communicated to nearby communities via press releases, forecasts, and reports by the Hydrologic Forecasting Center, and or real time operation/monitoring data on Manitoba Transportation and

Infrastructure's website. Manitoba Transportation and Infrastructure has developed a draft Complaint Resolution Process intended to collect, respond to, and resolve any Project-related complaints. Complaints regarding ice will be addressed through this process and may include specific monitoring activities such as visual observations, drone flights, surveys, etc., as required on a case-by-case basis.

4.0 ADAPTIVE MANAGEMENT AND MONITORING

4.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The federal *Impact Assessment Act* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the environmental assessment,
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required,
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects,
- provide information on environmental effects and mitigation that can be used to improve and/or support future environmental assessments including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

In summary, operation of the LMOC and LSMOC in the winter will be performed in a manner to reduce the severity of ice formations in the outlet channels. Warning signage indicating potential areas of thin lake ice will be displayed at the channel inlets and outlets in accordance with TC requirements. Other waterway access restrictions related to hazardous ice conditions in the channels will be identified as provided in the AMP. Conditions in the channels will be monitored during winter operation, which will include water levels, ice processes, ice thicknesses, and water temperature. Monitoring techniques will include deployment of water level and temperature sensors, conducting reconnaissance surveys, or use of time-lapse cameras. Although operation of the outlet channels is not anticipated to have any negative impacts on ice processes in the Project-affected flow system, incident-based ice monitoring may also be conducted to respond to ice-related complaints in accordance with Manitoba Transportation and Infrastructure's Complaint Resolution Process (CRP).

4.2 Follow up Response

As indicated, in the event of adverse ice conditions in the channels or connected flow system, mitigation measures may include operational adjustments (e.g., flow reductions) in the outlet channels, or deployment of equipment such as long-reach excavators to help clear ice jams. The latter is not expected to be a regular occurrence as operational measures are intended to prevent the formation of ice jams in the outlet channels and connected waterways. Adaptive management options to be considered, if required, include expanding/ adjusting ice monitoring protocols (e.g., increasing frequency of monitoring), modifying winter operation of the outlet channels in accordance with the Operating Guidelines, and installation of additional ice management works such as ice booms.

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Aquatic Effects Monitoring Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

1.0 INTRODUCTION 1

1.1 Purpose and Scope 1

1.2 Objectives 2

2.0 OVERALL APPROACH 3

2.1 Monitoring Phases 5

2.2 Study Area 6

2.3 Adaptive Management 7

3.0 SURFACE WATER QUALITY 9

3.1 Rationale 9

3.2 Approach 10

3.2.1 Key Questions and Study Overview 10

3.2.2 Baseline Information 10

3.2.3 Identification of Benchmarks 11

3.3 Surface Water Quality Monitoring 12

3.3.1 Purpose 12

3.3.2 Timing 12

3.3.3 Field and Laboratory Methods 12

3.3.4 Parameters 13

3.3.5 Data Analysis 13

3.4 Dissolved Oxygen Monitoring in the POCs 13

3.4.1 Purpose 13

3.4.2 Timing 13

3.4.3 Field and Laboratory Methods 14
3.4.4 Parameters 14
3.4.5 Data Analysis 14
3.5 TSS Monitoring 14
3.5.1 Purpose 14
3.5.2 Timing 14
3.5.3 Field and Laboratory Methods 15
3.5.4 Parameters 15
3.5.5 Data Analysis 16
3.6 Adaptive Management 16
4.0 AQUATIC HABITAT 18
4.1 Rationale 18
4.2 Approach 19
4.2.1 Key Questions and Overview of Studies 19
4.2.2 Baseline Information 20
4.2.3 Identification of Benchmarks 20
4.3 Aquatic Habitat at the POCs 21
4.3.1 Purpose 21
4.3.2 Timing 21
4.3.3 Field and Laboratory Methods 21
4.3.4 Parameters 22
4.3.5 Data Analysis 22
4.4 Substrate Composition in Lake St. Martin and Sturgeon Bay 22
4.4.1 Purpose 22
4.4.2 Timing 23
4.4.3 Field and Laboratory Methods 23
4.4.4 Parameters 23
4.4.5 Data Analysis 23

4.5 Lake Winnipeg Substrate at McBeth Point and Other Selected Locations 24
4.5.1 Purpose 24
4.5.2 Timing 24
4.5.3 Field and Laboratory Methods 24
4.5.4 Parameters 25
4.5.5 Data Analysis 25
4.6 Adaptive Management 25
5.0 FISH COMMUNITY 27
5.1 Rationale 27
5.2 Approach 28
5.2.1 Key Questions and Overview of Studies 28
5.2.2 Baseline Information 28
5.2.3 Identification of Benchmarks 29
5.3 Fish Community Monitoring in Lake St. Martin 30
5.3.1 Purpose 30
5.3.2 Timing 31
5.3.3 Field and Laboratory Methods 31
5.3.4 Parameters 31
5.3.5 Data Analysis 31
5.4 Fish Community Monitoring in Sturgeon Bay 32
5.4.1 Purpose 32
5.4.2 Timing 32
5.4.3 Field and Laboratory Methods 32
5.4.4 Parameters 32
5.4.5 Data Analysis 32
5.5 Fish Utilization of Birch and Buffalo Creek Drainages 33
5.5.1 Purpose 33
5.5.2 Timing 33
5.5.3 Field and Laboratory Methods 33

5.5.4 Parameters 33
5.5.5 Data Analysis 33
5.6 Adaptive Management 34
6.0 FISH SPAWNING 36
6.1 Rationale 36
6.2 Approach 36
6.2.1 Key Questions and Overview of Studies 36
6.2.2 Baseline Information 37
6.2.3 Identification of Benchmarks 38
6.3 Spring Fish Use of the Dauphin and Fairford Rivers 39
6.3.1 Purpose 39
6.3.2 Timing 39
6.3.3 Field and Laboratory Methods 39
6.3.4 Parameters 39
6.3.5 Data Analysis 40
6.4 Fall Fish Use of the Dauphin and Fairford Rivers 40
6.4.1 Purpose 40
6.4.2 Timing 40
6.4.3 Field and Laboratory Methods 40
6.4.4 Parameters 41
6.4.5 Data Analysis 41
6.5 Spring Larval Lake Whitefish Emergence on Lake St. Martin 41
6.5.1 Purpose 41
6.5.2 Timing 42
6.5.3 Field and Laboratory Methods 42
6.5.4 Parameters 42
6.5.5 Data Analysis 42
6.6 Spring Larval Fish Movements in Rivers 42
6.6.1 Purpose 42

6.6.2 Timing 43
6.6.3 Field and Laboratory Methods 43
6.6.4 Parameters 43
6.6.5 Data Analysis 43
6.7 Adaptive Management 44
7.0 EFFECTS AT THE PERMANENT OUTLET CHANNELS 46
7.1 Rationale 46
7.2 Approach 46
7.2.1 Key Questions and Overview of Studies 46
7.2.2 Baseline Information 47
7.2.3 Identification of Benchmarks 47
7.3 Fish Movement through the POCs 49
7.3.1 Purpose 49
7.3.2 Timing 49
7.3.3 Field and Laboratory Methods 49
7.3.4 Parameters 50
7.3.5 Data Analysis 50
7.4 Larval drift through the POCs 50
7.4.1 Purpose 50
7.4.2 Timing 50
7.4.3 Field and Laboratory Methods 50
7.4.4 Parameters 51
7.4.5 Data Analysis 51
7.5 Fish use of the Outlets during Channel Operation 51
7.5.1 Purpose 51
7.5.2 Timing 51
7.5.3 Field and Laboratory Methods 51
7.5.4 Parameters 52
7.5.5 Data Analysis 52

7.6 Fish Stranding in the Channels after WCS Closure 52
7.6.1 Purpose 52
7.6.2 Timing 52
7.6.3 Field and Laboratory Methods 53
7.6.4 Parameters 53
7.6.5 Data Analysis 53
7.7 Fish Use of the POCs following Closure and during Non-Operation 53
7.7.1 Purpose 53
7.7.2 Timing 53
7.7.3 Field and Laboratory Methods 53
7.7.4 Parameters 54
7.7.5 Data Analysis 54
7.8 Fish Mortality due to Dissolved Oxygen Depletion 54
7.8.1 Purpose 54
7.8.2 Timing 54
7.8.3 Field and Laboratory Methods 54
7.8.4 Parameters 55
7.8.5 Data Analysis 55
7.9 Adaptive Management 55
8.0 MERCURY IN FISH FLESH 58
8.1 Rationale 58
8.2 Approach 58
8.2.1 Key Questions and Overview of Studies 58
8.2.2 Baseline Information 58
8.2.3 Benchmark 58
8.3 Fish Mercury Concentration Monitoring 59
8.3.1 Purpose 59
8.3.2 Timing 59
8.3.3 Field and Laboratory Methods 59

8.3.4 Parameters 59
8.3.5 Data Analysis 59
8.4 Adaptive Management 59
9.0 SCHEDULE AND REPORTING 61
10.0 REFERENCES 63
APPENDIX 1 65
APPENDIX 2 74

List of Tables

Table 2-1: Definition of Project phases and states used in the AEMP

Table 2-2: Supplemental studies conducted prior to commissioning.

Table 2-3: Water quality parameters to be sampled.

Table 2-4: Hydrocarbon and pesticide parameters measured at selected water quality sampling sites.

Table 2-5: Schedule of monitoring planned to be conducted for the Aquatic Effects Monitoring Program.

List of Figures

Figure A: EMP Process

Figure 1-1: Location of Lake Manitoba and Lake St. Martin Outlet Channels and other waterbodies referenced in the AEMP. Arrows show direction of flow.

Figure 1-2: Location of surface water quality sampling sites.

Figure 1-3: Location of DO monitoring sites.

Figure 1-4: Location of turbidity logger and TSS sampling sites

Figure 1-5: Representative standard experimental gill net sites for Lake St. Martin fish community sampling

Figure 1-6: Representative index net sites for Sturgeon Bay fish community sampling as part of the CAMP. Sites may be added near the proposed LSMOC outlet.

Figure 1-7: Larval lake whitefish sampling sites on Lake St. Martin and larval drift trap sites on the Dauphin and Fairford rivers.

Figure 1-8: Location of hydroacoustic receiver stations to document downstream fish movements during POC operation.

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Aquatics Effects Monitoring Plan (AEMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.



Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

AEMP	Aquatic Effects Monitoring Plan
CAMP	Coordinated Aquatic Monitoring Program
CEMP	Construction Environmental Management Program
CPUE	Catch per Unit Effort
DFO	Fisheries and Oceans Canada (formerly Department of Fisheries and Oceans)
DO	Dissolved Oxygen
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EOC	Emergency Outlet Channel
EPP	Environmental Protection Plan
FOMP	Fish Offsetting and Mitigation Plan
FRCN	Fisher River Cree Nation
FRWCS	Fairford River Water Control Structure
GWMP	Groundwater Management Plan
km	kilometre
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
OEMP	Operation Environmental Management Program
PAL	Protection of Aquatic Life (in reference to water quality standards, objectives and guidelines)
PDA	Project Development Area
POC	Permanent Outlet Channels (refers to both the LMOC and the LSMOC)
PR	Provincial Road
the Project	the Lake Manitoba and Lake St. Martin Outlet Channel Project
RM	Rural Municipality

SMP	Sediment Management Plan
SWMP	Surface Water Management Plan
TSS	Total Suspended Solids
WCS	Water Control Structure
WetMP	Wetland Monitoring Plan

Glossary of Terms

Aquatic habitat: The living and non-living components of a lake, river, wetland or other waters upon which aquatic life depends.

Aquatic life: Organisms temporarily or permanently living or found in water.

Aquatic vegetation: Submerged, floating-leaved and floating plants that only grow on or beneath the water surface. Submerged plants may be rooted in soils or free-floating.

Baseline: Initial environmental conditions, prior to effects of the Project.

Construction Environmental Management Program: Manitoba Transportation and Infrastructure's program to protect the environment during the construction of the POC.

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Commissioning: After construction is complete, the Water Control Structures will be opened to allow water to enter the POCs and flow mitigation will be tested to determine if the POCs are functioning as planned.

Coordinated Aquatic Monitoring Program: An aquatic monitoring program being conducted at over 40 waterbodies in Manitoba conducted jointly by Manitoba and Manitoba Hydro.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dissolved oxygen: Oxygen molecules (O_2) dissolved in water.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Fisheries Act authorization: Under the federal Fisheries Act, if a Project is likely to cause the death of fish or the harmful alteration, disruption or destruction of fish habitat, then an authorization from the Minister of Fisheries, Oceans and the Canadian Coast Guard must be obtained.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

Offsetting: Measures such as habitat enhancement and restoration are required by DFO to provide additional fish production to replace the loss in production from natural habitats as a result of the construction of the Project.

Operational Period: Time after commissioning. The Water Control Structures may be open when water is being diverted through the POCs for flood management, or closed, when water is not being diverted for flood management. These two conditions are referred to as “operation” or “operating” and “non-operation” or “not operating”.

Project Environmental Requirements: Measures to protect the environment included in contract documents.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Stranding: Trapping fish such that death is imminent (on land or in an isolated area of water).

Suspended sediment: Particulate matter that is held in the water column due to movement of the water.

Turbidity: A measure of the relative clarity of water.

Water Control Structure (WCS): structures on the POCs that control whether and the amount of flow passing down the channels.

1.0 INTRODUCTION

1.1 Purpose and Scope

The Lake Manitoba and Lake St. Martin Outlet Channels Project Environmental Impact Statement (Project EIS) was submitted by Manitoba Transportation and Infrastructure in March 2020. The Project will require an authorization under the federal *Fisheries Act*, and to meet the requirements of the authorization, an offsetting plan to address losses to fish habitat that cannot be avoided or mitigated has been developed. This plan is presented in the Lake Manitoba Lake St. Martin Outlet Project Fish Offsetting and Mitigation Plan (FOMP).

The Project EIS provided an overview of planned monitoring; this Aquatic Effects Monitoring Plan (AEMP) provides a detailed description of monitoring that will be conducted during and after the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project) is commissioned. Results of monitoring will be used to determine whether unanticipated effects are occurring and whether modifications to planned mitigation measures are required. This plan also addresses anticipated requirements for monitoring that will be set out in provincial and federal licenses and permits for the Project; the final draft of this plan will be amended after final regulatory approvals are received to incorporate any additional monitoring requirements.

This AEMP does not include monitoring related to the management of the effects of construction activities; these are described within specific components of the Construction Environmental Management Program (CEMP). This AEMP also does not include monitoring specific to offsetting works that will be specified under the *Fisheries Act* authorization for this Project; monitoring for offsetting is described in the offsetting plan but methods will be consistent with those set out in this AEMP.

This AEMP has benefited from input received during the environmental review process from rights-holders, stakeholders, and regulators, and the final draft will be further amended to reflect results of on-going discussions. In addition, this plan has been revised after the initial draft issued in 2020, taking into consideration results from modelling and other physical environment studies conducted after completion of the Project EIS, as well as the on-going supplementary studies of the aquatic environment.

It should be noted that several other environmental management plans developed for the Project deal with water management, including a Surface Water Management Plan (SWMP), Groundwater Management Plan (GWMP), Wetland Monitoring Plan (WetMP), and a Sediment Management Plan (SMP).

1.2 Objectives

The specific objectives of this AEMP are to:

- Verify the anticipated effects to water quality and fish and fish habitat based on the environmental assessment completed for the Project;
- Determine the effectiveness of mitigation measures;
- Assess the need for additional mitigation measures if initial measures are not adequate;
- Determine the effectiveness of any additional/adapted measure(s); and
- Confirm compliance with regulatory requirements relevant to surface water quality and fish and fish habitat set out in the Project approvals (e.g., *Canadian Environmental Assessment Act 2012* approvals, *The Environment Act* provincial license; *Fisheries Act*).

2.0 OVERALL APPROACH

Monitoring activities described in this AEMP were identified based on an understanding of the existing environment and the anticipated changes that will occur because of the Project. As a flood mitigation project, changes to surface water flow are the primary drivers of environmental change. Water flows from Lake Manitoba via the Fairford River to Lake St. Martin, which drains via the Dauphin River to Sturgeon Bay on Lake Winnipeg (Appendix 1, Figure 1-1). The Fairford River Water Control Structure (FRWCS) is used to maintain suitable levels on Lake Manitoba upstream of the dam. Until 2011, the control structure was effective in managing Lake Manitoba levels within the desirable range; however, the 2011 flood resulted in extensive flooding on Lake Manitoba, Lake St. Martin, and the Dauphin River.

The Lake St. Martin Emergency Outlet Channel (EOC) was constructed from Lake St. Martin to the Dauphin River, via the Buffalo Creek system, to reduce flooding and was operated in both 2011 and 2014. The proposed Project will provide permanent flood mitigation channels. The route differs from the EOC in that there are two separate channels, one routed from Lake Manitoba to Lake St. Martin and a second from Lake St. Martin to Lake Winnipeg without entering the Dauphin River (Appendix 1, Figure 1-1). The two outlet channels (POCs) are intended to work together:

- The 24 kilometre (km) Lake Manitoba Outlet Channel (LMOC) will work in tandem with the existing FRWCS to help regulate water levels and mitigate flooding on Lake Manitoba; and
- The 24 km Lake St. Martin Outlet Channel (LSMOC) will restore a more natural water regime to Lake St. Martin and will also provide flood protection by mitigating increased inflows from operation of the FRWCS, as well as additional inflows from the planned outlet from Lake Manitoba.

During diversion of flow through the POCs, new pathways by which fish may move from upstream to downstream lakes will be created, as well as changes in habitat that may attract spawning fish, particularly at the channel outlets. When not in operation, a small baseflow will be provided to maintain dissolved oxygen (DO) levels at a level sufficient to support fish that may remain in the channels during periods of non-operation [1].

Operation of the POCs will substantially reduce the magnitude of flood flow in the Fairford and Dauphin rivers, but will also result in smaller reductions in median flows. However, flows in the rivers will continue to exhibit typical seasonal variation and will remain within historical ranges (KGS 2021a). Construction of the LMOC will divert flow from a portion of the Birch Creek watershed and result in a permanent reduction in creek discharge. Similarly, the construction of the LSMOC will divert a portion of flow in the Buffalo Creek watershed, permanently reducing discharge in the creek. It is currently proposed that flow reduction in the

[1] During periods of drought, (i.e., close to the 10th percentile) the baseflow in the LSMOC would be reduced to provide more water to the Dauphin River. Baseflow within LSMOC would be maintained at a level that would maintain sufficient DO in the channel to prevent fish kills.

lower portion of Birch Creek will be mitigated by the diversion of water from the LMOC during the open water season when the channel is not in operation. Similarly, it is proposed that water from the LSMOC will be provided to wetlands downstream of the channel during dry periods to help maintain wetland function. It is possible that some of the flow provided to the wetlands may eventually filter to Buffalo Creek augmenting flows during dry periods, though the potential magnitude of the effect cannot be estimated. Flow reductions in Buffalo Creek may be partially mitigated by the input of additional water into upstream wetlands during periods when the LSMOC is operated for flood control. Resultant effects to flow in Buffalo Creek, if any, would be detected during wetland monitoring that will be conducted by Manitoba Infrastructure and Transportation. For the purposes of this AEMP, effects to flow in Buffalo Creek due to water inputs to upstream wetlands are considered negligible.

Specific monitoring plans have been developed for the following aquatic components:

- surface water quality and sediment quality[2] (Section 3.0);
- aquatic habitat, including the newly wetted habitat in the POCs and representative shoals in Lake St. Martin, Sturgeon Bay and Lake Winnipeg to confirm that no unanticipated sedimentation occurs (Section 4.0);
- fish, which are addressed in studies focused on the fish community (Section 5.0), spawning including spawning migrations (Section 6.0), and use of newly created habitat in the POCs (Section 7.0); and
- mercury in fish flesh (Section 8.0).

For each aquatic component, a rationale for the proposed monitoring activity is provided based on potential effects identified during the environmental assessment, as well as from input received during the environmental review process from rights holders, stakeholders, and regulators, and ongoing modeling to better define environmental effects. Monitoring is described in terms of individual studies, and for certain effects, several studies will contribute to assessing a particular effect. Where appropriate, management thresholds are established against which post-Project conditions can be compared to determine whether follow-up actions are required. Monitoring study design is described in terms of the frequency of monitoring, field and laboratory methods, parameters to be measured, and data analysis. An overall schedule and description of reporting is provided in Section 9.0.

[2] Sediment quality will only be monitored if TSS sampling indicates the mobilization of large amounts of sediments.

2.1 Monitoring Phases

For the purposes of the monitoring program, Project phases have been divided into supplemental data collection prior to commissioning, monitoring during channel commissioning, and monitoring conducted during the operational phase (Appendix 2, Table 2-1).

The operational phase consists of three functional states:

1. when the WCSs are open and water is being diverted, referred to as channel operation. It is anticipated that the WCSs would typically be opened in spring or early summer and closed later in summer or fall prior to freeze-up. In the case of severe floods, when the channels cannot be closed before freeze-up, they would be operated all winter, perhaps at a reduced flow rate, until the following spring or summer, depending on water levels;
2. in the immediate period following WCS closure, which is referred to as post-operation of the channels. The duration of this period is dependent on the timing of channel operation but would be extended to include hatch of any fish eggs that were laid during channel operation; and
3. when the WCSs are closed beyond the post-operation period defined above. This is referred to as non-operation. During this phase, a baseflow will be pass through both channels [3].

Supplemental data studies are being conducted prior to channel commissioning where Manitoba Transportation and Infrastructure has determined through internal review and input from rights holders, stakeholders, public and regulators that additional data are needed. These additional data are required to provide the basis for pre/post-Project comparisons in the AEMP studies (Appendix 2, Table 2-2).

Monitoring of effects described in this AEMP will begin during commissioning of the POCs, which is expected to be completed prior to the start of the fall spawning window identified by DFO (September 15). Post-commissioning monitoring will continue in the subsequent winter and following open water season to confirm that conditions during non-operation are suitable to support any fish that enter the channels.

Due to the unpredictable requirement for operation of the channels for flood mitigation, it is not possible to schedule future monitoring by year. Therefore, operation studies were assigned based on channel usage, as defined in Appendix 2, Table 2-1. An operational event will trigger monitoring that will include studies when the WCSs are open and may continue for up to a year after they are closed, depending on the period during which the WCSs were open and the study. For example, if the POCs are operational during the spring spawning period, then spring spawning fish and larval drift studies will be conducted concurrent with operation. If operation continues into the fall, lake whitefish spawning period, then fall surveys of fish migration in the Dauphin and Fairford rivers and larval drift studies the following spring would be conducted. The duration of post-WCS closure study is defined for each study in the following sections. This AEMP also describes monitoring that will occur in the POCs after they have not been operated for three years to confirm

[3] During periods of drought, (i.e., close to the 10th percentile) the baseflow in the LSMOC would be reduced to provide more water to the Dauphin River. Baseflow within LSMOC would be maintained at a level that would maintain sufficient DO in the channel to prevent fish kills.

that conditions are suitable to support fish that may remain within the channels. The three year period is based on the anticipated time that inputs of leaf litter and other organic matter from the adjoining watershed may be sufficient to accumulate on the substrate and thus affect suitability as fish habitat; this duration may be modified based on results of post-commissioning studies.

Monitoring is proposed to be repeated for at least two periods when the channels are operated for flood mitigation, after the channels have been commissioned. It is anticipated that operation will occur on average once every three years, though given that wet periods typically occur for multiple years, this may result in operation for several consecutive years followed by no operation for several years. Monitoring will need to include typical channel operation conditions (i.e., lower magnitude floods where the POCs are operated for less than 6 months) and more extreme conditions (i.e., high magnitude flood where operation of the POCs are operated for more than 6 months). Monitoring during periods of non-operation will be repeated at approximately three year intervals until the channels are operated again and until it is demonstrated that the suitability of aquatic habitat in the channels does not decline during periods of non-operation. If after 10 years of non-operation conditions in the POCs are still suitable to support fish, then further monitoring during non-operation will be suspended.

After the second round of operational monitoring, Manitoba Transportation and Infrastructure will review results to date and determine future monitoring plans for both periods of operation and non-operation. A description of reporting with respect to study results is provided in Section 9.0.

2.2 Study Area

The study area for the AEMP overlaps with the Project Development Area (PDA) and Local Assessment Area (LAA) as defined for the Surface Water and Fish and Fish Habitat Assessments in the Project EIS. The study area (Appendix 1, Figure 1-1) includes:

- the channels (LMOC and LSMOC);
- excavated inlets and outlets at both channels;
- Watchorn Bay on Lake Manitoba;
- Sturgeon Bay on Lake Winnipeg;
- the Fairford River;
- the Dauphin River;
- Lake St. Martin;
- Birch Creek downstream of Reed Lake; and
- Buffalo Creek and Big Buffalo Lake.

The rationale and maps showing the specific sampling locations for each of the monitoring studies described in this AEMP are provided with each of the study descriptions. In response to concerns raised by Fisher River Cree Nation and other First Nations, a targeted aquatic habitat study will be conducted at selected locations near McBeth Point and Reindeer Island in Lake Winnipeg outside of Sturgeon Bay. This study is described in Section 4.5.

The spatial extent of the study area is sufficient to document Project-related effects. If effects are of greater magnitude than anticipated, the spatial extent of monitoring would be modified to document unanticipated changes if there is a risk that effects extend beyond the monitoring area. For example, marked changes to water quality as a result of POC operation are not anticipated. However, if monitoring sites at the mouth of the Dauphin River, at the outlet of the LSMOC and in Sturgeon Bay indicate marked changes from upstream sites in the Fairford River and Watchorn Bay that could be linked to operations of the POCs, then sampling would be extended to sites near the mouth of Sturgeon Bay and into Lake Winnipeg.

2.3 Adaptive Management

Manitoba Transportation and Infrastructure will use an adaptive management approach to determine whether monitoring study results indicate the need for a change in monitoring activities or mitigation measures. Manitoba Transportation and Infrastructure will retain an environmental consultant experienced in the conduct of monitoring studies described in this AEMP as well as in the analysis and interpretation of biological data, with emphasis on water quality, lake whitefish, walleye and sucker species. These components were selected as being of particular interest due to concerns raised during Project review with respect to effects to water quality within the study area and beyond, and the importance of these fish species to domestic, commercial, and recreational fisheries. Monitoring to address potential effects to these species also addresses other aquatic biota, given that studies provide information on aquatic habitat and the fish community as a whole. If analysis by the environmental consultant indicates that a benchmark indicating adverse effects of concern has been exceeded, then Manitoba Transportation and Infrastructure and their consultants will undertake a review to examine the potential for linkages to the Project and the need for changes to mitigation measures. It is anticipated that this review will be conducted in consultation with regulators. Manitoba Transportation and Infrastructure will also discuss results with directly affected rights-holders and the RM of Grahamdale and use input on observed changes shared by resource users and other rights-holders to inform the review and decision making. Modification of mitigation measures will be implemented if and as required, and subsequent monitoring will indicate whether the modified mitigation successfully addressed the environmental issue or whether further changes are required.

A two-staged approach is being used for adaptive management based on the development of two benchmarks: an early warning trigger, typically defined as a statistically significant change from baseline conditions as described for each environmental component; and a management threshold, the level of an indicator when the magnitude of an adverse effect attributed to the Project is sufficient that it may result in long term adverse effects to water quality and/or a key fish species (i.e., lake whitefish, walleye, and sucker where sucker support a fishery [4]). The early warning trigger is intended to highlight that a change has occurred. Detection of a statistically significant change from baseline conditions may indicate the need to modify the monitoring program to acquire additional information, and subsequent evaluation of potential causes of the change to determine whether it is related to the Project. Management thresholds indicate that

[4] Monitoring and mitigation measures are focussed on these key species but measures to protect these species will also protect other species and components of the aquatic ecosystem.

additional mitigation or management actions may need to be undertaken. Benchmarks are described for specific environmental components in the following sections of this AEMP. In most instances, collection and analysis of supplemental data is required before the numerical value of the benchmark can be calculated but the data that will be used to calculate benchmarks are described.

Results of monitoring will be reviewed after each field program to determine the answers to relevant key questions as described in this AEMP. Key questions will be addressed in consideration of:

- Is there a statistically significant difference from pre-Project conditions, i.e., has an early warning trigger been passed?
- Is the nature of the pre/post-Project difference sufficient to exceed a management threshold, i.e., is there a need to review and potentially modify mitigation measures?
- What is the monitoring result in comparison to anticipated effects based on the environmental assessment?

Where it is determined that further assessment is required, the following questions will be considered:

- Are further investigations required to determine if the effect is related to the Project? Are modifications to the monitoring plan required?
- What are the potential implications to the aquatic ecosystem, in particular species valued in a fishery (i.e., lake whitefish, walleye, and sucker)?
- Has a management threshold been reached and is additional mitigation required?
- If additional mitigation is required, what are potential methods and how could they be applied?
- What monitoring is required to determine whether the new mitigation measures are functioning as intended?

Where monitoring results show environmental changes that are not attributed to the Project, this information will be provided to Manitoba Environment, Climate, and Parks or other appropriate regulators. It should be noted that some changes (e.g., detection of invasive species) will be reported immediately as a condition of scientific collection permits required to conduct monitoring.

3.0 SURFACE WATER QUALITY

3.1 Rationale

Water quality is a key component of the aquatic environment and is critical for the maintenance of aquatic ecosystem health and, due to its importance to aquatic ecosystems, is required as part of effects monitoring. Monitoring of surface water quality will determine whether effects are as anticipated based on the environmental assessment as follows:

- The potential effect of changes in flow patterns due to operation of the channels, while not expected to affect water quality, has been raised as a concern during the environmental review process and will be considered.
- Temporary increases in suspended sediment may occur in some areas during channel operation as a result of changes in flow patterns. Armoring of channels and routine inspections and maintenance of erosion prone areas is expected to prevent erosion in the channels themselves.
- Depleted concentrations of DO in the POCs during periods of non-operation under ice cover is a concern, but it is expected that the provision of baseflow through the channels as a mitigation measure will prevent declines to critically low concentrations. Monitoring has been designed to confirm that baseflows are sufficient.

Surface water quality monitoring to address Project effects related to these linkages includes the following components:

- A surface water quality monitoring study at key locations throughout the study area to document spatial changes during channel operation.
- A study to monitor DO concentrations in the LMOC and LSMOC.
- A study to document spatial and temporal changes in total suspended solids (TSS) during channel operations to document sediment transport.

Sampling related to the management of construction-related effects (e.g., sampling of TSS conducted as part of the Surface Water Management Plan) is conducted under the Construction Environmental Management Program (CEMP).

3.2 Approach

3.2.1 Key Questions and Study Overview

Monitoring studies have been designed to address the following key questions with respect to water quality:

- Does water quality change as a result of operation of the POCs?
- Does DO in the POCs decline to critically low levels during periods of non-operation, in particular during late winter?
- Does the concentration of TSS during POC commissioning and operation reach concentrations that could be harmful to aquatic life?
- What are the estimated sediment loads being transported in the channels compared to the Dauphin and Fairford rivers?

Three studies will be conducted to monitor effects to water quality:

- Water quality survey during POC operation and for a sampling event post operation as described in Section 3.3.
- DO monitoring in POCs during non-operation as described in Section 3.4.
- TSS concentrations will be monitored during and for a period post operation as described in Section 3.5. TSS monitoring will be conducted to monitor sediment mobilization and transport during operation of the channels.

3.2.2 Baseline Information

Baseline data for the surface water quality program includes:

- data collected as part of EOC monitoring program (2011-2015; NSC and KGS 2016), primarily in the north basin of Lake St. Martin, in the Dauphin and Fairford rivers, and Sturgeon Bay;
- data collected as part of POC baseline studies, in particular on Watchorn Bay, Birch Bay on Lake St. Martin and Birch Creek (AAE Tech Services 2016);
- data collected by the Province of Manitoba (historic to present) at one location each on the Dauphin and Fairford rivers; and
- supplemental data collected at AEMP sites, fall 2020 - fall 2021 to provide a comparable record at all sites (NSC 2021a, 2022a); and

Additional pre-commissioning data will be collected as necessary and in consideration of the on-going environmental review process. It is currently planned to repeat sampling at the AEMP sites so that there are a minimum of three years of data for all sites.

3.2.3 Identification of Benchmarks

The environmental assessment concluded that the Project would not cause changes in water quality in the study area as a whole, but that there would be localized effects to concentrations of TSS during POC commissioning, and to DO within the POCs during winter under baseflow conditions.

The benchmarks in relation to each of the key questions are as follows:

- Does water quality change as a result of operation of the POCs?

  The early warning trigger identified for surface water quality parameters is a change from background conditions, defined as the pre-Project baseline for lakes and rivers, and the upstream lakes for the POCs. If a change is detected, comparisons would be made to upstream water quality to determine whether the change is due to incoming water or conditions within the study area. The biological significance of the change would be determined by comparing to guidelines for the Protection of Aquatic Life (PAL)[5] .

Management thresholds are provided for TSS and DO below. If an unanticipated increase occurs in water quality parameters besides TSS and DO, then the potential cause and biological effect would need to be investigated.

- Does DO in the POCs decline to critically low levels during periods of non-operation, in particular during late winter?

  The early warning trigger is a change for background conditions recorded during winter in upstream lakes. The management threshold will be a decline to critically low concentrations (i.e., <3 mg/L).

- Does the concentration of TSS during POC commissioning and operation reach concentrations that could be harmful to aquatic life?

  The early warning trigger is a change in background conditions from baseline in the receiving environment (i.e., Birch Bay and Sturgeon Bay). The management threshold is an increase above a daily average of 25 mg/L relative to reference locations in the nearshore of Birch Bay and Sturgeon Bay that are not affected by the plume from the POCs.

There is no benchmark for the final key question addressed by the water quality studies.

- What are the estimated sediment loads being transported in the channels compared to the Dauphin and Fairford rivers?

[5] PAL based on Manitoba and Canada guidelines:

Manitoba Water Stewardship (MWS). 2011. Manitoba Water Quality Standards, Objectives, and Guidelines. Manitoba Water Stewardship Report 2011-01. July 4, 2011. 68 pp.

Canadian Council of Ministers of the Environment (CCME). 1999 (Updated to 2020). Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg.

The information gathered by this study will be used in conjunction with the sediment deposition monitoring as described in Section 4.4.

3.3 Surface Water Quality Monitoring

3.3.1 Purpose

Monitoring will be conducted to determine whether water quality conditions change due to channel operations, specifically whether the change in flow patterns affects water quality. The reduction in flow in Birch and Buffalo creeks will not be linked to operation of the channels but monitoring will be conducted concurrently for greater efficiency.

This study will address the following key question:

- Does water quality as represented by a suite of parameters change as a result of operation of the POCs?

3.3.2 Timing

Water quality monitoring will be conducted during POC commissioning, and immediately prior to, during, and following POC operation for flood mitigation as described in Section 2.1.

Samples will be collected during four sampling sessions in each monitoring year to capture seasonal variability (i.e., once in spring, summer, fall, and winter).

3.3.3 Field and Laboratory Methods

Sampling sites for the water quality monitoring program will be similar to those sampled during baseline studies. Sampling sites will be located at the following locations (Appendix 1, Figure 1-2):

- Two sites in Lake Manitoba in Watchorn Bay (offshore of the proposed LMOC and nearshore at the proposed LMOC);
- Two sites in Birch Creek (at Provincial Road [PR] 239 and near the outlet at Lake St. Martin);
- Two sites in the Fairford River (at highway 6 and near the outlet at Lake St. Martin);
- One site in the LMOC near Lake St Martin;
- Five sites in Lake St. Martin (Birch Bay, middle of the south basin, at the Narrows, middle of the north basin, and the eastern bay near the proposed inlet to the LSMOC);
- Three sites in the Dauphin River (at Lake St. Martin, near the provincial monitoring station at the “Big Bend”, and at Sturgeon Bay);
- One site in Big Buffalo Lake;
- One site in Buffalo Creek at the Dauphin River;
- One site in the LSMOC near Sturgeon Bay; and
- Two sites in Lake Winnipeg in Sturgeon Bay (nearshore at the proposed outlet of the LSMOC and offshore of the proposed LSMOC).

3.3.4 Parameters

In situ parameters will include temperature, pH, DO, turbidity and conductivity and Secchi disk depth (lake sites). Laboratory analyses will include a suite of physical parameters, nutrients, and metals (including mercury) and major ions. These are listed in Appendix 2, Table 2-3. Additional parameters including, pesticides, hydrocarbons, cyanobacteria cell counts, microcystin, and *Escherichia coli* will be included during the summer sampling season when concentrations are expected to be the highest. Samples will be collected at sampling stations on the upper Fairford and Dauphin Rivers and at Birch Creek at its confluence with Lake St. Martin to provide a measure of background conditions when the channels are not in operation. When the channels are in operation, samples will also be collected at the outlets of the LMOC and LSMOC. Hydrocarbon and pesticide parameters are listed in Appendix 2, Table 2-4.

3.3.5 Data Analysis

Analyses will focus on key indicators and include pre/post Project comparisons and comparison to guidelines.

3.4 Dissolved Oxygen Monitoring in the POCs

3.4.1 Purpose

Fish require adequate concentrations of DO in water to survive. Depleted concentrations of DO in the POCs during periods of non-operation under ice cover are a concern, but it is expected that planned mitigation (i.e., baseflows in both channels) will prevent declines to critically low concentrations. Monitoring has been designed to confirm that mitigation is sufficient.

This study will address the following key question:

- Does DO in the POCs decline to critically low levels during periods of non-operation in late winter?

3.4.2 Timing

Monitoring will be conducted during periods of maximum DO depletion in late winter. Monitoring will be conducted at the following times:

- during the winter following POC commissioning;
- during the winter following POC operation for flood mitigation; and
- after extended periods of non-operation (3 years).

During the winter following commissioning, additional monitoring may be conducted on a monthly basis to determine how DO concentrations may change as winter progresses.

3.4.3 Field and Laboratory Methods

DO concentrations will be measured during late winter at each of the following sites (Appendix 1, Figure 1-3):

- one near the POC inlets;
- one immediately upstream and one immediately downstream of the WCS in the LMOC;
- two sites in representative pools along the LSMOC
- one site each near the downstream end of the POCs (lowermost pool in the LSMOC).

3.4.4 Parameters

Dissolved oxygen and water temperature will be recorded at each of the monitoring locations.

3.4.5 Data Analysis

Data analysis will focus on comparing DO concentration to the PAL required to support fish as well as lethal limits as described in Section 3.2.3.

Monitoring results will be used to assess the potential for fish mortality to occur within the LMOC and LSMOC during periods of non-operation under ice cover.

3.5 TSS Monitoring

3.5.1 Purpose

The LSMOC and LMOC are not expected to be sources of sediment post-commissioning due to armouring. Operation of the LMOC and LSMOC during flood conditions may result in a change in the amount of sediment that is moved downstream from Lake Manitoba through the Fairford River, Lake St Martin, and the Dauphin River to Sturgeon Bay.

This study addresses the following key questions:

- Does the concentration of TSS during POC commissioning and operation reach concentrations that could be harmful to aquatic life?
- What is the sediment load transported in the channels compared to the Dauphin and Fairford rivers?

3.5.2 Timing

Monitoring will be conducted during POC commissioning and immediately prior to, during and shortly after operation of the POCs for flood mitigation based on timing described in Section 2.1.

3.5.3 Field and Laboratory Methods

TSS monitoring will be conducted by deploying turbidity loggers at key locations to provide a continuous record of turbidity conditions during commissioning [6] and periods of operation. A detailed sediment monitoring plan is presented in the Sediment Management Plan for this Project. Results of the monitoring presented here will indicate whether channel armouring and other sediment controls are effective. If sediment releases from the channels are of concern, monitoring activities will be re-evaluated and adjusted to provide a more detailed assessment of TSS concentrations during operations. It is currently assumed that TSS introductions will be minimal during operation.

Water samples will be collected during the period of operation from each logger location and analyzed for turbidity and TSS concentration. This will allow for the development of site-specific turbidity/TSS relationships and allow the conversion of turbidity logger data to TSS and provide a continuous TSS record at each logger location.

Loggers will be deployed shortly before the onset of channel operation to establish initial turbidity/TSS conditions and will remain in place until after channel operation has ceased and TSS concentrations have returned to pre-operation baseline conditions.

Loggers will be deployed at the following locations (Appendix 1, Figure 1-4):

- the Fairford River at Lake Manitoba;
- the Fairford River at Lake St. Martin;
- Watchorn Bay on Lake Manitoba at the LMOC;
- outlet of the LMOC at Birch Bay on Lake St. Martin and a nearby reference location (to be selected based on field conditions, not shown on Appendix 1, Figure 1-4);
- the Dauphin River at Lake St. Martin;
- the Dauphin River at Sturgeon Bay;
- the LSMOC at Lake St. Martin; and
- the outlet of the LSMOC at Sturgeon Bay and a nearby reference location (to be selected based on field conditions, not shown on Appendix 1, Figure 1-4).

3.5.4 Parameters

Key parameters to be monitored include turbidity and TSS.

[6] The sediment management plan provides a detailed protocol for use of turbidity loggers to monitor potential TSS increases during commissioning.

3.5.5 Data Analysis

Analysis will focus upon temporal changes to turbidity/TSS at each logger location. Comparison in trends of TSS between logger locations will provide insight into sediment transport throughout the system during periods of operation. Using TSS concentrations as inputs, an empirical model will be used to calculate sediment loading into Lake St. Martin and Sturgeon Bay following each operation.

Comparison of TSS concentrations measured at the outlets of the POCs to PAL (increase of 25 mg/L above background as measured at the nearby reference locations) will identify the potential for adverse effects on aquatic biota related to inputs from the channels.

3.6 Adaptive Management

The need for the implementation of adaptive management will follow the process set out in Section 2.3. The nature of mitigation cannot be determined at this time, however, potential measures are provided below based on the key questions. It should be noted that current assessments indicate that none of the changes presupposed in the key questions will occur.

1. Does surface water quality as represented by a suite of parameters change as a result of operation of the POCs?

   Apart from the localized effects with respect to TSS and DO described below, no changes to surface water quality that would have adverse effects to biota are expected; if unanticipated changes occur, than these would need to be addressed.

2. Does DO in the POCs decline to critically low levels during periods of non-operation during late winter?

   Planned mitigation measures include providing a permanent baseflow to the LSMOC and LMOC [7]. If DO concentrations decline to critically low levels despite the baseflows, measures to be considered include increasing the baseflow.

3. a. Does the concentration of TSS during POC commissioning reach concentrations that could be harmful to aquatic life?

   b. Does the concentration of TSS during POC operation for flood mitigation reach concentrations that could be harmful to aquatic life?

   The current mitigation plan during commissioning is the use of real-time turbidity loggers to track increases in turbidity (surrogate for TSS) attributed to construction activities during opening of the WCSs such that they could be manipulated to maintain TSS concentrations within target levels.

[7] During periods of drought, (i.e., close to the 10th percentile) the baseflow in the LSMOC would be reduced to provide more water to the Dauphin River. Baseflow within LSMOC would be maintained at a level that would maintain sufficient DO in the channel to prevent fish kills.

If increases in TSS are greater than anticipated, the POCs will be inspected to determine whether armouring in the channels is functioning as intended.

In the event that TSS monitoring indicates that the load of sediment transported via the channels is greater than expected and deposition occurs in Lake St. Martin and Sturgeon Bay, then sediment quality sampling that was conducted at key locations in fall 2020 and 2021 (NSC 2022b) will be repeated.

4.0 AQUATIC HABITAT

4.1 Rationale

Aquatic habitat is the physical, chemical, and biological environment in which aquatic organisms live. Consequently, changes to aquatic habitat can affect the organisms that live there. The Project may affect aquatic habitat through the following linkages:

- construction of the LMOC and LSMOC will create new aquatic habitat that will be available to fish;
- excavation in Watchorn Bay, Lake St. Martin, and Sturgeon Bay at the channel inlets and outlets will disrupt existing habitat including benthic invertebrates at these locations. Habitat may further evolve both between and during periods that flow is diverted through the channels;
- sediments may be transported when flow is passed through the channels both during commissioning and operation for flood mitigation. Increased water velocity at the channel outlets may mobilize sediments at the channel outlets. Mobilized sediments may deposit further downstream, potentially altering the substrate composition in depositional areas;
- operation of the LSMOC is expected to increase the water velocity at the Narrows between the south and north basins of Lake St. Martin to a greater extent than occurs naturally during floods. The increased velocity may change substrate composition in the vicinity of the Narrows; and
- construction of the POCs will reduce the inflow and thereby change existing aquatic habitat in the Birch Creek and Buffalo Creek systems. Flow reductions will be mitigated in part: it is proposed that the lower section of Birch Creek will receive diverted water from the LMOC when it is not in operation; and Buffalo Creek may receive drainage from rewatering of wetlands during dry periods.

Aquatic habitat monitoring will document habitat conditions in the LMOC and LSMOC to provide the basis for determining their suitability to support fish that may use those areas prior to, during and following channel operation. Monitoring at the inlets and outlets of the POC will document whether these areas are stable and supporting a benthic invertebrate community or are experiencing erosion or sedimentation. Monitoring of substrate at key locations in Lake St. Martin and Sturgeon Bay will indicate whether changes are occurring as a result of flow diversion through the channels. Habitat conditions in Birch and Buffalo creeks will be recorded during fish surveys (Section 5.5), but habitat before and after construction of the channels will not be quantified because under existing conditions habitat varies widely depending on seasonal and inter-annual variations in flow. Dissolved oxygen is an important habitat characteristic that will be addressed under water quality (Section 3.4).

Diversion of flow through the POCs will reduce flows in the Dauphin and Fairford rivers, in particular at flood levels and to a lesser extent at median and lower flows. Hydraulic modeling to determine changes to water velocity and depth in the rivers indicates that current sediment transport processes will be maintained (i.e., non-depositional reaches will not become depositional) and water levels and velocities will remain within the ranges known to support fish migrations (KGS Group 2021a). Therefore changes in the hydrograph of the rivers are not expected to affect fish use and are not considered further in terms of effects to habitat.

An additional study will be undertaken outside of the study area to address specific concerns raised by Fisher River Cree Nation, who noted that fine sediments appeared at nearshore locations in Lake Winnipeg beyond the mouth of Sturgeon Bay in the years following operation of the EOC. This additional study will document existing substrate at locations selected in consultation with FRCN fishers and provide the basis for post-Project comparison.

4.2 Approach

4.2.1 Key Questions and Overview of Studies

Monitoring studies have been designed to address the following key questions with respect to aquatic habitat:

- What is the water depth and substrate of aquatic habitat available to fish in the LMOC and LSMOC during periods when the channels are not in operation and does it change over time, both after operation and if the channels are not operated for more than three years?
- How does habitat, in particular substrate and the benthic invertebrate community, in the excavated inlets and outlets differ from nearby natural areas and does it change over time, both after operation of the channels and if the channels are not operated for more than three years?
- Do fine sediments accumulate on rocky reefs in Birch Bay that may be affected by sediment releases during operation of the LMOC and, if so, does the substrate revert to the pre-diversion condition over time due to wind and wave action?
- Do fine sediments accumulate on rocky reefs in Sturgeon Bay that may be affected by sediment releases during operation of the LSMOC and, if so, does the substrate revert to the pre-diversion condition over time due to wind and wave action?
- Does the substrate composition in the vicinity of the Lake St. Martin Narrows change as a result of operation of the LSMOC?
- Does the substrate composition at selected nearshore sites in Lake Winnipeg (i.e., at mouth of Sturgeon Bay, off of McBeth Point, southeast shore of Reindeer Island) change after operation of the LSMOC?

Several studies will be conducted to address these questions:

- Aquatic habitat (substrate type, water depth and benthic invertebrates composition and abundance) will be recorded within the excavated inlets and outlets and at representative sites within the channels after commissioning and during and after operation as described in Section 4.3;
- Substrate will be assessed at selected sites in Lake St. Martin and Sturgeon Bay pre-commissioning and again after commissioning and operation as described in Section 4.4;
- Substrate and the presence of suspended material will be assessed at selected sites in Lake Winnipeg pre-commissioning and after commissioning and operation as described in Section 4.5;

4.2.2 Baseline Information

Bathymetric and substrate classification is available for existing habitat at the inlets and outlets of both channels, portions of the Fairford and Dauphin Rivers, Lake St. Martin, and the southern portion of Sturgeon Bay (AAE Tech Services 2016; NSC 2016a; NSC 2022c).

Benthic invertebrate information has been collected from the inlet and outlet areas of both channels (AAE Tech Services 2016; NSC 2016a; NSC 2019a).

Supplemental high resolution bathymetric and substrate classification data were collected at selected areas within Birch Bay during fall 2021 (NSC 2022c). Additional substrate information was also collected in the Lake St. Martin Narrows during fall 2021 (NSC 2022c). A supplemental study will be conducted during summer 2022 to obtain high resolution substrate data at selected monitoring locations in Sturgeon Bay and in the vicinity of MacBeth Point in Lake Winnipeg.

4.2.3 Identification of Benchmarks

Early warning triggers for the aquatic habitat studies will generally be based on pre-/post-comparisons to determine whether changes are greater than can be attributed to natural spatial and temporal variation as follows:

- Substrate in the inlets and outlets and channels will be compared to post-construction conditions to determine whether changes occur over time;
- Benthic invertebrate community composition and abundance in the inlets and outlets will be compared to nearby similar reference sites to determine whether areas are re-colonized. The benthic invertebrate community that develops in the channels will be compared to that at the inlets and outlets as well as the reference sites in the natural lake environment;
- Substrate along transects at select locations will be compared between pre- and post-operation to determine the extent of fine sediment deposition within Lake St. Martin and Sturgeon Bay; and
- A similar approach will be used to compare substrate classification maps in the vicinity of McBeth Point. Comparison between years will be provided to describe changes in habitat and sediment type.

If changes to aquatic habitat are observed to exceed the above-stated early warning triggers (i.e., changes that appear greater than can be attributed to natural variation), then the need for further studies would be considered in the context of potential biological effects as discussed in Section 2.3.

4.3 Aquatic Habitat at the POCs

4.3.1 Purpose

Aquatic habitat monitoring will be conducted in the inlet/outlet areas and within the LMOC and LSMOC to determine the suitability of the habitat to support fish and other aquatic biota that may use those areas prior to, during, and following channel operations.

This study will address the following key questions:

- What is the depth and substrate of aquatic habitat available to fish in the LMOC and LSMOC during periods when the channels are not in operation and does it change over time, both after operation and if the channels are not operated for more than three years?
- How does habitat, in particular substrate, in the excavated inlets and outlets differ from pre-construction and does it change over time, both after operation of the channels and if the channels are not operated for more than three years?
- What is the species composition and abundance of the benthic invertebrate community that develops in the excavated inlets and outlets and POCs?

4.3.2 Timing

Initial habitat and benthic invertebrate assessment will occur one year after the channels have been wetted during commissioning. Waiting one year will allow time for altered and newly created habitat to become established and stabilize.

Subsequent sampling will be conducted following POC operation for flood mitigation to document how conditions in the channels may change due to operation based on the timing set out in Section 2.1.

Additional monitoring will be conducted if a non-operational period extends for three years to determine whether conditions in the channels change over time, in particular whether organic or inorganic materials accumulate within the channels.

4.3.3 Field and Laboratory Methods

Habitat conditions in the LMOC and the inlets and outlets of both channels will be recorded using standard boat-based sonar to collect hydroacoustic information describing water depth and substrate classification. Substrate samples will be collected from survey areas to help interpret and validate substrate classifications derived from the hydroacoustic data.

Methods for habitat mapping/description in the LSMOC will be determined once the channel has been constructed and sampling conditions are known. It is anticipated that a combination of remote sensing (i.e., collection of aerial imagery) and field measurements of habitat parameters will be used.

Benthic invertebrates will be collected at the inlet and outlet of each channel as well as at several locations within each channel and nearby reference areas. Sampling locations within the channels will be determined once the channels are constructed and substrate information is available such that representative habitats can be selected.

Benthic invertebrate samples will be collected using a ponar dredge. Replicate samples will be collected at each sampling location. Samples will be preserved at the collection site and delivered to a laboratory for analysis.

4.3.4 Parameters

Habitat parameters will include water depth, substrate and distribution of aquatic macrophytes.

Benthic invertebrate samples will be sorted and enumerated in a laboratory. Indices of species composition and diversity will be calculated.

Habitat information will be supplemented by the results of DO sampling collected during studies described in Section 3.4.

4.3.5 Data Analysis

Physical habitat parameter analyses will include production of bathymetric and substrate classification maps for survey areas and calculation of spatial area for different habitat classes. As additional years of data are acquired, comparison between years will be provided to describe changes in habitat within the channels.

Water quality conditions will be described based upon results of studies described in Section 3.4.

Benthic invertebrate species composition and density will be calculated. Changes in benthic invertebrate community and diversity indices will be compared between sampling years and to pre-Project data.

4.4 Substrate Composition in Lake St. Martin and Sturgeon Bay

4.4.1 Purpose

Substrate monitoring will be conducted at selected shoals within the modelled sediment plume from channel commissioning in Lake St. Martin and Sturgeon Bay (Hatch 2021; KGS Group 2021b; Hatch and KGS Group 2022) to determine whether long-term changes in substrate composition have occurred. These studies will address the fate of fine sediments transported during operation of the POCs. Modelling conducted to-date has indicated that fine sediments may be deposited along the outflow of the LMOC and LSMOC, but fines deposited on coarse substrates are expected to be sorted such that current areas of coarse substrate remain free of fines. Monitoring will also confirm the prediction that substrate composition in the vicinity of the Lake St. Martin Narrows will not change during operation of the LSMOC due to the incremental increase in velocity through the Narrows.

The following key questions will be addressed:

- Do fine sediments accumulate on rocky reefs in Birch Bay due to operation of the LMOC and, if so, does the substrate revert to the pre-diversion condition within three years[8]?
- Do fine sediments accumulate on rocky reefs in Sturgeon Bay due to operation of the LSMOC and, if so, does the substrate revert to the pre-diversion condition over time within three years?
- Does the substrate composition in the vicinity of the Lake St. Martin Narrows change as a result of operation of the LSMOC?

4.4.2 Timing

Sampling in Lake St. Martin was conducted in 2021 (NSC 2022c) and work in Sturgeon Bay is planned for 2022.

Sampling will occur immediately after the first operation and, if sediment deposition is observed, be repeated three years later in conjunction with non-operational monitoring to determine whether sediments have re-mobilized. The requirement for additional monitoring will be evaluated following completion of monitoring for the first operation.

4.4.3 Field and Laboratory Methods

Substrate conditions will be recorded using boat-based sonar to collect hydroacoustic information describing water depth and substrate classification. Substrate samples will be collected from survey areas to help interpret and validate substrate classifications derived from the hydroacoustic data.

4.4.4 Parameters

Physical habitat parameters will include water depth and substrate type. Physical substrate samples will be analyzed for particle size.

4.4.5 Data Analysis

Physical habitat parameter analyses will include production of bathymetric and substrate classification maps for survey areas and calculation of spatial area for different habitat classes. As additional years of data are acquired, comparison between years will be provided to describe changes in habitat and sediment type.

[8] The three year period is based on the anticipated time that inputs of leaf litter and other organic matter from the adjoining watershed may be sufficient to accumulate on the substrate and thus affect suitability as fish habitat; this duration may be modified based on results of post-commissioning studies.

4.5 Lake Winnipeg Substrate at McBeth Point and Other Selected Locations

4.5.1 Purpose

Fisher River Cree Nation (FRCN) fishers identified that fine sediments appeared at fishing sites off of McBeth point approximately a year after operation of the EOC and then dispersed over the following years; although the origin is not certain, fishers felt it was likely that the sediments originated from operation of the EOC. To determine whether operation of the LSMOC results in similar mobilization of inorganic and organic material, monitoring will be conducted within Sturgeon Bay at McBeth Point and other locations near Reindeer Island to document conditions at several locations where fine sediments/debris may accumulate in nearshore areas. These data will be used to confirm if sediment accumulations occur after operation of the LSMOC.

The following key question will be addressed:

- Does the substrate composition at selected nearshore sites in Lake Winnipeg (i.e., at mouth of Sturgeon Bay, near McBeth Point, southeast shore of Reindeer Island) change after operation of the LSMOC?

4.5.2 Timing

Sampling will be conducted at least once prior to commissioning to document baseline conditions. A second year of sampling may be conducted prior to commissioning if inter-annual variability is a concern or of interest.

Sampling will continue annually for three years following the first operation based on the observation by Fisher River fishers that fine materials appeared approximately one year after EOC operation (i.e., required time to be transported out of Sturgeon Bay). The requirement for additional monitoring will be evaluated following completion of monitoring for the first operation.

4.5.3 Field and Laboratory Methods

Substrate conditions at McBeth Point and additional areas within Sturgeon Bay will be recorded using standard boat-based sonar to collect hydroacoustic information describing water depth and substrate classification. Substrate samples will be collected from survey areas to help interpret and validate substrate classifications derived from the hydroacoustic data.

The characteristics of the water immediately above the substrate surface will be recorded with a Kemmerer sampler and photographed. Analysis of TSS and total organic carbon will be conducted at each site.

4.5.4 Parameters

Physical habitat parameters will include water depth and substrate type. Physical substrate samples will be analyzed for particle size, while analysis of TSS and total organic carbon will be conducted from water samples at each site.

4.5.5 Data Analysis

Physical habitat parameter analyses will include production of bathymetric and substrate classification maps for all survey areas and calculation of spatial area for different habitat classes. As additional years of data are acquired, comparison between years will be provided to describe changes in habitat and sediment type.

Water quality conditions will be described.

4.6 Adaptive Management

The need for the implementation of adaptive management will follow the process set out in Section 2.3, first considering whether a change from pre-Project conditions has occurred and, if so, whether effects are greater than anticipated in the environmental assessment and require the implementation of mitigation measures. The nature of mitigation cannot be determined at this time; however, potential measures are provided below based on the key questions. It should be noted that current assessments indicate that none of the changes pre-supposed in the key questions will occur.

1. What is the water depth and substrate type of aquatic habitat available to fish in the LMOC and LSMOC during periods when the channels are not in operation and do they change over time, both after operation and if the channels are not operated for more than three years [9]?

   If depth and substrate in the channels are not as predicted in the environmental assessment, or the channels are very unstable or become heavily silted with fine sediments or organic matter, then the potential effects to biota would be considered. If, for example, large amounts of organic material accumulate in the channels and this creates adverse conditions for the survival of fish due to the development of critically low concentrations of DO, then the need to remove organic material as part of channel maintenance would be considered.

2. How does habitat, in particular substrate, in the excavated inlets and outlets differ from pre-construction and does it change over time, both after operation of the channels and if the channels are not operated for more than three years?

   If substrates at the inlets and outlets are unstable or experience extensive sediment deposition and do not support benthic invertebrates, then the need for measures to stabilize the substrates would be considered.

[9] The three year period is based on the anticipated time that inputs of leaf litter and other organic matter from the adjoining watershed may be sufficient to accumulate on the substrate and thus affect suitability as fish habitat.

3. Do fine sediments accumulate on rocky reefs in Birch Bay due to operation of the LMOC and, if so, does the substrate revert to the pre-diversion condition over time?

   If the release of sediments as a result of operation of the LMOC is greater than predicted and these sediments deposit over rocky reefs in Birch Bay and are not readily remobilized, then the potential effect to fish (i.e., lake whitefish spawning) would be considered based on results of the pertinent monitoring study (Section 6.5). If sedimentation is found to cause an adverse effect to fish (as per the benchmarks identified in Section 6.2.3, i.e., larval lake whitefish emergence in Birch Bay), then means to reduce sediment deposition would be considered. The appropriate means would depend on the source of the sedimentation.

4. Do fine sediments accumulate on rocky reefs in Sturgeon Bay that may be affected by sediment releases during operation of the LSMOC and, if so, does the substrate revert to the pre-diversion condition within three years?

   If the release of sediments as a result of operation of the LSMOC is greater than predicted and these sediments deposit over rocky reefs in Sturgeon Bay and are not readily remobilized, then the potential effect to fish would be considered based on results of the pertinent monitoring study (fish community, Section 5.4). If sedimentation is found to cause an adverse effect, then means to reduce sediment deposition would be considered. The appropriate means would depend on the source of the sedimentation.

5. Does the substrate composition in the vicinity of the Narrows change as a result of operation of the LSMOC?

   If operation of the LSMOC increases velocity in the vicinity of the Lake St. Martin Narrows to the extent that all substrates required for spawning are scoured away, the survey would be extended to determine whether substrates were shifted to nearby areas of lower velocity. There is limited opportunity for remediation at the site. Other measures to support lake whitefish spawning in Lake St. Martin would need to be investigated.

6. Does the substrate composition at selected nearshore sites in Lake Winnipeg (i.e., at mouth of Sturgeon Bay, off of McBeth Point, southeast shore of Reindeer Island) change after operation of the LSMOC?

   No effects to substrate in Lake Winnipeg are predicted, but this study is being conducted to address concerns of FRCN based on observed changes following operation of the EOC. If changes are observed following operation of the POCs and are attributed to the Project, then suitable mitigation measures would be identified in consultation with the FRCN and other local fishers.

5.0 FISH COMMUNITY

5.1 Rationale

Fish are an important component of the aquatic ecosystem. Waterbodies in the study area support domestic, commercial, and recreational fisheries. Monitoring of the fish community will address whether effects are as predicted in the environmental assessment and determine whether mitigation strategies to minimize effects to the fish community are effective. Five main potential pathways by which the Project could affect fish were identified during the assessment, as follows:

- transfer of adult and larval fish from Lake Manitoba to Lake St. Martin and from Lake St. Martin to Sturgeon Bay during operation of the outlet channels;
- possible stranding and subsequent mortality of fish in the outlet channels following operation;
- changes to groundwater inflow potentially affecting the success of lake whitefish egg incubation in Lake St. Martin;
- effects related to changes in flow, in particular reducing the attraction to the Dauphin and Fairford rivers and creating an alternate attraction to fish at the LMOC and LSMOC outlets; and
- effects of sediment inputs on the fish community in Lake St. Martin and Sturgeon Bay.

The environmental assessment determined that these effects will likely not be significant, based on planned mitigation. Monitoring will confirm these predictions or, if effects are greater than predicted, determine whether additional mitigation is required.

Studies to address the fish community in this AEMP are presented in three sections: measurement of fish community metrics (this section); studies to examine specific Project effects on spawning (Section 6.0) and studies to address effects at the POCs (Section 7.0). The input of sediment is addressed as a component of total suspended sediment transport studies (Section 3.5) and aquatic habitat (Section 4.0).

The studies described in this section will determine whether the fish community is changing over time. The fish population is the ultimate metric of interest for the monitoring studies; even if changes in spawning directly linked to the Project are observed, if recruitment continues to support the existing fish population and fisheries, then no changes to Project mitigation measures would be required. Results of the fish community monitoring will need to be considered in conjunction with studies described in Section 6.0 (spawning) and at the POCs (Section 7.0) to determine whether any observed changes are linked to the Project. Results of water quality (Section 3.0) and aquatic habitat (Section 4.0) monitoring would also be examined to determine whether a possible causal link to the Project exists.

The fish community can be affected by many factors external to the Project, including:

- stocking of walleye as a component of the offsetting for the EOC operation may increase walleye recruitment;
- changes in water temperatures and flows linked to variations in weather and climate;

- eutrophication;
- the arrival and proliferation of invasive species, in particular zebra mussel and spiny waterflea, which are known to occur in adjacent waterbodies; and
- changes in the effort and species targeted in the commercial fishery.

To assist in determining whether changes are related to the Project as opposed to external factors, results of fish community monitoring will be considered in the context of regional changes detected in other Manitoba waters (e.g., commercial fishing records from other areas of Lake Winnipeg and Lake Manitoba, the Coordinated Aquatic Monitoring Program conducted by Manitoba Department of Natural Resources and Northern Development and Manitoba Hydro [CAMP; 2008-ongoing]).

5.2 Approach

5.2.1 Key Questions and Overview of Studies

Fish community studies have been designed to address the following questions:

- Does the species composition and abundance of the fish community in Lake St. Martin change over time, specifically after channel operation?
- Does the species composition and abundance of the fish community in Sturgeon Bay change over time?
- Does the fish community of Birch Creek and Buffalo Creek change following construction of the POCs?

To address these questions, three studies will be conducted:

- fish community monitoring in Lake St. Martin;
- fish community monitoring in Sturgeon Bay; and
- fish community monitoring in Birch and Buffalo creeks.

5.2.2 Baseline Information

Information pertinent to fish abundance and species composition includes:

- long-term commercial fish harvest data collected by the Province of Manitoba in Lake Manitoba, Lake St. Martin, and Sturgeon Bay;
- fish community data (i.e., experimental gillnetting, length, weight, spawning condition) collected from north basin of Lake St. Martin and numerous sites in southern Sturgeon Bay in spring and fall as part of monitoring for the EOC (2011-2015; NSC 2016b);
- fish community data collected from the north and south basins of Lake St. Martin (i.e., experimental gillnetting, length, weight, age and growth) as part of supplemental studies for the Project (2018, 2021; NSC 2019b and NSC 2022d);
- supplemental studies conducted during spring and fall 2018 to document fish use of habitat occurring at the inlet and outlet of the LSMOC (NSC 2019c); and
- long-term fish community data (i.e., experimental gillnetting, length, weight) collected annually in August from Sturgeon Bay as part of CAMP (2008-ongoing).

One more sample year of fish community data will be collected from Lake St. Martin as part of supplemental data collection prior to POC commissioning.

Baseline data describing fish use of Birch Creek includes:

- aquatic habitat surveys conducted in fall 2015 and spring 2016 (AAE Tech Services 2016);
- brief site visits conducted in spring 2018 (NSC 2019d) and spring 2020; and
- supplemental data describing aquatic habitat and fish use collected in spring 2021 under extreme low flow conditions (NSC 2022e) and in 2022 under extreme high flow conditions.

Baseline data describing fish use of the Buffalo Creek drainage was collected prior to, during and following EOC operation and includes:

- spawning investigations in the lower section of Buffalo Creek conducted from fall 2011 to spring 2015, including collection of fish eggs, larval fish, and spawning adults (NSC 2016b);
- fish utilization studies of Buffalo Creek as part of EOC monitoring (2011-2015; NSC 2016b);
- fish utilization studies of Big Buffalo Lake as part of EOC monitoring, and following EOC operations (2011-2015 [NSC 2016b]; Big Buffalo Lake was not sampled following the 2014/2015 EOC operation);
- supplemental data collected in spring 2021 (flow conditions in 2021 were very low) to describe fish use following changes in habitat (in particular the loss of beaver dams preventing access from the Dauphin River) as a result of the EOC operation (NSC 2022e); and
- supplemental data collected in spring 2022 under high flow conditions.

5.2.3 Identification of Benchmarks

The environmental assessment predicted that operation of the POCs would not result in significant long-term changes in the fish communities of Lake Manitoba, Lake St. Martin or Sturgeon Bay. The fish community studies will provide the basis for determining whether an overall change is occurring, but results of other studies in this AEMP will be needed to determine whether observed changes are due to the Project. In addition, as noted in Section 5.1, the fish community is subject to many other stressors influences, including climate change, invasive species, fisheries, stocking of walleye, and eutrophication, and these factors would need to be considered when examining potential causes of change. Comparison to other areas, where the fish community is not affected by the Project, will be important in determining whether changes are occurring as a result of external factors.

Early warning triggers indicate that a detectable change has occurred, and an examination of on-going monitoring is needed to confirm that data being collected are adequate to determine the potential causes of the effect. Management thresholds indicate a magnitude of change where mitigation measures may need to be evaluated and modified.

Benchmarks in relation to each of the key questions/studies are as follows:

- Does the species composition and abundance of the fish community in Lake St. Martin change over time, specifically after channel operation?

  Key indicators, specifically catch per unit effort (CPUE) of the total fish community and key species (walleye, lake whitefish, northern pike, white sucker and shorthead redhorse) and population characteristics for walleye and lake whitefish including year class strength, size distribution and condition will be used to address this key question. The early warning trigger will be based on detection of a statistically significant change from pre-commissioning period; the magnitude of a detectable change will depend on the specific parameter. The management threshold will be a change in a key indicator to outside of the range detected during previous studies. Numerical values for these benchmarks will be calculated after completion of supplemental studies listed in Section 2.1.

- Does the species composition and abundance of the fish community in Sturgeon Bay change over time?

  Benchmarks will be same as set out for Lake St. Martin but be based on data collected at the CAMP sites sampled in Sturgeon Bay.

- Does the fish community of Birch Creek and Buffalo Creek change following construction of the POCs?

  Fish use of these creeks is highly variable and flow dependent, therefore, numerical benchmarks will not be applied. Rather, survey results will be considered in terms of the presence/absence of common species in spring and summer, the presence of a definite spawning run of white sucker in spring, and presence of larval drift of spring-spawning species as observed during pre-commissioning studies.

5.3 Fish Community Monitoring in Lake St. Martin

5.3.1 Purpose

Fish community composition monitoring in Lake St. Martin is being conducted to address the following question:

- Does the species composition and abundance of the fish community in Lake St. Martin change over time, specifically after channel operation?

  The intent of this study is to identify whether there is a change - the cause of the change would need to be determined based on results of other studies. It should be noted that the ultimate metric of concern for the studies is the abundance and condition of the key species in the fish community. Metrics assessed in other studies (e.g., larval fish studies to determine whether reproduction is successfully occurring in Birch Bay) provide causal links to the potential changes in the fish community; however, the importance of changes recorded in larval fish abundance would be assessed in terms of the ultimate affect on adult fish abundance.

5.3.2 Timing

Monitoring will be conducted at approximately three year intervals to determine whether the fish community is changing over time. During periods when the POCs are in operation, monitoring will be conducted in the year following operation. The timing of monitoring may be adjusted depending on the duration and effects observed during POC operation. For example, if the timing of operation may have affected lake whitefish spawning success, then monitoring of the fish community in Lake St. Martin would be adjusted to confirm that fish which had been hatched during POC operation would have sufficient time to grow large enough to be susceptible to capture in the sampling gear.

5.3.3 Field and Laboratory Methods

Fish community sampling will be conducted using standard experimental and small mesh gill nets comparable to those used during EOC monitoring, Project baseline data collection and the CAMP program in Sturgeon Bay described in Section 5.4. Sampling locations post-Project will be comparable to those used during the pre-commissioning studies (Appendix 1, Figure 1-5). It should be noted that some shifts in location may be required depending on water levels and flows in a given year.

5.3.4 Parameters

At each sampling location, captured fish will be enumerated by species, measured for length and weight, and information describing their spawning condition will be noted. Ageing structures will also be collected.

Sampling effort (i.e., duration of gill net set) will be recorded for each sampling location.

Annual landings of the commercial catch by species in Lake St. Martin will be obtained, and interviews with the Provincial Fisheries Manager and commercial fishers will be conducted to obtain estimates of effort, and conditions that affected the fishery to provide context for the catch data.

5.3.5 Data Analysis

Fish community and population metrics will be calculated for each year in which sampling occurs. Fish community metrics include overall richness (number of species), presence of invasive species, and relative abundance. These descriptive metrics will be compared qualitatively to pre-Project data to determine whether they fall within the pre-Project range as well as comparison to nearby areas such as Sturgeon Bay (sampled under the CAMP). Population metrics for individual species include CPUE, condition, length-frequency distribution, and year class strength (walleye and lake whitefish). CPUE and condition will be statistically compared to pre-Project data. Length-frequency distributions will be qualitatively compared to the variation observed during pre-Project sampling in 2018, 2021 and an additional year prior to Project commissioning. Year-class strength will be examined for absent year classes and changes in recruitment patterns before/after the Project (e.g., consistent year class strength, erratic recruitment).

The commercial catch data will be compared to catches over time, excluding years that the fishery was not in operation, to determine whether marked changes in catch have occurred. These data will be both an index of change over time and also an input into explaining potential changes in the experimental gillnetting results.

5.4 Fish Community Monitoring in Sturgeon Bay

5.4.1 Purpose

Fish community monitoring in Sturgeon Bay will rely on monitoring conducted under CAMP. This program is designed to identify long term changes in fish communities and populations and will be used to address the following key question:

- Does the species composition and abundance of the fish community in Sturgeon Bay change over time?

5.4.2 Timing

Fish community in Sturgeon Bay is monitored annually under CAMP. Data for all years will be requested in years when monitoring is conducted on Lake St. Martin (Section 5.3).

5.4.3 Field and Laboratory Methods

Fish community sampling will be conducted using standard experimental gill nets also used for fish community monitoring in Lake St. Martin (Section 5.3). See Appendix 1, Figure 1-6 for representative sampling locations.

5.4.4 Parameters

At each sampling location, captured fish will be enumerated by species, measured for length and weight, and information describing their spawning condition will be noted. Ageing structures will also be collected.

Sampling effort (i.e., duration of gill net set) will be recorded for each sampling location.

Annual landings of the commercial catch by species in Sturgeon Bay will be obtained, and interviews with the Provincial Fisheries Manager and commercial fishers will be conducted during years when monitoring occurs on Lake St. Martin (see Section 5.3) to obtain estimates of effort, and conditions that affected the fishery to provide context for the catch data.

5.4.5 Data Analysis

Raw data will be requested from the CAMP program.

Fish community and population metrics will be calculated for each year in which sampling occurs. These include species abundance, condition, and growth. Community composition will be compared to existing baseline data to determine whether the post-Project monitoring data falls within the expected variation.

The commercial catch data will be compared to catches over time, excluding years that the fishery was not in operation, to determine whether marked changes in catch have occurred. These data will be both an index of change over time and also an input into explaining potential changes in the experimental gillnetting results.

5.5 Fish Utilization of Birch and Buffalo Creek Drainages

5.5.1 Purpose

Investigations will be conducted to determine the extent to which fish continue to use habitat in Birch and Buffalo creeks following changes in flow after construction of the POCs.

The following key question will be addressed:

- Does the fish community of Birch Creek and Buffalo Creek change following construction of the POCs?

5.5.2 Timing

Monitoring will be conducted during the first spring following construction and commissioning of the POCs when a portion of the creeks' watershed have been diverted into the drainage ditches adjacent to the POCs. Monitoring will be repeated in the future when the POCs are being monitored under non-operation conditions (i.e., during periods of natural low runoff/flow) to determine whether there are changes in the fish community in the long term.

5.5.3 Field and Laboratory Methods

Fish will be collected from selected representative locations in Birch and Buffalo creeks.

Sampling methods will be determined by site conditions. It is anticipated that a combination of sampling methods will be used, likely including backpack electrofishing, hoop nets and drift traps. Habitat conditions will be documented with photographs and *in situ* measurements of selected parameters (e.g., velocity, wetted width and depth).

Monitoring will be comprised of several short sampling sessions per sampling year to maintain effort at a reasonable level while providing sampling coverage throughout spring. This is to account for the timing of spawning-related movements of large-bodied fish into the lower creek reaches, during spring and to examine change in fish abundance as flow recedes following the spring freshet.

5.5.4 Parameters

At each sampling location, captured fish will be enumerated by species, measured for length and weight, and information describing their spawning condition will be noted.

Sampling effort will be recorded for each sampling location.

5.5.5 Data Analysis

Analyses will include the calculation of relative abundance and CPUE for each species and for each location.

Comparison of site-specific fish use metrics (relative abundance, CPUE) will be generated for baseline conditions and following flow reduction.

5.6 Adaptive Management

The intent of the fish community studies is to determine whether a detectable change in the fish community has occurred; however, the results of fish community investigations would need to be considered in conjunction with other studies in this AEMP to determine whether a change is attributable to operation of the POCs. For example, if lake whitefish in Lake St. Martin exhibit poor year classes, an analysis would be conducted to first determine how the timing of poor year classes coincides with operation of the POCs as well as flows on the Dauphin and Fairford rivers, and secondly, whether results of fall migration or spring larval studies correspond with poor year classes. Context for observed changes would also be obtained from similar monitoring programs conducted on nearby waterbodies (e.g., sampling conducted by CAMP). Lake whitefish populations may be affected by factors apart from the Project, such as the proliferation of invasive zebra mussels, increases in invasive spiny water flea, increases in water temperature linked to climate change, and fish harvests.

The need for additional mitigation measures with respect to the Project will be determined based on the magnitude of effects observed in relation to monitoring benchmarks set out in Section 5.2.3. Two benchmarks (i.e., early warning triggers and management thresholds) were identified in Section 5.2.3. In general, the early warning triggers indicate that a statistically significant change in key indicators has occurred and a review of the monitoring program is required to determine whether modifications to the study are needed to better define potential effects. The early warning trigger is intended to proactively modify the scope of the studies, if and as required, such that information to address potential adverse effects is obtained in a timely manner. In the case of the fish community metrics, the analysis would also examine whether changes are linked to the Project or external factors. The management threshold benchmark set out for the fish community indicate whether changes to or additional mitigation measures are required. The discussion below provides some potential measures, but the appropriate response would need to be determined based on an analysis of all monitoring results.

Does the species composition and abundance of the fish community in Lake St. Martin change over time, specifically after channel operation?

The management threshold will be a change in the key indicators (specifically CPUE of the total fish community and key species [walleye, lake whitefish, northern pike, white sucker and shorthead redhorse]) and population characteristics for walleye and lake whitefish including year class strength, size distribution and condition) to outside of the range detected during previous studies. A potential increase in walleye year class strength in years when stocking is conducted could indicate effects of stocking as an offset for the EOC.

Population-level effects as a result of the Project would most likely occur as a result of decreased recruitment, due to adverse effects on spawning, egg hatch or larval fish survival. These effects would be addressed through measures set out in relation to the spawning studies, Section 6.7. Effects could also occur due to an increase in fish movement into Lake St. Martin from Lake Manitoba or from Lake St. Martin into Lake Winnipeg. Potential effects due to increased fish movement would be assessed through monitoring as outlined in Section 7.3.

Does the species composition and abundance of the fish community in Sturgeon Bay change over time?

Benchmarks will be the same as set out for Lake St. Martin but will be based on data collected as part of CAMP in Sturgeon Bay.

Possible Project-related causes could be linked to sediment transport (adaptive management is provided in Section 3.6) and reduced reproductive success as addressed in studies on the Dauphin River and associated adaptive management in Section 6.7. It should be noted that changes to fish populations in Sturgeon Bay might also result from changes to Lake Winnipeg and determining linkages to the Project could be challenging.

Does the fish community of Birch Creek and Buffalo Creek decrease following construction of the POCs?

In the absence of mitigation, fish use of the creeks is expected to decrease. Proposed inputs of flow to Birch Creek are expected to maintain current spring use and extend the period through the open water season that fish habitat is provided. Therefore, survey results will be compared to existing conditions anticipating an increase. If no increase is observed or use declines, then conditions in the creek will be examined to determine if additional flow or other habitat modifications are required.

Buffalo Creek is expected to decline in suitability for fish. This decline is being addressed for offsetting and information obtained through monitoring is intended to document the change in fish usage.

6.0 FISH SPAWNING

6.1 Rationale

The environmental assessment identified several pathways by which the Project could affect fish spawning success, and ultimately, fish populations:

- changes to groundwater inflow potentially affecting the success of lake whitefish egg incubation in Lake St. Martin, specifically Birch Bay;
- changes to spawning habitat in Lake St. Martin, as a result of sediment deposition and/or changes in velocity;
- effects related to reducing the attraction flow to the Dauphin and Fairford rivers and/or creating an alternate attraction to fish at the LMOC and LSMOC outlets; and
- changes to spawning habitat in Sturgeon Bay due to sediment deposition.

The environmental assessment determined that these effects will likely not be significant, based on planned mitigation. Monitoring will confirm these predictions or, if effects are greater than predicted, determine whether additional mitigation is required.

The studies described in this section will determine whether there are changes to numbers of spawning adults, as well as drifting post hatch larvae. Potential effects to spawning habitat will also be identified based on the input of sediment at the outlets of the POCs (Section 3.5) and deposition of sediment on coarse substrates (Section 4.4).

6.2 Approach

6.2.1 Key Questions and Overview of Studies

The Project has the potential to affect spawning fish in the Dauphin and Fairford rivers and Lake St. Martin through several pathways. These include attraction of fish to the outlets of the POCs rather than the rivers to spawn, a reduction of groundwater input into Lake St. Martin (specifically Birch Bay) that may affect spawning habitat for lake whitefish, and an increase in water velocity through the Narrows that may affect spawning by lake whitefish in this area. However, the environmental assessment predicted that these changes will be small in magnitude and have little effect on fish populations. The following studies will be conducted to confirm this prediction.

Fish spawning studies have been designed to address the following questions:

- Does the timing and magnitude of spring spawning movements in the Dauphin and Fairford rivers change over time, specifically during POC operation?
- Does the timing and magnitude of fall movements and, in particular, lake whitefish spawning movements in the Dauphin and Fairford rivers change over time, specifically during POC operation?

- Does the occurrence and density of lake whitefish larvae within Lake St. Martin in the spring (including Birch Bay and the Narrows) change over time?
- Does the species composition and number of larval fish passively drifting in the Fairford and Dauphin rivers change over time, specifically during POC operation?

To address these questions, four studies will be conducted to assess:

- spring fish use of the Dauphin and Fairford rivers, with emphasis on spawning migrations of sucker and walleye;
- fall fish use of Dauphin and Fairford rivers, with emphasis on the fall spawning migration by lake whitefish;
- larval lake whitefish emergence on Lake St. Martin; and
- larval fish drift in the Dauphin and Fairford rivers.

6.2.2 Baseline Information

Information pertinent to fish spawning includes:

- data collected during EOC monitoring to document lake whitefish spawning and the presence of other fish species in the lower Dauphin River (2011-2014; NSC 2016b);
- supplemental studies conducted during spring and fall 2018 to document fish use of habitat occurring at the inlet and outlet of the LSMOC (NSC 2019c);
- supplemental studies conducted in fall 2020 and 2021 to document fish use of the Dauphin and Fairford rivers, with emphasis on documenting the timing and magnitude of lake whitefish movements through the Dauphin River, Lake St. Martin, and the Fairford River (NSC 2021b, 2022f); and
- supplemental studies conducted during spring 2021 to document species occurrence and abundance of fish in the Fairford and Dauphin rivers (NSC 2022f).

An additional spring sampling event 2021 to document species occurrence and abundance of fish in the Fairford and Dauphin rivers will be completed prior to POC commissioning.

Information pertinent to larval fish movements in the Dauphin and Fairford rivers includes:

- data documenting downstream larval fish movements from Lake St. Martin to Sturgeon Bay collected during and between periods of operation of the EOC (2012-2015; NSC 2016b); and
- data from supplemental studies conducted during spring 2021 (NSC 2022g) and 2022 to describe larval fish movements from Lake Manitoba to Lake St. Martin and from Lake St. Martin to Sturgeon Bay.

An additional spring sampling event documenting larval fish movements in the Dauphin and Fairford rivers will be completed prior to POC commissioning.

Information pertinent to the abundance and distribution of larval fish in Lake St. Martin includes:

- data collected during spring 2012-2014 in the north basin during EOC studies (NSC 2016b);
- data collected during the Project EIS baseline studies to document the occurrence, abundance, and distribution of larval fish in Lake St. Martin (2016-2018; AAE Tech Services 2016);

- supplemental studies conducted during spring and fall 2018 to document fish use of habitat occurring at the inlet and outlet of the LSMOC (NSC 2019c); and
- data collected during supplemental studies conducted during spring 2021 (NSC 2022g) and spring 2022 to document the occurrence, abundance, and distribution of larval fish in Lake St. Martin.

Additional data documenting larval fish abundance in Lake St. Martin will be collected prior to POC commissioning.

6.2.3 Identification of Benchmarks

The fish spawning studies will provide direct information on the relative number of adult spawners and newly hatched larval fish and as such provide the most direct indication as to whether operation of the POCs is potentially affecting fish populations. However, spawning is highly variable among years, depending on environmental conditions such as stream flow, water temperature, and lake elevation. Early warning triggers have been identified to indicate that a change may have occurred and that study design should be reviewed to confirm that data being collected are adequate to determine the potential causes of the effect. Management thresholds indicate a magnitude of change where mitigation measures may need to be evaluated and modified.

Benchmarks in relation to each of the key questions/studies are as follows:

- Does the timing and magnitude of spring spawning movements in the Dauphin and Fairford rivers change over time, specifically during POC operation?

  Results of standardized boat electrofishing conducted prior to commissioning will be compared during operation based on the presence/absence of key species, and a categorical comparison of abundance over the three days with the highest catches (coinciding with peak spawning movement), i.e., low, medium and high. The early warning trigger is the decline of key species by one category and the absence of less frequent species in one year; the management threshold is a change observed over two monitoring cycles.

- Does the timing and magnitude of fall movements and, in particular, lake whitefish spawning movements, in the Dauphin and Fairford rivers change over time, specifically during POC operation?

  Results of standardized boat electrofishing conducted prior to commissioning will be compared during operation based on a categorical comparison of abundance over the three days with the highest catches (coinciding with peak spawning movement), i.e., low, medium and high. The early warning trigger is the decline of lake whitefish by one category; the management threshold is a change observed over two monitoring cycles.

- Does the occurrence and density of lake whitefish larvae within Lake St. Martin in the spring (including Birch Bay and the Narrows) change over time?

  The early warning trigger is a decline in the frequency of larval fish capture in any of the three areas where sampling occurs (i.e., south basin, Narrows and north basin). The management threshold is if the decline in frequency occurs for two monitoring cycles.

- Does the species composition and number of larval fish passively drifting in the Fairford and Dauphin rivers change over time, specifically during POC operation?

  The early warning threshold is a statistically significant decline in the CPUE of a key species. The management threshold is the absence of a key species for one year.

6.3 Spring Fish Use of the Dauphin and Fairford Rivers

6.3.1 Purpose

Monitoring will be conducted to determine the extent to which, if any, operation of the channels affects use of the Dauphin and Fairford rivers by spring spawning species. These include (but are not limited to) walleye, white sucker, and Shorthead Redhorse.

The following key question will be addressed:

- Does the timing and magnitude of spring spawning movements into the Dauphin and Fairford rivers change over time, specifically during POC operation?

6.3.2 Timing

Monitoring will occur during April/May if the POCs are in operation. Activities would be conducted concurrently with the larval drift studies (Section 6.6). The frequency and duration of monitoring will be as described in Section 2.1.

6.3.3 Field and Laboratory Methods

Fish will be collected from the Fairford and Dauphin rivers using a boat-based electrofisher to document fish use during spring and to determine the presence of spawning fish.

It is anticipated that monitoring will be comprised of several short sampling sessions per sampling year to maintain effort at a reasonable level while providing sampling coverage throughout spring. This is to account for the timing of spawning-related movements of large-bodied fish during spring -and to examine change in fish abundance as flow recedes following the spring freshet.

6.3.4 Parameters

At each sampling location, captured fish will be enumerated by species, measured for length and weight, and information describing their spawning condition will be noted.

Sampling effort (i.e., number of seconds the electrofisher was in operation) will be recorded for each sampling location.

6.3.5 Data Analysis

Analyses will include the calculation of size, condition, relative abundance, and CPUE for each species and for each location.

Comparison of site-specific fish use metrics (relative abundance, CPUE, and number of spawners) will be provided between baseline conditions and following flow reduction.

6.4 Fall Fish Use of the Dauphin and Fairford Rivers

6.4.1 Purpose

Monitoring will be conducted to determine the extent to which, if any, operation of the channels affects use of the Dauphin and Fairford rivers by fall spawning species and other species that use the rivers as a fall movement corridor. In particular, the investigations will be conducted to determine the extent to which, if any, operation of the channels affects the lake whitefish spawning migration in the Dauphin and Fairford rivers.

The following key question will be addressed:

- Does the timing and magnitude of the fall movements and, in particular, lake whitefish spawning movements in the Dauphin and Fairford rivers change over time, specifically during POC operation?

6.4.2 Timing

Monitoring will be conducted during fall in years that flood waters are diverted through the POCs after mid-September to October, coincident with the timing of lake whitefish spawning movements. Monitoring will only be conducted during years when the channels are operated during the spawning migration period. The frequency and duration of monitoring will be as described in Section 2.1.

6.4.3 Field and Laboratory Methods

Fall fish movements into the Dauphin and Fairford rivers will be monitored using boat electrofishing. Boat electrofishing was used to assess the timing and magnitude of fall whitefish movements during EOC studies in 2011-2014 and in the Dauphin and Fairford rivers during supplemental studies conducted during fall 2020, spring 2021, and fall 2021. While this method does not provide a total count of migrants, CPUE based on boat electrofishing catches provides a means for comparison of fish abundance between sampling sessions and years and will be used to obtain a relative estimate of fish abundance. Boat electrofishing will be conducted periodically through fall (mid-September to freeze up) to capture changes in fish occupation ion the rivers and movement patterns as fall progresses. Sampling will be conducted in the Fairford River at a location immediately downstream of the FRWCS and at a second location immediately upstream of Lake St. Martin. Similarly, sampling will be conducted in the Dauphin River at a location immediately downstream of Lake St. Martin and at a second location immediately upstream of Sturgeon Bay.

Split-beam hydroacoustic technology was used during supplemental studies to provide an assessment of fall fish activity in the Dauphin River during 2020 and 2021. The technology provides an enumeration of fish movements past a "receiver station" by direction and fish size, but does not identify fish to species and cannot determine repeated upstream and downstream movements by individual fish. While this method provided useful information regarding fish activity in the Dauphin River, boat electrofishing is efficient and more flexible with respect to use in the widely varying flow conditions experienced in the Dauphin and Fairford rivers. Split-beam hydroacoustic technology may be used in the future as a secondary method of monitoring fish activity if information in addition to boat electrofishing CPUE is required.

6.4.4 Parameters

Fish captured by boat electrofishing will provide species identification, size data, and information describing the spawning condition of migrating fish.

6.4.5 Data Analysis

Boat electrofishing data will be analyzed to describe species composition, size and spawning condition of fish moving into the Fairford and Dauphin rivers during fall. Catch-per-unit effort from the boat electrofishing catches will be calculated to compare relative fish abundance between years and locations. Fish abundance data collected during POC operation will be compared to pre-operation data to determine changes in fish movements in the Dauphin and Fairford rivers.

6.5 Spring Larval Lake Whitefish Emergence on Lake St. Martin

6.5.1 Purpose

The LMOC has the potential to affect lake whitefish spawning through several linkages. First, following construction of the LMOC there is the potential to affect local groundwater discharges in the vicinity of the channel outlet. A reduction in groundwater discharge to Birch Bay on Lake St. Martin could reduce the suitability of the bay for lake whitefish spawning if groundwater upwellings are one of the factors influencing lake whitefish spawning success. However, it is expected that any reduction in groundwater discharge would be negligible relative to surface flow. Operation of the LMOC may also affect lake whitefish spawning habitat in Birch Bay as a result of the deposition of fine sediments transported during channel operation on areas of coarse substrate. Additionally, an increase in water velocity through the Narrows during LMOC operation may adversely affect lake whitefish spawning at that location.

Monitoring will be conducted to determine whether operation of the LMOC affects lake whitefish reproductive success within Lake St. Martin. Larval lake whitefish will be sampled at several locations in Lake St. Martin including Birch Bay and the Narrows (Appendix 1, Figure 1-7).

The following key question will be addressed:

- Does the occurrence and density of lake whitefish larvae within Lake St. Martin in the spring (including Birch Bay and the Narrows) change in relation to channel operations??

6.5.2 Timing

Monitoring for larval lake whitefish in Lake St. Martin will occur the spring after commissioning to determine whether effects occurred in Birch Bay and in the years when the channel is operated after September 15 to determine whether lake whitefish successfully spawned in Lake St. Martin. The frequency and duration of monitoring will be as described in Section 2.1.

6.5.3 Field and Laboratory Methods

Larval fish will be collected from the surface waters of Lake St. Martin using a neuston sampler. Volume of water filtered by the sampler will be measured to allow for the calculation of larval fish densities.

Sampling will occur immediately after ice break up, a period when larval whitefish have very recently hatched, are poor swimmers, and are generally associated with the surface of the water column.

Although the Birch Bay area and Narrows of Lake St. Martin are the most likely areas to be affected by the Project, larval fish sampling will be conducted throughout the north and south basins to provide comparison of larval catches from other areas of the lake.

6.5.4 Parameters

Larval fish densities will be estimated based upon the catch and the volume of water filtered by the neuston sampler.

6.5.5 Data Analysis

Larval fish catches will be enumerated by species, sample, and sampling location. Larval lake whitefish (and other species) densities will be calculated for each sample site and sampling area. Comparison between sampling areas and sampling years will be provided. Baseline data will be compared with post-construction data to determine whether a change in lake whitefish reproductive success has occurred.

6.6 Spring Larval Fish Movements in Rivers

6.6.1 Purpose

The objective of this study is to determine the species composition and numbers of larval fish that may passively drift down the Fairford and Dauphin rivers during and immediately after POC operation. This study will provide context for the number of drifting larval fish found in the POCs (Section 7.4) and also indicate the success of spring and fall spawning fish during operation of the POCs. It should be noted that drifting larval lake whitefish hatch the spring after eggs are laid; therefore, the success of fall spawning during or immediately after closure of the WCSs is determined by drift the following spring.

The following key question will be addressed:

- Does the species composition and number of larval fish passively drifting in the Fairford and Dauphin rivers change over time, specifically during POC operation?

6.6.2 Timing

Monitoring studies will be conducted during channel operation to determine the species composition and abundance of larval fish that drift down the Fairford and Dauphin rivers. In years when the channels operate during the lake whitefish fall spawning migration (after September 15), monitoring will also occur in the spring following operation. The frequency and duration of monitoring will be as described in Section 2.1.

6.6.3 Field and Laboratory Methods

Larval fish drift will be monitored at the following locations (Appendix 1, Figure 1-7):

- Fairford River downstream of Lake Manitoba;
- Fairford River upstream of Lake St. Martin;
- Dauphin River downstream of Lake St. Martin;
- Dauphin River upstream of confluence with Buffalo Creek; and
- Dauphin River downstream of Buffalo Creek but upstream of the influence of Sturgeon Bay.

Larval fish will be captured using larval drift traps. Two traps will be set at each sampling location and will sample continuously during each sampling session. Flow meters will be used to estimate the volume of water that is sampled.

Monitoring will be comprised of several sampling sessions per sampling year to maintain sampling effort at a reasonable level while providing coverage throughout spring. This is to account for differences in the timing of hatch and at which larvae of different species are vulnerable to passive movement with water flow. Specifically, larval lake whitefish drift immediately after ice off, while spring spawning species such as walleye and sucker drift later in spring.

6.6.4 Parameters

Larval fish densities will be estimated based upon the catch and the volume of water sampled by the drift traps.

6.6.5 Data Analysis

Data will be analyzed to provide an estimate of larval movements by species, location and date during each sampling year. Comparisons will be provided for the Dauphin and Fairford rivers for periods of varying discharge.

6.7 Adaptive Management

Two levels of benchmark were identified in Section 6.2.3: early warning triggers indicate that a change may have occurred, and that study design should be reviewed to confirm that data being collected are adequate to determine the potential causes of the effect; and management thresholds indicate a magnitude of change where mitigation measures may need to be evaluated and modified. The early warning trigger is intended to proactively modify the scope of the studies, if and as required, such that information to address potential adverse effects is obtained in a timely manner. In the case of the fish spawning metrics, the analysis would also examine whether related variables have been affected. For example, if a decline in the emergence of larval lake whitefish is observed on Lake St. Martin, then potential linkages to the Project such as changes to aquatic habitat from increased sedimentation would be examined. The management threshold benchmark indicates that a change in spawning has occurred, although that may not ultimately affect the fish community. However, the need for changes to mitigation measures would be assessed. The discussion below provides some potential measures, but the appropriate response would need to be determined based on an analysis of all monitoring results.

Does the timing and magnitude of spring spawning movements in the Dauphin and Fairford rivers change over time, specifically during POC operation?

The management threshold for spring spawning movements in the Dauphin and Fairford rivers is a change in fish CPUE observed over two monitoring cycles (i.e., two separate flood events).

Management actions would depend on the cause of the change. For example, if fish are aggregating at the outlet of the LMOC rather than moving up the Fairford River, recruitment would be monitored to determine if spawning success at the outlet was comparable to that of the Fairford and if not, what measures could be taken to improve the outlet as spawning habitat.

Does the timing and magnitude of the fall lake whitefish spawning movement in the Dauphin and Fairford rivers change over time, specifically during POC operation?

As with the spring spawning studies, the management threshold is a change in CPUE during the peak fall spawning run observed over two monitoring cycles.

Changes in lake whitefish numbers may be linked to external factors such as warmer water temperatures and this possibility would be assessed by determining whether monitoring in other areas has shown similar declines. Management actions would depend on the cause of the change. For example, if fish are aggregating at the outlet of the LSMOC rather than moving up the Dauphin River, recruitment would be monitored to determine if spawning success at the outlet was comparable to in Lake St. Martin and the Dauphin River and if not, what measures could be taken to improve the outlet as spawning habitat. Other potential measures would include stocking to supplement fish production.

Does the occurrence and density of lake whitefish larvae within Lake St. Martin in the spring (including Birch Bay and the Narrows) change over time?

The management threshold for larval fish abundance in Lake St. Martin is a decline in the frequency of capture in standard neuston tows for two flood events. The appropriate mitigation would depend on the cause for this decline. For example, if unanticipated sedimentation occurs in the spawning habitat in the south basin of Lake St. Martin then substrate may be placed to create new spawning shoals.

Does the species composition and number of larval fish passively drifting in the Fairford and Dauphin rivers change over time, specifically during POC operation?

The management threshold for larval drift in the rivers is the absence of a key species for a single year, or a decline in the CPUE below the range observed during pre-commissioning studies for two flood events. Potential management measures would depend on the cause of the decline, which could be due to reduced populations of adult fish, a degradation of spawning habitat in the rivers, or conditions in Lake St. Martin upstream where many of the larval fish originate.

7.0 EFFECTS AT THE PERMANENT OUTLET CHANNELS

7.1 Rationale

The Project has the potential to affect the fish community through several pathways directly linked to operation of the POCs, as follows:

- increased movements of adult and larval fish from Lake Manitoba to Lake St. Martin and from Lake St. Martin to Sturgeon Bay via the channels may result in a loss to upstream populations;
- attraction of fish away from the Fairford River and to the new inflow in Lake St. Martin during operation of the LMOC and away from the Dauphin River and to the new inflow in Sturgeon Bay during operation of the LSMOC may result in a reduction in successful spawning and ultimately recruitment;
- possible stranding and subsequent mortality of fish in the POCs following closure of the WCSs; and
- possible mortality of fish occupying the channels when the WCSs are closed due to DO declining to critically low concentrations.

The environmental assessment indicated that these effects were not significant, based on planned mitigation. However, monitoring is required to confirm these assessments and determine whether modifications to planned mitigation measures are required as described in Section 7.9. Results of studies described in this section will provide information on direct effects to fish at the channels and, taken together with results of studies described in Sections 5.0 and 6.0, indicate whether fish interactions with the channels have the potential to result in adverse effects to the fish community as a whole. For example, the numbers of fish attracted to spawn at the POC outlets, if any, will be compared to numbers using the Dauphin and Fairford rivers during operation to determine whether there is a potential for a detectable reduction in recruitment.

7.2 Approach

7.2.1 Key Questions and Overview of Studies

Monitoring of the POCs has been designed to address the following questions:

- What is the number and species composition of adult and juvenile fish that move downstream through the LMOC and LSMOC during channel operation?
- What is the number and species composition of larval fish that passively drift downstream through the LMOC and LSMOC during channel operation?
- Do fish use habitat at the LMOC and LSMOC outflows during periods of channel operation, specifically for spawning?

- Do fish become stranded (i.e., trapped on dry land or within wetted habitat from which they cannot move to an adjoining lake and death is therefore imminent) within the LMOC and LSMOC following closure of the WCSs?
- Do fish use habitat within the LMOC and LSMOC after WCS closure, making them potentially vulnerable to mortality?
- Does fish mortality occur within the LMOC and LSMOC during periods of low DO concentrations?

To address these questions, six studies will be conducted to assess:

- Adult and juvenile fish movement through the POCs;
- Larval drift through the POCs;
- Fish use of the POC outlets during channel operation;
- Fish stranding after WCS closure;
- Fish use of the POCs when the WCSs are closed; and
- Fish mortality after low DO, if observed.

7.2.2 Baseline Information

Data will be collected after the POCs are constructed.

7.2.3 Identification of Benchmarks

Fish use of the POCs will be examined in the context of potential adverse effects to the fish community in Lake Manitoba, Lake St. Martin and Sturgeon Bay. Therefore, benchmarks are a proportion of the potentially affected fish community: early warning triggers are meant to indicate a level below which relatively few fish are present in the POCs and an effect would be unlikely; and management thresholds are intended to indicate when a negative effect to the fish community may occur. However, exceedance of a management threshold does not indicate that an adverse effect to the fish community is occurring; rather it indicates that a targeted investigation is required to determine whether an adverse effect is occurring and, if so, help identify the appropriate mitigation measure. Results of monitoring programs focused on the fish community (Section 5.0) and fish spawning (Section 6.0) would be a key input to this investigation. Adaptive management measures to be considered for the POCs are provided in Section 7.9.

Benchmarks in relation to each of the key questions/studies are as follows:

- What is the number and species composition of adult and juvenile fish that move downstream through the LMOC and LSMOC during channel operation?

  Fish moving downstream through the POCs represent a loss to the upstream population and a gain to the downstream population. However, fish will also be able to move back upstream via the Fairford and Dauphin rivers. The early warning trigger is set at 5% of the harvest in 2000-2010 in the upstream commercial fishery (i.e., Lake Manitoba in the vicinity of the Fairford River for the LMOC and Lake St.

Martin for the LSMOC)[10]. This level of emigration is not expected to have an adverse effect on the sustainability of the fish population. The management threshold is set at 20% of the commercial fishery for the upstream commercial fishery, as emigration at this level may affect fish numbers; however, movements through the channels will also be considered in the context of fish movements recorded during other studies. For example, a large number of lake whitefish migrate upstream and downstream in the Dauphin River each year and movement of these fish downstream via the LSMOC during operation instead of the Dauphin River would not affect the population.

- What is the number and species composition of larval fish that drift downstream through the LMOC and LSMOC during channel operation?

  As with adult and juvenile fish, the transfer of larval fish represents a loss to upstream fish populations but not a net loss of fish. Larval drift downstream via the Fairford and Dauphin rivers occurs naturally and will be recorded during operation of the POCs (Section 6.6). If the number of larvae per unit of flow moving through the POCs is comparable to that in the two rivers, then the net amount of downstream movement is not affected by the Project (i.e., the same number of larvae would have moved downstream if all flow had passed via the rivers). The early warning trigger will be if the concentration of larvae is 10% greater in the POCs than the rivers and the management threshold will be 50% higher. The potential importance of downstream drift would also be considered in terms of the total numbers (i.e., if larvae drifting in the POCs represent less than 10% of the total drift in the Dauphin and or Fairford rivers and the channels, then this would not be a concern even if the density is higher).

- Do fish use habitat at the LMOC and LSMOC outflows during periods of channel operation, specifically for spawning?

  The early warning trigger for fish aggregating at the outflows would be numbers markedly higher than present overall in the lake, i.e., a CPUE that is 30% greater than the average catch in the lake. This would indicate that fish are attracted to the outlets. The management threshold would be if the CPUE at the outlets is greater than during the spawning runs in the Fairford and Dauphin rivers for the LMOC and LSMOC outlets, respectively. Exceedance of the management threshold would not indicate that an adverse effect is occurring, only that further investigation is required.

- Do fish become stranded within the LMOC and LSMOC following closure of the WCSs?

  This question is intended to address fish mortalities due to being trapped on the banks or isolated pools in the POCs as water levels drop, or on the drop structures in the LSMOC. The early warning trigger is set at 25 stranded fish observed along either the LMOC or the LSMOC. The management threshold is set at 50 fish at which point a salvage would be conducted.

[10] These years were selected because they represent the last decade where fishing was conducted annually prior to the 2011 flood.

- Do fish use habitat within the LMOC and LSMOC?

  The early warning trigger is a CPUE that is 20% of the CPUE in the Fairford and Dauphin rivers during comparable times of year. The management threshold is 50% of the CPUE in the rivers. Exceedance of the management objective does not indicate that an adverse effect to fish populations is occurring, but rather that conditions in the channels should be assessed as described in Section 7.9.

- Does fish mortality occur within the LMOC and LSMOC during periods of low oxygen concentrations?

  Criteria would be similar to those for mortality as a result of stranding, i.e., the early warning trigger is set at 10 fish and the management threshold is set at 50 fish.

7.3 Fish Movement through the POCs

7.3.1 Purpose

Operation of the LMOC and LSMOC may result in increased movements of fish from Lake Manitoba to Lake St. Martin and from Lake St. Martin to Sturgeon Bay via the channels. The effects of these movements on fish populations are expected to be minimal, but monitoring will be required to determine the extent to which downstream fish movements occur during channel operation, and whether there is an effect on the fish community related to increased downstream movements.

The following key question will be addressed:

- What is the number and species composition of adult and juvenile fish that move downstream through the LMOC and LSMOC during channel operation?

7.3.2 Timing

Downstream fish movements in the LMOC and LSMOC will be monitored during operation of the POCs for flood mitigation. The frequency and duration of monitoring will be as described in Section 2.1.

7.3.3 Field and Laboratory Methods

Split-beam hydroacoustics will be used to enumerate fish moving downstream past the WCSs in the LMOC and LSMOC (Appendix 1, Figure 1-8). “Receiver stations” will be installed in the channels immediately downstream of the WCSs at the onset of operation and will remain in place for the period of operation. The use of split-beam hydroacoustic technology provides an enumeration of fish movement past the receiver station by direction and size but does not identify fish to species.

Periodic fish sampling will be required to determine fish species moving through the channels and assist in analysis of hydroacoustic data. It is anticipated that a suite of fish capture techniques may be used, possibly including boat electrofishing, hoop nets, or gill nets. Captured fish will be enumerated by species and location, measured for size and examined for spawning status and external injuries.

7.3.4 Parameters

Data collected with the split-beam hydroacoustic program will include daily counts of fish moving downstream past the receiver station, and size estimates for fish moving past the station.

Fish captures will provide species identification and additional biological data.

7.3.5 Data Analysis

Hydroacoustic and fish capture data will be analyzed to provide daily counts of the number and size of fish and an estimate of the species composition of fish moving downstream within the channels.

7.4 Larval drift through the POCs

7.4.1 Purpose

This study will monitor larval fish movements from Lake Manitoba to Lake St. Martin and from Lake St. Martin to Sturgeon Bay to determine the species composition and numbers of larvae that may passively drift down the POCs during operation.

The following key question will be addressed:

- What is the number and species composition of larval fish that passively drift downstream through the LMOC and LSMOC during channel operation?

7.4.2 Timing

Monitoring studies will be conducted during operation of the POCs for flood mitigation. The frequency and duration of monitoring will be as described in Section 2.1.

7.4.3 Field and Laboratory Methods

Larval fish drift will be monitored at the following locations:

- inlet and outlet of the LMOC; and
- inlet and outlet of the LSMOC.

Larval fish will be captured using larval drift traps comparable to those used in the Dauphin and Fairford rivers (Section 6.6). Two traps will be set at each sampling location and will sample continuously during each sampling session. Flow meters will be used to estimate the portion of channel flow that is sampled.

It is anticipated that monitoring will be comprised of several sampling sessions per sampling year to maintain sampling effort at a reasonable level while providing coverage throughout spring. This is to account for differences in the timing of hatch and at which larvae of different species are vulnerable to passive movement with water flow. Specifically, larval lake whitefish drift immediately after ice off, while spring spawning species such as walleye and sucker drift later in spring.

7.4.4 Parameters

Larval fish densities will be estimated based upon the catch and the volume of water sampled by the drift traps.

7.4.5 Data Analysis

Data will be analyzed to provide an estimate of larval movements by species, location and date during each sampling year. Comparisons will be provided to drift in the Dauphin and Fairford rivers described in Section 6.6.

7.5 Fish use of the Outlets during Channel Operation

7.5.1 Purpose

This study will determine the extent to which, if any, fish will be attracted to spawn at the outlets during channel operation.

The following key question will be addressed:

- Do fish use habitat at the LMOC and LSMOC outflows during periods of channel operation and are fish using these areas for spawning?

7.5.2 Timing

Monitoring will be conducted during operation of the channels for flood mitigation. The frequency and duration of monitoring will be as described in Section 2.1.

7.5.3 Field and Laboratory Methods

Sampling will be conducted downstream of the control structure at the LMOC and downstream of the final drop structure on the LSMOC.

A suite of sampling methods will be used to document fish occurrence and habitat use within the channel outflows. Fish capture methods will be based on site conditions (e.g., water velocity and depth) but it is expected that a combination of methods including boat electrofishing, gill nets, and/or hoop nets will be used. Captured fish will be enumerated by species and location, measured for size and examined for spawning status and external injuries.

Habitat use will focus on spawning (i.e., are fish spawning in the outflows). The occurrence and success of spawning in outflow areas will be documented by the collection of fish eggs, using egg mats, during spring and/or fall. Larval drift will also be recorded in drift traps, as described in Section 6.6.

The timing of the spawning-related activities to be documented will dictate the timing of studies. For example, during spring, larval lake whitefish hatch shortly after ice off, adult walleye and white sucker move to spawning areas and begin to spawn concurrently or shortly thereafter, and larval walleye and white sucker

hatch about 2-3 weeks after spawning occurs. During fall, lake whitefish and cisco begin to congregate prior to spawning as temperatures decrease below about 8°C, with actual spawning occurring at temperatures ranging from 0-5°C. Consequently, a series of short-duration field campaigns (2-4 days) will be conducted at two week intervals during spring and/or fall during each monitoring period to provide snapshots of biological activity over a broader time period, allow field investigations to target specific biological occurrences, and document general spring and fall fish activity and habitat use as the season progresses.

7.5.4 Parameters

Adult and juvenile fish will be identified to species, measured and examined to determine sex and state of spawning condition.

Eggs and larval fish will be identified and enumerated by species and sampling location.

7.5.5 Data Analysis

Adult and juvenile fish data will analyzed by location (e.g., LMOC inlet) to describe the fish species, size of fish and spawning status of fish using outflow habitat during spring and fall.

Fish egg data will be used to provide descriptions of where spawning may have occurred at each location.

Larval fish occurrence and abundance data will be used to examine where spawning may have occurred (channel inlet vs outfall areas) and spawning success.

7.6 Fish Stranding in the Channels after WCS Closure

7.6.1 Purpose

Fish could be stranded within the POCs following closure, in particular if drawdown within the channels occurs rapidly. Within the LSMOC, fish may be stranded on the rock ramps comprising the downstream slope of the drop structures or along the shores of the channel. Channel closure is expected to increase water levels upstream of the control structure in the LMOC to the level of Lake Manitoba, but rapid drawdown could strand fish between the LMOC control structure and Lake St. Martin.

The following key question will be addressed:

- Do fish become stranded within the LMOC and LSMOC following closure of the WCSs?

7.6.2 Timing

Monitoring will occur immediately following WCS closure during commissioning and following closure after operation for flood mitigation. The frequency and duration of monitoring will be as described in Section 2.1.

7.6.3 Field and Laboratory Methods

Searches will be conducted along both banks of the LMOC downstream of the WCS to look for stranded fish immediately following closure of the channel. Stranded fish will be enumerated to species and locations where stranding occurs will be recorded. Size data will be collected from stranded fish.

Monitoring will also be conducted along the LSMOC during closure to look for fish that may become stranded on the downstream portions of the drop structures as waters recede. If a total of more than 50 fish are observed at all of the drop structures combined then a fish salvage will be implemented immediately to collect and release stranded fish. If a salvage is implemented, salvage crews will be stationed at each drop structure as required, and salvaged fish will be enumerated by location and species, measured and examined for injury and released into the LSMOC. Salvage crews will remain onsite until water levels within the LSMOC have stabilized. Salvaged fish will be enumerated by species and salvage location.

7.6.4 Parameters

Parameters include fish species and distribution, fish counts, and fish size data.

7.6.5 Data Analysis

Survey results will be analyzed to describe the occurrence, abundance, and distribution of stranded fish.

7.7 Fish Use of the POCs following Closure and during Non-Operation

7.7.1 Purpose

Fish may be attracted to the POCs, increasing their potential vulnerability to sub-optimal habitat conditions in the POCs. Surveys will be conducted to determine whether fish remain within the POCs following WCS closures.

The following key question will be addressed:

- Do fish use habitat within the LMOC and LSMOC?

7.7.2 Timing

Monitoring will occur a few weeks after WCS closure during commissioning and following closure after operation for flood mitigation. The frequency and duration of monitoring will be as described in Section 2.1.

7.7.3 Field and Laboratory Methods

Surveys will be conducted in fall if the WCSs are closed before mid September to document the numbers and species of fish present within the POCs both upstream and downstream of the WCSs. Surveys will be repeated in spring to document the fish that successfully overwintered in the channels. If the POCs are operated through the winter, then surveys will be conducted a few weeks after channel closure during the

open water season to allow fish the opportunity to move out of the channels. Surveys will be repeated if channels are not operated for an extended period (three or more years) to determine the numbers of fish still present. Surveys will also be repeated if conditions in the channels might significantly change (for example if the baseflow in the LSMOC would be reduced during drought conditions).

Fish will be captured using a combination of methods including boat electrofishing, backpack electrofishing, and gillnetting. Captured fish will be enumerated by species and location and will be measured and examined to determine spawning status (i.e., juvenile fish, adult fish in spawning condition).

7.7.4 Parameters

Parameters include fish species and distribution, fish counts, and fish size data. Fishing effort and biological parameters of captured fish (length, weight, state of sexual maturity) will be recorded.

7.7.5 Data Analysis

Survey results will be analyzed to describe the occurrence, abundance, and distribution of fish within POCs at various time periods following WCS closure.

7.8 Fish Mortality due to Dissolved Oxygen Depletion

7.8.1 Purpose

If low DO concentrations are recorded during winter water quality monitoring (Section 3.4), surveys will be conducted to determine whether fish mortality has occurred.

The following key question will be addressed:

- Does fish mortality occur within the LMOC and LSMOC during periods of low oxygen concentrations in winter?

7.8.2 Timing

Monitoring will be determined based upon results of DO monitoring described in Section 3.4.

7.8.3 Field and Laboratory Methods

Shoreline searches for fish mortalities in LMOC will be conducted by boat immediately after ice break up if ice conditions permit. If ice cover precludes the use of a boat, searches will be conducted by foot. Searches will focus on areas within the LMOC where recorded DO conditions were lowest, but other representative areas along the channel will also be searched.

Shoreline searches in the LSMOC will be conducted by foot immediately after ice break up in spring. Searches will focus along the banks of representative pools where DO has been monitored and are known to contain fish (Section 7.7).

7.8.4 Parameters

The occurrence, distribution, abundance, and distribution of fish mortalities will be recorded.

7.8.5 Data Analysis

Counts of fish mortalities will be tabulated by species and location.

7.9 Adaptive Management

The need for additional mitigation measures with respect to the POCs will be determined based on the magnitude of effects observed in relation to monitoring benchmarks set out in Section 7.2.3 and the risk to fish populations in Lake Manitoba, Lake St. Martin, and Lake Winnipeg. If changes to mitigation measures are required, the response would need to be determined based on effects observed in the POCs in conjunction with effects observed in the study area as a whole.

Two benchmarks (i.e., early warning triggers and management thresholds) were identified in Section 7.2.3. In general the early warning triggers indicate that a significant number of fish are present at the POCs, and a review of the monitoring program is required to determine whether modifications to the study are needed to better define potential effects. The early warning trigger is intended to proactively modify the scope of the studies, if and as required, such that information to address potential adverse effects is obtained in a timely manner. With respect to the POCs, the management threshold is the trigger to examine whether adverse effects to fish at the POCs are of sufficient magnitude to affect the fish communities in the study area.

The following discussion provides potential adaptive management measures that may be implemented if management thresholds are exceeded for each of the key questions.

What is the number and species composition of adult and juvenile fish that move downstream through the LMOC and LSMOC during channel operation?

Fish moving downstream through the POCs represent a loss to the upstream population and a gain to the downstream population. However, fish will also be able to move back upstream via the Fairford and Dauphin rivers. The management threshold is set at 20% of the commercial fishery as emigration at this level may affect fish numbers; however, as noted in Section 7.2.3, movements through the channels will also be considered in the context of fish movements recorded during other studies.

If a large number of fish are moving downstream then current commercial fisheries production data and other data sources (e.g., Lake St. Martin fish community data [Section 5.3]; CAMP data collected in the north basin of Lake Manitoba) would be examined in detail to determine if a downward trend in fish populations is observed. If necessary, measures to reduce fish emigration would need to be investigated.

What is the number and species composition of larval fish that drift downstream through the LMOC and LSMOC during channel operation?

The transfer of larval fish represents a loss to upstream fish populations but not a net loss of fish. Larval drift downstream via the Fairford and Dauphin rivers occurs naturally and will be recorded during operation of the POCs (Section 6.6). The management threshold will be a CPUE of larval drift in the POCs 50% higher than in the rivers.

As noted in Section 7.2.3, drift would also be considered in terms of total numbers compared to the rivers and in the context of other monitoring results, for example whether recruitment of key species (i.e., the year class strength) is notably lower in years of POC operation. If an adverse effect is observed, then measures to enhance recruitment in upstream lakes to offset these losses may be considered. These measures would depend on the adverse effect noted but may include the creation of spawning habitat and stocking.

Do fish use habitat at the LMOC and LSMOC outflows during periods of channel operation, specifically for spawning?

The management threshold would be a CPUE at the outlets that is greater than during the spawning runs in the Fairford and Dauphin rivers for the LMOC and LSMOC outlets, respectively, indicating that a fish are aggregating at the outlets. Exceedance of the management threshold would not indicate that an adverse effect is occurring, only that further investigation is required. In particular, the numbers of fish spawning at the outlets, and the fate of spawn (i.e., do eggs hatch) would be investigated. If conditions at the outlets do not support successful egg hatch, then measures to improve conditions would be investigated (e.g., placement of suitable substrate, extension of POC operation to allow for egg hatch).

Do fish become stranded within the LMOC and LSMOC following closure of the WCSs?

The management threshold for mortality due to stranding is set at 50 fish. Measures to mitigate stranding would depend on the location and timing of trapped fish. Potential measures include:

- modification of the shutdown procedure to induce fish to leave the POCs to reduce the incidence of stranding;
- recontouring the channel if there are isolated pools or other structures that are trapping fish; and
- conducting a fish salvage if large numbers of fish are stranded on the rock ramps at the downstream sides of the drop structures.

Do fish use habitat within the LMOC and LSMOC?

The management threshold is 50% of the CPUE in the rivers, but exceedance of threshold does not indicate that an adverse effect to fish populations is occurring, but rather that conditions in the channels should be assessed to determine if they are suitable to support fish production (rather than just conveying fish to the downstream waterbody) or if modified shut down procedures should be employed to trigger fish to leave the channels as the WCSs are closed.

Does fish mortality occur within the LMOC and LSMOC during periods of low oxygen concentrations?

Criteria would be like those for mortality due to stranding, i.e., the management threshold is set at 50 fish. If DO is reaching critically low levels, then methods of increasing DO such as increasing flow through the channels when they are not being operated for flood mitigation would be investigated. In addition, potential causes, and remedies for DO depletion would be examined (e.g., is organic matter accumulating in the channels during periods between use for flood mitigation and increasing the biological oxygen demand?).

8.0 MERCURY IN FISH FLESH

8.1 Rationale

Disruption and inundation of organic materials can increase the activity of bacteria that convert inorganic to organic mercury (i.e., methylmercury). Methylmercury can be taken up by aquatic organisms and passed up the food chain, becoming more concentrated in organisms higher up the food chain. Elevated concentrations of mercury in fish flesh can lead to human health concerns if fish is a large part of the diet. Although it is expected that the Project will not result in increased mercury concentrations in fish because flood mitigation will reduce overland flooding and associated inundation of organic soils. This parameter will be monitored to address concerns of local resource users. Initial monitoring will be conducted after commissioning of the POCs as this will be when organic soils in the immediate drainage basin are disrupted by construction and new areas within the drainage ditches are wetted.

8.2 Approach

8.2.1 Key Questions and Overview of Studies

Monitoring will address the following key question in respect to mercury in fish flesh:

- Will construction and commissioning of the Project result in increases in fish mercury concentrations that exceed baseline concentrations in Lake Manitoba, Lake St. Martin, and Sturgeon Bay?

One study will be conducted to address this question:

- Mercury concentrations in the flesh of fish from Lake Manitoba, Lake St. Martin and Sturgeon Bay will be monitored after commissioning of the POCs to determine if mercury concentrations increase and, if so, determine if it may be related to the Project.

8.2.2 Baseline Information

Total mercury concentration data was collected as part of EOC monitoring and as part of baseline studies for the Project (NSC 2013). Supplemental data were collected in fall 2018, fall 2020 and fall 2021.

8.2.3 Benchmark

The benchmark for the fish mercury monitoring program will be compared to the baseline total mercury concentration in walleye, northern pike, and lake whitefish from Lake Manitoba, Lake St. Martin and Sturgeon Bay based on recently collected data. Comparisons will also be made to the concentrations recorded during the EOC monitoring and available data from the commercial fishery. If there is a statistically significant increase in mercury concentration, then further steps would be taken as set out under adaptive management (Section 8.4).

8.3 Fish Mercury Concentration Monitoring

8.3.1 Purpose

Mercury concentrations in the flesh of fish from Lake Manitoba, Lake St. Martin and Sturgeon Bay will be monitored.

8.3.2 Timing

Initial mercury monitoring will be conducted following commissioning of the POCs. Subsequent mercury monitoring may be conducted after channel operation, generally in conjunction with fish community sampling on Lake St. Martin, if an increase in mercury concentrations is recorded after channel commissioning. The time frame over which mercury concentrations continue to increase in fish following changes to the aquatic environment varies and can be in the order of five years (i.e., period before peak concentrations are reached). Consequently, additional samples will be collected from commercial catches for five years after commissioning. If operation of flood mitigation occurs during this period, then samples will also be collected during fish community studies.

8.3.3 Field and Laboratory Methods

Tissue samples will be collected from a sample of walleye, northern pike, and lake whitefish for mercury analysis. When biological studies are not being conducted as part of this AEMP, fish will be purchased from commercial fishers. A range of fish lengths will be sampled if available.

8.3.4 Parameters

Parameters measured will include fish length, weight, age and total mercury.

8.3.5 Data Analysis

To reduce the effect of fish size/age and to facilitate comparisons over time, mean mercury concentrations will be standardized to a common fish length. These standard means will be calculated from unique regression equations, by species and waterbody, based on the analysis of logarithmic transformations of muscle mercury concentration and fork length.

8.4 Adaptive Management

If mercury concentrations significantly increase following commissioning of the channels, this information would be conveyed to the appropriate regulators to determine whether changes need to be communicated to consumers of fish. Other data sources (e.g., other mercury monitoring done of commercial fish catches, province wide studies such as CAMP) would be examined to determine whether this increase is attributable to the Project or other causes.

If an increase in mercury concentrations attributable to the POCs occurs after commissioning, then monitoring of mercury concentrations will occur again after diversion of water through the POCs for flood mitigation.

9.0 SCHEDULE AND REPORTING

As discussed in Section 2.1, monitoring activities for the Project are being conducted during several time periods:

- Supplemental data collection – additional studies planned prior to commissioning, as identified in Appendix 2, Table 2-2;
- Commissioning and immediate post-commissioning – will provide information on conditions in the POCs after they are wetted; and
- Operational phase – includes periods when the POCs are diverting water for flood mitigation, the year following operation, and times of non-operation.

The frequency and timing of studies during each time period is presented in Appendix 2, Table 2-5.

As discussed in the preceding sections, the supplemental data, in conjunction with data collected during operation of the EOC and to support the environmental assessment, will be used to calculate numeric values for benchmarks that have been identified in this AEMP. Prior to commissioning of the POCs, a report will be produced providing the numerical values of the benchmarks.

Commissioning (i.e., initial diversion of flow through the POCs) is currently planned to occur outside of the sensitive timing periods defined by DFO (i.e., commissioning is planned to occur between July 1 – September 15). Results of monitoring conducted during and in the year following commissioning will be used to determine whether modifications are required to monitoring planned for flood events when flows are diverted through the POCs (i.e., operation monitoring) as follows:

- Results of TSS and other water quality monitoring downstream of the outlets during commissioning will indicate whether diversion of flow through the POCs has the potential to have greater than anticipated effects to water quality. In particular, the need to extend the spatial extent of monitoring will be assessed;
- Habitat conditions in the channels after being wetted, including both open water and under ice, will be evaluated to determine whether there are any immediate concerns with fish survival. DO concentrations and water depth will be the focus of this analysis;
- The numbers and species of fish that are present in the channels as a result of the flow diversion and wetting will be assessed to determine whether there is a concern with stranding of fish in the channels and whether potential modifications to ramp down procedures should be implemented; and
- Water quality, habitat, and fish will be examined in Birch Creek and Buffalo Creek after the channels have been commissioned to document conditions in the creeks and provide assurance that conditions are suitable for the survival of fish.

During the operational phase, annual workplans will be developed prior to each open water season when monitoring is required or anticipated to be required based on flood projections, considering the results of the previous studies, and status of operation/non operation of the POCs. If benchmarks were exceeded in the preceding monitoring period and the need for adaptive management (including modifications to the monitoring program, and development and implementation of additional mitigation) was identified, then monitoring activities would be adjusted accordingly.

Reports that document the methods and results of the studies will be produced within one year of completion of the field studies conducted in that particular year. Where a second year of study is required, reporting would be completed prior to the start of the following field season such that results can inform activities to be implemented in that year. Reports will provide the following information:

- The objective of the particular study;
- Methods, including a description of any departure from the methods set out in the AEMP;
- Results of the study and comparison to pre-Project conditions, where applicable;
- Comparison to previous monitoring results, where relevant;
- Comparison to benchmarks set out in the AEMP;
- A discussion of results in comparison to anticipated effects identified during the environmental assessment, indicating whether unanticipated changes may be occurring; and
- Recommendations for modifications to the monitoring program, if any.

A synthesis report describing aquatic monitoring results will be prepared after two cycles of monitoring related to channel operation have been completed. The synthesis will include:

- A summary of monitoring studies and results completed to date, including in relation to the magnitude of flood events;
- Comparison of monitored parameters pre and post-Project, and in reference to anticipated environmental effects;
- A comparison to management thresholds, where relevant;
- A discussion of the overall changes observed as a result of the Project;
- A description of recommended and/or implemented changes to mitigation measures (e.g., fish salvage, shut down procedures for POCs to reduce fish stranding); and
- Recommendations for future monitoring.

10.0 REFERENCES

AAE Tech Services Inc. 2016. Fisheries and Aquatic Habitat Baseline Assessment. Lake Manitoba Outlet Channel Route Options. A report prepared for Manitoba Infrastructure.

Hatch. 2021. Lake Manitoba Outlet Channel – Sediment Transport Modeling to Manage excess Sediment Concentrations During Commissioning, Rev 0.

Hatch and KGS Group. 2022. Lake Manitoba Outlet Channel / Lake St. Martin Outlet Channel Updated Sediment Transport Assessment During Commissioning with Channel Armouring, Rev 0.

KGS Group. 2021a. Lake Manitoba and Lake St. Martin Outlet Channels Analysis of Physical Impacts to Rivers within the Hydraulic System, Rev 0.

KGS Group. 2021b. Lake St. Martin Outlet Channel Sediment Transport Modelling to Manage Excess Sediment Concentrations During Commissioning, Rev 0.

NSC. 2013. Emergency Reduction of Lake Manitoba and Lake St. Martin Water Levels – Results of Aquatic Environmental Monitoring Conducted During Fall 2011. A report prepared for Manitoba Infrastructure and Transportation.

NSC. 2016a. Lake St. Martin Emergency Outlet Channel Assessment of Effects and Development of Habitat Compensation – Volume 4: Habitat. A report prepared for Manitoba Infrastructure and Transportation.

NSC. 2016b. Lake St. Martin Emergency Outlet Channel Assessment of Effects and Development of Habitat Compensation – Volume 5: Fish. A report prepared for Manitoba Infrastructure and Transportation.

NSC. 2019a. Lake Manitoba and Lake St. Martin Outlet Channel Project: Benthic Invertebrate Investigations 2018. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2019b. Lake Manitoba and Lake St. Martin Outlet Channel Project: Lake St. Martin Index Gillnetting Survey – 2018. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2019c. Lake Manitoba and Lake St. Martin Outlet Channel Project: Fisheries Investigations at the LSMOC Inlet and Outlet. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2019d. Lake Manitoba and Lake St. Martin Outlet Channel Project: Spring Fish Use in Watercourses along the Lake Manitoba Outlet Channel Alignment. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2021a. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Fall 2020 to Spring 2021. Water Quality. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2021b. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Fall 2020. Lake Whitefish Spawning Movements. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022a. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Fall 2021. Water Quality. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022b. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Fall 2021. Sediment Quality. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022c. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Fall 2021. Aquatic Habitat in The Narrows and Birch Bay of Lake St. Martin. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022d. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring 2021. Lake St Martin Index Gillnetting Survey. A report prepared for Manitoba Transportation and Infrastructure. May 2022.

NSC. 2022e. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Spring 2021. Fish Use of Buffalo and Birch Creeks. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022f. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring 2020 and 2021. Fish Use of the Fairford and Dauphin Rivers. A report prepared for Manitoba Transportation and Infrastructure.

NSC. 2022g. Lake Manitoba and Lake St. Martin Outlet Channels Project - Aquatic Environment Monitoring Spring 2021. Larval Fish Studies. A report prepared for Manitoba Transportation and Infrastructure.

NSC and KGS Group. 2016. Lake St. Martin Emergency Outlet Channel Assessment of Effects and Development of Habitat Compensation – Volume 3: Water Quality. A report prepared for Manitoba Infrastructure and Transportation.

APPENDIX 1

Figures

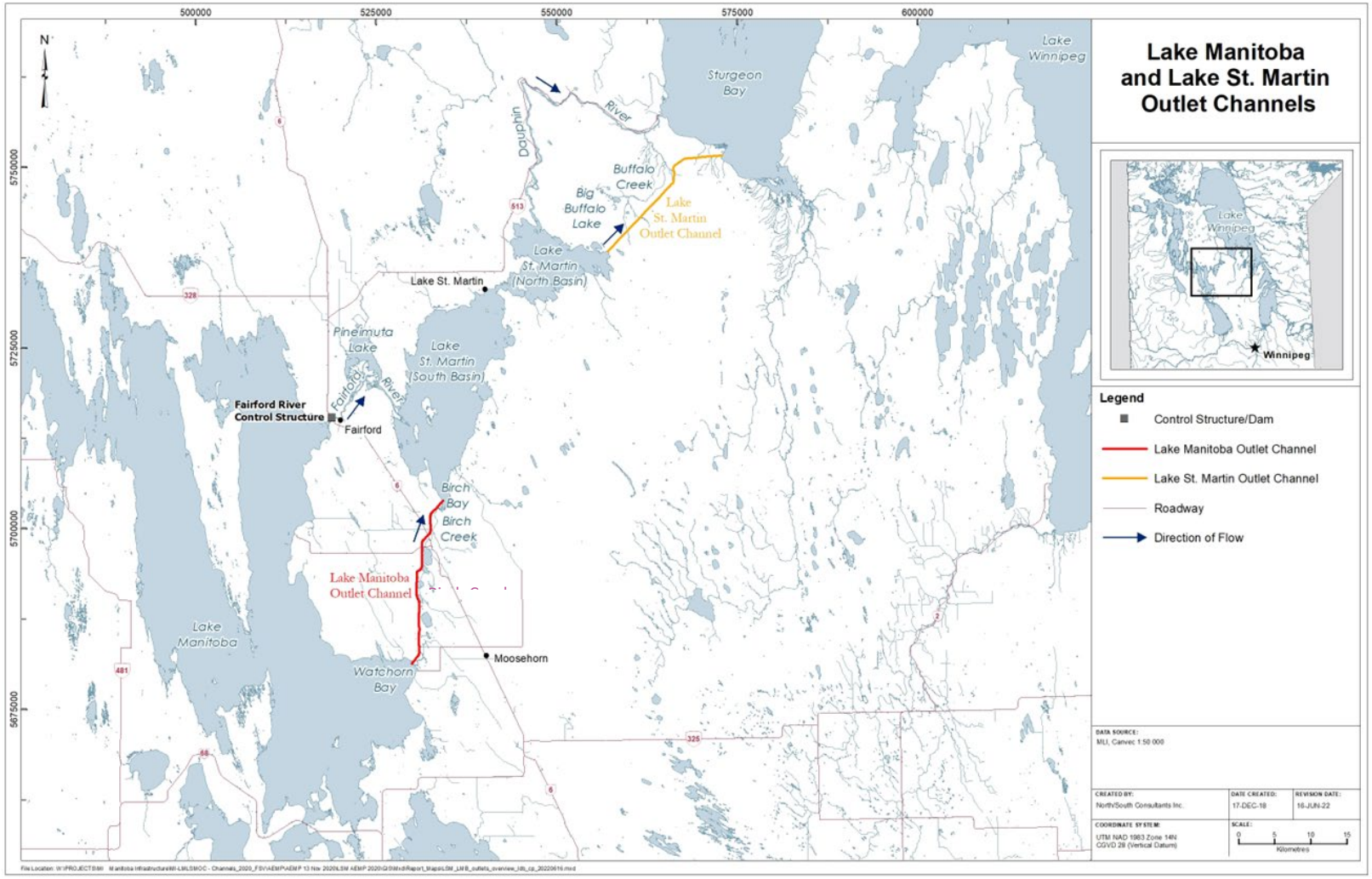


Figure 1-1: Location of Lake Manitoba and Lake St. Martin Outlet Channels and other waterbodies referenced in the AEMP. Arrows show direction of flow.

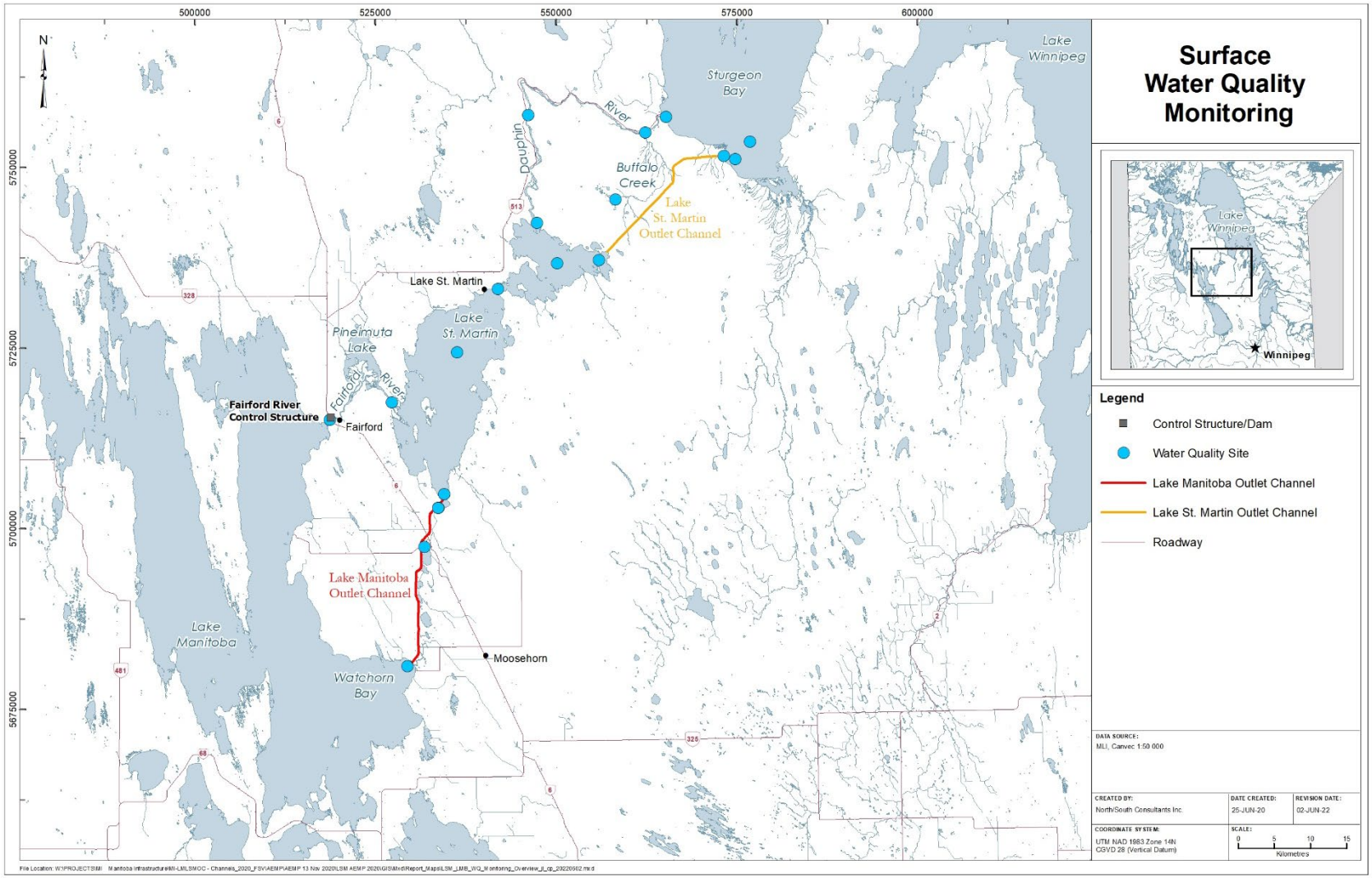


Figure 1-2: Location of surface water quality sampling sites.

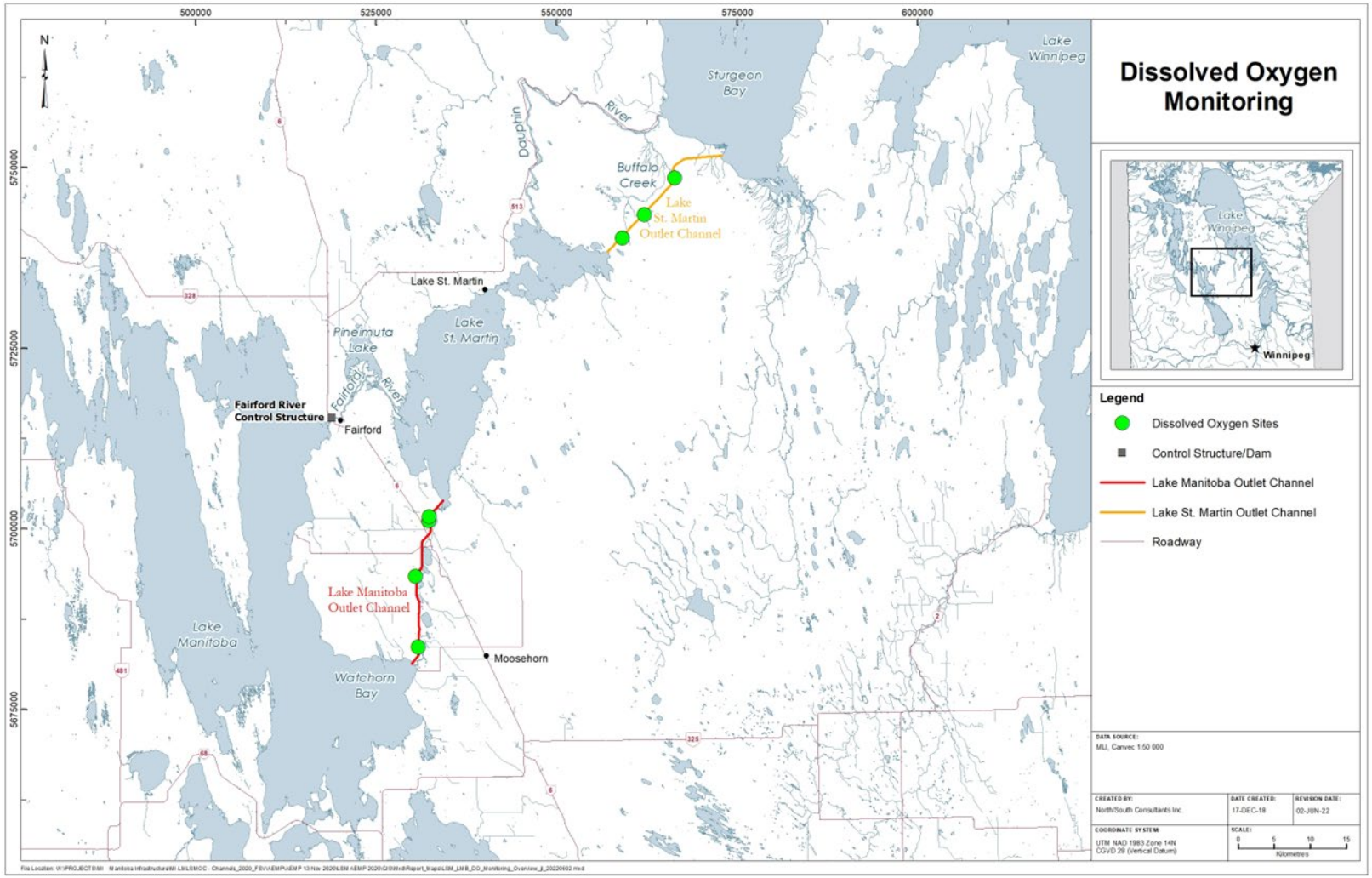


Figure 1-3: Location of DO monitoring sites.

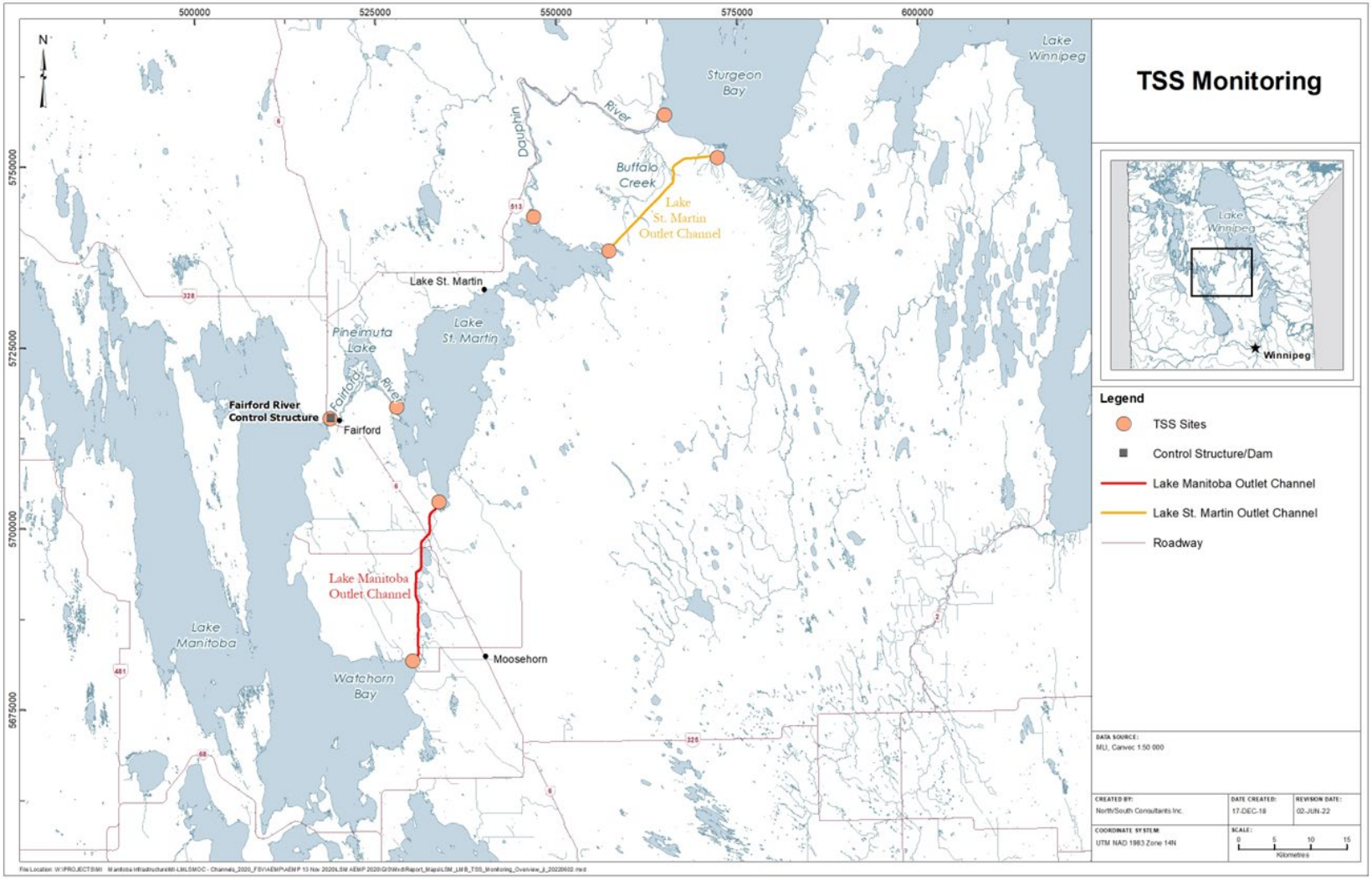


Figure 1-4: Location of turbidity logger and TSS sampling sites

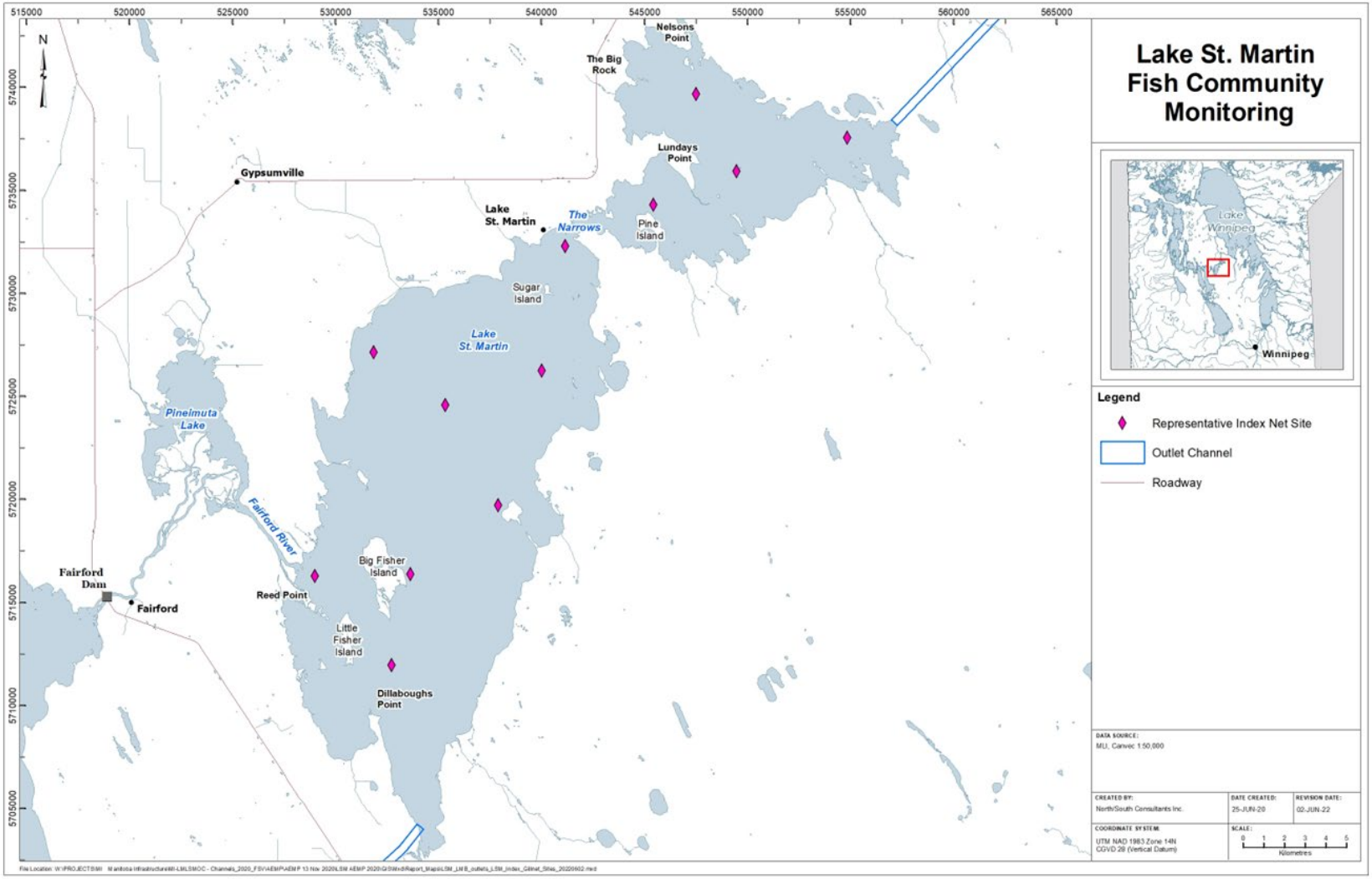


Figure 1-5: Representative standard experimental gill net sites for Lake St. Martin fish community sampling

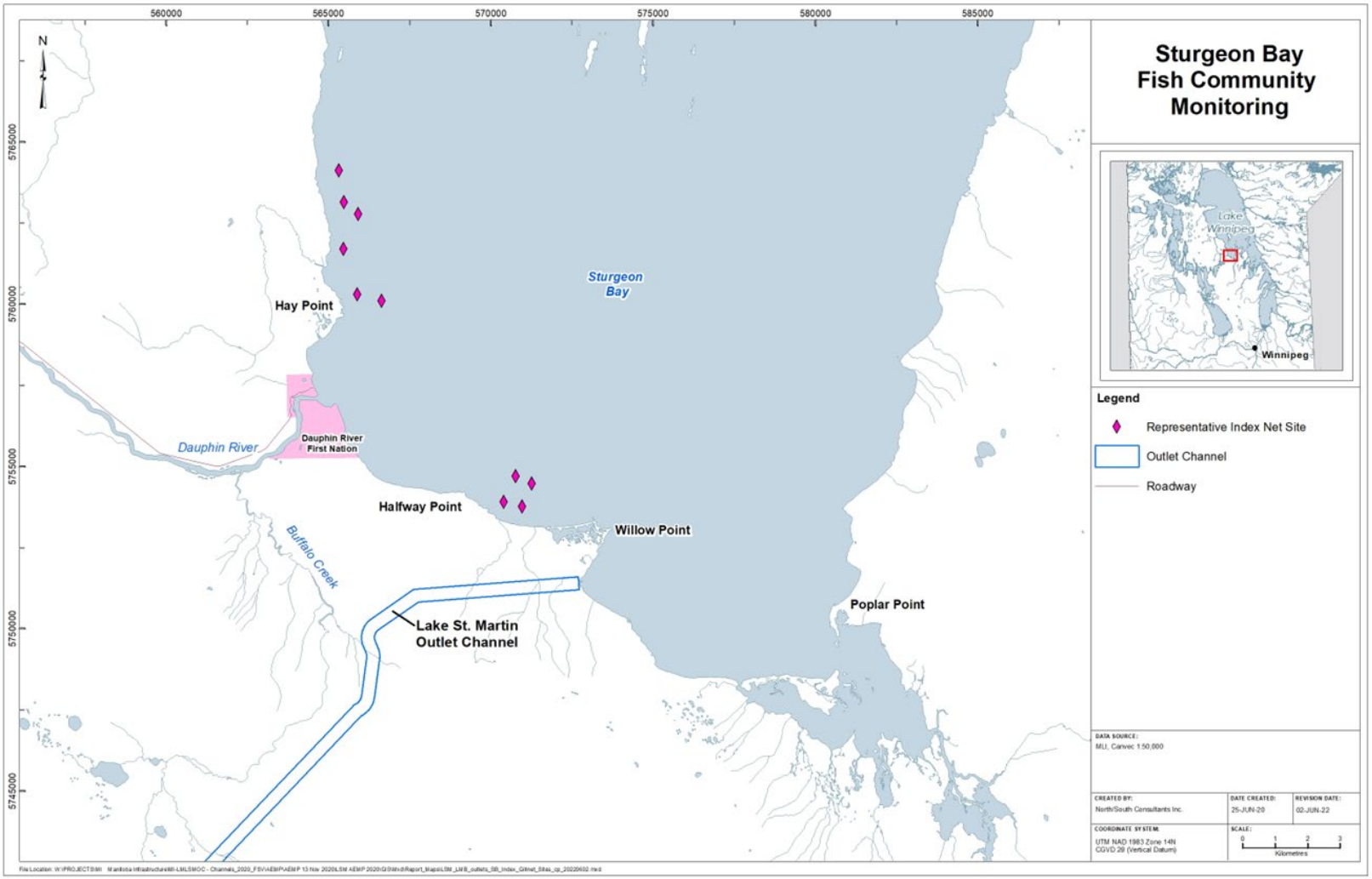


Figure 1-6: Representative index net sites for Sturgeon Bay fish community sampling as part of the CAMP. Sites may be added near the proposed LSMOC outlet.

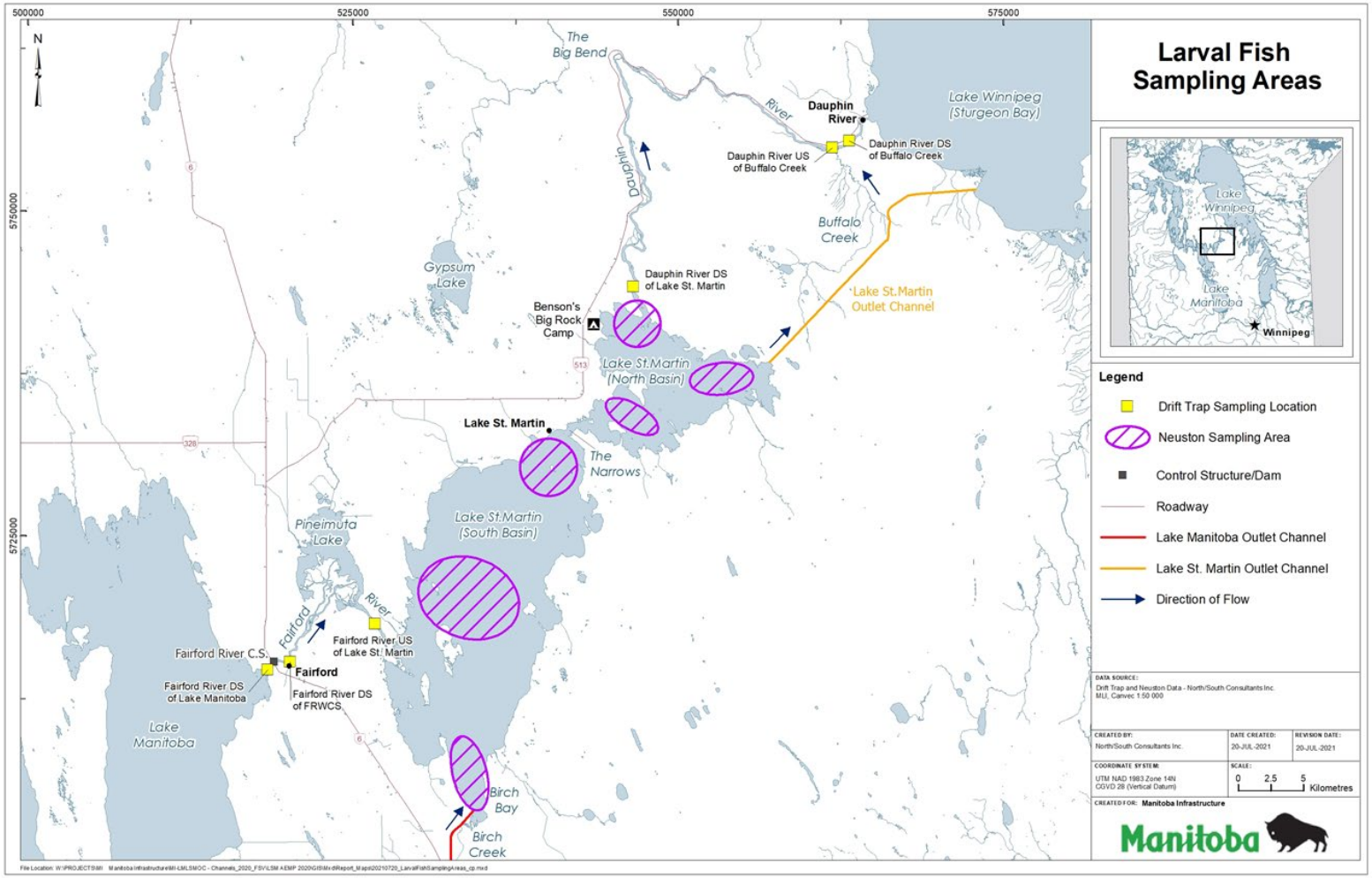


Figure 1-7: Larval lake whitefish sampling sites on Lake St. Martin and larval drift trap sites on the Dauphin and Fairford rivers.

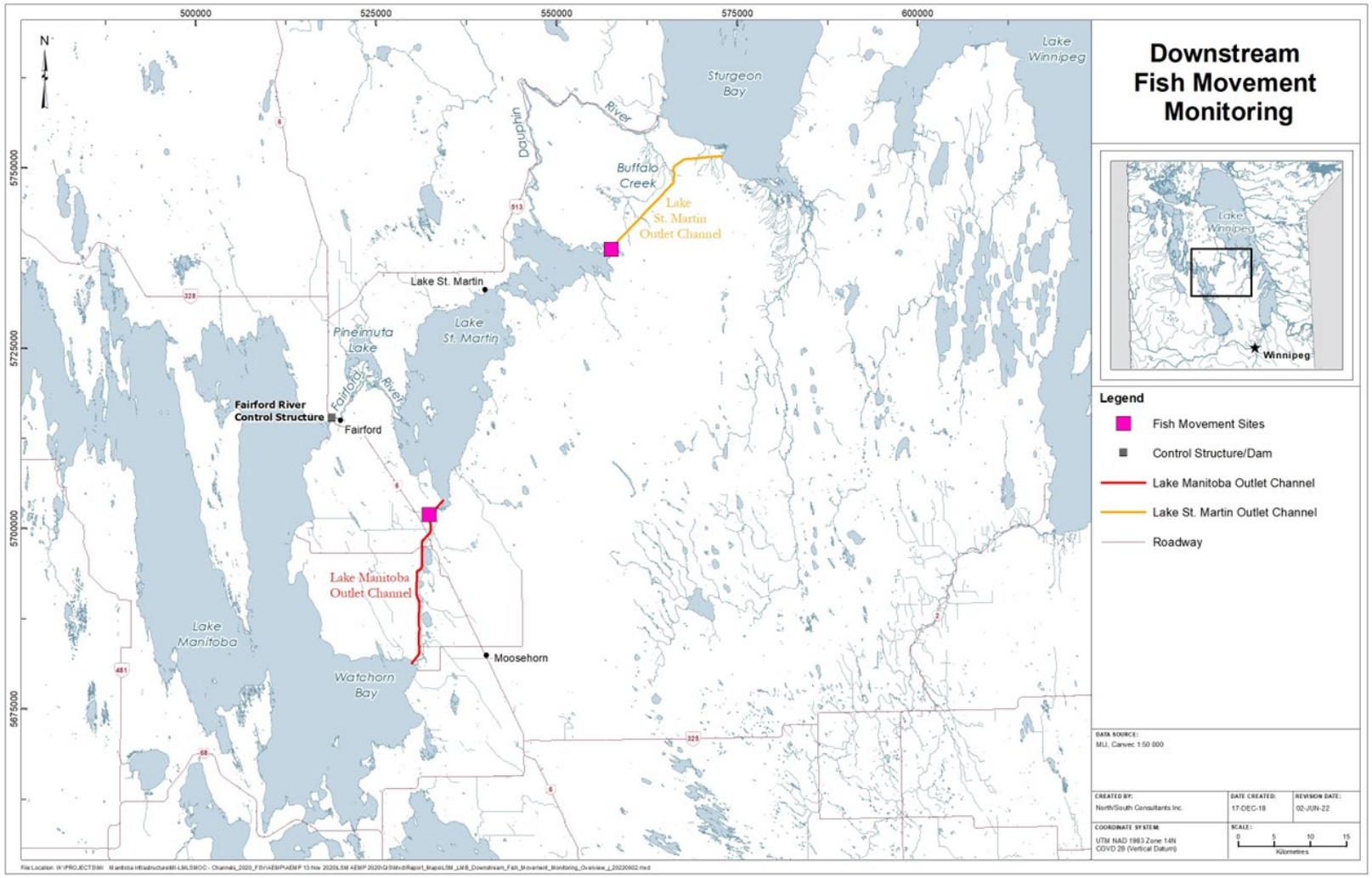


Figure 1-8: Location of hydroacoustic receiver stations to document downstream fish movements during POC operation.

APPENDIX 2

Tables

Table 2-1: Definition of Project phases and states used in the AEMP

Project phase	Phase definition
Supplemental Data Collection	The period prior to commissioning; construction activities that are occurring are not expected to affect the aquatic environment components being studied. Supplemental studies conducted to provide information to address additional data requirements identified during AEMP development.
Commissioning and immediate post-commissioning	Construction is complete and operation of channels is being tested during commissioning. Data collected when flow is passing through the channels and when the channels are watered but there is no flow for one year after the WCSs are first opened.
Operational Period	Construction and commissioning are complete, channels have been watered. The operational phase consists of three states described below.
State of Operation	**State definition**
Water Control Structures Closed = non-operation state	Water control structures are closed, and water is not being diverted for flood mitigation. Monitoring studies conducted to determine whether conditions in the POCs are suitable for the survival of fish that are present. Studies may also be conducted in Birch and Buffalo creeks where adverse affects are more likely under natural low flow conditions.
Water Control Structures Open = operation state	Water control structures are open and water is being diverted to alleviate flood conditions. Monitoring studies to describe effects related to water diversion through channels.
Post-closure of Water Control Structures = post-operation state	The immediate year following diversion of water through channels. Monitoring studies to determine effects of operation that may only be evident following operation. E.g., egg hatch of fall spawning fish in spring following operation.

Table 2-2: Supplemental studies conducted prior to commissioning.

Supplemental Studies	Study Objective	AEMP Section
Surface water quality	Provide additional water quality data at sites throughout study area, collected concurrently to allow assessment of spatial variation among sites. Data collection late summer 2020 – late fall 2021. An additional year of data collection will occur prior to commissioning of the POCs.	3.3
Sediment quality in Lake St. Martin and Sturgeon Bay	Provide pre-Project data on sediment quality at selected locations in the study area. Data collection fall 2020, supplemented by additional sites in 2021.	3.5
Substrate composition at sites in Lake St. Martin and Sturgeon Bay	Provide pre-Project substrate composition at sites where modelling has indicated that fine sediments may be deposited over coarse substrates during commissioning. Data collection 2021 (Lake St. Martin) and 2022 (Sturgeon Bay).	4.4
Substrate composition at sites in Lake Winnipeg, including the nearshore off McBeth Point.	Provide pre-Project substrate composition at sites where Fisher River Cree Nation indicated that sediments accumulated after operation of the EOC to provide the basis for comparison after commissioning of the POCs. Data collection summer 2022. Need for additional pre-commissioning data will be determined based on results.	4.5
Fish community monitoring in Lake St. Martin	Fish community composition data from Lake St. Martin to provide additional data against which potential changes related to channel operation will be assessed. Data collection 2018, 2021, and an additional year prior to commissioning.	5.3
Fish use of Birch Creek and Buffalo Creek	Investigations were conducted to determine the extent to which fish currently use habitat in the Birch and Buffalo creeks. Habitat information was also recorded during surveys. Data collection in 2021 (low flow) and 2022 (high flow).	5.5
Spring fish spawning in Fairford and Dauphin rivers	Determine the presence of adult fish during spring in the Dauphin and Fairford rivers. Data collection in 2021 and an additional year prior to commissioning.	6.3

Supplemental Studies	Study Objective	AEMP Section
Fall Fish Use of the Dauphin and Fairford Rivers	The magnitude and timing of fall fish movements, with emphasis on the lake whitefish, were documented in the Dauphin and Fairford rivers. Data collection in 2020 and 2021. These studies were conducted under extreme drought conditions to supplement studies conducted during the operation of the EOC under flood conditions. The need to collect additional data under conditions other than drought or flood will be assessed.	6.4
Larval Lake Whitefish in Lake St. Martin	The abundance and distribution of larval lake whitefish in Lake St. Martin were documented during early spring to determine the location of successful egg hatch in the lake. Data collection in 2021 and 2022. An additional year of data collection will occur prior to commissioning of the POCs.	6.5
Larval fish drift in Fairford and Dauphin rivers	Larval fish drift along the Fairford and Dauphin rivers provides the species composition and numbers of larval fish currently drifting through the system. Studies target both fall and spring spawners. Data collection in 2021 and 2022. An additional year of data collection will occur prior to commissioning of the POCs.	6.6

Table 2-3: Water quality parameters to be sampled.

Parameter Groups		
Routine Parameters	**Metals (Total and Dissolved) and Major Ions**	
Routine Chemistry	Aluminum (Al)	Nickel (Ni)
Total alkalinity, as CaCO3	Antimony (Sb)	Phosphorus (P)
Bicarbonate alkalinity as HCO3	Arsenic (As)	Potassium (K)
Carbonate alkalinity, as CO3	Barium (Ba)	Rubidium (Rb)
Hydroxide alkalinity, as OH	Beryllium (Be)	Selenium (Se)
pH	Bismuth (Bi)	Silicon (Si)
Conductivity	Boron (B)	Silver (Ag)
Total Dissolved Solids	Cadmium (Cd)	Sodium (Na)
Hardness, as CaCO3	Calcium (Ca)	Strontium (Sr)
Nutrients	Cesium (Cs)	Sulphate (dissolved)
Total Ammonia (as N)	Chloride (dissolved)	Sulfur (S)
Nitrate (as N)	Chromium (Cr)	Tellurium (Te)
Nitrite (as N)	Cobalt (Co)	Thallium (Tl)
Nitrate and Nitrite (as N)	Copper (Cu)	Thorium (Th)
Total Kjeldahl Nitrogen	Iron (Fe)	Tin (Sn)
Total Nitrogen	Lead (Pb)	Titanium (Ti)
Dissolved Phosphorus	Lithium (Li)	Tungsten (W)
Total Particulate Phosphorus	Magnesium (Mg)	Uranium (U)
Total Phosphorus	Manganese (Mn)	Vanadium (V)
Total Inorganic Carbon	Mercury (Hg)	Zinc (Zn)
Total Organic Carbon	Molybdenum (Mo)	Zirconium (Zr)
Dissolved Organic Carbon		
Total Carbon		
Water Clarity		
Total Suspended Solids		
Turbidity		
True Colour		
Algal Pigments		
Chlorophyll a		
Phaeophytin a		

Table 2-4: Hydrocarbon and pesticide parameters measured at selected water quality sampling sites.

Parameter Group			
Hydrocarbon Parameters		Pesticide Parameters	
Benzene	Indeno(1,2,3-cd)pyrene	Aldrin	Oxychlordane
Ethyl benzene	1-Methyl Naphthalene	alpha-BHC	Pentachloronitrobenzene
Toluene	2-Methyl Naphthalene	beta-BHC	AMPA
o-Xylene	Naphthalene	gamma-hexachlorocyclohexane	Bromoxynil
m+p-Xylenes	Phenanthrene	delta-BHC	Clopyralid
Xylenes (Total)	Pyrene	a-chlordane	2,4-D
F1 (C6-C10)	Quinoline	g-chlordane	Dicamba
F1-BTEX	B(a)P Total Potency Equivalent	o,p-DDD	2,4-DB
F2-Naphth		pp-DDD	2,4-DP
F2 (C10-C16)		o,p-DDE	Dinoseb
F3-PAH		pp-DDE	MCPA
F3 (C16-C34)		op-DDT	MCPB
F4 (C34-C50)		pp-DDT	Mecoprop
Total Hydrocarbons (C6-C50)		Dieldrin	Picloram
Acenaphthene		Endosulfan I	2,4,5-T
Acenaphthylene		Endosulfan II	2,4,5-TP
Acridine		Endosulfan Sulfate	Triclopyr
Anthracene		Endrin	Atrazine
Benzo(a)anthracene		Endrin Aldehyde	Atrazine+N-Dealkylated Metabolites

Parameter Group			
Hydrocarbon Parameters		Pesticide Parameters	
Benzo(a)pyrene		Heptachlor	Ethalfluralin
Benzo(b&j)fluoranthene		Heptachlor Epoxide	Atrazine Desethyl
Benzo(g,h,i)perylene		Hexachlorobenzene	Fluazifop-p-butyl
Benzo(k)fluoranthene		Hexachlorobutadiene	Glyphosate
Chrysene		Hexachloroethane	Diclofop-methyl
Dibenzo(a,h)anthracene		Methoxychlor	Triallate
Fluoranthene		Mirex	Trifluralin
Fluorene		trans-Nonachlor	

Table 2-5: Schedule of monitoring planned to be conducted for the Aquatic Effects Monitoring Program.

Study	Additional Supplemental Data 2022 +	Commissioning [1]	Post-Construction		
			Non-Operation	Operation	Post-Operation
Surface Water Quality					
Core Water Quality	X	X		X	X
DO		X	X		X
TSS		X		X	X
Aquatic Habitat					
Habitat at the POCs		X	X		X
Lake St. Martin and Sturgeon Bay Substrate	X	X			X
McBeth Point	X	X			X
Fish - Community Studies					
Lake St. Martin [2]	X		X		X
Sturgeon Bay [3]	X	X	X	X	X
Commercial Fishing Records	X		X		X
Birch and Buffalo Creeks	X	X	X		
Fish - Spawning					
Spring Use of Dauphin and Fairford Rivers	X			X	
Fall Use of Dauphin and Fairford Rivers				X	
Larval Lake Whitefish in Lake St. Martin	X	X			X
Larval Fish Movements in Rivers	X			X	X

Study	Additional Supplemental Data 2022 +	Commissioning [1]	Post-Construction		
			Non-Operation	Operation	Post-Operation
Fish - Effects at the POCs					
Adult Fish Movements in POCs				X	
Larval Fish Movements in POCs				X	
Fish Use of the Outlets				X	
Fish Stranding after Closure		X			X
Fish Use of POCs		X	X		X
Fish Mortality due to DO Depletion [4]		TBD			TBD
Fish - Mercury					
Mercury in Fish Flesh [5]		X			TBD

Notes:
Supplemental data collection to be completed prior to commissioning. Operation refers to the period when the WCs are open for flood mitigation; post operation is the period of monitoring immediately after WCS closure to address effects of operation. Non-operation is a period when the WCSs have been closed for more than a year. Note the monitoring of construction effects to water quality is presented in the Surface Water Management Plan.

1 The commissioning period begins when POCs are initially watered and extends for one year thereafter.
2 Monitoring will occur after POC operation and on an approximately 3 year cycle if POC operation does not occur
3 Sturgeon Bay fish community will be monitored annually as part of CAMP, results will be utilized by AEMP.
4 Monitoring will be conducted if DO levels decline to critically low concentrations.
5 Mercury samples will be collected for up to five years after channel commissioning

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Wetland Monitoring Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vii

1.0 INTRODUCTION 1

1.1 Purpose and Scope 1

1.2 Wetland Mapping Background 2

1.3 Study Areas 2

1.3.1 Previous Monitoring/Survey Locations 5

1.4 Monitoring Plan Objectives 6

1.4.1 Objectives 6

1.4.2 Adaptive Management Approach 7

2.0 REGIONAL SETTING 9

2.1 Ecological Context 9

2.2 Existing Wetlands and Predicted Impacts 10

2.2.1 Existing Wetland Class and Abundance 10

2.2.2 Predicted Impacts to Wetlands 23

2.3 Hydrogeological Context and Predicted Impacts 24

2.4 Hydrological Context and Predicted Impacts 31

2.5 Vegetation Species at Risk 36

2.6 Wildlife Species at Risk 37

2.6.1 Habitat Descriptions for Wetland-Dependent Wildlife SAR 38

2.7 Data Gaps 39

2.7.3 Surface Water 42

3.0 MONITORING PROGRAM DESIGN 43
3.1 Overall Design Considerations 43
3.2 Monitoring Sites 44
4.0 MONITORING PROGRAM STUDIES 50
4.1 Overall Program Requirements 50
4.1.1 Monitoring Parameters 51
4.1.2 Adaptive Management 56
4.2 Wetland Form Monitoring 64
4.3 Groundwater Monitoring 64
4.4 Surface Water Monitoring 65
4.5 Vegetation Community Composition (Vascular and Non-vascular) and Wetland Vegetation SOCC Monitoring 69
4.6 Wildlife Biodiversity, Habitat and Wetland Dependent Wildlife SAR Monitoring 71
4.7 Baseline Site Conditions 73
4.8 Indigenous Monitoring Involvement 73
4.9 Analysis 74
4.10 Schedule 75
4.11 Reporting 76
5.0 IMPLEMENTATION CONSIDERATIONS 78
6.0 REFERENCES 79
APPENDIX 1 82

List of Tables

Table 1: Wetland Classifications
Table 2: Wetland Classification within the Modified LAA and LMOC PDA
Table 3: Wetland Classification within the Modified LAA and LSMOC PDA
Table 4: LSMOC Baseline Groundwater Quality Measurement Ranges from field measurements (MI, 2020)
Table 5: LMOC Groundwater Exceedances, 2019 Sampling Event (MTI 2022c)
Table 6: LMOC Surface Water Monitoring Sites
Table 7: Vegetation SOCC Conservation Status Ranks
Table 8: Wildlife SAR Conservation Status Ranks
Table 9: Surface and Groundwater Influence on Project Wetland Classes
Table 10: Proposed Preliminary Wetland Monitoring Sites – LMOC
Table 11: Proposed Wetland Monitoring Sites - LSMOC
Table 12: Summary of LMOC and LSMOC Wetland Monitoring Indicators (adapted from ABMI, 2016)
Table 13: Standards and Benchmarks for Monitoring Parameters
Table 14: Summary of Surface Water Quality Parameters for Regional and Local Waterways in the Project EIS RAA1 (MI, 2020)
Table 15: Project EIS Proposed Water Quality Monitoring Parameters
Table 16: Wetland Species at Risk Survey Criteria (MTI 2022e)

List of Figures

Figure A: EMP Process
Figure 1: Overview of the LMOC Study Areas
Figure 2: Overview of the LSMOC Study Areas
Figure 3: Regional Groundwater Flow (MI, 2020)
Figure 4: Watersheds within the LMOC Study Area (MTI 2022c)
Figure 5: Surface Water Catchment Areas Intercepted by the LSMOC (MTI 2022c)
Figure 6: Buffalo Creek Watershed and Surface Flows, LSMOC Study Area, Post-construction (MTI 2022c)

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Wetland Monitoring Plan (WetMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *The Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase

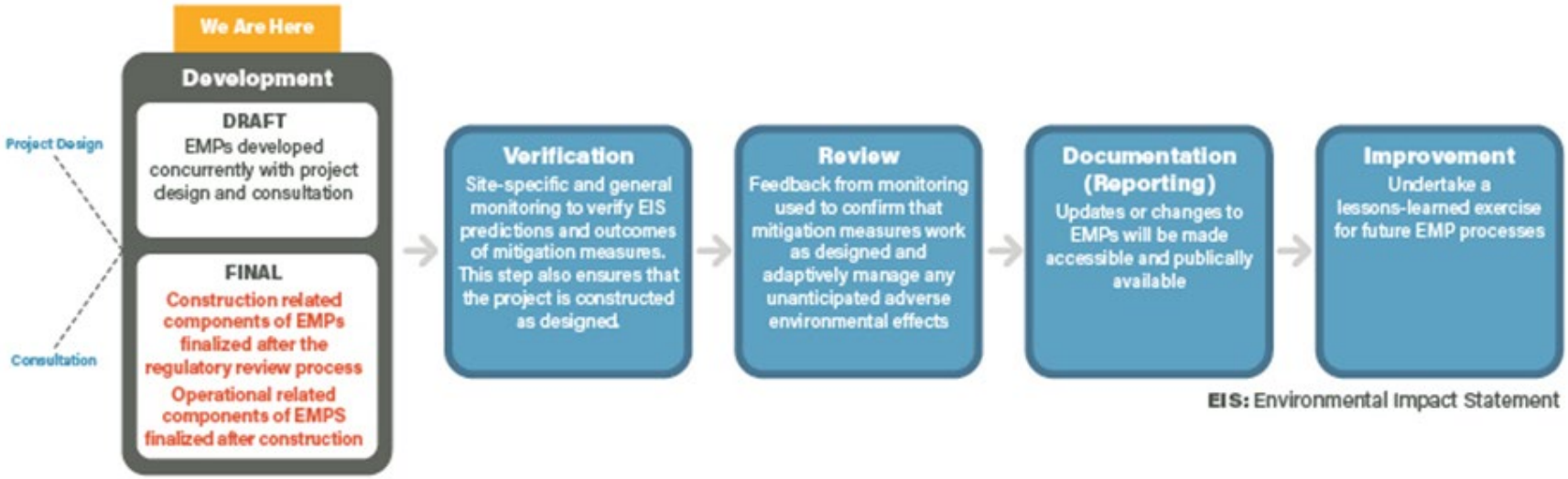


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	Percent
ARU	autonomous recording units
BACI	Before-After-Control-Impact design
CDWQ	Guidelines for Canadian Drinking Water Quality
CEMP	Construction Environmental Management Program
cm	centimetre
DO	Dissolved Oxygen
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EOC	Emergency Outlet Channel
GIS	Geographical Information System
GWMP	Groundwater Management Plan
ha	hectare
km	kilometre
km^2	square kilometre
KMP	Key Measurable Parameter
LAA	local assessment area
LMOC	Lake Manitoba Outlet Channel Project
LSMOC	Lake St. Martin Outlet Channel Project
m	metre
m^3/s	cubic metres per second
MB CDC	Manitoba Conservation Data Centre
mbgs	metres below ground surface
masl	metres above sea level
MSOF-FAL	MB Standards, Objectives, and Guidelines for the Protection of Freshwater Aquatic Life

OEMP	Operation Environmental Management Program
PDA	Project development area
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RAA	regional assessment area
RM	Rural Municipality
ROW	right-of-way
SAR	Species at Risk
SARA	*Species at Risk Act*
SOCC	Species of Conservation Concern
sp.	Species, one
spp.	Species, more than one
SWMP	Surface Water Management Plan
WCP	Wetland Compensation Plan
WCS	water control structure
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan

Glossary of Terms

Alkalinity: A pH value of greater than 7.0 (pH is a way to measure the acidity or alkalinity of a solution).

Non-native Invasive Species and Weeds: Not native or not naturally occurring to a region/habitat. E.g., weed species such as Canada Thistle and introduced species such as Russian olive trees.

Baseline: Initial environmental conditions prior to construction or anthropogenic actions.

Benchmark: Degree of change from baseline conditions.

Contractor: Refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Dissolved oxygen: Oxygen molecules (O_2) dissolved in water.

Environmental Monitor: Refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Ericaceous shrubs: Shrub species that can tolerate growing in acidic conditions.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below the saturated zone.

Groundwater quality: Refers to the chemical composition of groundwater and its suitability for various uses and also varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current land use practices that may contribute to anthropogenic effects.

Groundwater quantity: Refers to the availability of groundwater at a given rate for production and use, and it varies widely depending upon the local geologic setting, hydrogeological conditions, and past/current groundwater use.

Hydraulic Conductivity: Symbolized as K, is a property of vascular plants, soils and rocks that describes the ease with which a fluid (usually water) can move through pore spaces or fractures. It depends on the intrinsic permeability of the material, the degree of saturation, and on the density and viscosity of the fluid.

Hydrogeology: The study of the interrelationships of geologic materials and processes with water, especially groundwater.

Indicator species: A species (e.g., plant or wildlife) that can be used to assume conditions in a particular habitat.

Measurable parameter: A physical attribute/characteristic (e.g., temperature, water depth, plant abundance) that can be measured and used to compare against a standard or benchmark.

Minerotrophic: Referring to wetlands that contain water that is rich in dissolved minerals.

Ombrogenous: Referring to wetlands that rely on rainwater for dissolved minerals and are therefore nutrient-poor.

Orthoimagery: Geo-referenced images of the Earth's surface from satellite or airborne (planes, drones) sensors.

Peatland: Refers to:

> (a) a bog, fen or swamp, and
>
> (b) has waterlogged conditions that prevent plan material from fully decomposing, resulting in the production of organic matter exceeding its decomposition causing a net accumulation of peat.

Runoff: Surface water that flows into streams or back into the water source rather than seeping into the ground.

Standards: Established scientific limits.

Stewart and Kantrud system: A wetland classification system that identifies 5 classes of prairie wetlands (Manitoba Sustainable Development 2020). The class is determined by the length of time that the wetland holds surface water in a year of average moisture conditions and the associated vegetation and soils.

- Class I: short-lived wetlands (retains water for one week or less), mainly existing in spring after winter snow melts or big rains, typically supporting vegetation such as Kentucky bluegrass, goldenrod and forbes.
- Class II: short-lived wetlands (retains water for one week to one month), mainly existing in spring after winter snow melts or big rains, typically supporting vegetation such as fine stemmed grasses, sedges and forbs.
- Class III: semi-permanent or seasonal, meaning that it retains water for one month to three months, often dry by mid-June but may hold water for the entire year, often lasting fewer than five months; typically supporting shallow marsh vegetation such as emergent wetland grasses, sedges and rushes on gleysolic soils.
- Class IV: semi-permanent, meaning that it retains water for more than three months, holds some water year-round under wetter conditions but goes dry in below-average years, often lasting more than five months; typically supporting marsh vegetation and submerged aquatic vegetation such as cattails, bulrushes and pond weeds in the central area of the wetland as on gleysolic soils.
- Class V: permanent, meaning that it retains water year-round in average years with permanent open water in the central areas but may go dry in years with well below average moisture conditions; typically having a central area that is open water free of vegetation surrounded by a zone of submerged aquatic vegetation such as cattails, bulrushes and pond weeds on gleysolic soils.

Species at Risk: Species that are listed, tracked and protected under the *Species at Risk Act.*

Species of Conservation Concern: Species in addition to species at risk (SAR) that are listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); for listing under *The Species at Risk Act* (SARA) as special concern, threatened or endangered (Government of Canada 2019a) or those listed by the Manitoba Conservation Data Centre (MB CDC) as provincially rare (i.e., S1 or S2 rankings; MB CDC 2018).

Surface water: Water that is on the Earth's surface, such as in a stream, river, lake, or reservoir.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Turbidity: A measure of the relative clarity of water.

Wetland: Refers to:

(a) a marsh, bog, fen, swamp or ponded shallow water, and

(b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

1.0 INTRODUCTION

1.1 Purpose and Scope

The Project Environmental Impact Statement (EIS) completed for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the "Project") identified that some direct loss of wetland habitat would occur during construction (Manitoba Infrastructure [MI] 2020). In addition, the Project EIS identified that wetlands adjacent to Lake St. Martin and Lake Manitoba might be indirectly affected by the management of flood waters during Project operation (i.e., flood conditions) as well as through alteration of hydrology due to changes in surface and groundwater flows under non-flood conditions (MTI 2022d). During operation, alterations to drainage flows will affect soil moisture regimes and hydrologic function upgradient and downgradient of the Lake Manitoba Outlet Channel (LMOC) and Lake St. Martin Outlet Channel (LSMOC) (MI 2002b).

Wetlands are an integral component of a watershed, providing numerous flood control and ecological benefits, including providing habitat for a wide variety of plant and wildlife species, many of which are of cultural importance to local Indigenous rights-holders. As such, wetlands were identified in the Project EIS as a valued ecosystem component. During a review of the Project EIS and supporting documents, Federal government agencies, Indigenous rights-holders and other stakeholders (e.g., Rural Municipality [RM] of Grahamdale) identified concerns that the Project would result in unavoidable direct and indirect impacts on wetlands within and adjacent to the channels. To address direct impacts to wetlands (i.e., wetland loss from channel and associated infrastructure development) and to meet federal recommendations (Federal Policy for Wetland Conservation, 1991) and provincial regulatory requirements (*The Water Rights Act* and associated Regulation), Manitoba Transportation and Infrastructure (formerly Manitoba Infrastructure) developed a Wetland Compensation Plan (WCP) (MTI 2022d) in support of the Project that provides offsetting for directly affected wetlands.

The Wetland Monitoring Plan (WetMP) has been prepared by WSP Canada Inc. for Manitoba Transportation and Infrastructure in response to comments received from governmental, Indigenous and other stakeholder groups and to provide a monitoring program that assesses potential indirect effects on wetlands, including changes to class/size of wetlands, surface and groundwater quality and quantity, vegetation cover (plant species compositions/abundance) and wildlife habitat from changes to groundwater and surface water regimes for those wetlands outside the Project footprint that do not receive compensation under the provincial system.

The purpose of the WetMP is to provide a comprehensive, integrated monitoring plan that tests the predictions of the Project EIS with respect to indirect wetland effects, determines the effectiveness of mitigation measures, and the requirement for, and nature of associated follow-up where required.

This document outlines the past work contributing to the Project EIS and wetland compensation discussions with federal and provincial regulators, the objectives of the WetMP, and the ecological context and available baseline information. This background information informed the approach to the WetMP, which is described in terms of program design and implementation.

1.2 Wetland Mapping Background

Pre-construction surveys (including a vegetation survey) and updated wetland mapping were completed in 2020 to supplement baseline environmental information previously collected and documented in background reports for the Project's EIS. The wetland mapping submitted as part of the Project EIS drew from coarse resolution regional mapping by other agencies. The updated wetland mapping was completed to improve the resolution and accuracy of previous mapping, both through digital mapping methods and with ground-ground-truthing (in conjunction with the pre-construction vegetation survey), and to fill the analysis gaps.

The updated mapping was completed using geographical information system (GIS)-based wetland and terrestrial land cover mapping techniques to improve past mapping exercises, focusing on the Project development area (PDA) and the immediately adjacent lands. Mapping was constrained in part by coverage of the input orthoimagery and LiDAR data available, which were limited to an area within 1.5 kilometres (km) of centreline (referred to as the modified local assessment area [Modified LAA]). However, this data was of a much finer resolution than what was used previously, which facilitated mapping of wetland and upland areas at 1:5,000 scale. This mapping in combination with ground-truthing, provided more accurate wetland and upland community delineation and characterization, resulting in impact predictions with higher confidence. For wetlands, the improved mapping allowed a more accurate assessment of the potential wetland impact, which aided in informing compensation value in terms of both area and ecological function of wetlands for the development of the WCP in support of the Project. The mapping also helped identify wetlands within the Modified LAA that might be indirectly affected by the construction and operation of the outlet channels. Those impacts could not be predicted with confidence. As such, this WetMP will facilitate confirming effects on wetland form and function within the modified LAA.

1.3 Study Areas

The LMOC and LSMOC study areas used during the previous environmental studies and in the Project EIS provide useful baseline data that can be helpful in monitoring for indirect effects on wetland water supply and ecological function. Wetlands are a unique habitat in that they rely on a water flood regime that in turn influences the vegetation and wildlife that use them. This WetMP focused on the previous work within the Modified LAA, including surface and groundwater surveys and vegetation, wetland, and wildlife assessments (refer to Figures 1 and 2). This information collected on wetlands within the Modified LAA allowed for determining wetland type (class), abundance, and dominant vegetation cover/wildlife habitat present. This information in turn aided in the selection of potential wetland monitoring sites representative of the wetland types as well as with the selection of key measurable parameter (KMPs) (e.g., indicator plant species groups) that facilitate the determination of functional changes in wetlands. Selection of potential monitoring sites where baseline sampling sites overlap offered good context of background data on which to track change for the initial establishment of monitoring sites during the initial year (baseline year),

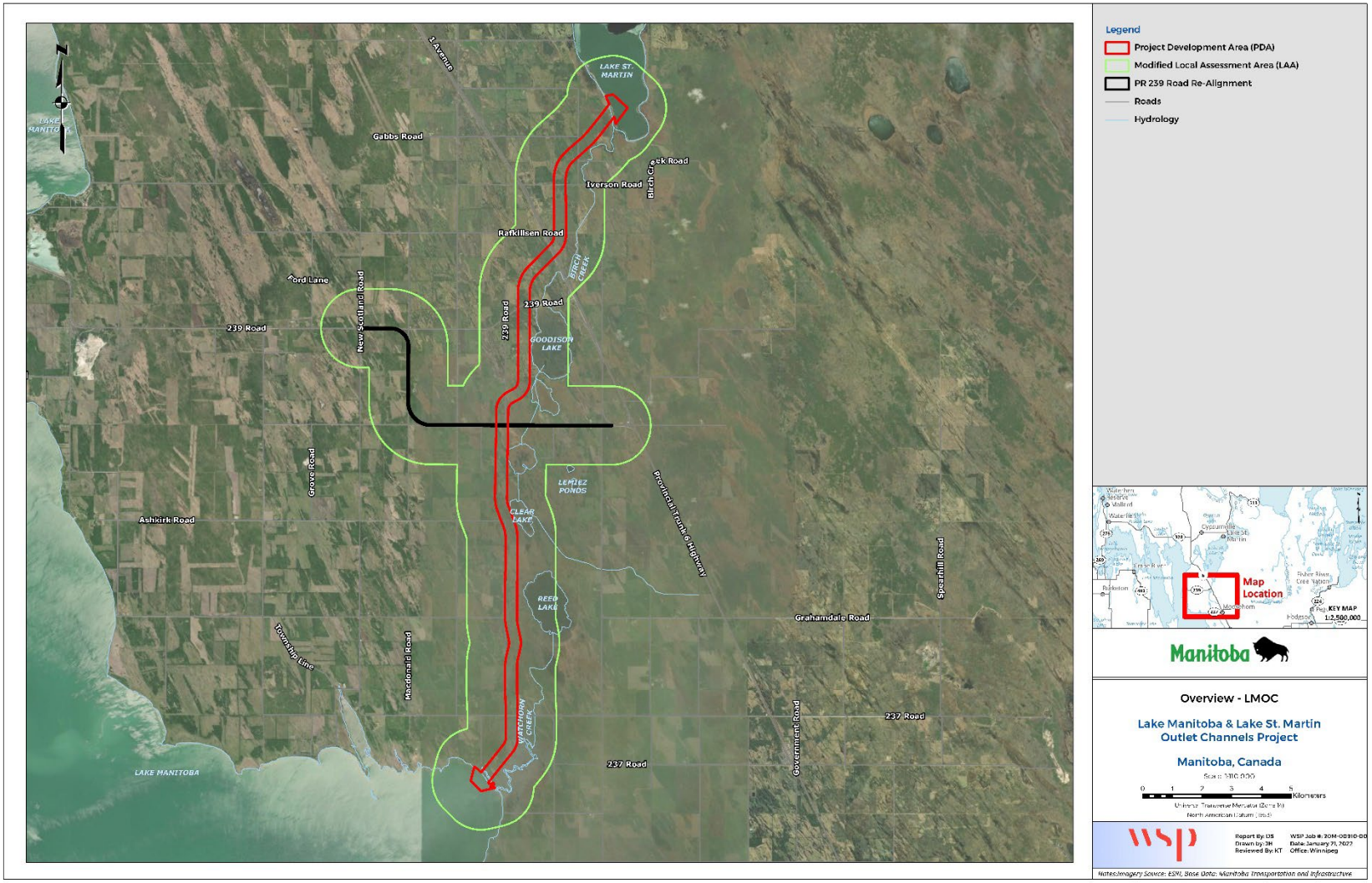


Figure 1: Overview of the LMOC Study Areas

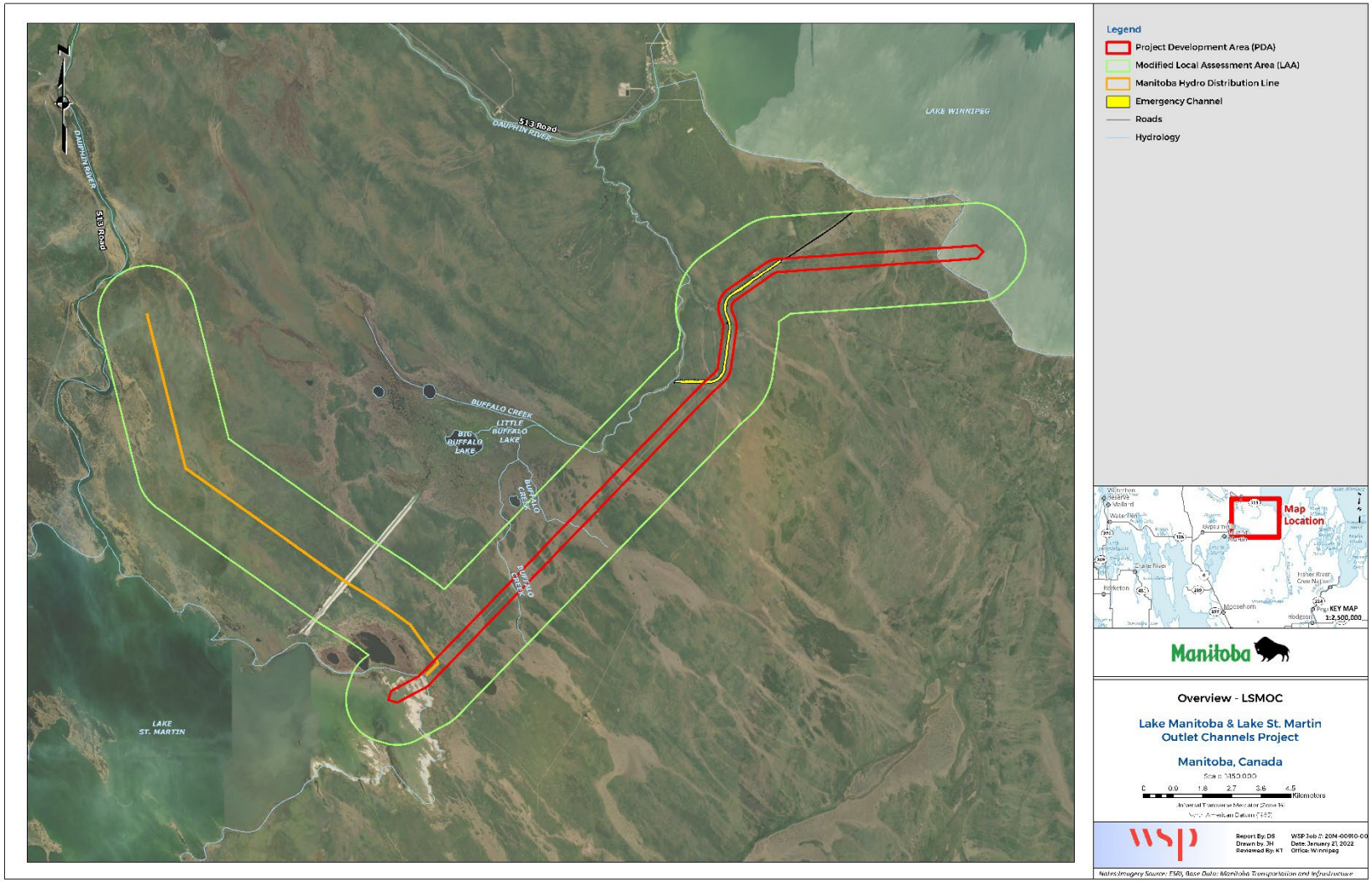


Figure 2: Overview of the LSMOC Study Areas

1.3.1 Previous Monitoring/Survey Locations

In support of the Project, baseline data was collected by Manitoba Transportation and Infrastructure's consultants including, surface water quality, groundwater conditions, vegetation ecosystem classification and cover, wetland classification and extent, wildlife species at risk (SAR) and vegetation plant species of conservation concern (SOCC) presences/absence. Monitoring/survey locations for these previous assessments are provided in Figures 1A, 1B, 2A, 2B, 3A, 3B, 4A and 4B in Appendix 1 and included the following sites:

- Twelve surface water quality monitoring sites were established between 2017 and 2019 within the LMOC Project EIS LAA and included monitoring at locations such as Watchorn Creek, Birch Creek, Reed Lake, Clear Lake, Water Lake, Goodison Lake, Lake St. Martin, and Lake Manitoba (Stantec Consulting Ltd. [Stantec], 2021a). Within the LSMOC seven surface water sampling locations were established between 2019 and 2020 in the PDA or Project EIS LAA.
    - Two of the LSMOC surface water sites are located within the PDA and, therefore, will be lost as potential monitoring sites once the channel is constructed. As such, they are not likely to provide long-term comparative baseline monitoring information for future wetland monitoring activities.
- Eighty-five monitoring wells have been installed in the PDA and six wells outside of the PDA of the outlet channels between 2017 and 2019. In 2019, groundwater quality and quantity monitoring in conjunction with geotechnical testing was conducted within the LMOC PDA and at bridge structure locations, at four existing wells and 12 new well locations (including pump, observation, and test hole wells). Twelve instrumental test holes were established in 2015 in the LSMOC PDA, with survey and monitoring completed in 2019 (MTI 2022b).
    - Construction of the LMOC and LSMOC will remove all these groundwater monitoring wells. As such, use of these sites for baseline comparison for future monitoring activities of groundwater parameter in wetlands will not be feasible.
- The updated wetland mapping completed in 2020 (WSP, 2020) identified wetland classes and aerial extent within the Modified LAA and the PDA for both the LMOC and LSMOC. Field verification of a subset of the wetlands within the PDA provided additional details on general site characteristics and vegetation cover/species present.
    - Many of these wetland verification sites will remain intact or can shift to remnant wetland areas adjacent to the PDA (within Modified LAA) to provide baseline monitoring for future comparisons.
- Wildlife surveys were completed in 2017 as part of the baseline studies for the Project and included surveys for breeding birds, SAR (e.g., rail yellow) and amphibians. The 2020 preconstruction survey included breeding songbird and yellow rail surveys. Survey locations that detected bird and amphibian SAR were mapped for the channel study areas and included sites with the Modified LAA as well as within the Project EIS regional assessment area (RAA).
    - Two amphibian and two bird survey locations detected SAR within the Project EIS LAA for the LMOC and LSMOC, respectively and as such, have the potential to provide a limited baseline comparison.

1.4 Monitoring Plan Objectives

Monitoring is part of the provincial and federal environmental assessment process, as part of the follow-up on impacts and mitigation with uncertain outcomes. Monitoring of indirect impacts on wetlands within the Modified LAA will consider the Federal Policy on Wetland Conservation (1991), which recommends an assessment of wetland loss in terms of both form (i.e., wetland class) and ecological function. In practice, such impacts are challenging to predict, particularly where surface and groundwater drainage patterns may be disrupted. As such, a Before-After-Control-Impact (BACI) design (Underwood, 1992) is proposed for this monitoring plan, which will maximize the use of baseline data collected during the project to detect long-term (before-after) effects, as well as more immediate changes using paired control-subject sites. BACI designs are an effective method to assess human-induced distance of environmental variables when random selection of treatment or subject sites is not possible (Conner, Saunders, Bouwes and Jordan, 2016). This approach will allow Manitoba Transportation and Infrastructure to track changes of KMPs (e.g., specific plant assemblages) over time and separate seasonal from Project effects. It will also allow for early detection of impacts, triggering an adaptive management approach to assess the scale of change and develop mitigation measures.

The Project EIS described potential changes to hydrology and hydrogeological conditions adjacent to the outlet channels, which included the diversion of surface flows in some watersheds (e.g., Buffalo Creek in the LSMOC) and in groundwater inputs to surface waterbodies (e.g., Reed Lake). The outlet channels will be constructed with a ditch on the upgradient side ("outside drain" in the Project EIS), which will capture and redirect surface flows, and possibly shallow groundwater away from downgradient wetlands. Wetlands associated with these areas of predicted change as well as those of concern to Federal departments, Indigenous rights-holders and other stakeholders that overlap with an area of potential and measurable change, provide a focus for the WetMP. Given the uncertainty regarding predicted impacts in these areas, an adaptive management approach will be adopted (refer to Section 1.4.2).

1.4.1 Objectives

The objective of the WetMP is to outline a framework for multi-disciplinary studies that will enable Manitoba Transportation and Infrastructure to determine and evaluate potential indirect effects on wetlands in the Modified LAA, and provide guidance for appropriate action required in the event that indirect effects exceed standards or benchmarks (process of active management). The overarching monitoring program will consist of an integrated sampling and assessment structure, including field, remote and laboratory components. By following a BACI structure, a comparison of conditions in potentially affected (subject) wetlands adjacent to the PDA (within 100 - 200 metres [m]) will be made against those in pre-disturbance and control locations to allow for the determination and quantification of potential effects. This will be accomplished by monitoring KMPs that influence the form and function of wetlands in the Modified LAA. The WetMP will assess changes to wetland form in terms of classification, and wetland function in terms of surface water flow/quality, groundwater interchange/hydraulics, vegetative cover (function), wildlife habitat for species biodiversity and SAR, and use by Indigenous rights-holders. This approach is consistent with similar monitoring programs conducted for linear development in the Athabasca Oil Sands region of Alberta (refer to Section 3.1).

Specific components of the WetMP objective are as follows:

- Evaluate effects on wetland function for those wetlands that do not receive compensation under the WCP, but that may be indirectly affected by the Project. The WetMP provides a process to evaluate changes to wetland form and function in terms of:
    - surface water flow/quality
    - groundwater parameters
    - wetland class
    - vegetative cover, including wildlife habitat (biodiversity and SOCC/SAR)
    - use by Indigenous rights-holders
    - Meet federal Wetland Policy guidance to assess change to wetland form and function (hydrological, ecological), including changes in wetland class (e.g., drying or increased hydroperiod effects).
- Maximize monitoring efforts by coordinating program design with other previous baseline studies and construction/operation monitoring plans (including the Groundwater Management Plan [GWMP], Revegetation Management Plan, Surface Water Management Plan [SWMP] and the Wildlife Monitoring Plan [WMP]) to capture all relevant Project data indicative of functional wetland impacts.
- Identify benchmarks or thresholds for when Project related activities may be deleterious to wetlands and vegetation and wildlife species.

1.4.2 Adaptive Management Approach

The *Impact Assessment Act* process includes an adaptive management process to address impacts with uncertainty or public concern. Specifically, the Act requires a follow-up program: "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) further explains that a follow-up program is used to:

- verify predicted environmental effects
- determine the effectiveness of mitigation measures, and inform modifications or new measures where required
- support implementation of adaptive management measures to address unanticipated adverse environmental effects
- provide information on environmental effects and mitigation to improve future environmental assessments and cumulative environmental effects assessments
- support environmental management systems used to manage the environmental effects of projects

The WetMP will assess changes to wetland size and class, key indicator functional forms and drainage patterns by focusing on sites of concern to Federal departments, Indigenous rights-holders and other stakeholders where changes to groundwater and surface water flow and quality are anticipated, which in turn could affect vegetation community composition, wildlife habitat, presence of SOCC/SAR, and use by Indigenous rights-holders. An adaptive approach will be employed in the WetMP to allow for the flexibility to monitor changes to wetlands adjacent to the PDA (within 100 - 200 m), thereby identifying the potential

need to assess effects on wetlands within the Modified LAA and to determine the need for mitigation strategies or further offsetting such as through restoration or enhancement activities or additional rehabilitation measures.

The spatial extent of the Modified LAA is anticipated to be sufficient to document Project-related indirect effects. If effects are of greater magnitude than anticipated, the spatial extent of monitoring could be modified to document unanticipated changes if there is a risk that effects extend beyond the LAA.

2.0 REGIONAL SETTING

2.1 Ecological Context

The Project lies within the Boreal Plains Ecozone, a region where the terrain is generally flat, with a distinct north to south trending ridged and swale (drumlinoid) topography formed from subglacial deposition, with slopes of 1 to 3 percent (%). Ridges are generally well-drained and support upland forest vegetation, while the swales are poorly drained and support wetland communities. These characteristic physiographic features are evident in aerial imagery of the channel areas: southeast to northwest-trending, shallow drumlin ridges are very evident in the LMOC area, and complex patterns of bog, fens, and small streams dominate the LSMOC area. Jack pine (*Pinus banksiana*), white spruce (*Picea glauca*), trembling aspen (*Populus tremuloides*), and white birch (*Betula papyrifera*) are the dominant upland trees present in the Boreal Plains Ecozone, with balsam poplar (*Populus balsamifera*) occupying transitional and wetland ecosystems. The occurrence of black spruce (*Picea mariana*) and tamarack (*Larix laricina*) increases moving north as peatland habitats increase in frequency and scale in the landscape (Smith et al., 1998). The Project components traverse two Ecoregions of the Boreal Plains Ecozone: the Interlake Plain and Mid-Boreal Lowland.

The LMOC lies within the Interlake Plain Ecoregion. The regional landform is underlain by low relief Paleozoic limestone bedrock, with a general surface form of a level to ridged lake terrace complex. Surficial deposits range from loamy glacial till, varying from deep (>30 m) to very shallow (<20 m) deposits to water-worked areas with veneers to blankets of glaciolacustrine sand, gravel and boulder deposits (Smith et al., 1998). Flooding issues are linked to the low relief: at times of high seasonal precipitation, surface flows in the south will collect in low-lying swales between drumlins and ridges or in the lowland floodplains adjacent to larger lakes. The resulting landscape includes complexes of large graminoid marsh and shrubby swamp wetlands of temporary to seasonal water duration, with smaller to moderately large kettle ponds supporting permanent to semi-permanent marshes and shallow open water. Trembling aspen is the dominant forest cover, with balsam poplar and white spruce mixedwood stands occurring less frequently (Smith et al., 1998). Depressional lowland areas support sedges (*Carex* spp.), meadow grasses (*Poaceae*) and willows (*Salix* spp.), and reed and cattail (*Typha latifolia*) emergent species in deeper marshes with reed and cattail (*Typha latifolia*) emergent species in deeper marshes. Mineral wetlands (marshes, swamps) are typically surface water fed but can also have some groundwater supply. Reed Lake was identified to have some groundwater influence in the Project EIS (MI, 2020).

The LSMOC lies within the southern part of the Mid-Boreal Lowland Ecoregion. Climatic factors combined with the smoothing action of clay, silt and sand glacial deposits from Lake Agassiz have supported the development of complex patterns of bog, fens, small streams and large to very large lakes (Smith et al., 1998), such as Lake Winnipeg. In the Mid-Boreal Lowland Ecoregion, predominant tree species in upland communities consist of trembling aspen, Jack pine, white spruce, and occasionally balsam fir (*Abies balsamea*), with black spruce and balsam poplar present on transitional sites (Smith et al., 1998). Peatland vegetation consists of black spruce, ericaceous shrubs (*Ericaceae*), and moss (e.g., Sphagnum) in bog habitats,

with tamarack, swamp birch (*Betula pumila*), sedges and brown moss dominating fens (Smith et al., 1998). Bogs are primarily surface water fed, while fens typically have a mixture of ground and surface water inputs.

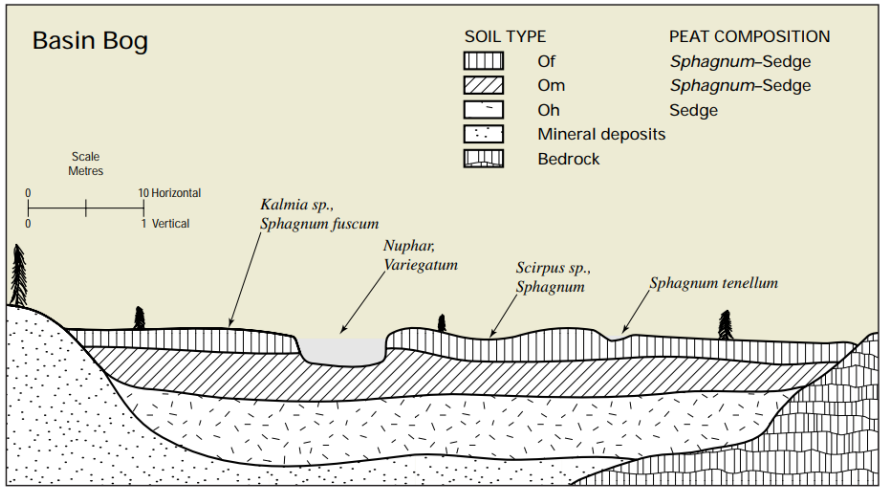
2.2 Existing Wetlands and Predicted Impacts

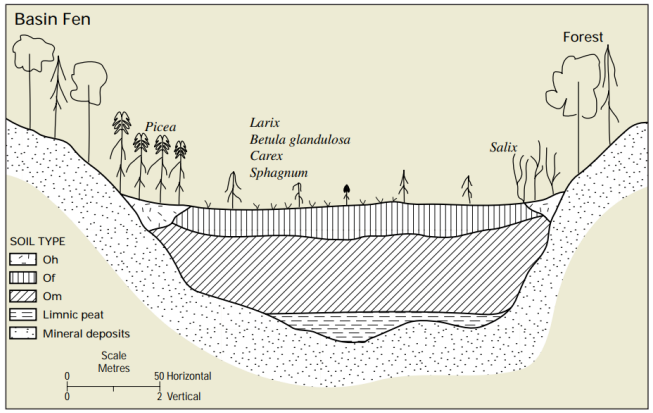
2.2.1 Existing Wetland Class and Abundance

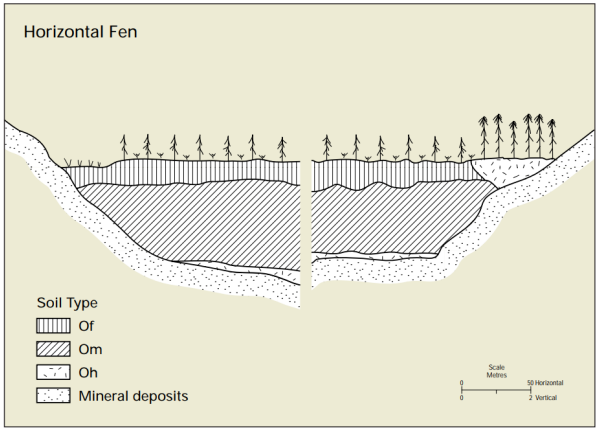
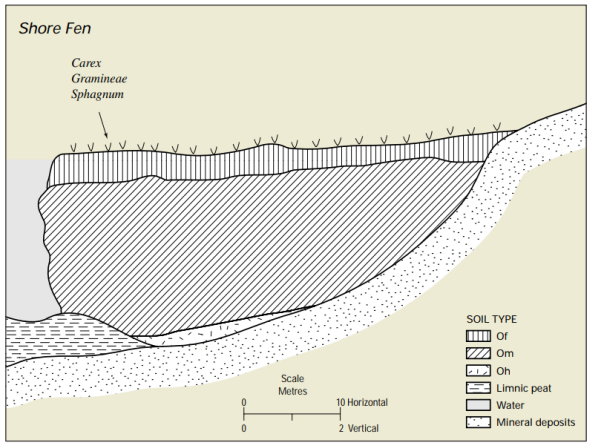
In 2020, wetland mapping was refined to better delineate the diverse types of wetlands and uplands in the northern (LSMOC and Manitoba Hydro distribution line) and southern (LMOC and Provincial Road 239 realignment) Project areas to support planning and the WCP. For wetlands, both the Stewart and Kantrud (1971) system and the Canadian Wetland Classification System (National Wetlands Working Group, 1997) were used (Table 1). The combination allowed identification of the marshes in the southern Project areas and the organic and swamp wetland types in the northern Project areas. Further, the Steward and Kantrud system is used in Manitoba's wetland compensation process. Waterbodies and all anthropogenic land cover types followed the EOSD Land Cover classification for the Manitoba area (Wulder and Nelson, 2003).

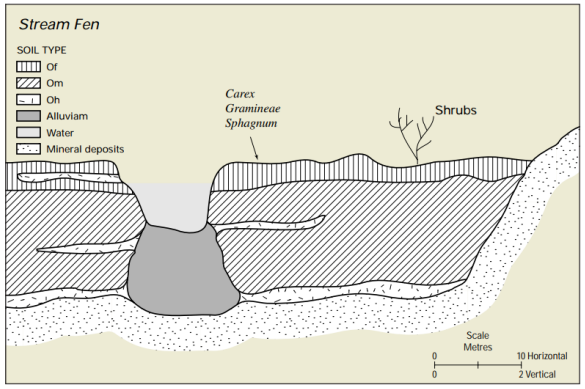
The Stewart and Kantrud classification differentiate wetlands based on the duration of wetted conditions in the deepest part of the wetland. Wetlands range from permanent waterbodies to those that have open water for only part of the year. The system includes two wetlands that support water only briefly during the year (Class I and II wetlands, see wetland classes in Table 1). Of these, only Class II wetlands could be accurately identified in the updating exercise. Class I wetlands could not be mapped accurately using the GIS mapping approach since, by definition, such areas are wet only briefly in early spring or during rain events. Neither Class I nor Class II wetlands require compensation under Manitoba's *Water Rights Act* or its Regulations.

Table 1: Wetland Classifications

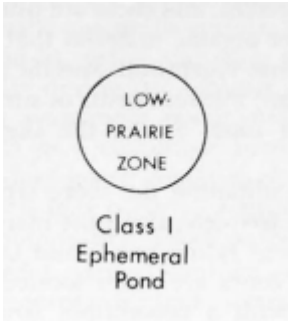
Classification System	Description	Image Example
Canadian Wetland Classification System[1]		
Bog – Bogs are peat wetlands that have a raised or level surface and are unaffected by runoff waters or groundwaters from surrounding mineral soils. In general, the water table is at or slightly below the surface of the bog. Precipitation and snowmelt are the primary water sources of bogs, and as such, bogs are ombrogenous (rely on rainwater for dissolved minerals and are therefore nutrient poor). The water is bogs is therefore low in dissolved minerals and are acidic. (pH between 4.0-4.8). They may be treed or treeless and are typically covered with Sphagnum spp, and ericaceous shrubs (tolerate acidic conditions) and have an acceptation of peat[1].		
Basin Bog	Topographically confined peatland with poor nutrients and level surface; water input limited to snowmelt, rain and local surface run-off. Located in basins with a flat surface across the entire peatland; there are no surface streams that feed into the wetland. The thickest peat depth is found in the centre of the bog basin[1].	 Image 1. Basin Bog (Image from Canadian Wetland Classification System[1])

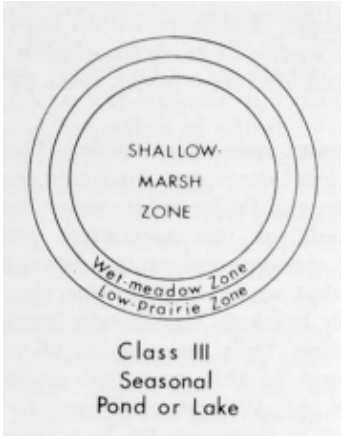
Classification System	Description	Image Example
Fen – Fens are peat wetlands that have fluctuating water levels and are minerotrophic (waters in fens are rich in dissolved minerals). Movement of groundwater and surface water is characteristic of fens. Fens are composed of variable thickness of moderately decomposed sedge and brown moss peats. Wetter fens contain graminoid vegetation and some bryophytes, whereas fens with lower water tables contain shrubs, and the driest fens may contain trees (typically black spruce)[1].		
Basin Fen	Topographically confined peatland in basins; water inputs consisting of snowmelt, rain, surface runoff, and groundwater. Basin fens may be entirely isolated to both surface water streams inflow and outflow or may lack inflowing streams but will have surface stream outflow. Bain fens may be flat or slightly concave, and thickness of peat is variable but often exceeds 2 m in depth[1]	 Image 2. Basin Fen (Image from Canadian Wetland Classification System[1])

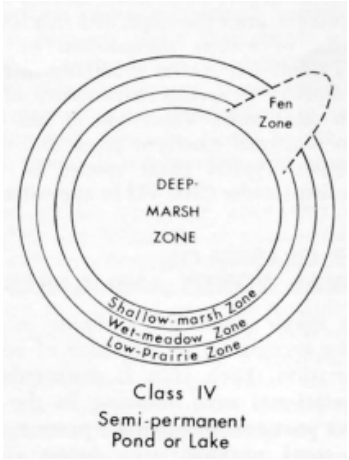
Classification System	Description	Image Example
Horizontal Fen	Uniformly vegetated peatland on broad depressions or plains; water inputs consisting of snowmelt, rain, surface runoff, and groundwater. Horizontal fens are typically uniformly vegetated by graminoid, shrub or tree species. Driver treed islands may be present. Peta thickness varies from 2 to 3 m in depth[1].	 Image 3. Horizontal Fen (Image from Canadian Wetland Classification System[1]). Center portion of wetland omitted from image to emphasize margins.
Shore Fen	Peatland situated adjacent to lakes or ponds with firmly anchored surface peat; water inputs consist of snowmelt, rain, surface runoff, groundwater and surface flow. Peat depth typically exceeds 2 m[1].	 Image 4. Shore Fen (Image from Canadian Wetland Classification System[1])

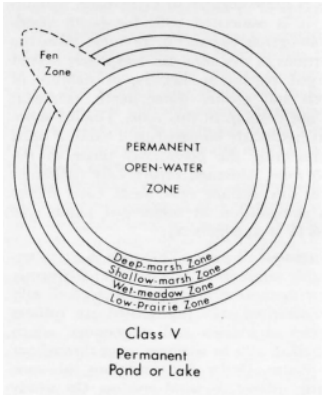
Classification System	Description	Image Example
Stream Fen	Peatland located in main channel or along banks of permanent or semi-permanent streams; water inputs consist of snowmelt, rain, surface runoff, groundwater and surface flow. The low gradient and slow water flow associated with the stream allow for the formation of peat along the stream edges. Peat depth is variable and often exceeds 3 m in depth. Water table depth is affected by steam levels under normal and flood conditions[1].	 Image 5. Stream Fen (Image from Canadian Wetland Classification System[1])
Swamp – Swamps are wetlands that are dominated by treed or tall shrubs and are influenced by minerotrophic groundwater, either on mineral or organic soils[1].		
Basin Swamp	Topographically confined shrubby or treed wetland with less than 40 centimetres (cm) of organic soil. Water is derived by surface water runoff, groundwater or precipitation and occasionally by small inflowing streams[1].	No image in Canadian Wetland Classification System[1]
Lacustrine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along the shores of permanent ponds or lakes; water level affected by lake during high water periods[1].	No image in Canadian Wetland Classification System[1]

Classification System	Description	Image Example
Lagg Swamp	Sloping shrubby or treed wetland with less than 40 cm of organic soil occurring between upland mineral terrain and peatlands[1].	No image in Canadian Wetland Classification System[1]
Riverine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along banks of rivers and permanent and intermittent streams; subject to flooding when stream or river waters are high. Water table is maintained by the water level in the adjacent river or stream[1].	No image in Canadian Wetland Classification System[1]
Unconfined Flat Swamp	Broad shrubby or treed wetland that lack defined edges; with less than 40 cm of organic soil. Occur among other kinds of wetlands with poorly defined edges[1].	No image in Canadian Wetland Classification System[1]
Prairie Pothole Wetland Classification System, Stewart and Kantrud (1971)[2]		
Marsh – Marshes are wetlands characterized by periodic or persistent standing water or slow-moving surface water. Water levels in marshes may fluctuate seasonally or annually due to flooding, groundwater recharge, seepage losses or evapotranspiration. Marshes receive water through surface runoff, steam inflow, precipitation, and groundwater discharge. Marshes are generally nutrient rich and may be alkaline. Vegetation species include graminoids, shrubs, forbs and emergent plants[1].		

Classification System	Description	Image Example
Class I	Temporary wetland with standing water present after snowmelt or rainfall events; standing water lasting only a few weeks after snowmelt and a few days after rainfall[3].	 Image 6. Class I Wetland[2]
Class II	Temporary graminoid/forb mineral wetland with wet meadow plant community; surface water is present for a short period of time after snowmelt or heavy rainfall.	  Image 7. Class II Wetland (image from WSP, 2020). Image 8. Class II Wetland[2]

Classification System	Description	Image Example
Class III	Seasonal graminoid/forb mineral wetland with shallow wetland plant community; surface water is present throughout the majority of the growing season but is typically dry by the end of summer. Water sources for Class III wetlands in the Project area may include precipitation (annual rainfall and snowfall), runoff from surrounding areas as well as shallow groundwater recharge*.	  Image 9. Class III Wetland (image from WSP, 2020). Image 10. Class III Wetland[2]

Classification System	Description	Image Example
Class IV	Semi-permanent graminoid/forb mineral wetland with deep wetland community; surface water is present for most or all of the year, except in periods of drought. Water sources for Class IV wetlands in the Project area may include precipitation (annual rainfall and snowfall), runoff from surrounding areas as well as shallow groundwater recharge*.	  Image 11. Class IV Wetland (image from WSP, 2020). Image 12. Class IV Wetland[2]

Classification System	Description	Image Example
Class V	Permanent graminoid/forb mineral wetland with open water community; surface water is present throughout the year. Water sources for Class V wetlands in the Project area may include precipitation (annual rainfall and snowfall), runoff from surrounding areas as well as shallow groundwater recharge*.	  Image 13. Class V Wetland (image from WSP). Image 14. Class I Wetland[2]

Classification System	Description	Image Example
Other		
Water Bodies		
Water Bodies	Consists of all open water, including lakes, rivers, streams, ponds and lagoons.	 Image 15. Class V Wetland (image from WSP).

Notes:

[1] Warner, B.G. and Rubec, C.D.A. (eds.) 1997. The Canadian Wetland Classification System, 2nd Edition. Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 pp.

[2] Stewart, R.E. and H.A. Kantrud. 1971 Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

[3] Manitoba Conservation and Climate and Manitoba Agriculture and Resource Development (n.d.). Wetland Classification Key.

[4] *Refer to Section 2.6.2 for additional details on groundwater recharge to wetlands in the Project area.

Table 2 provides a summary of wetland classes and areas mapped in the LMOC PDA and Modified LAA, and links to compensation requirements.

Table 2: Wetland Classification within the Modified LAA and LMOC PDA

Broad Land Cover Category	Land Cover Class	Area in LMOC Modified LAA (ha)	Area in LMOC PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha)[1]
Other Water/Bare	Water Bodies	480.85	64.18	64.18	N/A
Wetlands					
Marsh	Class II	325.22	68.01	68.01	N/A
	Class III	1,120.53	197.91	197.91	197.91
	Class IV	638.87	38.38	38.38	N/A
	Class V	297.29	0.83	0.83	N/A
Swamp	Basin Swamp	102.85	47.76	47.76	N/A
	Lacustrine Swamp	1.75	0.74	0.74	N/A
Total Wetlands		**2,486.52**	**353.63**	**353.63**	**197.91**

Notes:

The *Water Rights Act* sets out requirements for restoration, enhancement, and/or compensation of prescribed wetlands that are lost or altered by the construction, operation and maintenance of a Project. The prescribed wetlands considered for compensation under the W*ater Rights Act* for the Lake Manitoba and Lake St. Martin Outlet Channels Project include Class III, IV and V wetlands.

Table 3 provides a summary of the overall wetland cover found within the LSMOC PDA and the Modified LAA. This outlet channel passes through extensive peatlands, including a range of bogs and fens, many of which are contiguous. Fens were the most abundant wetland type in the PDA and Modified LAA, and horizontal fens comprised the main type of fen. Fen wetlands occupy flat terrain, are fed by both groundwater and surface water flows, and can have slow velocity surface flow. The outlet channel, where it bisects such wetlands, will have both direct and indirect effects that extend beyond the PDA. Swamps were also relatively abundant in the LSMOC PDA and were often found adjacent to fens and bogs where terrain sloped up slightly, such that soils were not inundated year-round. Neither swamps nor peatlands are addressed in Manitoba's Wetland Compensation Policy, and only the small area of Class III marsh impact (0.11 hectares [ha]) requires compensation under The Water Rights Regulation.

Table 3: Wetland Classification within the Modified LAA and LSMOC PDA

Broad Land Cover Category	Land Cover Class	Area in LSMOC Modified LAA (ha)	Total Impacted Area in the LSMOC PDA (ha)	Estimated Impacted Area in the PDA (ha)	Compensation Area Requirements (ha)[1]
Other Water/ Bare	Water Bodies	573.61	1.39	30.47	N/A
Wetlands					
Marsh	Class I	0	0	0	N/A
	Class II	0	0	0	N/A
	Class III	15.05	0.11	0.11	0.11
	Class IV	42.40	N/A	N/A	N/A
Peatland	Basin Bog	722.66	114.10	114.10	N/A
	Basin Fen	196.54	40.94	40.94	N/A
	Horizontal Fen	3,335.27	333.26	333.26	N/A
	Shore Fen	126.18	4.84	4.84	N/A
	Stream Fen	1,728.69	232.53	232.53	N/A
Swamp	Basin Swamp	7.22	3.78	3.78	N/A
	Lacustrine Swamp	71.59	10.66	10.66	N/A
	Lagg Swamp	158.29	11.46	11.46	N/A
	Riverine Swamp	12.81			
	Unconfined Flat Swamp	80.17	18.06	18.06	N/A

Broad Land Cover Category	Land Cover Class	Area in LSMOC Modified LAA (ha)	Total Impacted Area in the LSMOC PDA (ha)	Estimated Impacted Area in the PDA (ha)	Compensation Area Requirements (ha)[1]
Wetland Total		6,496.87	769.74	769.74	0.11

Notes:

The *Water Rights Act* sets out requirements for restoration, enhancement, and/or compensation of prescribed wetlands that are lost or altered by the construction, operation and maintenance of a project. The prescribed wetlands considered for compensation under the *Water Rights Act* for the Lake Manitoba and Lake St. Martin Outlet Channels Project include Class III, IV and V wetlands.

2.2.2 Predicted Impacts to Wetlands

Construction of the LMOC and LSMOC will result in direct loss to wetland habitat intersected by the Project footprint. Wetlands adjacent to Lake St. Martin and Lake Manitoba have the potential to be indirectly affected by Project operations due to changes in surface and groundwater flows during non-flood conditions (MTI 2022c). For the LMOC, upgradient surface drainage structures (outside drain) are anticipated to limit the extent of effects on surface water drainage and shallow subsurface flow to the PDA; however, downgradient (i.e., on the east side) of the PDA, residual effects are anticipated to potentially extend up to 1,000 m into the Modified LAA (MI, 2020; KGS Group [KGS] 2021a). Changes to water balance east of the LMOC PDA may change water levels in wetlands which could reduce areas of open water, change vegetation composition toward those species adapted to lower water levels/less frequent flooding and ultimately reduce wetland extent or change wetland class (MTI 2022d).

Residual effects to surface drainage and shallow subsurface flow along the LSMOC are anticipated to also extend beyond the PDA into the Modified LAA (MI, 2020). Surface water drainage structures (outside drain) constructed on the upgradient side of the LSMOC (i.e., the east side of the channel) will limit the increased wetness of land outside of the PDA resulting from the impoundment of water against the LSMOC. There is the potential for surface and shallow subsurface flow to be affected along the entire length of the LSMOC. Effects are not anticipated to extend beyond 600 m downgradient and potentially up to 1,000 m upgradient (during 1 in 100-year flood conditions) and perpendicular to the channel (MI, 2020; KGS 2021a). Implementation of the outside drains along the LSMOC will minimize the wetting up on the east side of the LSMOC channel which in turn is anticipated to minimize impacts to the vegetation communities associated with the wetlands outside the PDA (MTI 2022d).

Changes to water levels, vegetation composition and coverage, may cause changes to wetland habitat quantity and quantity resulting in effects on wildlife species, including migratory birds, waterbirds, and SAR. Wetland-dependent wildlife species, including SAR such as yellow rail, least bittern and northern leopard frog, rely on particular wetland types/habitat to complete their life cycles (e.g., nesting, breeding, staging and over-wintering).

2.3 Hydrogeological Context and Predicted Impacts

Information about the areas of potential impact on groundwater flow to wetlands within the Modified LAA is critical to monitoring indirect effects on wetlands. Similarly, baseline data from past monitoring activities can be used to compare data collected at control and impact sites before and after construction to detect changes over longer timeframes.

The Project lies within the Interlake area of the Manitoba lowland physiographic region. Bedrock is present along the alignment and dips gently to the southwest. The bedrock is a carbonate rock with minor clastic and argillaceous units. Tills, proglacial lacustrine sediments, and younger organic deposits overlay the bedrock within the sites in the Project EIS LAA. The LMOC study area is predominantly dominated by a large silty to silt clay till layer, with areas of exposed bedrock where the till is thinner, while the LSMOC is dominated by a thick clay to silty clay layer below a thin peat and organic layer. A deeper silt to silt till is superimposed over the limestone bedrock (KGS, 2021b).

Topography is relatively flat at the site, and regional topography slopes gently towards Lake Winnipeg, Lake St. Martin, and Lake Manitoba. Figure 3 illustrates regional topography at the site.

Groundwater within the PDA has been monitored since 2017 via monitoring wells that have been constructed as part of previous geotechnical investigations. There were 85 monitoring wells installed in the PDA and seven wells outside of the PDA. The geotechnical investigation, which included the drilling program along the site, had been primarily completed by KGS. Groundwater wells were installed from 2015 through 2019 by KGS, apart from 2017, when wells were installed by Manitoba Transportation and Infrastructure along the LSMOC. Ranges in depths along the LSMOC are from 1.22 metres below ground surface (mbgs) to 30.78 mbgs (212.261 metres above sea level [masl] and 220.207, respectively) (KGS, 2019). At the time of this report, the well construction details along the LMOC, such as date of construction, well depths, screen intervals, etc. are unknown.

Groundwater levels within the PDA ranged from 247.84 m to 248.70 masl at the LMOC and 243.5 masl to 257.5 masl at the LSMOC. The highest recorded groundwater level was after a significant precipitation event on July 13, 2014, at G05LM002A, which is screened in the limestone bedrock (KGS, 2021a). As outlined in the GWMP, all of these wells within the PDA will be destroyed during construction). No monitoring wells exist within the Project EIS LAA with the exception of six wells TH19-KGS-19, TH15-03(A), TH15_02(A), TH19-KGS-20, TH15-01, TH-GD-08 and TH-GD-02 (refer to Figures 1A 1B, 2A and 2B Appendix 1).

Groundwater flow was observed during the baseline monitoring program, generally moving towards the future proposed LSMOC and LMOC alignments as well as Lake Winnipeg, Lake St. Martin, and Lake Manitoba. Figure 3 below illustrates the groundwater flow at the site (MI 2020).

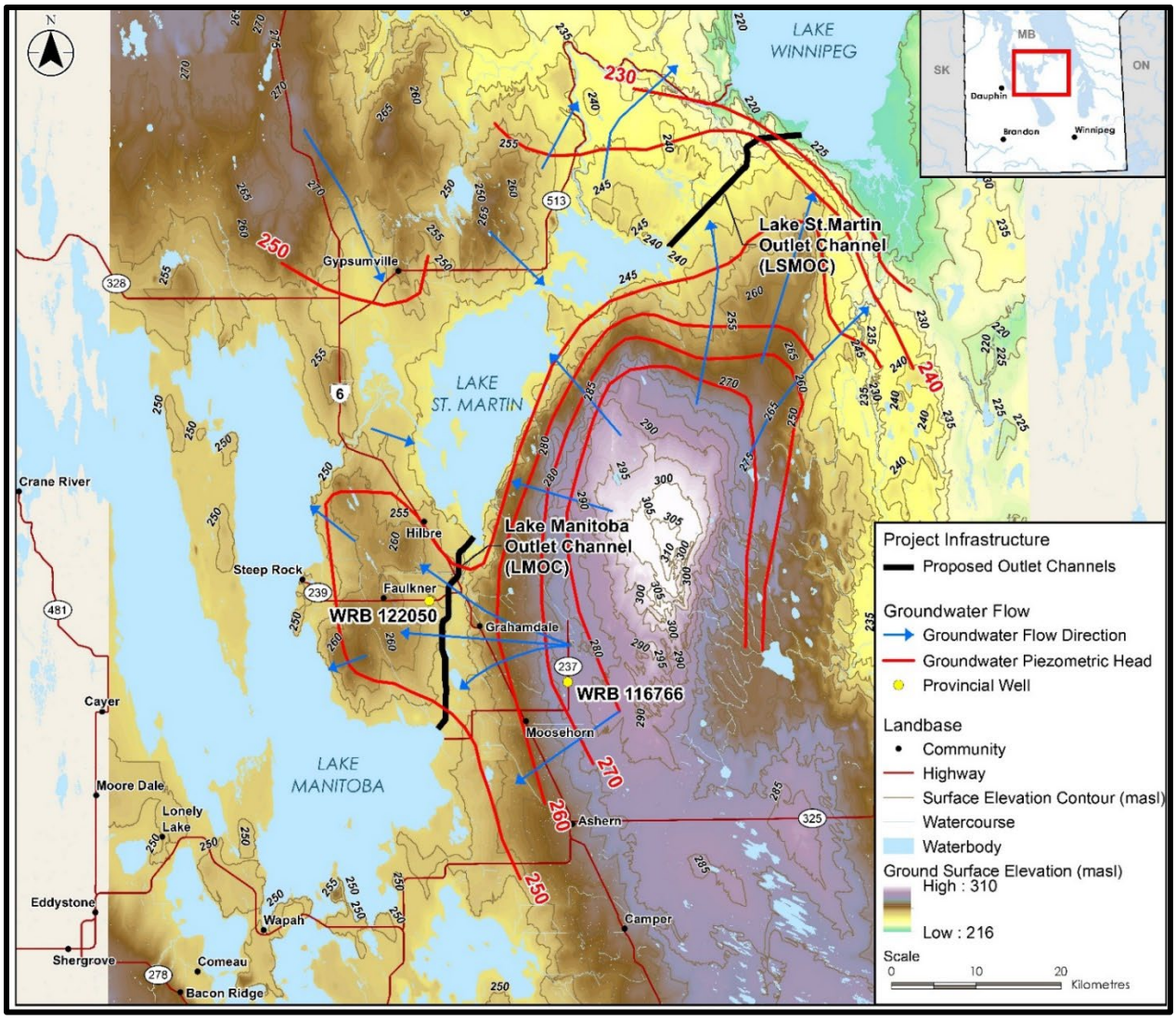


Figure 3: Regional Groundwater Flow (MI, 2020)

Groundwater flow within the northern region of the LMOC flows towards the west, and near the outlet channel, groundwater flows southerly into Lake Manitoba. While the LSMOC is observed to be flowing north towards Lake Winnipeg. Figures 5A and 5B, Appendix 1 illustrate site specific groundwater flow at the LMOC and LSMOC, respectively.

Groundwater quality sample analysis has been completed during previous monitoring events conducted in 2016, 2017, 2018, 2019, and 2020 (MTI 2022b). Groundwater parameters were tested against the Canadian Water Quality Guidelines for Protection of Aquatic Life (CWQG-Fal) (short-and-long-term), Manitoba Standards, Objectives, and Guidelines for the Protection of Freshwater Aquatic Life (MSOF-FAL) (chronic and acute), and Guidelines for Canadian Drinking Water Quality (CDWQ) (MTI 2022b).

As outlined in the GWMP, groundwater quality results from samples collected at LSMOC in March, June and October 2019 and again in June and October 2020 are provided in Table 4 below. This quality sampling was conducted during the preliminary design phase of the Project for the purpose of obtaining baseline parameters to support environmental assessments for the Project. These samples were obtained from 31 standpipes, three pump wells, and one sentinel well and were sampled and analyzed for water chemistry. The other two sentinel wells were sampled when they were installed in September 2019.

Table 4: LSMOC Baseline Groundwater Quality Measurement Ranges from field measurements (MI, 2020)

Field Parameter	Range of 2019 Monitoring Results		Range of 2020 Monitoring Results	
	Minimum	Maximum	Minimum	Maximum
pH	6.51	8.76	6.00	8.50
Electric Conductivity (µS/cm)	436	1,888	522.6	1,163
Dissolved Oxygen (DO) (mg/L)	0.36	13.72	0.19	8.07
Oxygen Reduction Potential (mV)	-93.2	490	-29.0	82.2

As outlined in the KGS report (KGS, 2021b), there were samples collected from the overlying till and samples also from the bedrock aquifer for LSMOC. The till groundwater geochemistry is unique from the bedrock aquifer groundwater geochemistry, and surface water geochemistry, and shows generally higher dissolved solids and more frequent elevated percentages of sulphate and chloride than in the bedrock groundwater or surface water system. One well at the proposed location of the Water Control Structure (WCS) is typically high in dissolved solids and sulphate. The low permeability of the till limits any water influx into the till, either from discharge from fresher groundwater below or recharge from fresher surface water and wetland sources perched above the till. The integrity and functioning of the till aquitard are demonstrated by its thickness and low permeability characteristics, combined with its unique groundwater geochemistry, and with the observation of upward gradients (to flowing artesian conditions) and because it demonstrates a confining

condition for the underlying bedrock aquifer throughout the region of the LSMOC. Bedrock groundwater chemistry along the channel alignment is generally similar and consistent with a few wells showing more mineralized conditions with higher dissolved solids and sulphate. It should be noted that one well near the end of the channel near Lake Winnipeg that shows significant flux in water type seasonality which could indicate a connection with surface water sources or changes in groundwater flow paths (KGS, 2021c).

LMOC groundwater quality monitoring was conducted from thirteen sites, including pump wells, observation wells, and test hole wells (within the channel right of way and at future bridge structure locations) established by the Hatch team, were monitored for groundwater quality during field campaigns in June, August, and October of 2019 (Appendix 1, Figure 1A and 1B). Sampling frequency at groundwater sites was dependent on the timing of well installation following geotechnical work; therefore, some sites were not sampled on every 2019 campaign. Groundwater sample collection was also limited at some sites by lack of landowner permission for personnel access and site conditions.

Table 5 below (refer to Figures 1A and 1B, Appendix 1) is a summary of the exceedances for DO, Turbidity, Fluoride, Total Phosphorus, Total Dissolved Solids (TDS), E-Coli., Total Coliforms, Toluene, Dissolved Manganese, Dissolved Zinc, Total Aluminium, Total Copper, Total Iron and Total Manganese. Figures 1A and 1B Appendix 1 provide locations of groundwater sampling locations).

Table 5: LMOC Groundwater Exceedances, 2019 Sampling Event (MTI 2022c)

Parameter	Guidelines		Sites Where Exceedances are Present	No. of Exceedances	Percent Exceedances	Max. Value	Site of Max. Value	Date of Max Value
Dissolved Oxygen	CWQG-FAL	>5.5/6/6.5/ 9.5[VAR-B]	BH19-12, BH19-29, CH19-08, CH19-37, OW19-05, OW19-16, OW19-18, OW19-23, OW19-40, OW19-17, PW19-06, PW19-22	17	68%	0.98[+]	Ow19_18[+]	7-Oct-19[+]
Turbidity Field (NTU)	CDWQ	≤0.3/1.0/0.1 [G]	BH19-12, BH19-29, CH19-08, CH19-37, OW19-05, OW19-16, OW19-18, OW19-23, OW19-40, PW19-17, CH19-11, PW19-06, PW19-22	20	80%	166.67	CH19-08	7-Oct-19
Fluoride	CWQG-FAL	0.12[B]	BH19-12, BH19-29, CH19-08, CH19-37, OW19-05, OW19-16, OW19-18, OW19-23, OW19-40, PW19-17, CH19-11, PW19-06, PW19-22	23	92%	0.855	BH19-29	20-Aug-19
Total Phosphorus	MSOF-FAL	0.025[C]	CH19-08, OW19-05, PW19-06	5	25%	0.191	CH19-08	7-Oct-19
Total Dissolved Solids	CDWQ	≤500[E]	CH19-08	3	12%	561	CH19-08	7-Oct-19

Parameter	Guidelines		Sites Where Exceedances are Present	No. of Exceedances	Percent Exceedances	Max. Value	Site of Max. Value	Date of Max Value
E-Coli (mpn/100 mL)	CDWQ	0[G]	CH19-23	1	5%	2	OW19-23	8-Oct-19
Total Coliforms (mpn/100 mL)	CDWQ	0[G]	BH19-12, BH19-29, CH19-08, CH19-37, OW19-05, OW19-16, OW19-18, OW19-23, OW19-40	12	60%	196	OW19-16	19-Aug-19
Toluene	CWQG-FAL	0.002[B]	OW19-05	1	5%	0.0098	OW19-05	19-Aug-19
Dissolved manganese	CDWQ	≤0.05[E]	OW19-05	1	5%	0.0546	OW19-05	19-Aug-19
Dissolved Zinc	CWQG-FAL	Varies with hardness	CH19-37, OW19-18, OW19-23, PW19-17, PW19-06, PW19-22	6	30%	0.128	OW19-18	7-Oct-19
Total Aluminum	CWQG-FAL MSOG-FAL CDWQ	Varies with pH	CH19-08, OW19-05, PW19-06, PW19-22	7	35%	2.15	CH19-08	19-Aug-19
Total Copper	CWQG-FAL CDWQ	Varies with hardness	BH19-29, CH19-08, CH19-37, OW19-40	5	25%	0.0310	CH19-37	8-Oct-19

Parameter	Guidelines		Sites Where Exceedances are Present	No. of Exceedances	Percent Exceedances	Max. Value	Site of Max. Value	Date of Max Value
Total Iron	CWQG-FAL MSOG-FAL CDWQ	0.3[B/D/E]	CH19-08, OW19-05	5	25%	3.11	CH19-08	19-Aug-19
Total Manganese	CWQG-FAL CDWQ	≤0.05[E]	CH19-08, OW19-05	3	15%	0.125	CH19-08	7-Oct-19

Notes:
Results are in mg/L unless otherwise specified in the parameter column.
Percent Exceedances: percent of total collected samples with guideline exceedances.

+ DO values listed are the minimum value since it is the value farthest from the acceptable guidelines.
VAR Lowest acceptable DO concentration: for warm mater biota: early life stages = 6 mg/L; for warm water biota: other life stages = 5.5 mg/L; for cold water biota: early life stages = 9.5 mg/L; for cold water biota: other life stages = 6.5 mg/L

A Canadian Water Quality Guideline (CWQG)-FAL Freshwater Aquatics Short Term

B CWQG-FAL Freshwater Aquatics Long Term

C Manitoba standard, objectives and guidelines (MSOG)-FAL Tier I – Water Quality Guidelines – Freshwater Aquatic Life

D MSOG-FAL Tier III – Water Quality Guidelines – Freshwater Aquatic Life

E CDWQ Aesthetic Objectives/Operational Guidelines

F CDWQ Maximum Acceptable Concentration

G CDWQ Microbial Parameters

2.4 Hydrological Context and Predicted Impacts

Surface water flows are a critical aspect of wetland form and function since water flood duration and depth will determine the vegetation that can establish and be sustained, as well as the wildlife that may use it. Areas of predicted impact and current hydrological context informed candidate site selection, while past water monitoring sites offer baseline data useful for future comparison to control and impact monitoring sites.

2.4.1 LMOC

The LMOC is located within the Birch Creek and Watchorn Creek drainage systems. As shown in Figure 4, the LMOC will cross Birch Creek and Watchorn Creek drainage areas, intercepting part of the surface runoffs currently draining into these creeks. The Birch Creek current watershed area is estimated at 286 square kilometres (km^2) and drains toward Lake St. Martin. Birch Creek generally flows parallel and east of the LMOC alignment, outside of the PDA, and feeds numerous wetlands and lakes along that alignment, such as Reed Lake, Clear Lake, Water Lake and Goodison Lake. Roughly 27% of its total drainage area, or 78.5 km^2, is located to the west of the LMOC. This section of the watershed is expected to be "affected" by the LMOC, meaning that the Birch Creek effective drainage area is expected to be reduced by about 27%, as LMOC would intercept any runoff coming from the western sub-watersheds (MI, 2020). A preliminary hydrologic assessment of Birch Creek estimated the mean annual flow to be 15 cubic metres per second (m^3/s) at its outlet in Lake St. Martin (MTI 2022c). The impact of this drainage area reduction on Birch Creek water balance remains unclear, as no water balance or hydrological modelling has been completed so far.

Watchorn Creek has a total drainage area of 93 km^2 and drains into Watchorn Bay, near the inlet of the LMOC. About 89 km^2 of its watershed is located on the east side of the LMOC, and only about 3.7 km^2 of the watershed, or 4%, is located on the west side of the LMOC and is expected to be impacted by the Project.

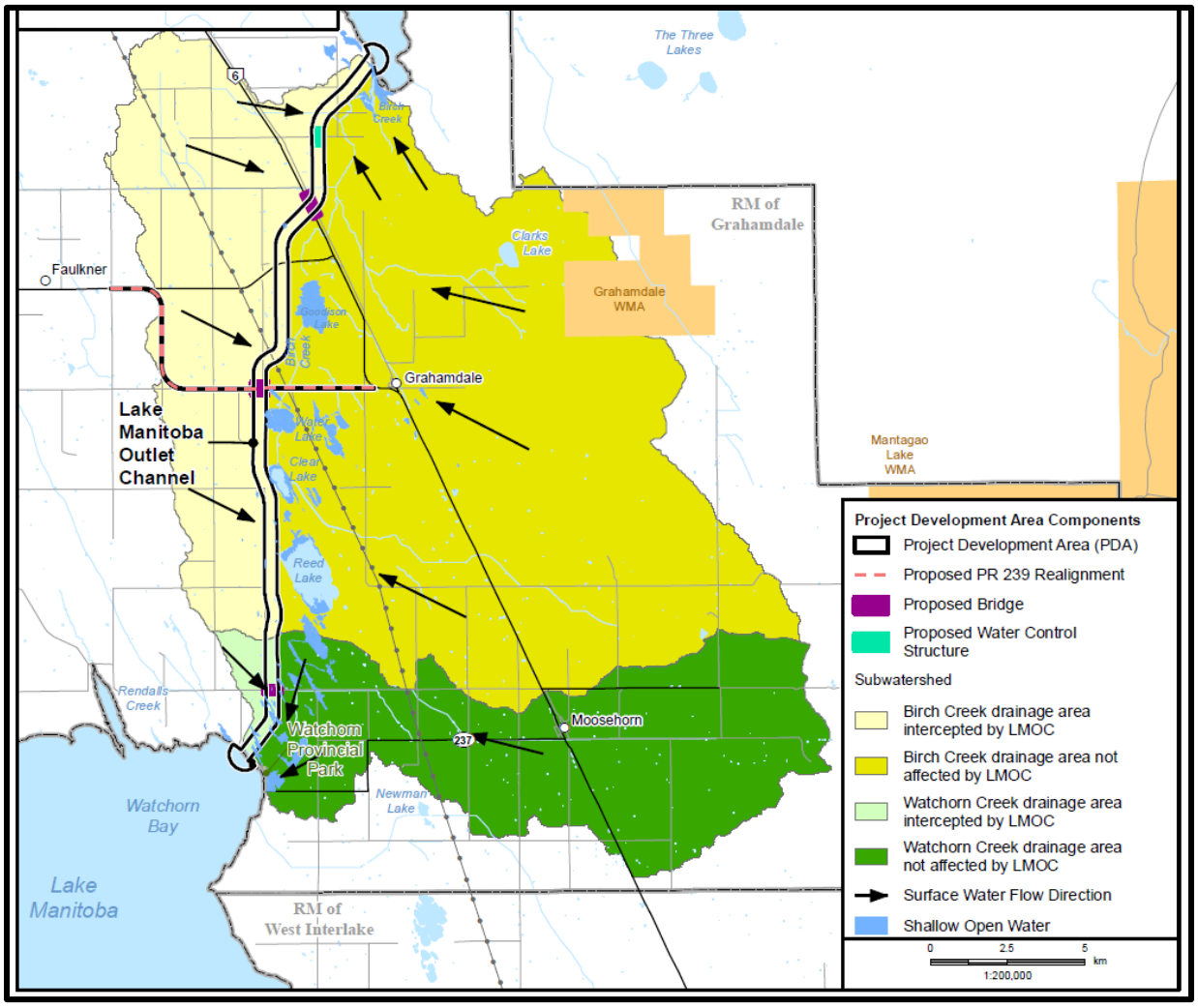


Figure 4: Watersheds within the LMOC Study Area (MTI 2022c)

The LMOC watersheds were monitored between 2017 and 2019 at ten monitoring sites. The characteristics of these monitoring stations are summarized in Table 6 and are shown on Figures 1A, 1B, 2A and 2B, Appendix 1. Monitoring at these sites generally consisted of punctual surface water sampling and water depth measurements. In 2019, water sampling and water depth measurements were conducted in June, August, and October.

Twelve surface water quality monitoring sites, identified on Figure 2 in the Aquatic Effects Monitoring Plan (AEMP) (MTI 2022a)completed for the Project; monitoring sites were established between 2017 and 2019 within the LMOC Project EIS LAA and included monitoring at locations such as Watchorn Creek, Birch Creek, Reed Lake, Clear Lake, Water Lake, Goodison Lake, Lake St. Martin and Lake Manitoba (MTI 2022c). Other water sampling sites are also identified in the AEMP (MTI 2022a) and the Project SWMP (MTI 2022c).

Table 6: LMOC Surface Water Monitoring Sites

Watershed	Sites ID	Data
Lake Manitoba	D1	Water quality and water depth
Watchorn Creek	D2	Water quality and water depth
Birch Creek	2017-2019: D3, D4, D6, D8 2019: D10, D11, D12,	Water quality and water depth
Lake St. Martin	D9	Water quality and water depth

2.4.2 LSMOC

The LSMOC is located within the Buffalo Creek drainage system (Figure 5 and Figure 6). The Buffalo Creek watershed comprises Big Buffalo Lake, Little Buffalo Lake, and several small unnamed lakes, ponds, and creeks. It discharges into the Dauphin River downstream of the Big Rapids, about 4 km from the outlet of Dauphin River into Sturgeon Bay. Its drainage area is estimated to about 31.5 km^2 at that location, of which 16.2 km^2, or 52% of its total drainage area, is projected to be intercepted by the LSMOC. To mitigate the diversion of flows from the east side of the watershed, various mitigation options are currently being explored. One of these options consists of constructing a ditch on the west side of the channel from a gated control structure in the LSMOC WCS. The ditch would carry flows from Lake St. Martin and be released at one or more points to distribute flow to the area of wetlands downgradient of the outlet channel (MTI 2022c). The preferred mitigation option has not been selected yet. Moreover, the full hydrological impact of this reduction in drainage area is currently under study but no results have been published yet. The effectiveness of the potential mitigation options on downgradient wetlands remains uncertain.

Buffalo Creek was monitored between 2011 and 2015 to support aquatic monitoring of the Lake St. Martin Emergency Outlet Channel (EOC). Measured base flow during that period ranged from approximately 1 m^3/s and 10 m^3/s and peak flows of up to about 25 m^3/s were observed following significant storm events (MTI 2022c). The anticipated impact upgradient of the LSMOC on surface drainage consists of increased impoundment due to poor drainage and water accumulation. Inversely, drying down is expected downgradient of the LSMOC due to surface water being intercepted by the channel. The Project EIS reports that LSMOC impact on surface and shallow subsurface drainage is not expected to occur beyond 500 m upgradient or downgradient. No hydraulic analysis supporting this assumption is mentioned in the Project EIS. To test this assumption, monitoring stations will have to be implemented within and outside a 500 m buffer from the channels. The location selection of the monitoring stations is discussed in Section 3.1.

Within the LSMOC, seven surface water sampling locations were established between 2019 and 2020 in the PDA or Project EIS LAA. Two of the LSMOC surface water sites are located within the PDA and, therefore, will be lost as potential monitoring sites once the channel is constructed. As such, while they will provide baseline information, they cannot be used for baseline comparison to future monitoring activities for surface water parameters.

Vegetation analysis using remote sensing methods (NDVI, vegetation health index) on the existing EOC suggested that soil drainage/moisture impacts extended up to 1,600 m upgradient and 600 m downgradient and perpendicular to the outlet channel (MTI 2022c). Generally, though, effects were most noticeable within 300 m of the channel, and the 1,600 m effect was linked to backwater effects from impounded flows. The EOC had no provisions for drainage from the upstream side of the channel, as proposed for the LSMOC, and thus lessened effect on wetlands adjacent to the channel is predicted. The proposed drainage channel is predicted to limit upgradient effects to about 500 m, an impact assessed conservatively along both sides of the entire channel alignment in the Project EIS and supplemental updates as outlined in the environmental assessment (EA) information responses.

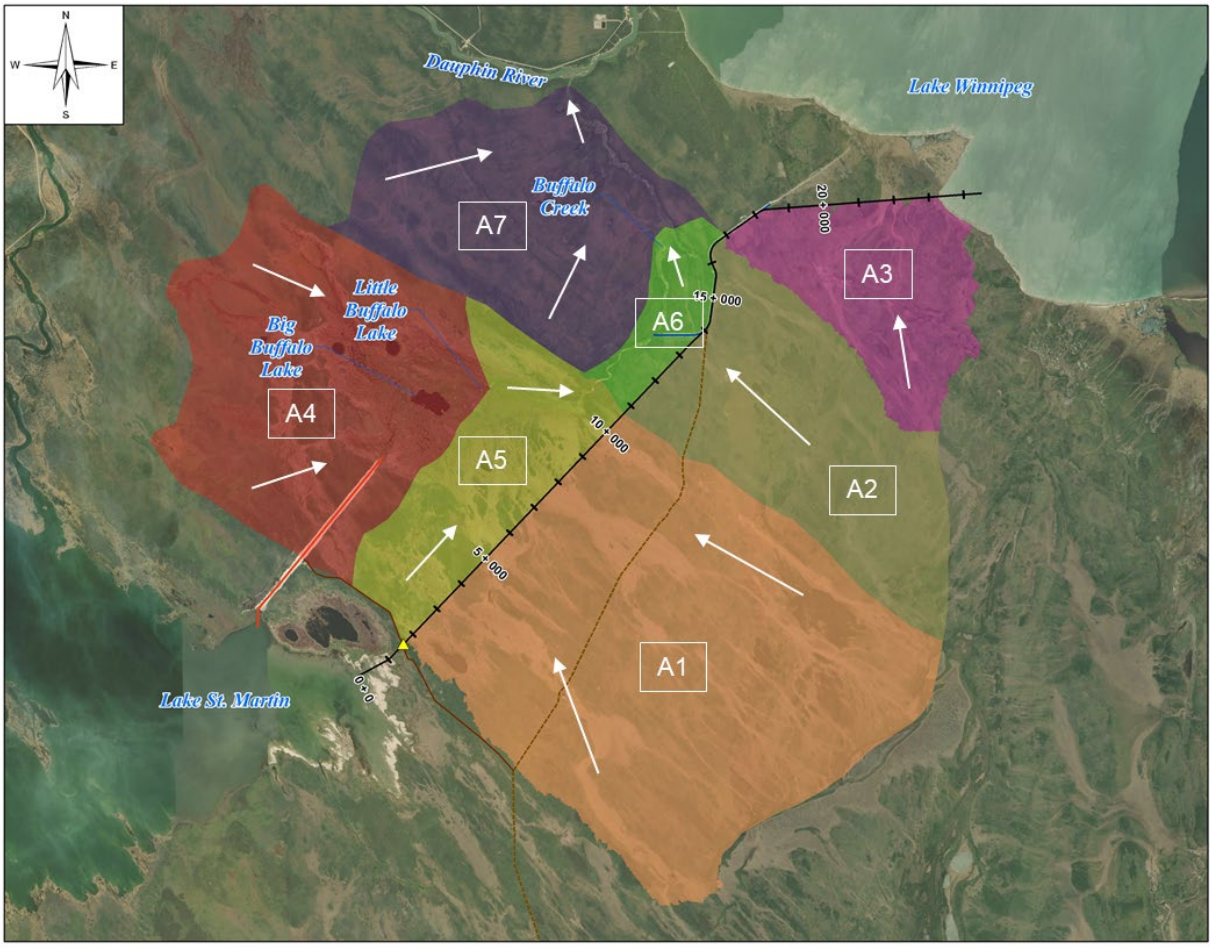
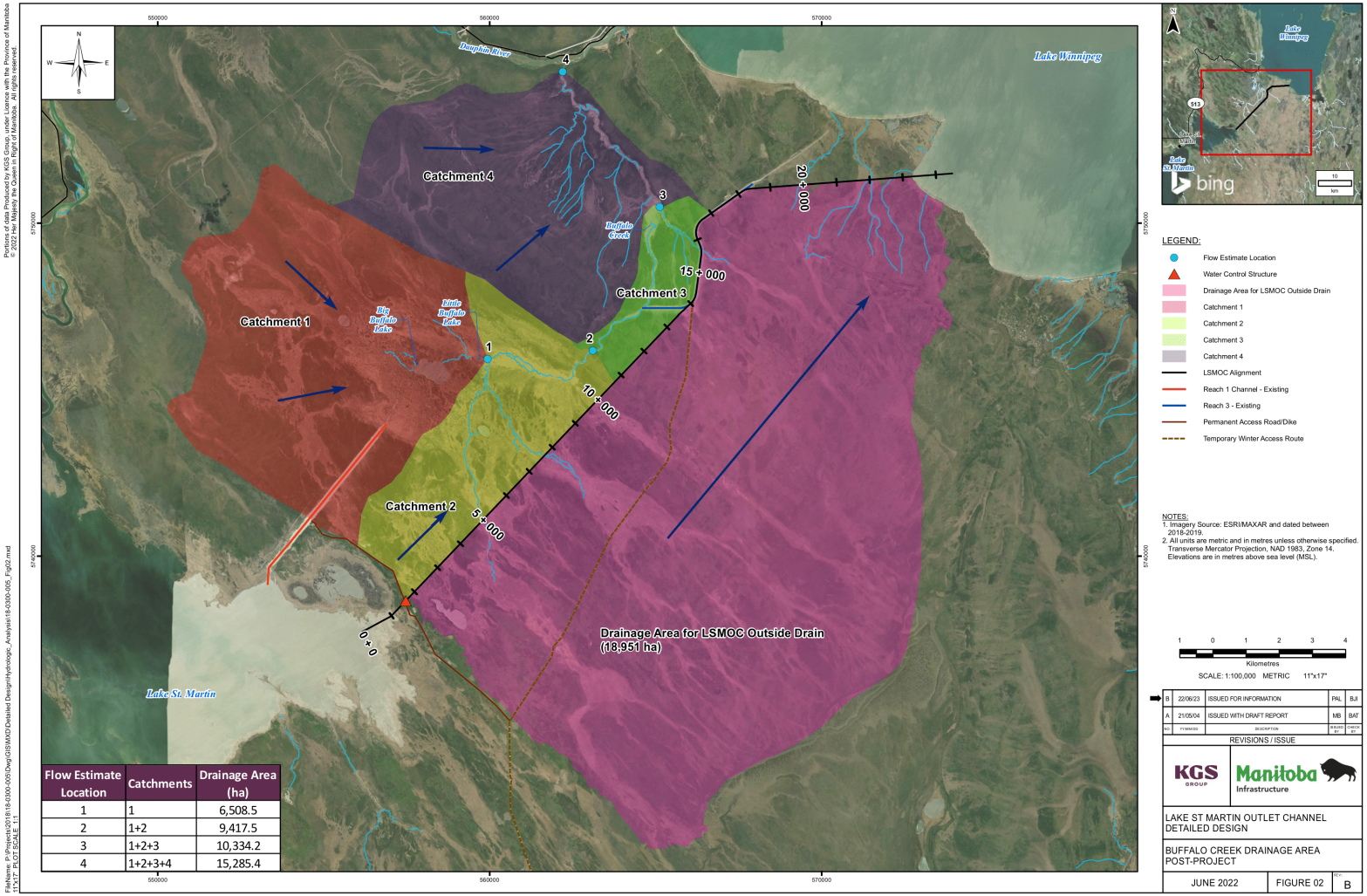


Figure 5: Surface Water Catchment Areas Intercepted by the LSMOC (MTI 2022c)



Flow Estimate Location	Catchments	Drainage Area (ha)
1	1	6,508.5
2	1+2	9,417.5
3	1+2+3	10,334.2
4	1+2+3+4	15,285.4

Figure 6: Buffalo Creek Watershed and Surface Flows, LSMOC Study Area, Post-construction (MTI 2022c)

2.5 Vegetation Species at Risk

Plant SOCC were identified in the PDA during vegetation and wetland pre-construction surveys (refer to Figures 3A, 3B, 4A and 4B, Appendix 1). Two plant SOCCs were observed in wetland areas, including narrow-leaved water plantain (*Alisma gramineum*) and yellow sedge (*Carex flava*). One plant SOCC was observed in wetland areas prior to 2020 surveys, dragon's mouth orchid (*Arethusa bulbosa*). The conservation status rank of these species is provided in Table 7. Habitat preferences and status information for these species are briefly described below.

Table 7: Vegetation SOCC Conservation Status Ranks

Species	MBCDC[1]		Schedule 1 of SARA
Narrow-leaved Water Plantain	S1	Critically imperilled - At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.	Not listed
Yellow Sedge	S2	Imperilled - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.	Not listed
Dragon's Mouth Orchid	S2	Imperilled - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.	Not listed

Notes:

[1] Information obtained from: MB CDC (Manitoba Agriculture and Resource Development, 2021a) and Nature Serve (Nature Serve Explorer, 2022).

Narrow-leaved Water Plantain

Narrow-leaved water-plantain was found on the upstream, flooded southeast side of the existing Lake St. Martin EOC in the northeastern portion of LSMOC. As narrow-leaved water plantain was observed in a marsh created by water impoundment against the existing EOC, there is potential for a population increase as additional impounded areas are created on the upstream side of the LSMOC. However, drying effects on the downstream side will limit suitable habitat for this species to establish and spread. Monitoring will focus on any populations that may be present in the Modified LAA or that establish during or after construction, and any changes in population size or plant vigour.

Yellow Sedge

Yellow sedge was observed in 2020 in an overgrown cutline intersecting in a rich swamp within Manitoba Hydro's distribution line PDA. Drying effects on the downstream side may result in a change of moisture regime in swamp habitats, resulting in habitats that are no longer wet enough to support this species. Monitoring within wetland sites in the LSMOC Modified LAA will seek to identify any existing and new populations, and any changes in population size or plant vigour.

Dragon's Mouth Orchid

One species was found during SOCC surveys prior to 2020, the dragon's mouth orchid (Arethusa bulbosa). It was observed in an open tamarack-dominated horizontal fen, southeast of the existing EOC. Increased flooding at the location where this individual was found may result in conditions outside the window of tolerance for this species, negatively affecting this specific population. Drying of fens on the downstream side of the channel may have the same effect, resulting in a reduction in the local population of dragon's mouth orchids. Monitoring sites will seek to identify occurrences of this species in the Modified LAA, and track change over time.

2.6 Wildlife Species at Risk

The Project EIS and the supporting WMP developed for the Project identified the yellow rail (*Coturnicops noveboracensis*), least bittern (*Ixobrychus exilis*), and northern leopard frog (*Lithobates pipiens*) as the SAR most likely to be affected by altered wetland function within the Project EIS LAA, based on the species' habitat preference and wetland classes present (MTI 2022e). Indirect effects of the Project on wetlands adjacent to the outlet channels due to altered drainage patterns (e.g., increased water retention in wetlands on the west side of the LMOC and decreased water flow on the east side) have the potential to alter habitat characteristics for wetland-dependent migratory birds and SAR that require specific habitat conditions and is why surveys for wetland dependent SAR have been included as part of the WetMP. The conservation status ranks of these species is provided in Table 8.

Of the wetlands identified during the pre-construction vegetation-wetland mapping program, the following types are considered suitable for each of the wildlife SAR:

- Least bittern – Class IV and V marsh
- Yellow rail – stream fen, shore fen, Class II and III marsh
- Northern leopard frog – Class II, III, IV and V marsh

This determination was made based on the habitat descriptions below in Section 2.6.1.

Table 8: Wildlife SAR Conservation Status Ranks

Species	Scientific Name	MBCDC[1]		Schedule 1 of SARA
Least Bittern	*Ixobrychus exilis*	S2S3B	Imperilled to Vulnerable - At a high to very high risk of extirpation in its breeding range in the province.	Threatened
Yellow Rail	*Coturnicops noveboracensis*	S3B	Vulnerable - At a high risk of extirpation in its breeding range in the province.	Special Concern
Northern Leopard Frog	*Lithobates pipiens*	S4	Widespread, abundant, and apparently secure throughout its range or in the province.	Special Concern

Notes:

[1] Information obtained from: MB CDC(Manitoba Agriculture and Resource Development, 2021b) and Nature Serve (Nature Serve Explorer, 2022).

2.6.1 Habitat Descriptions for Wetland-Dependent Wildlife SAR

2.6.1.1 Least Bittern

The least bittern's breeding habitat includes marsh environments dominated by emergent vegetation that are surrounded by areas of open water. Dense vegetation stands are a critical part of their breeding habitat as they construct their nests on platforms of stiff vegetation. Open water areas within 10 m of nesting sites are also critical for foraging (Government of Canada, 2018a).

Although no observations for the least bittern were recorded during the 2016 baseline studies nor the 2020 pre-construction breeding bird survey, breeding records do list this species as existing in the Project EIS LAA along the LMOC near Goodison Lake as well as near the LMOC inlet (MI, 2020).

2.6.1.2 Yellow Rail

The yellow rail is a nocturnal waterbird that inhabits wetland/marsh areas where there is little to no standing water (less than 12 cm of water) and where the ground stays wet for most of the summer, including wet meadows, hay fields, grassy marshes, floodplains, and bogs (Environment Canada, 2013a).

According to the Project EIS, the yellow rail has the potential to occur along the LMOC channel area and west of Lake St. Martin. Breeding records exist four km east of the LMOC, near Birch Bay, west of Lake St. Martin. This species was not detected during 2016 baseline surveys (MI, 2020), but was detected at several sites during pre-construction breeding bird surveys in 2020. The yellow rail was detected at edge-dominated fen sites adjacent to the LSMOC Modified LAA and within/outside of the Manitoba Hydro distribution line Modified LAA. This species commonly occurs in similar habitats to LeConte's sparrow (*Ammospiza leconteii*), Nelson's sparrow (*Ammospiza nelson*) and the sedge wren (*Cistothorus stellaris*). The LeConte's sparrow was detected south of Lake St. Martin.

2.6.1.3 Northern Leopard Frog

During their life cycle, northern leopard frogs utilize three distinct habitat types: they overwinter in deeper, permanent water bodies that are cold (<4 °C), well oxygenated (7-10 parts per million) and that do not freeze solid (Environment Canada, 2013b; breeding and larval development occurs in ponds, marshes, and lakes and sometimes creeks and streams; and during the summer they forage in moist upland meadows and native prairie grasslands. (Government of Canada, 2018b).

According to the Project EIS, a habitat for the northern leopard frog exists throughout the Project EIS LAA, with species observations in wetland habitats along both outlet channel rights-of-way (ROW) during the 2016 baseline survey (MI, 2020). This species was detected incidentally during 2016 baseline surveys south of Lake St. Martin (MI, 2020). There were no detections of this species during the pre-construction surveys, likely because surveys occurred after the breeding season had finished in 2020.

2.7 Data Gaps

2.7.1 Existing Wetlands

While updated mapping provides a good indication of the distribution of potential wetland habitat, the specific hydrological and hydrogeological water regimes contributing to potential candidate sites are not yet known. Collection of baseline data prior to construction from the representative candidate sites would be helpful to understand the relative contributions and specific water balance in monitoring sites and to confirm the degree of impact anticipated at proposed monitoring sites.

2.7.2 Groundwater

There are currently three sentinel wells located approximately 6 km north of the LSMOC at Dauphin River First Nation Community. There are also seven current monitoring wells located outside of the PDA (TH19-KGS-19, TH15-03(A), TH15_02(A), TH-GD-08 and TH-GD-02m) and two of the seven are outside the LAA (TH19-KGS-20, TH15-01). The majority of the current groundwater monitoring wells within the PDA will be decommissioned as construction progresses. The Project GWMP (MTI 2022b) generally outlines a groundwater monitoring plan indicating that where construction works interfere with existing monitoring wells, the wells either be decommissioned or relocated, as required, to enable continued collection of groundwater quality and quantity data during construction and operation phases. The GWMP could also support the WetMP and its associated surface water and ecological programs.

The location of the proposed groundwater monitoring wells for the WetMP is based on wetland type and classification. The wetlands of interest are those that are potentially groundwater dependent. Table 9 below summarizes the wetland types and classifications and recharge dependency.

Table 9: Surface and Groundwater Influence on Project Wetland Classes

Wetlands and Water	
***Bog*[2]**	
Basin Bog	Topographically confined peatland with poor nutrients and level surface; **water input limited to snowmelt, rain, and local surface run-off.**
Fen[2]	
Basin Fen	Topographically confined peatland; **water inputs consist of snowmelt, rain, surface runoff, and groundwater.**
Horizontal Fen	Uniformly vegetated peatland on broad depressions or plains; **water inputs consist of snowmelt, rain, surface runoff, and groundwater.**
Shore Fen	Peatland is situated adjacent to lakes or ponds with firmly anchored surface peat; **water inputs consist of snowmelt, rain, surface runoff, groundwater, and surface flow.**
Stream Fen	Peatland is located in main channel or along banks of permanent or semi-permanent streams; **water inputs consist of snowmelt, rain, surface runoff, groundwater, and surface flow.**
***Marsh*[3]**	
Class II	Temporary graminoid/forb mineral wetland with wet meadow plant community; **surface water is present for a short period of time (flooded 1 – 4 weeks[5]) after snowmelt or a heavy rainfall.**
Class III	Seasonal graminoid/forb mineral wetland with shallow wetland plant community; **surface water is present throughout most of the growing season but is typically dry by the end of summer (flooded 5-17 weeks).**
Class IV	Semi-permanent graminoid/forb mineral wetland with deep wetland community; **surface water is present for most or all of the year, except in periods of drought flooded (8-40 weeks).**
Class V	Permanent graminoid/forb mineral wetland with open water community; **surface water is present throughout the year (flooded 52 weeks).**

Wetlands and Water	
Swamp[2]	
Basin Swamp	Topographically confined shrubby or treed wetland with less than 40 cm of organic soil.
Lacustrine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along the shores of permanent ponds or lakes; **water level affected by a lake during high water periods.**
Lagg Swamp	Sloping shrubby or treed wetland with less than 40 cm of organic soil occurring between upland mineral terrain and peatlands; **water level affected by shallow groundwater and surface infiltration from peatland**.
Riverine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along banks of rivers and permanent and intermittent streams; **subject to flooding when a stream or river waters are high.**
Unconfined Flat Swamp	Broad shrubby or treed wetland with less than 40 cm of organic soil among other kinds of wetlands with poorly defined edges; **water level affected by shallow groundwater and surface infiltration from peatland**.
Water Bodies[4]	
Water Bodies	Consists of all open water, including lakes, rivers, streams, ponds, and lagoons **water level affected by surface runoff and/or shallow groundwater**

Notes:

1 Forest ecosystem classification for Manitoba (Zoladeski, et al., 1995)

2 Canadian Wetland Classification System (National Wetlands Working Group, 1997)

3 Prairie Pothole Wetland Classification System, Stewart and Kantrud (1971)

4 Manitoba Land Cover Classification (LCC) is based on the EOSD Land Cover Classification system (Wulder and Nelson, 2003)

5 Water flood durations based on Cowardin et al. (1979)

Table 9 above identifies wetlands that may have a groundwater dependency, including fens (Basin, Horizontal, Shore and Stream Fens), swamps (Lagg Swam and Unconfined Flat Swamp), and marshes (Class III, Class IV, and Class V wetlands). Collecting baseline groundwater quantity and quality information at these wetlands will provide critical pre-construction information that can help to interpret any changes identified during post-construction and operations phases of the Project. Currently there are no groundwater monitoring wells dedicated to wetland monitoring as part of the Project. As such, groundwater monitoring of those wetland systems that have groundwater recharge potential (Basin Fen, Horizontal Fen, Class III-V wetlands) is required to assess indirect impacts to wetlands.

2.7.3 Surface Water

Continuous flow and water level monitoring has not been conducted within Watchorn Creek, Buffalo Creek and Birch Creek watersheds. Therefore, no flow regime baselines can be established for any of these creeks. Although significant flow reduction is expected at Birch Creek and Buffalo Creek, it will not be quantifiable as hydrological baselines are unavailable. Collecting baseline flow information within these watersheds, downgradient of the LMOC and LSMOC channels, can help to interpret any changes identified during post-construction and operations phases of the Project. Continuous flow monitoring, pre- and post-construction is also recommended at the existing surface water monitoring sites to develop monthly flow regime statistics. Continuous monitoring will allow for a more robust baseline definition and for abnormal hydrotechnical trends during construction and operation of the LMOC and LSMOC. The SWMP (MTI 2022c) mentions that a hydrological analysis of Buffalo Creek was ongoing at the time to determine the potential impact of the LSMOC and Buffalo Creek and adjacent wetlands water inputs. The results of this study are currently not available but should be reviewed once they are released to ensure that the wetland areas that are expected to be impacted the most are covered by the WetMP.

3.0 MONITORING PROGRAM DESIGN

The proposed WetMP design incorporated concerns raised by the Federal regulatory agencies, Indigenous rights-holders and stakeholders as well as existing baseline data and monitoring information to identify sites and a monitoring approach consistent with a BACI strategy. The proposed sites, methodologies, analysis, and schedule for sampling described below provide a proposed framework that would be adapted to field conditions and construction plans.

3.1 Overall Design Considerations

The proposed design of the WetMP follows a BACI strategy, which builds on pre-construction baseline information to detect both short and long-term change. Paired control wetland (indirect effects not anticipated) and subject wetland (potential for indirect effects) monitoring sites within the same wetland class/types allow detection of short-term change resulting from Project activities. Where possible, subject sites are located in close proximity to or within the same wetland as previously conducted baseline survey sites, which also allows detection of change from undisturbed to constructed and operational states. This approach does not recreate the baseline inventory but instead aims to detect change due to the Project and differentiate it from seasonal / annual differences.

A robust design for wetland monitoring also considers co-variates that can influence observed changes in water levels, water quality and vegetation development. Co-variates can include contextual factors, drivers, stressors, and indicators of ecologically-relevant change. These factors will influence both site selection and monitoring approach. Co-variates can be managed in the design of a wetland monitoring program by considering the following factors:

- Contextual aspects include annual and seasonal climatic variation, beaver presence, fish, other land uses (agriculture, forestry, and transportation), and watershed order (Cobbaert, 2017; Eaton and Charrette, 2017).
- An approach that uses sentinel control and impact sites that are measured repeatedly over a long time period will better detect change in wetlands, given the effects of annual and seasonal climatic influences (Eaton and Charette, 2017).
- Use of available baseline data helps to establish typical pre-disturbance patterns in the various wetland types of interest, which will help identify unusual differences (e.g., in water levels or chemistry, Eaton and Charette, 2017).
- Semi-annual monitoring (April/May, after spring thaw and August/September, late summer) will capture the typical wetland water cycle of spring freshet and fall drawdown periods (Eaton and Charette, 2017).
- Selecting anticipatory parameters to monitor is preferred for adaptive management but can be challenging to identify (Eaton and Charette, 2017). Some flexibility should be included in the design to adjust parameters as monitoring continues. Inclusion of a full suite of parameters or sites that may later be deleted or adjusted ensures enough data to support adjustments.

- Clearly stated thresholds/benchmarks reflecting potential impacts of concerns should be identified in advance, as triggers for management response (Eaton and Charette, 2017).
- Use of rapid assessment techniques will reduce monitoring costs, but limit statistical analysis (Comer et al., 2017). The level of effort in data collection should match the statistical rigour needed to detect change.

The Athabasca Oil Sands region of Alberta has faced regulatory and stakeholder concerns related to landscape-scale wetland impacts that are similar to those raised for this Project. Various regulatory and research agencies in Alberta have developed wetland monitoring tools and approaches to assist in monitoring impacts related to water diversion and disturbances to mineral and peatland wetlands. In addition to the points raised above, Alberta Biodiversity Monitoring Institute [ABMI], 2016) recommended a suite of standard parameters to monitor disturbance impacts that have been incorporated in the methodology section below.

3.2 Monitoring Sites

Selection for candidate wetland monitoring sites focused on locations where wetland function could be measurably affected, where potential Project-related effects may occur on groundwater and surface water, in consideration of other Project monitoring objectives/plans/locations (e.g., , GWMP) to help inform detailed design, proximity to locations of previous baseline monitoring sites, and areas of concern to Federal, Indigenous, and other stakeholders.

3.2.1 Monitoring Site Criteria

The selection of monitoring locations drew on best management approaches for study design and available information collected during the Project EIS and pre-construction surveys, including wetland mapping and field confirmation, surface and groundwater monitoring, vegetation, wildlife and SOCC/SAR observations. Site selection also recognized that surface and groundwater impacts may not affect different wetland types similarly (e.g., seasonal marshes may be more sensitive to altered water regimes). Further, surface water and groundwater impacts do not necessarily overlap. Surface water diversion effects will apply throughout the Project, but groundwater effects will be localized and additive.

Accordingly, site selection criteria included the following considerations:

- Potential wetland drying impacts are predicted to arise from construction of the channel, with berms on either side and the outside drain on the upgradient side of the channel, which will divert water flows and change local drainage patterns. Some ponding is predicted on the upgradient side of the channel in certain locations. Both flooding and drying impacts could result in the wetlands within the Modified LAA, and both effects should be addressed in the WetMP.
- Upgradient ponding is predicted to extend up to 500 (LMOC) – 1,000 m (LSMOC) from the channels. As such, control wetland monitoring sites will require placement outside of the “zone” of potential indirect effects but be of similar wetland type/class to demonstrate comparable conditions to that downgradient of the channel but must also avoid potential flooding effects.

- Upgradient areas with the potential for flooding should be monitored separately to capture flooding / impoundment effects on wetlands within the Modified LAA.
- Wetlands of the same class will be used for paired control/subject sites. Large waterbodies (Class 4 and 5 wetlands, shallow lakes) that have existing surface water monitoring sites (and past baseline monitoring) can be used to monitor change without paired controls, since baseline data can provide 'before' data for comparisons to 'after,' post-construction monitoring. Suitable separate waterbodies for controls would be challenging to find.
- A variety of wetland types will be representative of a diversity of wetland vegetation community types and habitat for wildlife and wetland dependent SAR present within the Lake Manitoba and Lake St. Martin areas.
- Stratify wetland sampling to focus on dominant wetland classes within each study area.
- Wetland classes differ between the LSMOC and LMOC Modified LAAs, with peatlands dominating in the LSMOC, and marsh and swamps in the LMOC. The overall monitoring plan can include sites representative of the diversity of wetlands but for analytical purposes, will focus on dominant wetland classes in the LSMOC and LMOC, respectively. In general, wetlands representing <5% of the Modified LAA area were not selected for monitoring.
- Baseline monitoring sites for surface and groundwater, wetland vegetation wildlife species and SAR are available, and will provide useful pre-construction context. Previous baseline data was primarily collected within the PDA. The scope of the WetMP focuses on conditions outside the PDA. As such, the establishment of monitoring sites during a pre-construction year should be completed to provide baseline data in order to fulfill the before/after component of the design and have a repetitive number of sites in each wetland type for statistical analysis. New groundwater wells will be required at all wetland monitoring sites that may have groundwater influence (fens, swamps, Class III-V wetlands), due to construction impacts to existing monitoring wells. As stated above, wetlands representing <5% of the Modified LAA area were not selected for monitoring.
- A construction access road will be constructed on the upgradient side, of the channel, but immediately downgradient o the outside drain (i.e. between the drain and the channel), permanently removing wetland habitat but providing access to potential monitoring sites. However, the existing ROW may not necessarily provide access to monitoring sites adjacent to the channels. Where possible, sites should be located on Crown lands to ensure long-term access.
- The Manitoba Hydro distribution line construction will require limited site disturbance (clearing and foundation construction for towers) and should not exacerbate channel impacts. Additional monitoring sites where the distribution line and channel meet could be helpful to confirm interacting impacts, or lack of effect.
- Site selection will include selection of contingency sites and will need to be "field-fitted" and adaptive; if during monitoring site establishment, a site is deemed to be unsuitable (e.g., unforeseen disturbance to the stie from non-Project related activities), a contingency site will be utilized.
- Locate potential monitoring sites with adequate setbacks to avoid backflooding, constructed infrastructure and other land use effects (e.g., intensive grazing).
- Monitoring sites assume some improved access along the channels post-construction. However, baseline data and monitoring data collection would require helicopter access.

3.2.2 Monitoring Site Locations/Distribution

Using this set of selection criteria, preliminary paired control and subject sites have been identified on a stratified set of the dominant wetlands on the LSMOC and LMOC (refer to Figures 7A, 7B, 8A and 8B, Appendix 1). Using this approach, marsh, swamp, bog, and fen habitats will be monitored in areas with surface water, combined surface and groundwater impoundments or flood zones (refer to Tables 10 and 11 for a list of preliminary proposed wetland monitoring sites). Some baseline monitoring sites on two large, shallow lakes in the LMOC study area will serve as pre-construction (control) and post-construction (impact) monitoring sites (i.e., single, not paired sites), and baseline monitoring will help to track potential change.

Monitoring sites were distributed spatially along the LMOC and LSMOC according to wetland type and anticipated impacts on water regimes. In the LMOC, this resulted in a relatively even distribution of monitoring sites along the length of the proposed channel. In the LSMOC, there is a gap in monitoring sites near the outlet into Lake Winnipeg. This area is dominated by horizontal fen and may experience both groundwater and surface water impacts. It is also the location of the existing EOC, which has experienced previous flooding and drying impacts, such that water regimes for wetlands in this area will have already been changed over a wide zone (500 m – over 1 km, based on NDVI analysis in the Project EIS, (MI 2020). The EOC will be incorporated into the new LSMOC, and existing connections to surface water bodies will be blocked, and that, with the proposed water management mitigation to sustain some surface water flow across the channel, is predicted to impact wetlands within 500 m of the channel (MTI 2022c). Differentiating impacts of the new channel, the old channel and annual variation could be quite challenging in this area, given the anticipated combination of surface and groundwater impact and water management mitigation. The WetMP will compliment information collected in other monitoring programs for the Project. For example, the GWMP will be focusing on potential impacts on deep groundwater (aquifer) resources with monitoring of the aquifer conditions being conducted at the PDA and at locations up to 5 km from the PDA. The focus of the WetMP is on more localized indirect effects on wetlands, with the groundwater monitoring aspect for the WetMP focusing on potential impacts to wetlands from changes to shallow groundwater within 200 – 500 m of the PDA.

Monitoring aspects at each site will also be dependent on the characteristics of the wetland (refer to Table 10 and 11). For example, not all of the wetland types being monitored are recharged via shallow groundwater; thus, at such sites, groundwater monitoring would not occur. Similarity, for Class II wetlands, a continuous surface water probe would not be installed as these wetlands are ephemeral and typically are dry by mid-summer; water samples for laboratory analysis during the spring freshet would be collected at these wetlands instead.

Table 10: Proposed Preliminary Wetland Monitoring Sites – LMOC

Site Type	ID	Wetland Class	Easting	Northing
Control	1C	Class IV Wetland	533273.9761	5704599.33
Subject	1S	Class IV Wetland	534140.4883	5703369.545
Control	2C	Class II Wetland	531338.6175	5700418.94
Subject	2S	Class II Wetland	532543.5324	5700818.197
Control	3C	Class III Wetland	529983.6994	5696764.914
Subject	3S	Class III Wetland	531353.7147	5696815.185
Control	4C	Class III Wetland	529641.5264	5694200.766
Subject	4S	Class III Wetland	530647.6065	5693654.4
Control	5C	Class IV Wetland	529814.4469	5688400.42
Subject	5S	Class IV Wetland	530999.9149	5687296.047
Control	6C	Class III Wetland	529652.996	5686679.718
Subject	6S	Class III Wetland	531023.1436	5686829.367
Control	7C	Class II Wetland	529799.4538	5685217.3
Subject	7S	Class II Wetland	531022.2281	5684974.148
Control	8C	Class III Wetland	530000.8091	5683368.857
Subject	8S	Class III Wetland	531045.9154	5684213.805
Control	9C	Class IV Wetland	529024.6093	5682373.748
Subject	9S	Class IV Wetland	530829.3095	5682299.453
Ongoing Baseline Comparison	D10	Class V Wetland	531272.7971	5692229.408
Ongoing Baseline Comparison	D4	Water Bodies	531215	5689935
Total number of proposed monitoring sites: 20				

Table 11: Proposed Wetland Monitoring Sites - LSMOC

Type	ID	Wetland Class	Easting	Northing
Control	1C	Horizontal Fen	573108.1832	5752165.648
Subject	1S	Horizontal Fen	572789.492	5751139.195
Control	2C	Basin Bog	566197.5275	5746709.519
Subject	2SA	Basin Bog	565367.4019	5747332.218
Subject	2SB	Basin Bog	565761.1027	5746896.449
Control	3C	Horizontal Fen	564023.5742	5744331.836
Subject	3SA	Horizontal Fen	563028.8978	5744915.427
Subject	3SB	Horizontal Fen	563560.7115	5744600.573
Control	4C	Horizontal Fen	562647.7381	5742915.916
Subject	4SA	Horizontal Fen	561675.6838	5743597.535
Subject	4SB	Horizontal Fen	562300.7631	5743352.795
Control	5C	Stream Fen	560780.3052	5740696.189
Subject	5SA	Stream Fen	560231.0558	5741962.804
Subject	5SB	Stream Fen	560643.2775	5741545.158
Control	6C	Horizontal Fen	558943.2152	5738845.461
Subject	6SA	Horizontal Fen	558058.9547	5739756.836
Subject	6SB	Horizontal Fen	558528.3264	5739292.491
Control	7C	Stream Fen	558833.413	5738704.57
Subject	7SA	Stream Fen	557908.1418	5739216.291
Subject	7SB	Stream Fen	558269.2988	5738982.134

Type	ID	Wetland Class	Easting	Northing
Control	8C	Lacustrine Swamp	557831.6985	5737681.688
Subject	8SA	Lacustrine Swamp	557083.9631	5738671.248
Subject	8SB	Lacustrine Swamp	557517.8806	5738263.789
Total Number of Proposed Monitored Sites: 23				

Notes:

[1] Backflooding and drying impact monitoring site were identified for the LSMOC channel to accommodated predicted impact zones.

4.0 MONITORING PROGRAM STUDIES

Wetland function can be described in terms of the factors that influence habitat conditions (e.g., water supply and water quality) and the wetland form and plant and wildlife species that become established within a given site. Specific methods for measuring change in these disciplines have been developed by others and offer a framework for overall program requirements. That overall set of program requirements, and specific considerations and methodologies for wetlands, surface and groundwater, wetland vegetation, wildlife habitat, wetland dependant SAR and resources with Indigenous cultural significance are also described below.

Specific monitoring studies that form the basis of the program include:

- Surface water (quality and flow)
- Groundwater (quality and quantity)
- Wetland form (class and extent)
- Vegetation Community Composition (indicator species [richness, abundance, vigour], ingress of non-native invasive species and weeds, presence of plant SOCC, traditional/cultural use)
- Wildlife Biodiversity, Habitat and Wetland Dependent Wildlife SAR (indicator species [including indirectly through SAR presence], habitat quality indirectly through measurement of community composition studies, traditional/cultural use)

4.1 Overall Program Requirements

To assess indirect impacts on wetland form and function, a comprehensive set of monitoring parameters helps to ensure an integrated approach to assessing change in water inputs and potentially resulting impacts on vegetation and wildlife use of the available habitat. Other considerations include consistency in data management, including consistency in measurement methods. Establishing an overall framework for monitoring helps address these considerations and identify appropriate coordination and data management processes.

Key considerations utilized to develop the monitoring parameters included:

- can be measured and compared over time
- provides meaningful information to understanding indirect effects on wetlands
- can be repeated each year (i.e., same or similar methodology can be utilized to achieve results)
- utilize scientific standards or known methodologies
- can aid in informing other Project monitoring programs and activities
- can be adaptive (i.e., work with an adaptive management approach)

4.1.1 Monitoring Parameters

ABMI (2016) developed a set of parameters/indicators for wetland monitoring programs for assessing landscape-level impacts associated with development in Alberta's Athabasca Oil Sands region. Those indicators were adapted to provide a set of key indicators with measurable parameters related to predicted drying and flooding impacts associated with channel construction and operation of the LMOC and LSMOC.

Table 12 below summarizes the parameters, survey timing, and types of data, which can also help in planning for field / desktop analysis steps and data storage and management. Baseline characterization at each monitoring site will be required, ideally at least one year prior to construction. Subsequent monitoring will be done using continuous monitoring probes (surface and groundwater) and field monitoring in spring (April/May) and fall (August/September) to capture typical seasonal fluctuation due to freshet and fall drawdown. Monitoring would be expected to continue annually for up to five years post-construction, to allow sufficient time for vegetation and wildlife adaptations to changing water conditions to be evident. Following the adaptive management approach, annual reporting should be evaluated on an on-going basis to detect and track changes, inform development of additional mitigation or compensation (if required), and adjust monitoring scheduling and approach.

Since monitoring will continue over several years, compiling the resulting data within one centralized database and for the specific monitoring sites identified here that allow analysis of all factors that could affect wetland function will be essential. Manitoba Transportation and Infrastructurewill establish a digital data collection format that will allow integration and sharing of monitoring data collected by separate contractors (e.g., from groundwater, surface water, and wildlife monitoring teams).

Table 12: Summary of LMOC and LSMOC Wetland Monitoring Indicators (adapted from ABMI, 2016)

Functional Aspect	Measurable Parameter	Timing	Indicator Purpose	Type Of Data
Wetland Form	**Wetland Class and Extent**			
	Wetland Classification	Spring	Flood/drying impacts	Field
	Total Area (annual change from spring freshet and fall drawdown)	Spring & fall	Flood/drying impacts	Satellite imagery Spectral Signature (Remote Sensing)[1]
	Area of vegetative zone (including open water)	Fall	Flood/drying impacts	Satellite imagery Spectral Signature (Remote Sensing)[1]
	Wetted soils – whole study area	Fall	Flood/drying impacts	Satellite imagery Spectral Signature (Remote Sensing)[1]
Wetland Function	**Vegetation Community Composition**			
	Plant SOCC occurrence and abundance	Spring & fall	Tracking change in SOCC	Field
	Tree vigour	Spring	Tracking change in community composition	Field
	Ingress of non-native invasive species and weeds	Spring & fall	Tracking change in community composition	Field

Functional Aspect	Measurable Parameter	Timing	Indicator Purpose	Type Of Data
Wetland Function (cont'd)	Proportion of indicator species functional groups, species richness and diversity	Spring & fall	Tracking change in community composition	Field
	Indigenous culture use plants	Spring & fall	Tracking change in cultural land use	Field
	Wildlife Biodiversity and Habitat			
	Wetland species diversity	Spring breeding season	Tracking change in diversity	Field
	Habitat Suitability	Spring & Summer	Tracking change in community composition	Field
	Indigenous harvested wildlife	Spring & fall	Tracking change in cultural land use through the engagement of Indigenous monitoring	Field
Water	**Water Quality**			
	Temperature	Spring, late summer, late fall	Surface/groundwater change	Field
	pH and alkalinity	Spring, late summer, late fall	Surface/ground water change	Field & Laboratory
	Salinity	Spring, late summer, late fall	Surface/ground water change	Laboratory
	Conductivity	Spring, late summer, late fall	Surface/ground water change	Laboratory
	DO concentration	Spring, late summer, late fall	Surface/groundwater change	Laboratory
	Redox potential	Spring, late summer, late fall	Surface/groundwater change	Laboratory

Functional Aspect	Measurable Parameter	Timing	Indicator Purpose	Type Of Data
Water (cont'd)	Water transparency (TSS)	Spring, late summer, late fall	Surface/groundwater change	Laboratory
	Total dissolved solids (TDS)	Spring, late summer, late fall	Surface/groundwater change	Laboratory
	Hardness	Spring, late summer, late fall	Surface/groundwater change	Laboratory
	Chlorophyll a	Spring, late summer, late fall	Surface water change	Laboratory
	Mercury	Spring, late summer, late fall	Surface water change	Laboratory
	Pesticides	Spring, late summer, late fall	Surface water change	Laboratory
	Hydrocarbons	Spring, late summer, late fall	Surface water change	Laboratory
	Nutrients			
	Total nitrogen	Spring & fall sampling	Surface/groundwater change	Field
	Total phosphorus	Spring & fall sampling	Surface/groundwater change	Field
	Ions			
	Na^+, K^+, Ca^{2+}, Mg^{2+}	Spring & fall sampling	Surface/groundwater change	Field
	SO_4^{2-}, Cl^-, CO_3^{2-}, HCO_3	Spring & fall sampling	Surface/groundwater change	Field

Functional Aspect	Measurable Parameter	Timing	Indicator Purpose	Type Of Data
Water (cont'd)	**Metals**			
	Total, Iron (Fe), Aluminium (Al)	Spring & fall sampling	Surface/groundwater change	Field
	Water Quantity			
	Depth to groundwater table and amplitude of seasonal change	Continuous (probe)	Flood/drying impact (GW)	Field
	Surface water depth and amplitude of seasonal change	Continuous (probe)	Flood/drying impact (SW)	Field
	Soil moisture	Spring & fall sampling	Flood/drying impact	Field
Baseline Site Conditions	**Soil Quality**			
	Moisture	Spring & fall sampling	Baseline drainage characterization	Field
	Texture	First visit sampling	Baseline drainage characterization	Field
	Type	First visit sampling	Baseline drainage characterization	Field
	Depth (mineral /peat horizons)	First visit sampling	Baseline drainage characterization	Field
	Metals			
	Total, Fe, Al	First visit	Baseline drainage characterization	Field

Functional Aspect	Measurable Parameter	Timing	Indicator Purpose	Type Of Data
Baseline Site Conditions (cont'd)	**Nutrients**			
	Total Nitrogen	First visit	Baseline drainage characterization	Field
	Total Phosphorous	First visit	Baseline drainage characterization	Field
Land Use	% Disturbed land	Establishment & post-construction	Contextual factors	Satellite imagery Spectral Signature (Remote Sensing)[1]
	Linear density	Establishment & post-construction	Contextual factors	Satellite imagery Spectral Signature (Remote Sensing)[1]

Notes:

[1] Many vegetation and soils indices used to discriminate classes, e.g., Normalized Differeence Vegetation Index (NDVI)

4.1.2 Adaptive Management

Standards (established scientific limits/regulatory standards e.g., CCME Water Quality Standards for aquatic life), or benchmarks (degree of change from baseline conditions) will be used to detect meaningful change relative to the monitoring parameters listed above. An adaptive management approach will be applied to determine whether monitoring study results indicate the need for a change in monitoring activities or mitigation measures.

Manitoba Transportation and Infrastructure will retain an environmental consultant experienced in conducting monitoring studies described in this WetMP as well as in the analysis and interpretation of biological data, with emphasis on wetlands, groundwater, surface water, vegetation, and wildlife. While benchmarks and responses differ between aspects and variables, in general the following procedures will be observed.

A three-staged approach is being used for adaptive management based on the development of three benchmarks: a change notification indicating change is taking place; an early warning trigger; and a management threshold, the level of an indicator when the magnitude of an adverse effect attributed to the

Project is sufficient that it may result in long term adverse effects wetlands. The change notification is intended to highlight that a change has occurred, though not necessarily as a result of the Project, and additional or expanded monitoring or investigation may be required. The early warning trigger indicates a detection of a change that may require modifications to the monitoring program to acquire additional information, and/or subsequent evaluation of potential causes of the change to determine whether it is related to the Project. Management thresholds indicate that additional mitigation or management actions may need to be undertaken. Benchmarks are described for specific environmental components in Table 13 below. In most instances, collection and analysis of supplemental data is required before the numerical value of the benchmark can be calculated but the data that will be used to calculate benchmarks are described.

Results of monitoring will be reviewed after each field program to determine the answers to relevant key questions as described in this AEMP. Key questions will be addressed in consideration of:

- Is there a statistically significant difference from pre-Project conditions, i.e., has a change notification occurred or an early warning trigger been passed?
- Is the nature of the pre/post-Project difference sufficient to exceed a management threshold, i.e., should an adaptive measure be undertaken?
- What is the monitoring result in comparison to anticipated effects based on the environmental assessment?

Where it is determined that further assessment is required, the following questions will be considered:

- Are further investigations required to determine if the effect is related to the Project? Are modifications to the monitoring plan required?
- What are the potential implications to wetlands in the Modified LAA?
- Has a management threshold been reached and is additional mitigation required?
- If additional mitigation is required, what are potential methods and how could they be applied?
- What monitoring is required to determine whether the new mitigation measures are functioning as intended?

In the event analysis by the environmental consultant indicates that a benchmark or standard has been exceeded, then the experimental design calls for Manitoba Transportation and Infrastructure and their consultants to undertake a review to examine the potential for linkages to the Project and the need for changes to mitigation measures. It is anticipated that results of this review will be conducted in consultation with regulators. Manitoba Transportation and Infrastructure will also discuss results with directly affected First Nations communities and user input on observed changes shared by resource users and other First Nation members to inform the review and decision making. The Environmental Advisory Committee (EAC) - a committee comprised of local Indigenous rights-holders and representatives for the RM of Grahamdale - will be in contact with stakeholders regarding any issues or concerns, and may facilitate further adjustments on how and where monitoring occurs during construction and opertational periods. Modification of mitigation measures will be implemented if and as required and subsequent monitoring will indicate whether the modified mitigation successfully addressed the environmental issue or whether further changes are required.

In the event that changes are observed that are not attributable to the Project, these will be highlighted in reporting of monitoring results to provincial and federal environmental regulators.

Benchmarks for wetland ecological function are by their nature contextual and linked to subjective management goals. A conservative degree of change was set for benchmarked parameters to prompt further investigation and possible intervention or adjustment to operations if required. These benchmarks could be adjusted through consultation with other affected stakeholders (e.g., local farmers and ranchers, Indigenous rights-holders) to ensure meaningful ranges of change are identified relative to land use.

Table 13: Standards and Benchmarks for Monitoring Parameters

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Wetland	**Wetland Class and Extent**		
	Wetland Classification	Change in flood duration (per Cowardin et al. 1979 and Stewart and Kantrud 1971 classes).	Follow-up, investigate climate variables / external factors, Review water flow mitigation / access options.
	Total Area (annual change from spring and fall drawdown)	Change notification: less than 10% (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10-20% annual change unless similar change in control site.	Follow-up, investigate climate variables / external factors. Review water flow mitigation.
		Management threshold: Greater than 20% annual change unless similar change in control site.	If impacts to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).
	Area of vegetative zone (including open water)	Change notification: less than 10% (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10-20% annual change unless similar change in control site.	Follow-up, investigate climate variables / external factor. Review water flow mitigation.
		Management threshold: Greater than 20% annual change unless similar change in control site.	If impacts (i.e., drying down of wetlands, increased soil wetness, changes in vegetation community composition) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Wetland (cont'd)	Wetted soils (NDVI analysis) – whole study area	Change notification: NDVI reduced compared to baseline less than 500 m beyond channel (LSMOC). Less than 10% annual change from baseline (LMOC)	Follow-up, investigate climate variables / external factors.
		Early warning trigger: NDVI reduced compared to baseline between 500 m – 750 m beyond channel (LSMOC). 10 - 20% annual change from baseline (LMOC).	Follow-up, investigate climate variables / external factors. Review water flow mitigation.
		Management threshold: NDVI reduced compared baseline greater than 750 m beyond channel (LSMOC). Greater than 20% annual change (LMOC).	If impacts (i.e., drying down of wetlands, increased soil wetness, changes in vegetation community composition) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).
Wetland Species	**Vascular and Non-vascularly Plants**		
	Community Composition (richness/diversity)	Change notification: Less than 10% change in proportion of indicator species functional groups compared to control sites.	Expand survey effort, confirm natural / operational causes.
		Early warning trigger: 10 - 20% change in proportion of indicator species functional groups compared to control sites.	Follow-up, investigate climate variables / external factor. Review water flow mitigation.
		Management threshold: Greater than 20% change in proportion of indicator species functional groups compared to control sites.	If impacts (i.e., drying down of wetlands, increased soil wetness) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Wetland Species (cont'd)	Vegetation Health	Change notification: Decrease of vigour class by less than 10% for 30% or more of population at subject sites compared to control sites.	Expand survey effort, confirm natural / operational causes.
		Early warning trigger: Decrease of vigour class by 10 - 20% for 30% or more of population at subject sites compared to control sites.	Follow-up, investigate climate variables / external factor. Review water flow mitigation.
		Management threshold: Decrease of vigour class by greater than 20% for 30% or more of population at subject sites compared to control sites.	If impacts (i.e., drying down of wetlands, increased soil wetness) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).
	Abundance of Non-native Invasive Species and Weeds	Change notification: % cover of non-native invasive species and weeds exceeds normal range compared to control sites by less than 10% (assumption of annual variation).	Expand survey effort, confirm natural / operational causes.
		Early warning trigger: % cover of non-native invasive species and weeds exceeds normal range compared to control sites by 10 - 20%.	Follow-up, investigate climate variables / external factors. Review water flow mitigation.
		Management threshold: % cover of non-native invasive species and weeds exceeds normal range compared to control sites by greater than 20%.	If impacts (i.e., drying down of wetlands, increased soil wetness) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Wetland Species (cont'd)	Abundance of Plant SOCC	Change notification: Decrease in single species plant SOCC abundance by less than 10% at subject or control site (assumption of annual variation.	Expand survey effort, confirm natural / operational causes.
		Early warning trigger: Decrease in single species plant SOCC abundance by 10-20% at subject or control site.	Compare with vegetation community community and health results for larger changes. Follow-up, investigate climate variables / external factor. Review water flow mitigation.
		Management threshold: Decrease in single species plant SOCC abundance by greater than 20% at subject of control site.	If impacts (i.e., drying down of wetlands, increased soil wetness, change to vegetation community) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).
	Wildlife Species		
	Wildlife Biodiversity	Change notification: Less than 10% change in proportion of species diversity (including SAR) compared to control sites.	Expand survey effort, confirm natural / operational causes.
		Early warning trigger: 10 - 20% change in proportion of species diversity (including SAR) compared to control sites.	Compare with vegetation community community and health results as indicator of habitat changes. Follow-up, investigate climate variables / external factor. Review water flow mitigation.
		Management threshold: Greater than 20% change in proportion of species diversity (including SAR) compared to control sites.	If impacts (i.e., drying down of wetlands, increased soil wetness, changes to vegetation community) to wetland are observed or are expected, review / implement changes to local water management (per proposed mitigation plan).

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Water	**Water Quality**		
	Water quality objectives set out in: Canadian Water Quality Guidelines for Protection of Aquatic Life (short-and-long-term), Manitoba Standards, Objectives, and Guidelines for the protection of Freshwater Aquatic Life (chronic and acute)	Change notification: Water quality data exceeds historical baseline.	Increase monitoring frequency as deemed adequate.
		Early warning trigger: Water quality data exceeds water quality objectives.	Increase monitoring frequency as deemed adequate, investigate variable and root-cause.
		Management threshold: Water quality data and duration of exposure exceeds water quality objectives.	If impacts (i.e., drying down of wetlands, increased soil wetness, changes to vegetation community) to wetland are observed or are expected, implement changes to local water management (per proposed mitigation plan).
	Water Quantity		
	Depth to groundwater table	Change notification: Less than 10% change at subject sites compared to control sites (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10 - 20% annual change at subject sites compared to control sites.	Review water flow mitigation and cross-reference with wetland form variables to confirm impact.
		Management threshold: Greater than 20% annual change at subject sites compared to control sites.	If impacts (i.e., drying down of wetlands, increased soil wetness, changes to vegetation community) to wetland are observed or are expected, implement changes to local water management (per proposed mitigation plan).

Functional Aspect	Variable	Standard / Benchmark	Exceedance Response
Water (cont'd)	Surface water depth and amplitude of seasonal change	Change notification: Less than 10% change at subject sites compared to control sites (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10 - 20% annual change at subject sites compared to control sites.	Review water flow mitigation and cross-reference with wetland form variables to confirm impact.
		Management threshold: Greater than 20% annual change at subject sites compared to control sites.	If impacts (i.e., drying down of wetlands, increased soil wetness, changes to vegetation community) to wetland are observed or expected, implement changes to local water management (per proposed mitigation plan).
	Soil moisture	Change notification: Less than 10% annual change (one moisture regime class[1]) at subject sites compared to control sites (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10 - 20% annual change (one to two moisture regime classes[1]) at subject sites compared to control sites.	Review water flow mitigation.
		Management threshold: Greater than 20% annual change (one to two moisture regime classes[1]) at subject sites compared to control sites.	Implement changes to local water management (per proposed mitigation plan).
Indigenous Cultural	Resource availability (e.g., medicinal plants, harvested wildlife species)	Change notification: Less than 10% change at subject sites compared to control sites (assumption of annual variation).	Follow-up, investigate climate variables / external factors.
		Early warning trigger: 10 - 20% annual change at subject sites compared to control sites	Review water flow mitigation.
		Management threshold: Greater than 20% annual change at subject sites compared to control sites.	Implement changes to local water management (per proposed mitigation plan).

Notes:

Moisture regime classification to follow Forest Ecosystem Classification for Manitoba (Zoladeski et. al, 1995)

4.2 Wetland Form Monitoring

Potential indirect effects of the Project on wetland form will be monitored yearly through a combination of in-field verification and remote sensing techniques (e.g., NDVI). Comparisons of changes in wetland form at subject sites will be made with control sites as well as at a regional level to assess for indications of flooding or drying impacts on wetlands.

4.2.1 Measurable Parameters

Proposed monitoring aspects for wetland form include checking for a change in wetland form in terms of the following parameters:

- wetland classification (using Canadian and/or Stewart and Kantrud (1971) classification as appropriate),
- total wetland area (using standard delineation techniques and air photo interpretation such as Alberta Wetland Policy directives),
- total vegetated zone area (using standard delineation techniques and air photo interpretation such as Alberta Wetland Policy directives [Government of Alberta, 2022]), and
- wetted soil extent (landscape soil moisture levels from remote sensing, NDVI techniques).

4.2.2 Benchmark

Change would be detected based on seasonal (typical spring to fall) differences relative to pre-construction conditions (Table 3-4). Larger shifts in water drainage patterns observed at monitored wetlands using these parameters may signal need for additional investigation and adaptive management. Landscape level changes in wetted soils, measured using remote sensing techniques could indicate larger scale changes to water drainage patterns than originally predicted, and need for more extensive change to operational management. Changes beyond the predicted zone to be impacted may indicate unanticipated effects that would require further investigation.

4.3 Groundwater Monitoring

Groundwater water quantity and quality will be monitored through a combination of in-field techniques (i.e., continuous probe readings) and water sample collection and analysis at a qualified laboratory (spring and fall sampling) in conjunction with the surface water monitoring to develop an understanding of the interface between these water sources in applicable wetlands. Comparisons of changes in groundwater quality and quantity at subject sites will be made with control sites to assess for indications of changes in groundwater flow and quality in wetlands in relation to flooding or drying impacts on wetland form and function.

4.3.1 Measurable Parameters

Proposed monitoring parameters for surface water include:

- amplitude of seasonal change in piezometric levels
- water quality (in-field measures and laboratory analysis as per Tables 12 and 13.

4.3.2 Methods

It is assumed that all the new groundwater monitoring wells outlined above will be installed one year prior to construction activities. Wells will only be installed in applicable wetland types where groundwater contributes to wetland characteristics/function (i.e., fens, swamps, Class III-V wetlands). The proposed groundwater monitoring plan for an initial duration of five years is as follows:

- Groundwater levels will be obtained from data loggers which will be installed in all monitoring wells. These loggers are to be downloaded three times a year for a duration of one year after installation. This will provide as baseline water level data against which future impacts on groundwater can be compared. For the remaining four years these loggers will continue to be downloaded about three times a year.
- Groundwater quality will be collected twice a year in all monitoring wells for a duration of one year after installation. This will provide a baseline groundwater quality data against which future impacts on groundwater can be compared. The groundwater quality parameters to be collected are as follows:
    - Field analysis of pH, EC, DO, and temperature.
    - Laboratory analysis of TSS, TDS, fluoride, nitrogen, phosphorous, sulfide, sulphate, sodium, chloride, iron, and general metals.

These wetlands have a predominantly groundwater recharge potential. It is understood that nested wells (i.e., one shallow and one deep well at the same location) are not required for the wetland monitoring.

It should be noted that turbidity can influence analytical results therefore low flow pumping techniques may be required.

Following the first year of monitoring a report summarizing these baseline water levels, and groundwater quality will be generated. At that time, the frequency of water level monitoring and groundwater quality sampling will be reassessed and refined, if required. In addition, the groundwater analytical suite will also be reviewed and refined, where necessary.

4.3.3 Standard

The standards for groundwater monitoring will be through comparison between subject and control sites, compared to the data collected regionally during previous groundwater monitoring studies and comparison to water quality objectives set out in the Canadian Water Quality Guidelines for Protection of Aquatic Life (short-and-long-term), and the Manitoba Standards, Objectives, and Guidelines for the protection of Freshwater Aquatic Life (chronic and acute) as outlined in Table 13.

4.4 Surface Water Monitoring

Surface water quantity and quality will be monitored through a combination of in-field techniques (i.e., continuous probe readings) and water sample collection and analysis at a qualified laboratory (spring and fall sampling). Comparisons of changes in surface water quality and quantity at subject sites will be made with control sites to assess for indications of changes in surface water flow and quality in wetlands in relation to flooding or drying impacts on wetland form and function.

4.4.1 Measurable Parameters

Proposed monitoring parameters for surface water include:

- amplitude of seasonal change in water levels
- water quality (in-field measures and laboratory analysis as per Tables 12 and 13).

4.4.2 Methods

Continuous sampling loggers would be installed at wetland locations in spring and data collected in fall during field surface water quality sampling visits. Typical parameters that can be monitored with probes include water level, pH, temperature, alkalinity, salinity, conductivity, and DO. Data can be downloaded on site at the end of the season or transmitted remotely with telemetry systems via satellite/cell connection. Continuous monitoring should be implemented prior to construction to gather site-specific baseline data and complement the surveyed data being completed as part of the Project AEMP.

Field water chemistry and soil moisture samples summarized in Table 14 would be collected in spring and fall field visits and submitted for laboratory analysis. Baseline water chemistry would be collected prior to construction at all wetland monitoring sites, in spring and fall, at least one year prior to construction. Baseline data collected within the RAA during the Project EIS assessed larger waterbodies; none of the monitoring wetlands were previously assessed for water quality (Figures 1A and 1B, Appendix 1). Where applicable, water quality monitoring parameters proposed in the Project AEMP to be tracked as part of water quality monitoring (Table 15) were incorporated into this WetMP to allow comparison to the surrounding waterbodies which may provide information on the function of wetlands in terms of biofiltration and importance to other ecological aspects such as fisheries.

The amplitude of seasonal change is best estimated using continuous water levels measurements from spring (April/May), immediately after snow melt, until fall (August/September), after late summer draw down. Most mineral wetlands (i.e., marsh and swamp) in Canadian prairie climates will exhibit some change in water level over the summer season due to climatic change (dry/wet cycles). Snow melt and summer precipitation will maintain water levels early in the summer, but evaporative losses in August and September will lower water levels, exposing shorelines. Peatlands (bogs and fens) will show similar changes in water levels within the peat, which can be detected from soil pits or perforated pipes created within the wetted area of a peatland. Significant change from those seasonal amplitudes could indicate flooding or drying impacts arising from the LMOC and LSMOC construction and operation.

Table 14: Summary of Surface Water Quality Parameters for Regional and Local Waterways in the Project EIS RAA1 (MI, 2020)

Parameter	Fairford River	Watchorn Bay	WatchornCreek	Birch Bay	Birch Creek	Lake St. Martin	Buffalo Creek	DauphinRiver	Sturgeon Bay
Water temperature(°C)	0 to 23.5	0.5 to 26.1	4.5 to 21.5	5.5 to 21.8	5.4 to 20.5	0 to 26	0 to 25	0 to 26	0 to 23.5
Laboratory pH	7.59 to 8.67	8.35 to 8.62	7.56 to 8.22	8.24 to 8.61	8.06 to 8.49	8.03 to 8.68	8.12 to 8.19	7.48 to 9.15	7.8 to8.60
Laboratory conductivity (µmho/cm)	898 to 2.000	604 to 886	561 to 841	813 to 917	667 to 857	857 to 1,310	217 to 237	767 to 3,630	410 to 1,100
DO (mg/L)	4.4 to 15.1	5.2 to 12.7	1.60 to 8.31	5.4 to 10.6	3.11 to 10.04	6.1 to 14.4	6.4 to12.2	1.1 to 7.1	7.2 to 16.7
TSS (mg/L)	< 2.0 to 44	1 to 51	< 2.0 to 4	3.6 to 10.4	< 2.0 to 6.4	< 2.0 to 47	< 2.0 to 6.0	< 2.0 to 69	< 2.0 to 28
TDS (mg/L)	508 to 1.480	373 to 532	358 to 511	488 to 532	436 to 549	488 to 772	164 to 177	240 to 1,470	230 to 756
Hardness(CaCO3) (mg/L)	203 to 348	229 to 322	316 to 476	196 to 270	419 to 526	224 to 350	155 to 166	178 to 358	149 to 324
Total nitrogen(mg/L)	0.64 to 2.96	0.87 to 2.6	1.22 to 2.12	0.82 to 2.18	1.36 to 2.55	0.40 to 2.33	0.76 to 1.15	0.34 to 2.51	0.35 to 1.38
Total phosphorus(mg/L)	0.002 to 0.045	0.008 to 0.089	0.032 to 0.082	0.014 to 0.027	0.016 to 0.073	0.010 to 0.054	< 0.010 to 0.026	0.002 to 0.070	0.012 to 0.108
Chlorophyll a (µg/L)	<0.50 to 19.5	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	<0.50 to 9.16	0.37 to 0.52	0.47 to 9.0	0.13 to 14.7
E. coli (CFU/100 mL)	1 to 461	<1 to 114	20 to <100	1 to 613	11 to 249	Not Detected	Not Analyzed	1 to 100	Not Detected
Petroleum hydrocarbons	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Detected	Not Detected	Not Detected	Not Analyzed

Note:

Including Data Provided by Manitoba Environment, Climate and Parks.

Table 15: Project EIS Proposed Water Quality Monitoring Parameters

Category	Water Quality Parameters
Field Parameters	DO; E.C.; Oxidation Reduction Potential; pH; Temperature; Turbidity
General Chemistry	Alkalinity, Bicarbonate (as $CaCO_3$); Alkalinity, Carbonate (as $CaCO_3$); Alkalinity, Hydroxide (as $CaCO_3$); Alkalinity, Total; Hardness (as $CaCO_3$), Total Dissolved Solids; Chloride; Fluoride
Sediment	Total Suspended Solids
Microbiological Parameters	E.coli; Fecal Coliforms
Nutrients/Carbon	Ammonia (as N); Nitrate (as N); Nitrite (as N); Total Kieldahl Nitrogen; Nitrogen (total); Phosphorus; Total Phosphorus; Total (Dissolved) Phosphorus; Phosphorus, Total (Particulate); Phosphorus (PO_4), (dissolved and reactive); Dissolved Organic Carbon: Dissolved Inorganic Carbon; Total Organic Carbon; Total Inorganic Carbon
Petroleum Hydrocarbons	BTEX; Hydrocarbons
Metals	Standard Total/Dissolved Meals Scan (including Mercury)
Pesticides	Glyphosate; Organochlorinated

4.4.3 Standard

The standards for surface water monitoring will be through comparison between subject and control sites, compared to the data collected regionally during previous studies as outlined in Table 14 and comparison to water quality objectives set out in the Canadian Water Quality Guidelines for Protection of Aquatic Life (short-and-long-term), and the Manitoba Standards, Objectives, and Guidelines for the protection of Freshwater Aquatic Life (chronic and acute) as outlined in Table 13.

4.5 Vegetation Community Composition (Vascular and Non-vascular) and Wetland Vegetation SOCC Monitoring

Vegetation community composition for vascular and non-vascular plants and the presence of plant SOCC will be monitored in-field via spring and fall surveys. Comparisons of changes in vegetation composition, vigor, non-native invasive species and weeds and presence of plant SOCC at subject sites will be made with control sites to assess for indications of changes in vegetation cover in wetlands in relation to changes in surface and / or groundwater that may be associated with flooding or drying impacts on wetland form and function.

4.5.1 Measurable Parameters

To gain a broader understanding of potential effects on wetland vegetation communities, it is proposed that indicator species functional groups be utilized to aid in tracking changes to vegetation species richness, diversity and health. It should also be noted that SOCC species are often difficult to detect and abundance can fluctuate yearly as many species required specific habitat requirements. Proposed monitoring parameters include:

- proportion of indicator species functional groups (as a measurement of species richness and diversity)
- tree vigour (as a measurement of vegetation health)
- ingress of non-native invasive species and weeds (as a measurement of vegetation health)
- presses/abundance of plant SOCC overtime (if detected) (as a measurement of furcation of species richness and diversity)

4.5.2 Methods

4.5.2.1 Indicator Species and Non-native Invasive Species and Weeds Species

Species composition will be recorded through the use of a nested plot design, recording species name, strata, vigour on a 5 point scale, and % cover. Data collected will be analyzed to determine the percent cover of non-native invasive species and weeds. Species richness and diversity will be assessed statistically using the plant lists assembled. Finally, impacts on wetland vegetation community composition as a result of decrease or increase in moisture or nutrients will be assessed using indicator species functional groups. For example, in fen type wetlands, three functional groups could be used: wet forb, wet-rich bryophyte and dry bryophyte. Species in each functional group will be driven by observations during baseline monitoring data collection, but may include some or all of the species listed below.

1. Vascular plants are assigned to the wet forb group if a strong preference for wet habitats is indicated in the literature, and if they are categorized as “obligate wetland” species (i.e., hydrophytes that almost always occur in wetlands) in the PLANTS database (USDA NRCS 2018), which may include but not be limited tog: marsh-marigold (*Caltha palustris*), marsh cinquefoil (*Comarum palustris*), marsh willowherb (*Epilobium palustre*), swamp horsetail (*Equisetum fluvatile*), tufted loosestrife (*Lysimachia thyrsiflora*), buck-bean (*Menyanthes trifoliata*), dock species (*Rumex* sp.), scheuchzeria (*Scheuchzeria palustris*), seaside arrow-grass (*Triglochin maritima*), flat-leaved bladderwort (*Utricularia intermedia*) and small bladderwort (*Utricularia minor*).

2. Bryophytes are assigned to the dry bryophyte group if their distribution is limited to hummock microhabitats (Vitt and Lüth, 2017) and may include but not be limited to: *Aulacomnium palustre, Calypogeia sp., Calypogeia sphagnicola, Cephalozia connivens, Cephalozia lunulifolia, Cephalozia pleniceps, Cephalozia sp., Dicranum polysetum, Dicranum undulatum, Hylocomnium splendens, Pleurozium schreberi, Polytrichum strictum, Ptilium crista-castrensis, Sanonia uncinata, Sphagnum capillifolium, Sphagnum fuscum, Sphagnum girgensohnii, Tomentypnum falcifolium, Tomentypnum nitens.*

3. Bryophytes are assigned to the wet-rich bryophyte group if their distribution is limited to lawn, carpet and pool microhabitats in moderate-rich and extreme rich fens (Vitt and Lüth 2017) and may include but not be limited to: *Aneura pinguis, Calliergon cordifolium, Calliergon giganteum, Calliergon richardsonii, Calliergon trifarium, Calliergon sp., Drepanocladus aduncus, Drepanocladus sp., Hamatocaulis vernicosus, Limprichtia cossonii, Limprichtia revolvens, Lophozia rutheana, Meesia triquetra, Meesia uliginosa, Paludella squarrosa, Plagiomnium ellipticum, Sarmentypnum tundrae, Sphagnum contortum.*

Due to the difficult nature of field identification of bryophytes, field assessors should be encouraged to carry and be familiar with reputable guides during assessments. Crews should also be equipped for the potential to collect voucher specimens outside plots for species confirmation by bryophyte specialists following fieldwork.

4.5.2.2 Tree Vigor

Tree vigour assessments will incorporate the examination of 10 trees for up to two dominant species in treed wetlands. These trees will be marked and their GPS location recorded. Trees will be assigned a qualitative or quantitative ranking of vigour on a five-point scale and photographed for comparison across monitoring years.

4.5.2.3 Plant SOCC

Three wetland-dependant plant SOCC were observed in the LMOC and/or LSMOC PDA during previous surveys and were predicted to be affected by changes to the water regime in wetlands adjacent to the channels (e.g., flooding or drying of upland or wetland habitat). These species may also be present in the Modified LAA.

Baseline Monitoring

Rare plant occurrence at monitoring sites within the Modified LAA will be surveyed during the initial baseline monitoring visits (spring and fall). Subsequent monitoring can be adjusted based on the presence (or non-detection) of these or other plant SOCC. Rare plant surveys would follow standardized methodologies such as those outlined by the Alberta Native Plant Council (2012). Any plant SOCC observed would be identified visually, photographed, location recorded by GPS, and flagged / marked to allow repeated visits to the same location.

Monitoring During Construction and Post-Construction

For any monitoring sites at which plant SOCC are identified during the initial baseline monitoring, populations will be checked to confirm they are maintained during construction and operational phases of the Project. While populations may vary in size from year to year, changes in vigour and population size may indicate unanticipated ecological changes. Protocols such as those outlined by Elzinga, Salzer and Willoughby (1998) would be utilized to assess rare plant vigour and condition.

4.5.3 Benchmark

The benchmark for vegetation community monitoring will be through comparison between subject and control sites of similar wetland types, through a review of changes over time and to data collected during previous studies (e.g. 2020 Plant SOCC survey), as outlined in Table 13 and other planned monitoring programs for the Project.

4.6 Wildlife Biodiversity, Habitat and Wetland Dependent Wildlife SAR Monitoring

Monitoring for wildlife biodiversity (i.e., amphibians, migratory songbirds, and marsh birds) and for wetland-dependent wildlife SAR including species such as the yellow rail, least bitten and northern leopard frog will be completed at all the proposed control and subject wetland monitoring sites as identified in Table 12 and 13. Given the low density of rare species, monitoring will help confirm presence, and sustained use post-construction. Given the anticipated rarity of wildlife SAR within the modified LAA, biodiversity has been included as a monitoring parameter.

Section 2.2.2 identifies the anticipated impacts on the wetlands within the LMOC and LSMOC study areas. To gain a broader understanding of potential effects on wetland wildlife biodiversity and habitat it is proposed that key indicator species functional groups be utilized to aid in tracking changes to species riches and diversity. Species within a key indicator species functional group that are not a SAR and can be recorded with an autonomous recording units (ARU) will be considered if detections of SAR are minimal. The key indicator species functional groups will be identified that represent similar habitats to the three wildlife SAR species and will be included in the ARU analysis. Wildlife SAR species are often difficult to detect due to their rarity, mobility and requirements of specific habitat requirements. As such, the proposed monitoring parameters include:

- proportion of indicator species functional groups (measurement of songbirds and marsh birds as indictors of species richness and diversity). Note, if detected, wildlife SAR presence data would inform diversity measure
- vegetation community monitoring data combined with general habitat assessment (measurement for wildlife habitat suitability)

4.6.1 Methods

4.6.1.1 Wildlife Biodiversity and SAR Inventories at Impact and Subject Sites

Bird diversity (including songbirds and some waterbirds) and SAR occurrence will be determined through the use of ARU (e.g., Wildlife Acoustics Song Meters SM3 and SM4 [Wildlife Acoustics, 2020]). ARUs can be effective in detecting secretive marsh bird species and species rare across the landscape, particularly when attempting to optimize spatial and temporal coverage (Sidie-Slettedahl et al., 2015). ARUs will be deployed in the monitored wetlands during the peak breeding periods, and ARUs will be pre-programmed to collect daily recordings during peak calling periods for the respective SAR. Habitat descriptions at each site will be recorded and supplemented by data collected as part of the vegetation monitoring component of the WetMP, in order to record and track changes to vegetation communities which are indicative of potential changes to wildlife habitat, in particular for SAR. Specifically, during ARU establishment, habitat types around the unit will be described to confirm the habitats from which the multidirectional ARU microphone is recording.

Upon retrieval of the ARUs, the data files will be processed through a review of segments of the data to by a qualified biologist to assess biodiversity through the use of commercial software (e.g., Kaleidoscope Pro [Wildlife Acoustics, 2020]). A basic cluster analysis will be used to focus on the three wildlife SAR using sound files for the species of interest using a reference library. A qualified biologist will review and validate a sample of the results for false-negative and false-positive results.

Surveys will occur at the proposed control and subject wetland monitoring sites over the initial timeline, as described for other parameters in this WetMP (i.e., including groundwater and surface water parameters, vegetation, and wetland class) with an initial baseline year followed by five years of monitoring. Many marsh water birds have low detection rates, requiring several repeat visits to many survey sites to obtain sufficient data for statistical modelling (Tozer et al., 2006, 2016; Steidl et al., 2013). The initial sampling design can be reviewed after each year of sampling, to assess the need for adjustments, particularly if no SAR are detected at sites over several years. Survey periods, timing and frequency for SAR will follow those outlined in the Project Wildlife Management Plan (MTI 2022e) for continuity as summarized in Table 16.

Table 16: Wetland Species at Risk Survey Criteria (MTI 2022e)

Target Species	Survey Period	Survey Timing	Frequency
Least Bittern	Mid-May to early July	Sunrise to 4.5 h after sunrise	Daily
Yellow Rail	Mid- to late-May until mid-July	23:00 – 0300 h	Daily
Northern Leopard Frog	Early April until late-May	22:00 to 0300 h	Daily

4.6.1.2 Wildlife Habitat Suitability

Wildlife habit suitability will be monitored through information collected from the vegetation community composition monitoring combined with general habitat site characterization collected during ARU setup for diversity surveys, indirectly through the presence and continued use of sites by wetland-dependent wildlife SAR and information collected through other monitoring programs (e.g. Project WMP). The anticipated potential for detecting SAR is low; therefore, the BACI design will not be applicable to address potential effects on SAR. Any changes in form and function of the wetland will be considered as an assessment of habitat changes for SAR. Further opportunities to study habitat changes along the gradient using remote sensing techniques may be explored in the future. The purpose of the wildlife SAR component along with the other assessments included in the WetMP is to provide integrated monitoring with respect to indirect effects, in this case, habitat, and to measure the effectiveness of mitigation measures and follow-up.

4.6.2 Benchmark

The benchmark for wildlife diversity and habitat suitability will be through comparison between subject and control sites of similar wetland types, through review of changes over time and to data collected during previous studies (e.g. 2020 Bird SAR survey), as outlined in Table 13 and other planned monitoring programs for the Project.

4.7 Baseline Site Conditions

Baseline soil conditions (moisture, texture, type, and horizon depths) and chemistry (metals, nutrients) would be collected at initial monitoring site set-up, to characterize contextual factors that could influence soil drainage, or water chemistry. Other contextual factors, including land use (% disturbed area, linear density) would be determined from existing mapping information, within 500 m of each wetland site.

4.8 Indigenous Monitoring Involvement

Concerns about potential impacts on resources harvested for Indigenous cultural purposes have been discussed during Indigenous consultation conducted by Manitoba Transportation and Infrastructure. For example, Section 8.2.4.5 of the Project EIS identified that Indigenous rights-holders (Fisher River Cree Nation, Lake St. Martin First Nation, Black River First Nation) have indicated concerns over potential effects on the Buffalo Lake bog and creeks intersected by the LMOC and LSMOC from changes in drainage patterns in local wetlands. Specific resources have not yet been identified and in some cases, may be culturally sensitive or confidential, such that collection of information on the resources of concern cannot be easily integrated into this WetMP. However, by partnering with Indigenous monitoring personnel from interested Nations, there is an opportunity to build shared understanding of any observed changes to the monitored wetlands. That shared understanding, in turn, can help identify meaningful thresholds and benchmarks for change, particularly for those resources with seasonal variation and limited baseline information (e.g., groundwater and surface water levels, SAR, rare plants and culturally important plants or wildlife). The EAC will also be involved in the by facilitating discussions between Indigenous rights-holders and Manitoba Transportation and Infrastructure.

Indigenous cultural uses can be included in this program by recruiting traditional land use monitors from interested groups to assist in site monitoring activities. Working with Environmental Monitors would facilitate sharing of information, and discussion that can lead to mitigations based on findings from the Western scientific and Indigenous monitoring programs.

4.9 Analysis

Data analysis will include both quantitative / statistical analysis and comparison against identified criteria. Where possible, quantitative parameters were included in the study design, to facilitate statistical comparison (1) over time (before and after construction) and (2) within a given year (control and impact sites). This approach will help to differentiate seasonal or annual changes from Project impacts and help explore linkage to other quantitative influencing factors (e.g., annual precipitation and temperature patterns can influence evaporative loss from wetlands).

Quantitative thresholds included legislated standards (e.g., for water quality) and more subjective criteria for an acceptable degree of change (e.g., proportional changes from baselines and/or controls for water levels). In the case of subjective criteria, selection of appropriate cut-off points was somewhat arbitrary, and linked to perceived management objectives. Ideally, change would be compared to a long-term baseline that would identify the degree of annual or seasonal fluctuation. In this case, baseline data may be limited (e.g., for surface and groundwater levels and quality), and comparison to long term, pre-construction patterns will not be possible. Inclusion of control and impact sites is intended to compensate for this data gap, facilitating checks for effects of higher or lower precipitation or temperatures in a given year. The cut-off points do not necessarily reflect natural variation, and may require adjustment to reflect observed changes, including indirect effects on other ecological functions (e.g., vegetated wetland area, rare or cultural plant abundance).

Overall, the annual analysis over the early years of post-construction is structured to inform changes to criteria and cut-off points, and adjustments will be made, informed by observations and analysis. Analysis will aim to facilitate adaptive management, and observations will build on information collected over the initial five-year period of post-construction operation. As the effectiveness of mitigation measures to reduce indirect effects on wetlands becomes clearer, sampling parameters and frequency as well as associated thresholds and benchmarks may be periodically adjusted. An annual review of the WetMP results with stakeholder advisory committees, including an EAC, would be helpful in adjusting subjective benchmarks that are indicative of meaningful change, and to develop collaborative mitigation approaches, if adjustments are necessary.

For statistical analyses, quantitative data will be assessed between years (before and after construction) and within years (control and impact), using t-test comparisons for each sampling event. Specifically, analysis would compare the following data sets:

- **Between year comparisons:** Baseline replicate years (pre-construction) against post construction replicate years.
- **Within year comparisons:** Impact and control sites would be compared for the respective year of monitoring.

Any changes between years will be evaluated against potential environmental influences (e.g., annual precipitation, temperature) to determine if the observed change can be explained by the Project, or other confounding, natural factors. Observed changes will also be explored to identify other indirect effects caused by interaction amongst parameters (e.g., surface water level and vegetated area within the monitored wetland).

4.9.1 Adaptive Management

As previously mentioned, an adaptive management approach will be implemented as part of the WetMP. Under this approach the monitoring program will:

1. define the area of potential and measurable indirect effects;
2. design a sampling program within that zone to assess effects;
3. if there is a measurable and significant effect that is determined to be caused by the Project (as per Table 3-4), then take the following steps:
    a. assess measurable parameters and revise/refine if required;
    b. consider expanding the monitoring to further define the effect (e.g., establishment of additional monitoring sites further afield in a selected wetland complex);
    c. refine existing mitigation or develop new measures;
    d. if mitigation measures are ineffective with respect to reducing effects to or below a defined threshold/benchmark, then consideration may be given to other approaches (e.g., restoration or enhancement activities or additional rehabilitation measures)

[1] Note that for the few sites in larger waterbodies, only the between year comparisons will be possible, as there is no paired impact and control site available for these waterbodies.

4.10 Schedule

Although monitoring sites were selected near areas where surface water, groundwater, wetland vegetation and wildlife surveys have previously been completed for the Project, to facilitate their use as baseline comparators, wetland monitoring sites will be effectively established as new survey locations. In the case of groundwater monitoring wells, most of the previous sites will be removed during construction and new monitoring wells will be developed within the Modified LAA. Ideally, at least one year of pre-construction data should be collected from the newly established wetland monitoring sites allowing collection of one complete year of spring and fall data, prior to construction.

Tree clearing for the Project is proposed to begin in fall 2022, assuming all Project approvals are secured in summer 2022. Channel construction would then commence, with sequencing of LMOC and LSMOC infrastructure yet to be determined (assuming two years construction). Accordingly, additional baseline data could be collected from areas not yet constructed in 2023, while monitoring can also track change during construction, facilitating adaptations during the construction phase. Post-construction monitoring may thus start in different years for the LMOC and LMOC Projects. As noted above, five years of during/post-construction monitoring would be conducted, with an option for additional years, based on program findings.

The proposed monitoring schedule thus would ideally be as follows:

- Baseline monitoring and monitoring site establishment: Pre-construction (spring/fall)
- Year 1 (baseline/during-construction): April/May (spring) and August/September (fall)
- Year 2 (baseline/during construction): April/May (spring) and August/September (fall)
- Year 3 (post-construction): April/May (spring) and August/September (fall)
- Year 4 (post-construction): April/May (spring) and August/September (fall)
- Year 5 (post-construction): April/May (spring) and August/September (fall)

4.11 Reporting

Annual workplans will be developed prior to each monitoring season. If benchmarks were exceeded in the preceding monitoring year and the need for adaptive management (including modifications to the monitoring program, and development and implementation of additional mitigation) was identified, then monitoring activities and workplans would be adjusted accordingly. This iterative approach of advising Manitoba Transportation and Infrastructure in the development of adaptive management measures will apply to the construction phase in particular, and possibly during the operations phase.

The report that documents the methods, results, discussion and further recommendations (adaptive management requirements) will be produced by the consultant and reviewed by Manitoba Transportation and Infrastructure within one year of completion of the field studies conducted in that particular year. If the subsequent year involves field studies, the reports will be completed and reviewed at least two months prior to the field season to allow for informative planning of activities to be implement for that year. Reports will provide the following information:

- the objective of the particular study
- methods, including a description of any departure from the methods set out in the WetMP or additional details
- results of the study and comparison to pre-Project conditions, where applicable
- comparison to previous monitoring results, where relevant
- comparison to benchmarks set out in the WetMP
- a discussion of results in comparison to anticipated effects identified during the environmental assessment, indicating whether unanticipated changes may be occurring
- recommendations for modifications to the monitoring program, if any

A synthesis report describing wetland monitoring results will be prepared by the consultant for Manitoba Transportation and Infrastructure's review after two cycles of monitoring related to channel construction and/or operation have been completed. The synthesis will include:

- a summary of monitoring studies and results completed to date, including in relation to the magnitude of flood events
- comparison of monitored parameters pre and post-Project, and in reference to anticipated environmental effects
- a comparison to management thresholds, where relevant

- a discussion of the overall changes observed as a result of the Project
- a description of recommended and/or implemented changes to mitigation measures
- recommendations for future monitoring

Final annual and synthesis reporting will be shared with the EAC on an annual basis. Manitoba Transportation and Infrastructure will meet regularly with the EAC to provide updates on the WetMP.

5.0 IMPLEMENTATION CONSIDERATIONS

Implementation of this plan was based on certain assumptions regarding data management and construction scheduling. Considerations included:

- Need for at least one year of baseline (pre-construction) monitoring at all monitoring sites. Groundwater well establishment and site characterization should begin in spring in the year prior to construction, to collect one complete spring to summer season of baseline data.
- Access to monitoring sites will improve post-construction, as travel will be possible along the channel berms and Project access roads. Any baseline or early construction monitoring would require remote access (e.g., helicopter). Specific monitoring sites would be accessed through natural vegetation in most cases.
- To facilitate data storage, Manitoba Transportation and Infrastructurewill develop a database that will serve as a data warehouse for compiling and managing data over the full monitoring period. Manitoba Transportation and Infrastructure control over this data will ensure consistency in data collection, data entry and data analysis, which will be key for multi-year comparisons.
- The WetMP has assumed a list of parameters that would be measured with standardized field samples (e.g., for water quality), including field and/or trip blanks for quality control. While some flexibility is planned within the scope of assessment, to adjust sites and parameters to best detect and track changes associated with the LMOC and LSMOC Project, the methods of analysis, and data collection should remain consistent, if possible, to facilitate comparisons between years. Remote monitoring probes, the analytical laboratory, and general timing of collection can introduce other sources of variability, and thus should not change without incorporating comparison samples.
- This plan recommends a minimum five years of consistent monitoring, with the potential to extend monitoring longer, should impacts be detected. Conversely, specific parameters could be deleted from the program if, over time, change is not detected. Such adjustments should be considered on a case-by-case basis, as part of annual reporting and review as per an adaptive management approach.

Next steps in planning will include logistical arrangements, including selection of a contractor for baseline data collection and initial monitoring site set-up, development of a centralized database for data management, and procedures for data input and maintenance, including quality checks.

6.0 REFERENCES

AMBI (Alberta Biodiversity Monitoring Institute). 2016. *Knowledge Requirements – An integrated Wetland Monitoring Program for Alberta's Oil Sands Region, Program Goals, Questions, and Monitoring Approach.* ABMI. Accessed at: https://ftp-public.abmi.ca/home/publications/documents/449_Roy_etal_2017_RecommendationsForAnIntegratedWetlandMonitoringProgramAlbertaOSR_ABMI.pdf.

Alberta Native Plant Council.2012. ANPC Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. Alberta Native Plant Council. Accessed at: http://www.anpc.ab.ca/content/resources.php.

Cobbaert, D. 2017. Background on OSM wetland monitoring Program development. Webinar presentation, October 25, 2017. Alberta Environment and Parks, Environmental Monitoring and Science Division.

Comer, P.J. D. Faber-Langendoen, S. Menard, R. O'Connor, P. Higman, Y.M. Lee, and B. Klatt. 2017. *User Guide for Wetland Assessment and Monitoring in Natural Resource Damage Assessment and Restoration.* Prepared for DOI Natural Resource Damage Assessment and Restoration Program. NatureServe, Arlington, VA.

Cowardin, L.M., Carter, V., Golet, F.C. and L. Roe, E.T. 1979. Classification of wetlands and deepwater habitats of the United States. US Department of the Interior, Fish and Wildlife Series, Washington, DC, Jamestown, ND, Northern Prairie Wildlife Research Center. Accessed at: http://www.npwrc.usgs.gov/resource/wetlands/classwet.

Drake, K., Frey, M., Hogan, D. and R. Hedley. 2016. Using Digital Recordings and Sonogram Analysis to Obtain Counts of Yellow Rails. *Wildlife Society Bulletin 40*(20:346-354.

Eaton, B. and Charette, T (2017). *Drivers, stressors, and indicators of wetland change in Alberta's Oil Sands Region – potential for use in wetland monitoring.* Alberta Innovates – Technology Futures.

Elzinga, C.L., Salzer, D.W., and Willoughby, G.W. 1998. *Measuring and Monitoring Plant Populations.* United State, Bureau of Land Management: National Applied Resource Science Centre. Accessed at: https://archive.org/details/measuringmonitor05elzi.

Environment Canada. 2013a. Management Plan for the Yellow Rail (Coturnicops noveboracensis) in Canada. Species at Risk Act Management Plan Series. Environment Canada. iii + 24. Accessed at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/management-plans/yellow-rail-2013.html#_docInfo.

Environment Canada. 2013b. Management Plan for the Northern Leopard Frog (Lithobates pipiens), Western Boreal/Prairie Populations, in Canada. Species at Risk Act Management Plan Series. Environment Canada. iii + 28 pp. Accessed at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/management-plans/northern-leopard-frog-2013.html#_docInfo.

Government of Alberta. 2022. Alberta Wetland Policy Implementation. Guidance documents available at: https://www.alberta.ca/alberta-wetland-policy-implementation.aspx.

Government of Canada. 2018a. Species Profile – Least Bittern. Accessed at:: https://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=51.

Government of Canada. 2018b. Species Profile - Northern Leopard Frog Western Boreal/Prairie Populations. Accessed at: https://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=552.

KGS Group. 2019. *Lake St. Martin Outlet Channel Preliminary Design Geotechnical Data Report.* Draft – REV A. October 2019.

KGS Group. 2021a. Memorandum. Preliminary Hydraulic Design of the LSMOC Outside Drain. Rev 0.

KGS Group. 2021b. Lake St. Martin Outlet Groundwater Water Levels Assessment – Final Rev 0. July 29, 2021.

KGS Group 2021c. Lake St. Martin Outlet Groundwater Quality Assessment – Final July 28, 2021.

Manitoba Agriculture and Resource Development. 2021a. Vascular and Non-vascular Plant List - Manitoba Conservation Data, Wildlife, Fisheries and Enforcement Branch. Accessed at: http://www.manitoba.mb.ca/fish-wildlife/cdc/pubs/plant-list-mbcdc-2021-nov.pdf.

Manitoba Agriculture and Resource Development 2021b. Animal List - Manitoba Conservation Data, Wildlife, Fisheries and Enforcement Branch. Accessed at: https://gov.mb.ca/fish-wildlife/cdc/pubs/animal-list-mbcdc-2021-nov.pdf.

Manitoba Conservation and Climate and Manitoba Agriculture and Resource Development (n.d.). Wetland Classification Key. Accessed at: https://www.gov.mb.ca/sd/pubs/water/water_rights/mb_wetlands_classification_key.pdf.

MI (Manitoba Infrastructure) 2020. Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. March 9, 2020.

Manitoba Infrastructure. 2022a. Lake Lake Manitoba Lake St. Martin Outlet Channels Project: Aquatic Effects Monitoring Plan. Prepared by North/South Consultants. June 2022.

MTI (Manitoba Transportation and Infrastructure). 2022b. Lake Manitoba and Lake St. Martin Outlet Channels Project.Groundwater Management Plan. June 2022.

MTI (Manitoba Transportation and Infrastructure). 2022c. Lake Manitoba and Lake St. Martin Outlet Channels Project. Surface Water Management Plan. June 2022.

MTI (Manitoba Transportation and Infrastructure). 2022d. Lake Manitoba and Lake St. Martin Outlet Channels Project. Wetland Compensation Plan. June 2022.

MTI (Manitoba Transportation and Infrastructure). 2022e. Lake Manitoba and Lake St. Martin Outlet Channels Project.Wildlife Management Plan. June 2022.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 pp.

Nature Serve Explorer. 2022. *Statuses.* Accessed at: https://explorer.natureserve.org/AboutTheData/Statuses.

Sidie-Slettedahl, A., K. Jensen, R. Johnson, T. Arnold, J. Austin, and J. Stafford. 2015. Evaluation of autonomous recording units for detecting 3 species of secretive marsh birds. *Wildlife Society Bulletin 39*(3): 626-634.

Smith, R.E., Veldhuis, H., Mills, G.F., Eilers, R.G., Fraser, W.R. and Lelyk, G.W. 1998. *Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba. An ecological stratification of Manitoba's Natural Landscapes.* Technical Bulletin 1998-9E. Agriculture and Agri-Food Canada. Brandon, MB.

Stantec (Stantec Consulting Ltd.). 2021a. Lake Manitoba Outlet Channel 2019 Surface Water and Groundwater Monitoring Report. Prepared by Stantec Consulting Ltd. for Hatch Ltd.

Steidl, R. J., C. J. Conway, and A. R. Litt. 2013. Power to detect trends in abundance of secretive marsh birds: effects of species traits and sampling effort. *Journal of Wildlife Management 77*:445-453.

Stewart, R.E. and H.A. Kantrud. 1971 Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

Tozer, D. C., K. F. Abraham and E. Nol. 2006. Improving the accuracy of counts of wetland breeding birds at the point scale. *Wetlands 26*:518-527.

Tozer, D. C., K. L. Drake, and C. M. Falconer. 2016. Modelling detection probability to improve marsh bird surveys in southern Canada and the Great Lakes states. *Avian Conservation and Ecology 11*(2):3.

Underwood, A.J. 1992. Beyond BACI: the detection of environmental impacts on populations in the real, but variable, world. *Journal of Experimental Marine Biology and Ecology* 161(2): 145-178.

USDA NRCS (United States Department of Agriculture, Natural Resources Conservation Service). 2018. The PLANTS Database Available at: http://plants.usda.gov. National Plant Data Team, Greensboro, NC 27401-4901 USA. Accessed April 2022.

Vitt, D.H. and M. Luth. 2017. A Guide to Mosses and Liverworts of Alberta Peatlands. NAIT Boreal Research Institute. 141 pp.

Warner, B.G. and Rubec, C.D.A. (eds.) 1997. The Canadian Wetland Classification System, 2nd Edition. Wetlands Research Centre, University of Waterloo, Waterloo, ON Canada. 68 pp.

Wildlife Acoustics (2020). Song meter SM4 bioacoustic recorder user guide. https://www.wildlifeacoustics.com/uploads/user-guides/SM4-BAT-FS-USER-GUIDE-20200116.pdf. Accessed October 2020.

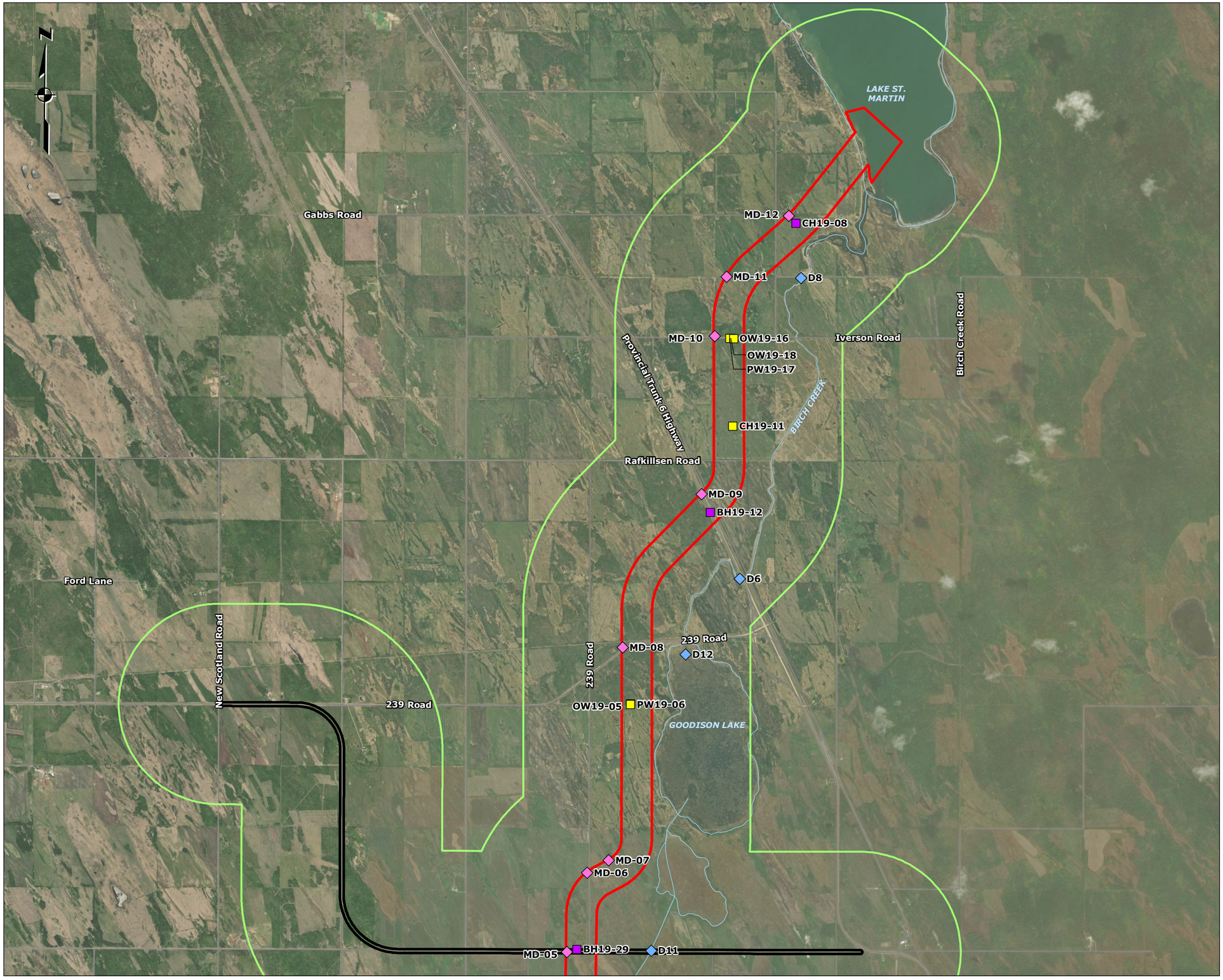
Wulder, M. and Nelson, T. 2003. EOSD Land Cover Classification Legend Report. Version 2. NRCAN, Canadian Forest Service. Victoria, BC.

WSP Canada Inc. 2020. Lake Manitoba and Lake St. Martin Outlet Channel Project. Preconstruction Environmental Field Work – Wetlands (CONS15843).

Zoladeski, C.A., Wickware, G.M., Delorme, R.J., Sims, R.A., Corns, I.G.W. 1995. Forest Ecosystem Classification for Manitoba. Special Report 2. Natural Resources Canada.

APPENDIX 1

Map Figures



Legend

- Groundwater Quality Sites (2019)
- Groundwater Quality Sites (2019, 2020, 2021)
- Suface Water Quality Sites (2019, 2020, 2021)
- Suface Water Quality Sites (2021)
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology



Manitoba

Figure 1A: Past Water Monitoring Sites - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

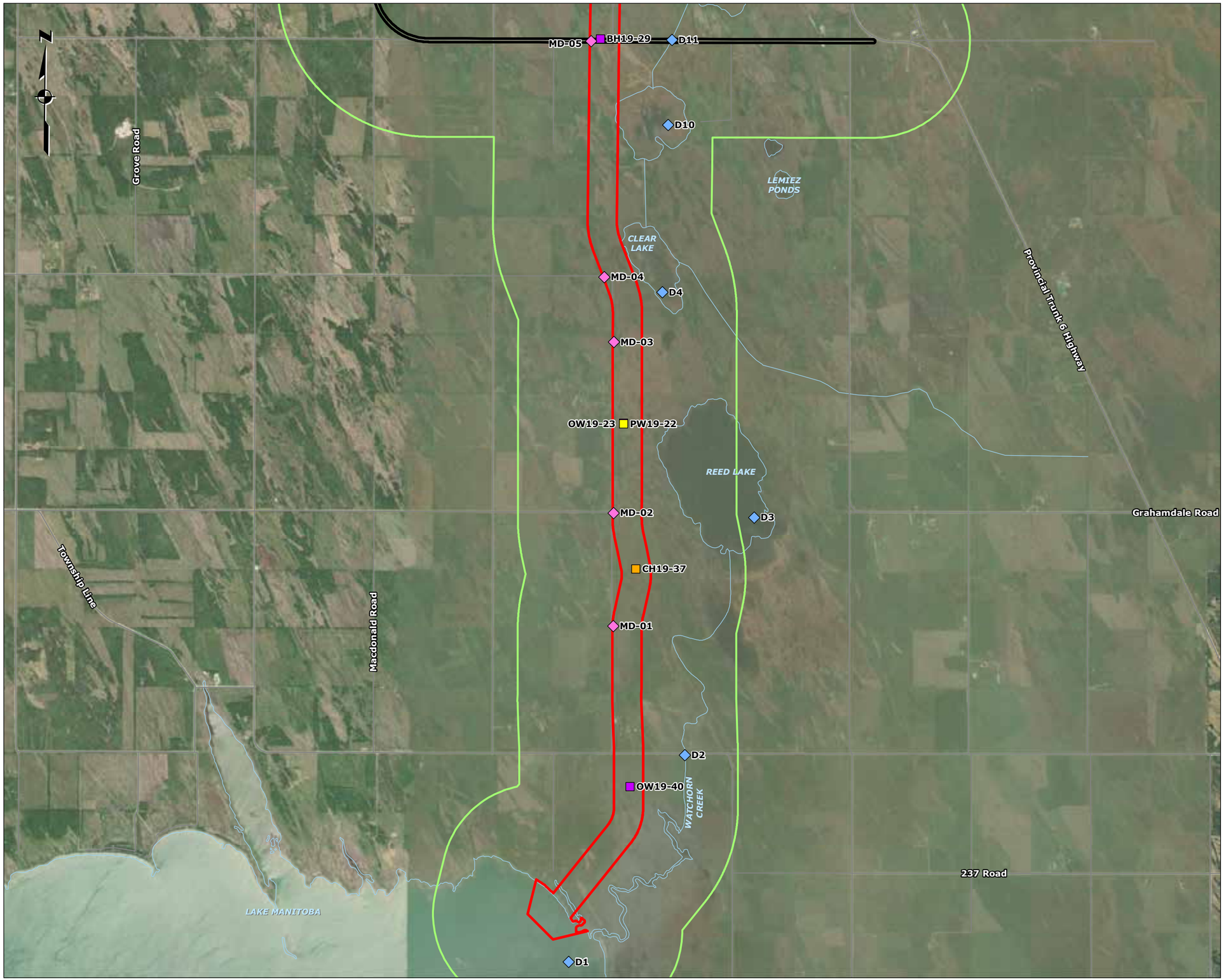
Universal Transverse Mercator (Zone 14)
North American Datum (1983)

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Report By: DS
Drawn by: JH
Reviewed By: KT

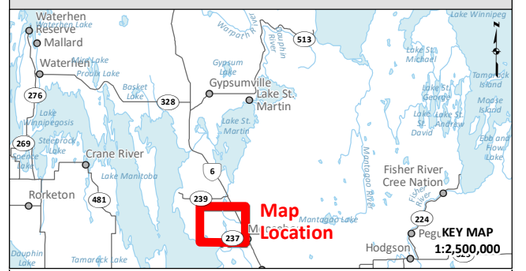
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Groundwater Quality Sites (2019)
- Groundwater Quality Sites (2019, 2020)
- Groundwater Quality Sites (2019, 2020, 2021)
- Suface Water Quality Sites (2019, 2020, 2021)
- Suface Water Quality Sites (2021)
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology



Manitoba

Figure 1B: Past Water Monitoring Sites - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

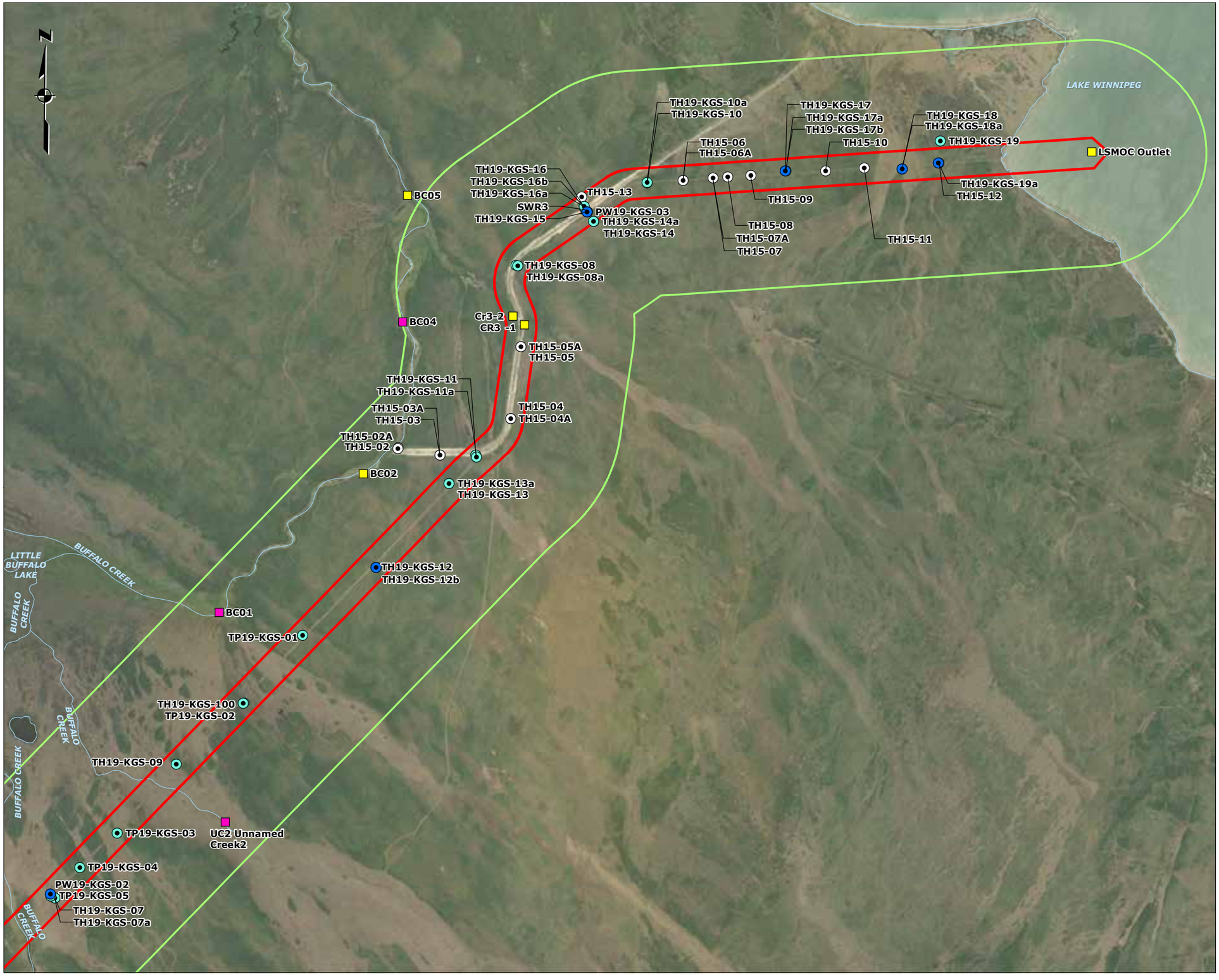
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Universal Transverse Mercator (Zone 14)
North American Datum (1983)

WSP

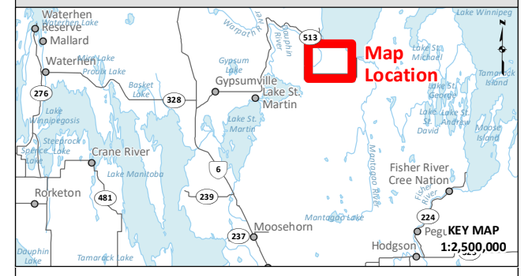
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Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Monitoring Well Instrumented
- Monitoring Well_Instrumented Groundwater Sample
- Monitoring Well Not Instrumented
- Surface Water Quality Station Design
- Surface Water Quality Station EIS
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Hydrology



Manitoba

Figure 2A: Past Water Monitoring Sites - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

wsp

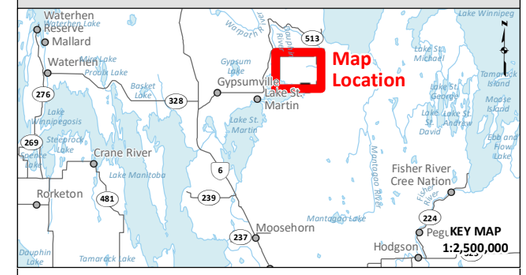
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Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Monitoring Well Instrumented
- Monitoring Well_Instrumented Groundwater Sample
- Monitoring Well Not Instrumented
- Surface Water Quality Station Design
- Surface Water Quality Station EIS
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Manitoba Hydro's Distribution Line
- Roads
- Hydrology



Manitoba

Figure 2B: Past Water Monitoring Sites - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

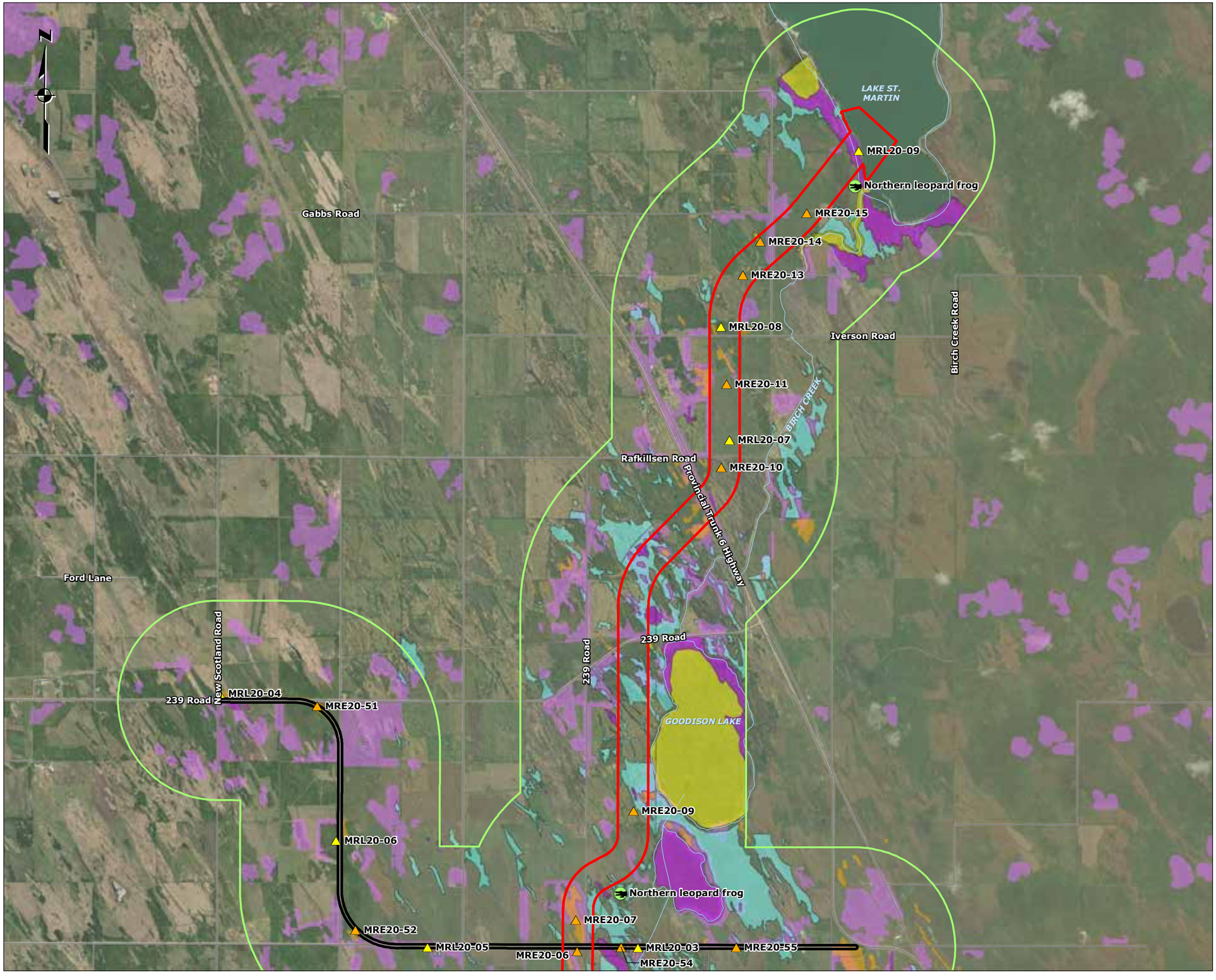
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North American Datum (1983)

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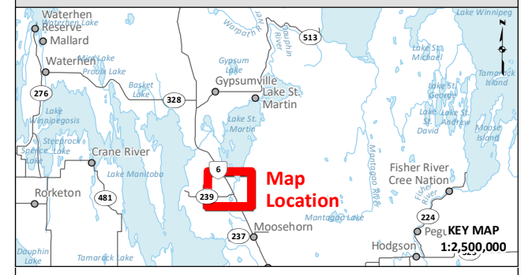
WSP Job #: 20M-00910-00
Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- WSP Early Summer SOCC Survey Location
- WSP Late Summer SOCC Survey Location
- Northern Leopard Frog
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology
- Modelled Breeding Habitat for Red-headed Woodpecker EIS
- Class 3 Wetlands
- Class 4 Wetlands
- Class 5 Wetlands
- Basin Swamp



Manitoba

Figure 3A: Wetlands and Previous Biophysical Monitoring Observations - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

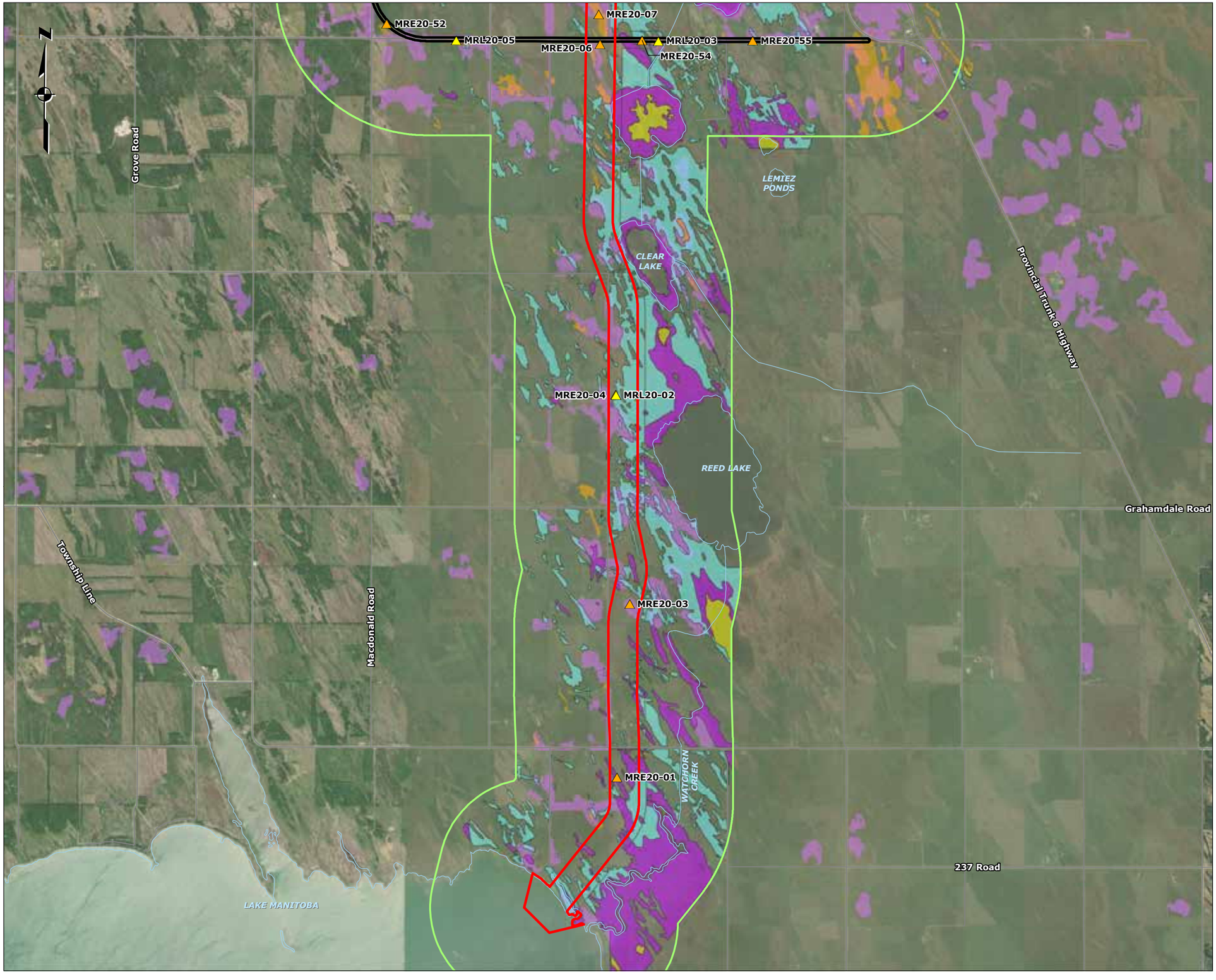
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North American Datum (1983)

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Report By: DS
Drawn by: JH
Reviewed By: KT

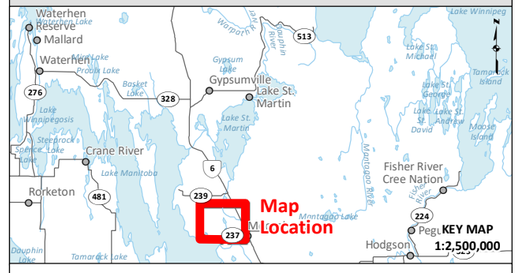
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- WSP Early Summer SOCC Survey Location
- WSP Late Summer SOCC Survey Location
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology
- Modelled Breeding Habitat for Red-headed Woodpecker EIS
- Class 3 Wetlands
- Class 4 Wetlands
- Class 5 Wetlands
- Basin Swamp
- Lacustrine Swamp



Manitoba

Figure 3B: Wetlands and Previous Biophysical Monitoring Observations - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

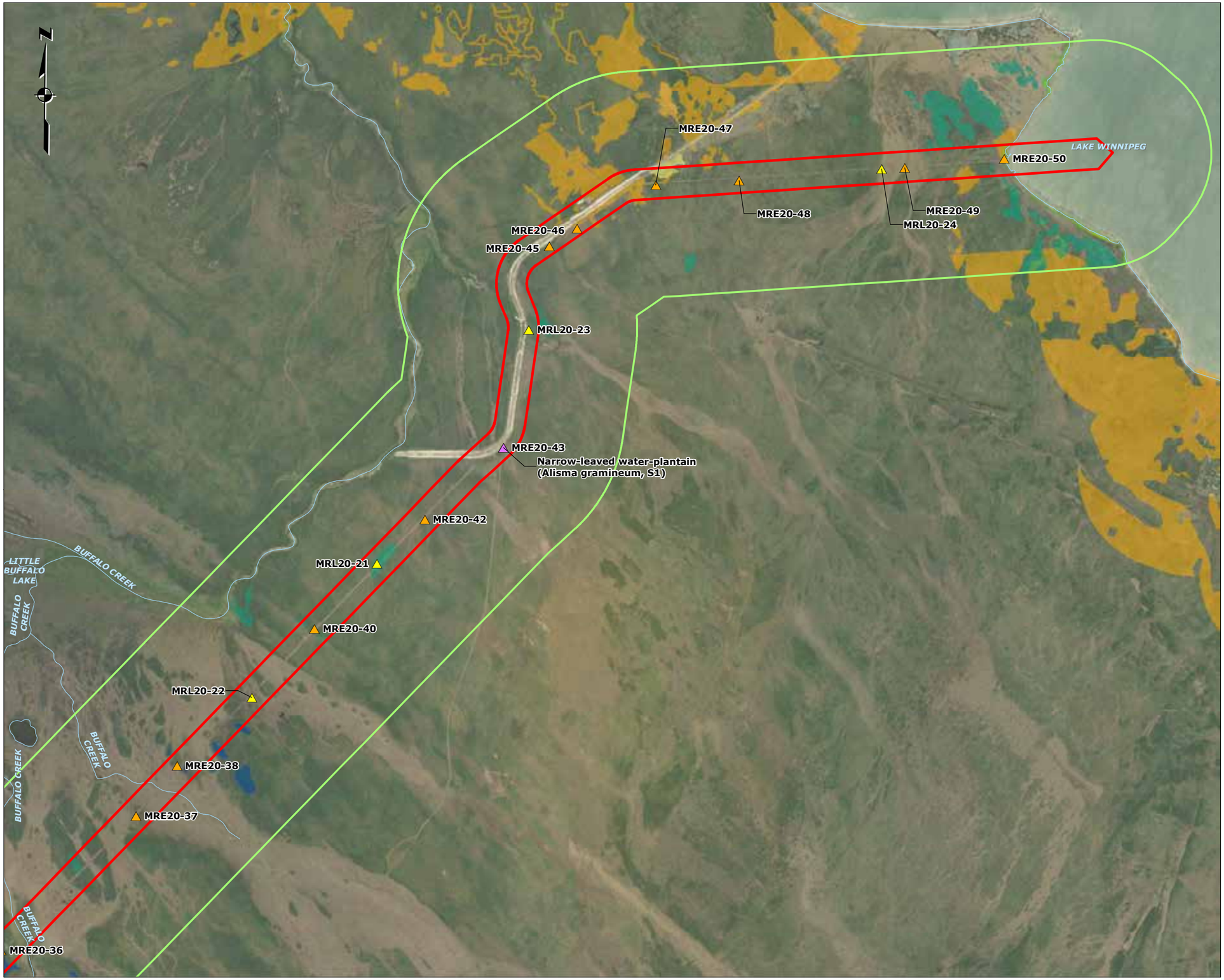
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North American Datum (1983)

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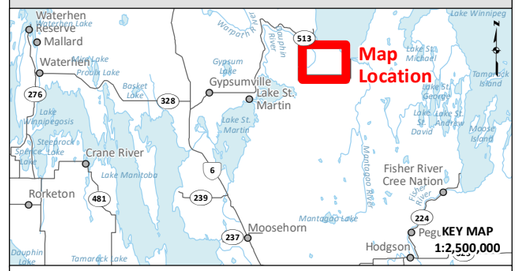
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- WSP Early Summer SOCC Survey Location
- WSP Late Summer SOCC Survey Location
- WSP SOCC Observation
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Hydrology
- Modelled Breeding Habitat for Eastern Whip-poor-will EIS
- Basin Swamp
- Lacustrine Swamp
- Lagg Swamp
- Unconfined Flat Swamp



Manitoba

Figure 4A: Wetlands and Previous Biophysical Monitoring Observations - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

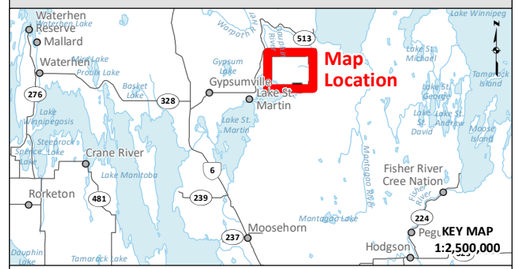
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Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- WSP Early Summer SOCC Survey Location
- WSP Late Summer SOCC Survey Location
- WSP SOCC Observation
- Yellow Rail Location
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Manitoba Hydro's Distribution Line
- Roads
- Hydrology
- Modelled Breeding Habitat for Eastern Whip-poor-will EIS
- Modelled Breeding Habitat for Red-headed Woodpecker EIS
- Class 3 Wetlands
- Class 4 Wetlands
- Lacustrine Swamp
- Lagg Swamp
- Riverine Swamp
- Unconfined Flat Swamp



Manitoba

Figure 4B: Wetlands and Previous Biophysical Monitoring Observations - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

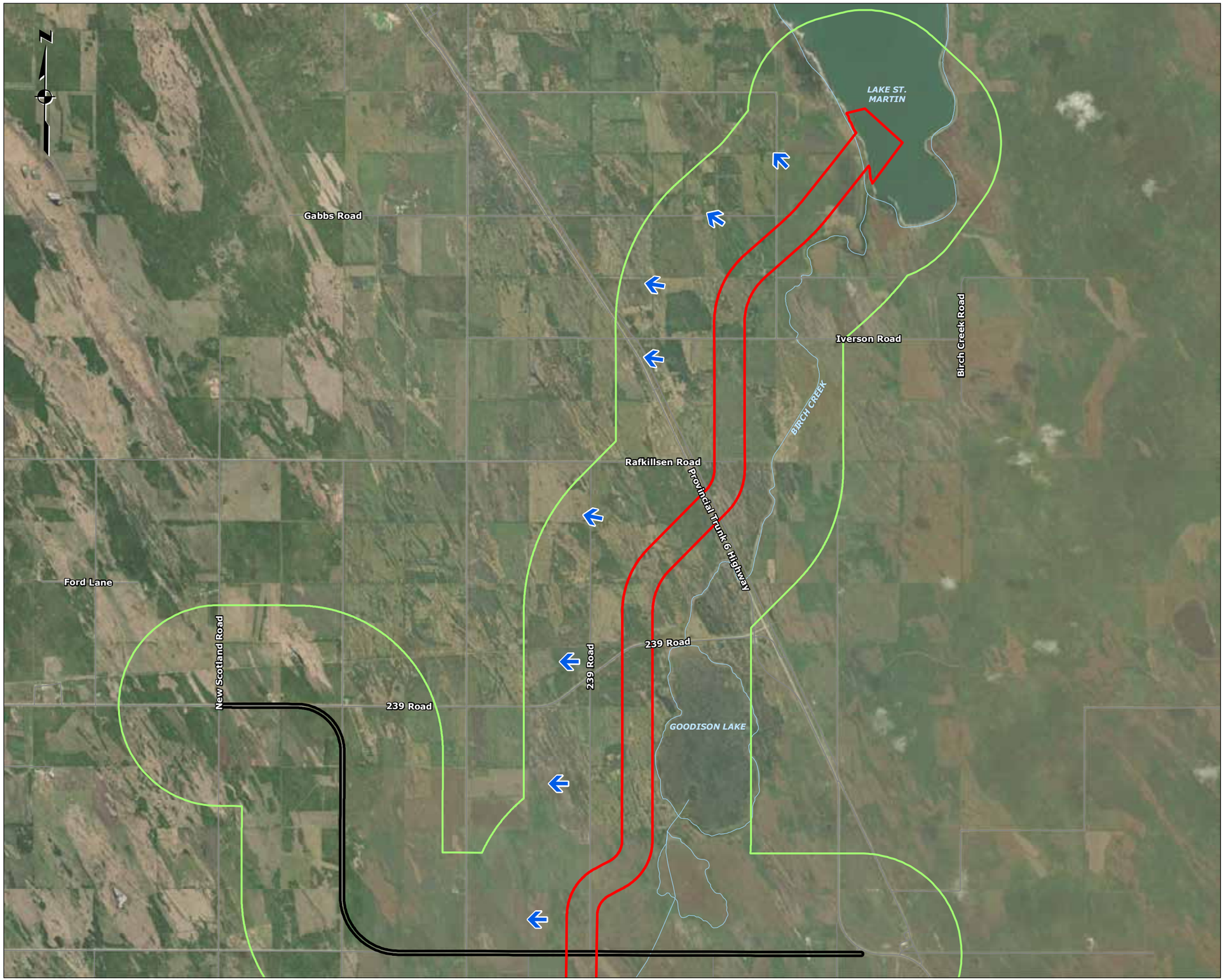
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0 1 2 3 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

Report By: DS	WSP Job #: 20M-00910-00
Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology
- Groundwater Flow



Manitoba

Figure 5A: Groundwater Flow - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

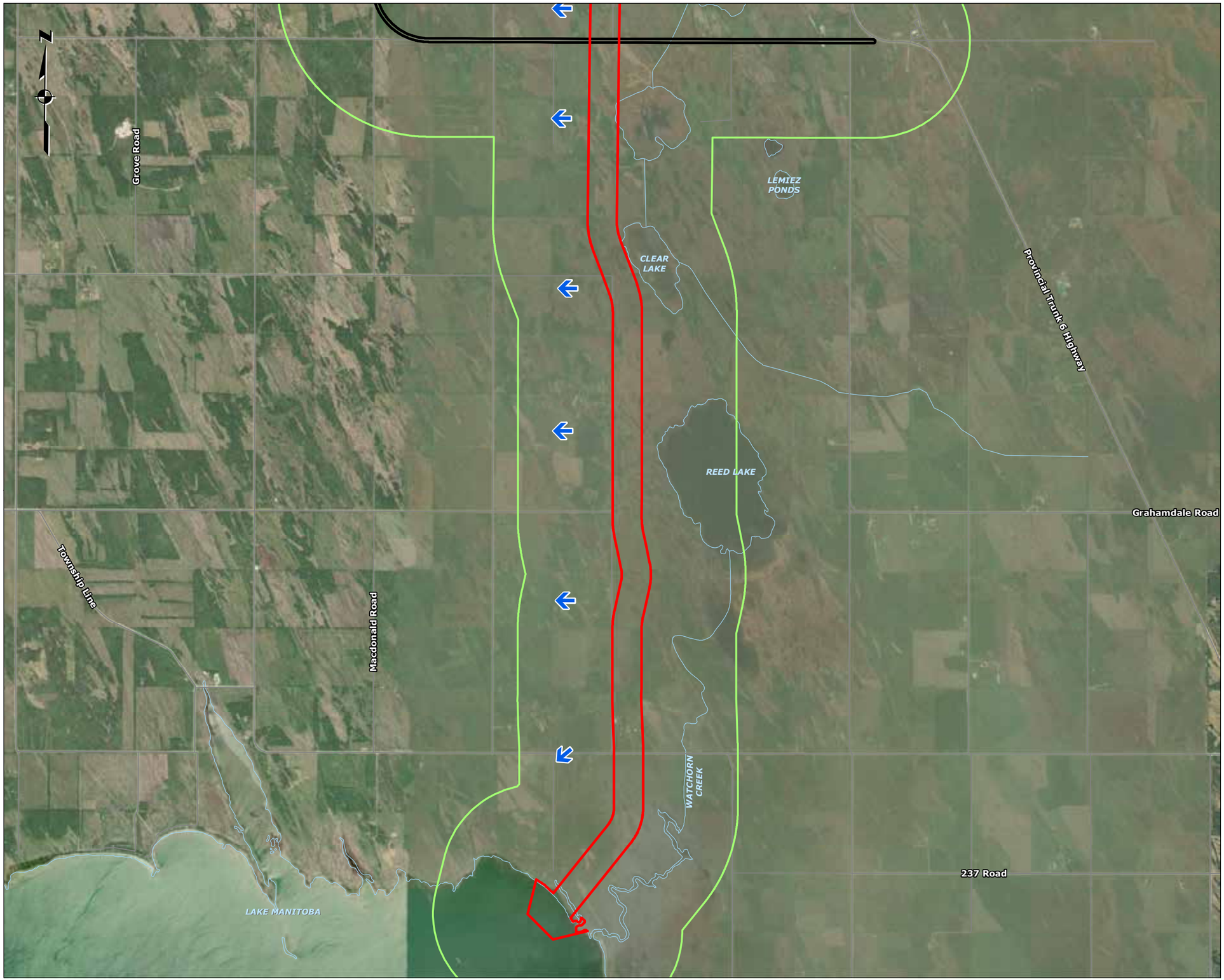
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wsp

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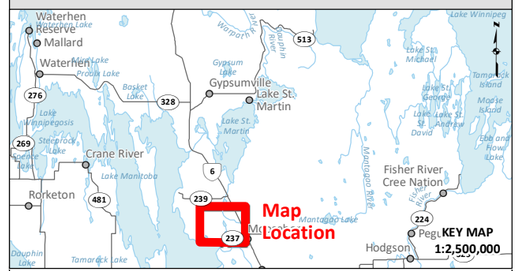
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Roads
- Hydrology
- Groundwater Flow



Manitoba

Figure 5B: Groundwater Flow - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

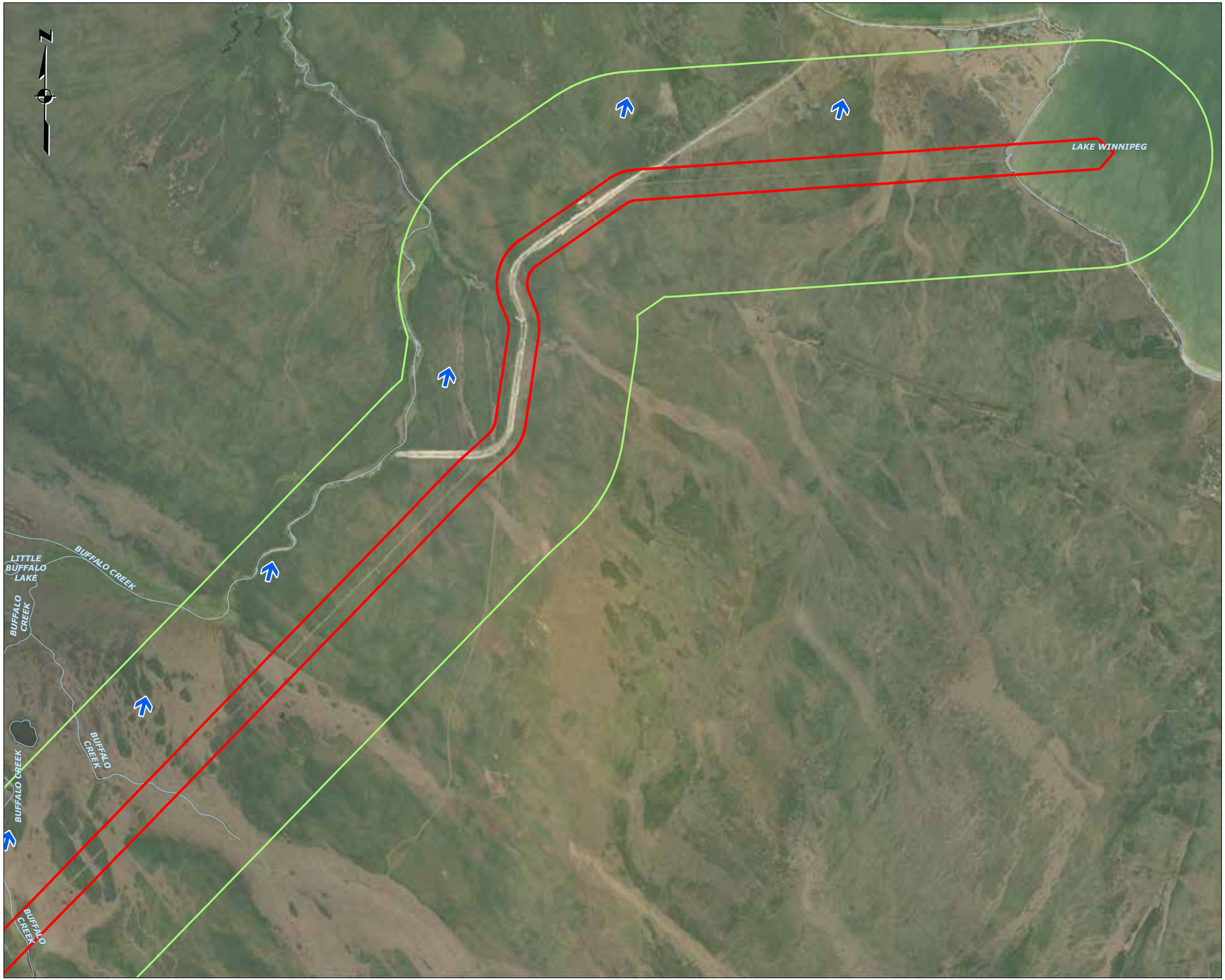
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Universal Transverse Mercator (Zone 14)
North American Datum (1983)

WSP

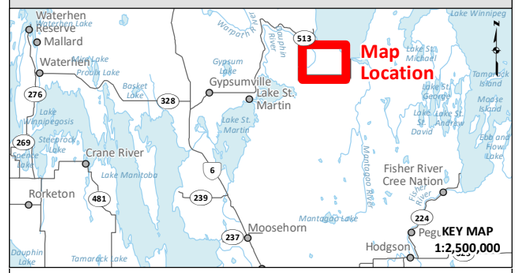
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Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Hydrology
- Groundwater Flow



Manitoba

Figure 6A: Groundwater Flow - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

wsp

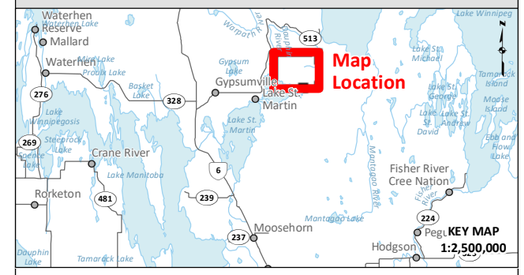
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Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Manitoba Hydro's Distribution Line
- Roads
- Hydrology
- Groundwater Flow



Manitoba

Figure 6B: Groundwater Flow - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

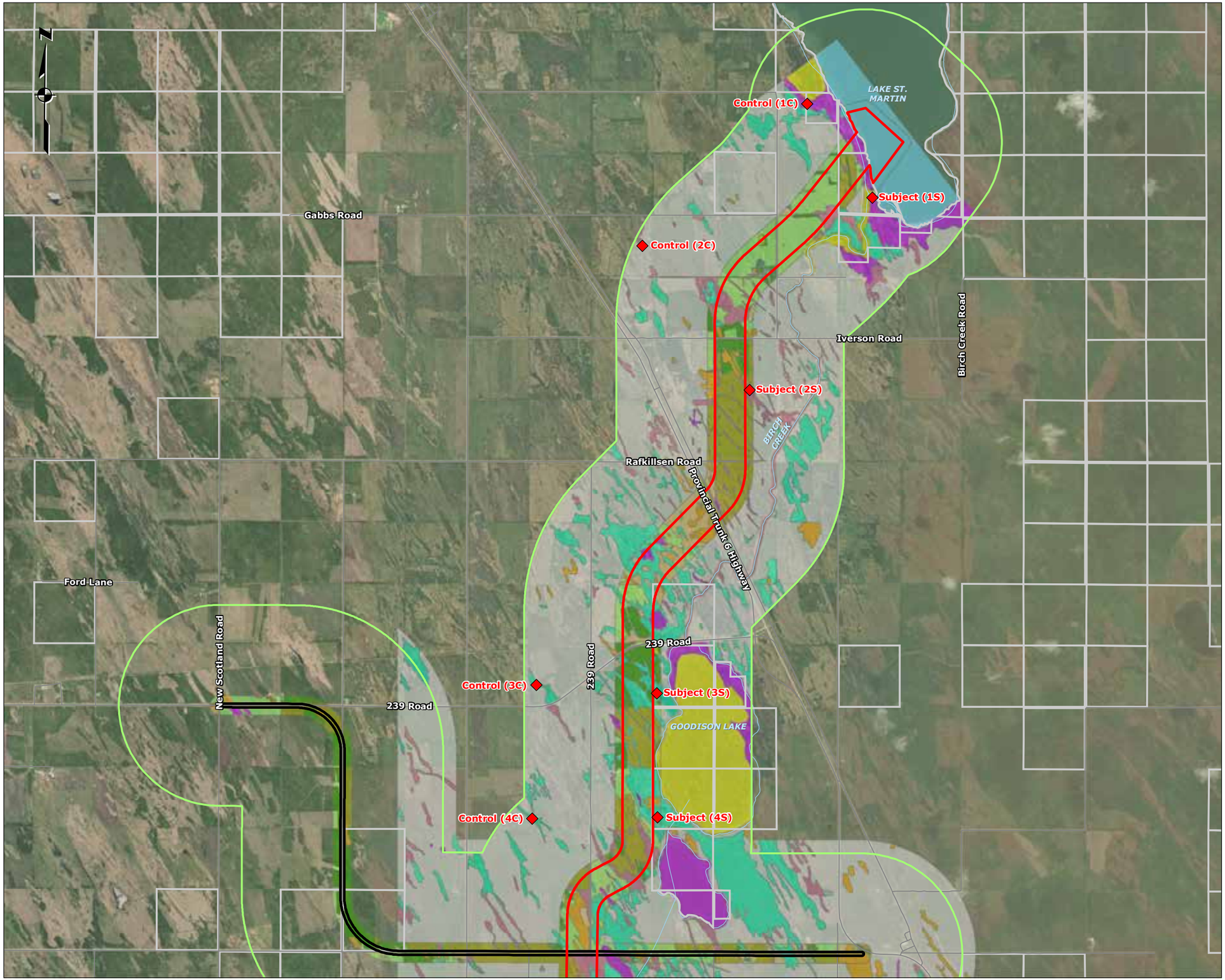
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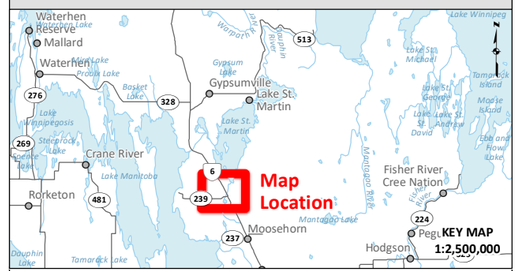
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Recommended Monitoring Sites
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Crown Land
- Roads
- Hydrology
- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Cultural Features
- Forage Crops
- Roads and Trails
- V1 = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland
- Water Bodies



Manitoba

Figure 7A: Proposed Wetland Monitoring Sites - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

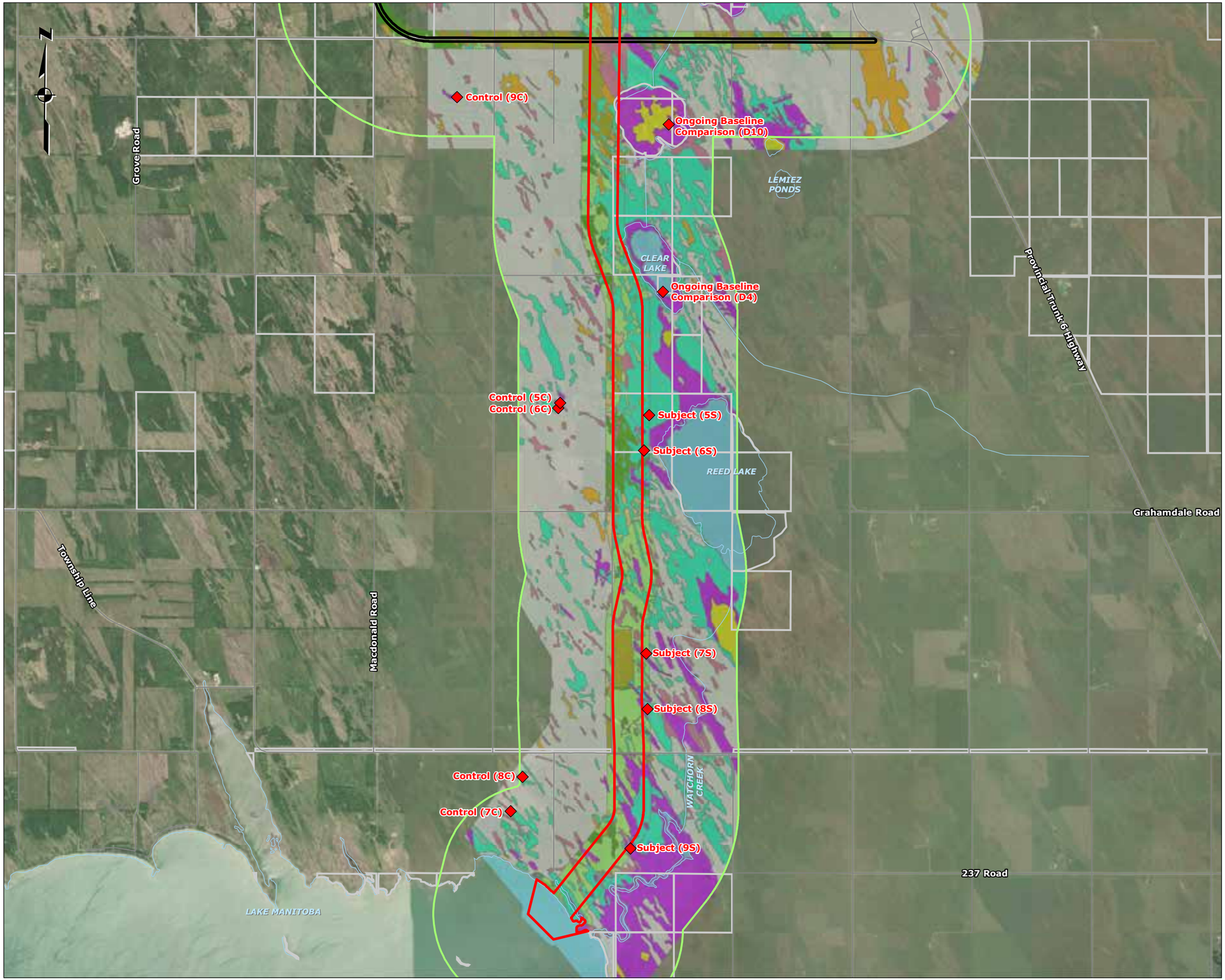
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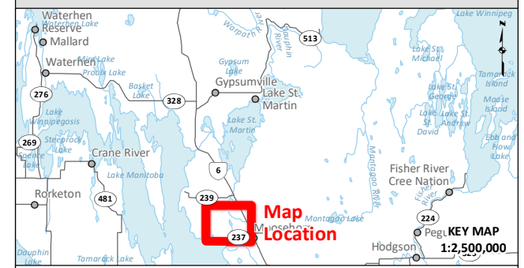
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Recommended Monitoring Sites
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- PR 239 Road Re-Alignment
- Crown Land
- Roads
- Hydrology
- Agricultural Cropland
- Bare Rock, Gravel and Sand
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Cultural Features
- Forage Crops
- Lacustrine Swamp
- Roads and Trails
- V1 = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland
- Water Bodies



Manitoba

Figure 7B: Proposed Wetland Monitoring Sites - LMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

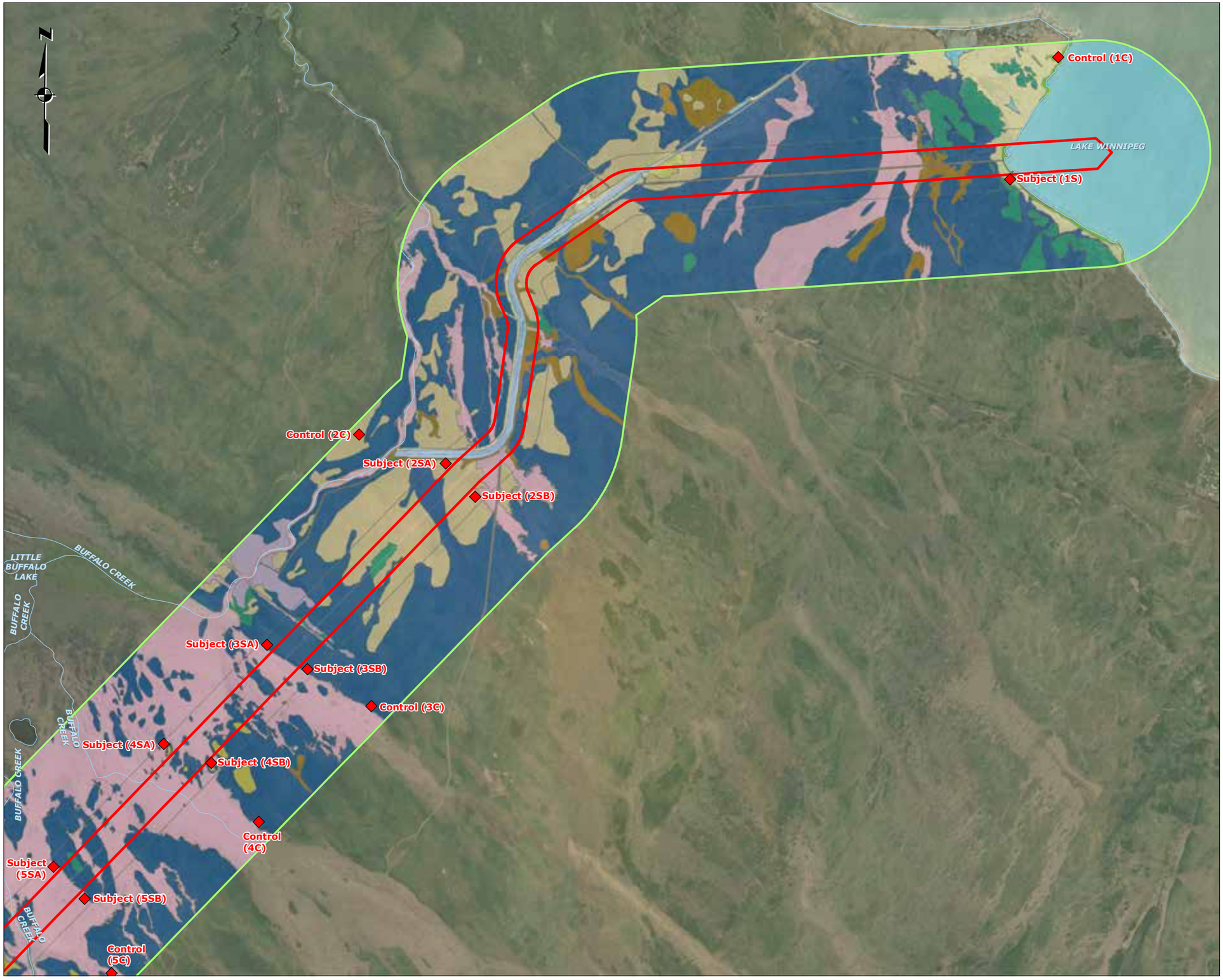
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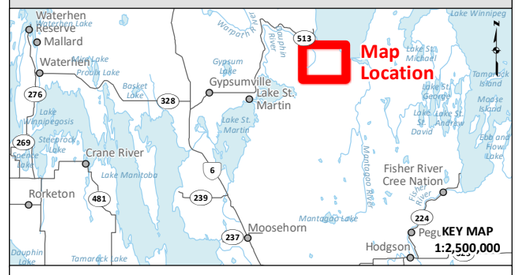
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Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Recommended Monitoring Sites
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Hydrology
- Bare Rock, Gravel and Sand
- Basin Bog
- Basin Fen
- Basin Swamp
- Channel
- Forest Cutovers
- Horizontal Fen
- Lacustrine Swamp
- Lagg Swamp
- Roads and Trails
- Shore Fen
- Stream Fen
- Unconfined Flat Swamp
- V1 = Balsam Poplar Hardwood and Mixedwood
- Water Bodies



Manitoba

Figure 8A: Proposed Wetland Monitoring Sites - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

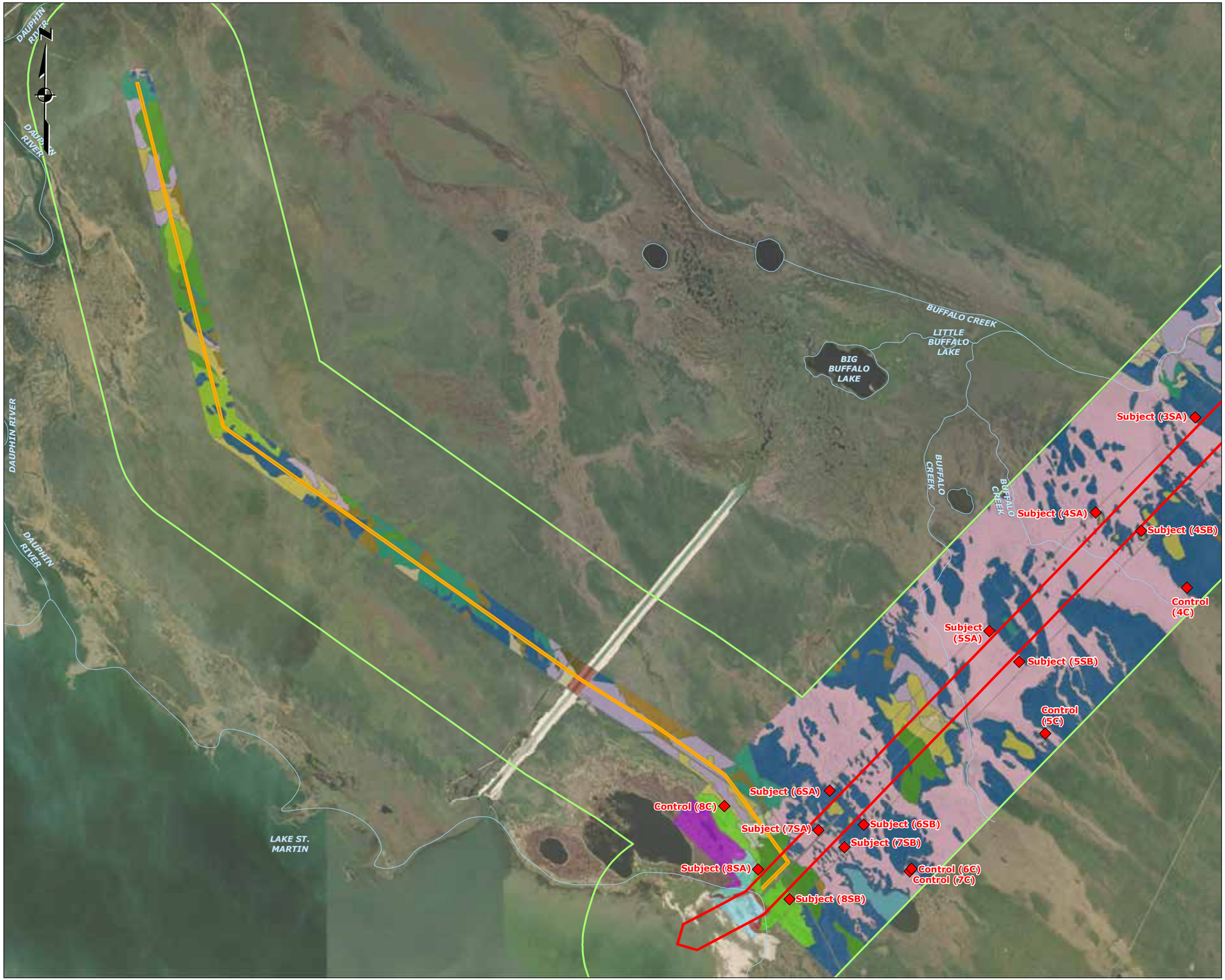
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Drawn by: JH
Reviewed By: KT

WSP Job #: 20M-00910-00
Date: January 21, 2022
Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure



Legend

- Recommended Monitoring Sites
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)
- Manitoba Hydro's Distribution Line
- Roads
- Hydrology
- Bare Rock, Gravel and Sand
- Basin Bog
- Basin Fen
- Class III_Wetland
- Class IV Wetland
- Forest Cutovers
- Horizontal Fen
- Lacustrine Swamp
- Lagg Swamp
- Riverine Swamp
- Roads and Trails
- Stream Fen
- Unconfined Flat Swamp
- V1 = Balsam Poplar Hardwood and Mixedwood
- V4 = White Birch Hardwood and Mixedwood
- V5 = Aspen Hardwood
- V24 = Jack Pine Conifer
- V28 = Jack Pine-Black Spruce/Feather Moss
- Water Bodies



Manitoba

Figure 8B: Proposed Wetland Monitoring Sites - LSMOC

Lake Manitoba & Lake St. Martin Outlet Channels Project

Manitoba, Canada

Scale: 1:50,000

0 1 2 3 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

wsp

Report By: DS	WSP Job #: 20M-00910-00
Drawn by: JH	Date: January 21, 2022
Reviewed By: KT	Office: Winnipeg

Notes:Imagery Source: ESRI, Base Data: Manitoba Transportation and Infrastructure

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Wetland Compensation Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms vi

1.0 INTRODUCTION 1

1.1 Purpose and Objectives 1

1.2 Background 2

1.3 Regulatory Requirements 6

1.4 Roles and Responsibilities 7

1.5 Indigenous Engagement 8

1.6 Related Documents 8

2.0 WETLAND DELINEATION 9

2.1 Methodology 9

2.1.1 Information Sources and Mapping 9

2.1.2 Field Verification 10

2.1.3 Wetland Classification System 10

2.2 Results 11

3.0 WETLAND COMPENSATION 12

3.1 Process 12

3.2 Wetlands Requiring Compensation 16

4.0 FOLLOW-UP AND MONITORING 17

5.0 REFERENCES 19

APPENDIX 1 21

List of Tables

Table 1: Key Roles Associated with Implementation of Wetland Compensation

Table 2: Class III, IV and V Wetlands Intersected by Project Components

Table 3: Wetland Compensation Ratios for Restoration and Enhancement

Table 1-1: Project Merged Land Cover Classification System and Habitat Descriptions for Class III, IV and V Wetlands

Table 1-2: Wetland Classification within the LMOC PDA

Table 1-3: Wetland Classification within the PR 239 Re-route PDA

Table 1-4: Wetland Classification within the LSMOC PDA

Table 1-5: Wetland Classification in the Power Distribution Line PDA

List of Figures

Figure A: EMP Process

Figure 1: Project Area

Figure 2: Wetlands in the LMOC Area

Figure 3: Wetlands in the LSMOC Area

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Wetland Compensation Plan (WCP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under *The Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

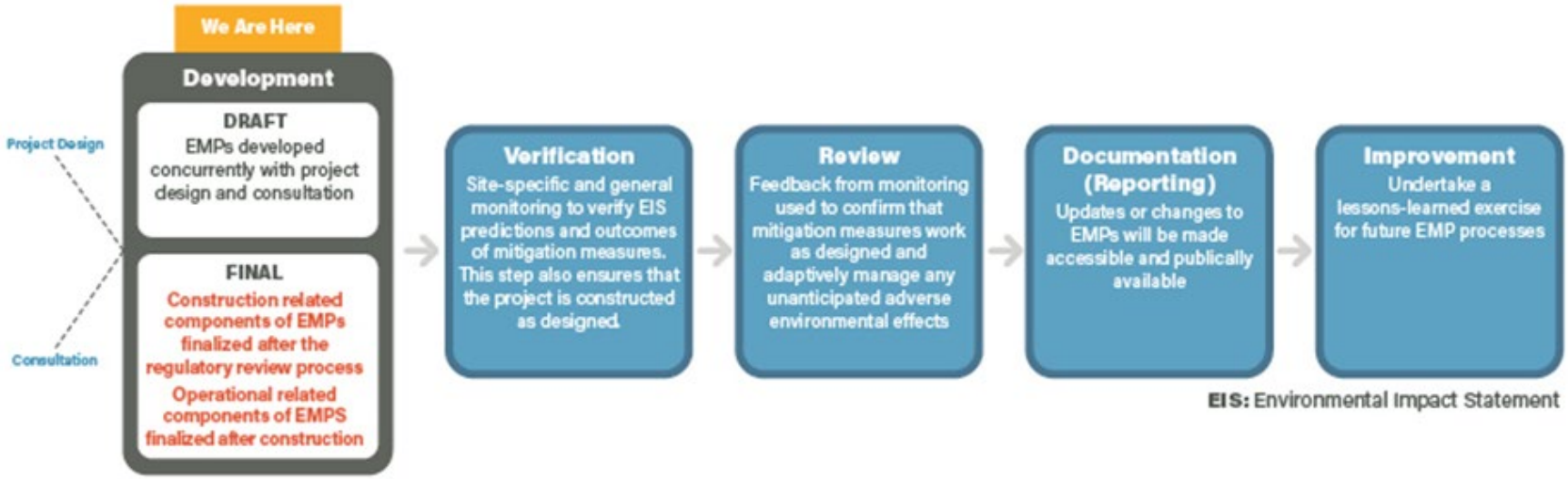


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	percent
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EOSD	Earth Observation for Sustainable Development
GWMP	Groundwater Management Plan
ha	hectares
km	kilometre
LCC	Land Cover Classification
LAA	local assessment area
LiDAR	Light Detection and Ranging
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MHHC	Manitoba Habitat Heritage Corporation
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
OEMP	Operation Environmental Management Program
PDA	Project development area
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Outlet Channel Project
RAA	regional assessment area
RM	Rural Municipality
RVMP	Revegetation Management Plan

SWMP	Surface Water Management Plan
WCP	Wetland Compensation Plan
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan
WRA	*Water Rights Act*
WRAA	*Water Resources Administration Act*

Glossary of Terms

Aquatic vegetation: Submerged, floating-leaved and floating plants that only grow on or beneath the water surface. Submerged plants may be rooted in soils or free-floating.

Baseline: Initial environmental conditions, prior to construction or anthropogenic actions.

Contractor: Refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Discharge: Rate of outflow; volume of water flowing down a river, from a lake outlet, or man-made structure.

Environmental Monitor: Refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Groundwater: Water that occurs beneath the land surface and fills the pore spaces of soil or rock below saturated zone.

The Owner: refers to Manitoba Transportation and Infrastructure or a designated representative delegated by Manitoba Transportation and Infrastructure with overall responsibility for, and oversight of, Project design, construction and operation.

Peatland: Refers to:

> (a) a bog, fen or swamp, and
>
> (b) has waterlogged conditions that prevent plan material from fully decomposing, resulting in the production of organic matter exceeding its decomposition causing in a net accumulation of peat.

Runoff: Surface water that flows overland and into streams, wetlands or waterbodies, or into drainage systems.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under section 35 of *The Constitution Act 1982*. Commonly, these include hunting, trapping, fishing or gathering rights.

Stewart and Kantrud system: A wetland classification system that identifies 5 classes of prairie wetlands (Manitoba Sustainable Development, 2020). The class is determined by the length of time that the wetland holds surface water in a year of average moisture conditions and the associated vegetation and soils.

- Class I: short-lived wetlands (retains water for one week or less), mainly existing in spring after winter snow melts or big rains, typically supporting vegetation such as Kentucky bluegrass, goldenrod, forbes.
- Class II: short-lived wetlands (retains water for one week to one month), mainly existing in spring after winter snow melts or big rains, typically supporting vegetation such as fine stemmed grasses, sedges and forbs.
- Class III: semi-permanent or seasonal, meaning that it retains water for one month to three months, often dry by mid-June but may hold water for the entire year, often lasting fewer than five months; typically supporting shallow marsh vegetation such as emergent wetland grasses, sedges and rushes on gleysolic soils.
- Class IV: semi-permanent, meaning that it retains water for more than three months, holds some water year-round under wetter conditions but go dry in below average years, often lasting more than five months; typically supporting marsh vegetation and submerged aquatic vegetation such as cattails, bulrushes and pond weeds in the central area of the wetland as on gleysolic soils.
- Class V: permanent, meaning that it retains water year-round in average years with permanent open water in the central areas, but may go dry in years with well below average moisture conditions; typically having a central area that is open water free of vegetation surrounded be a zone of submerged aquatic vegetation such as cattails, bulrushes and pond weeds on gleysolic soils.

Surface water: Water that is on the Earth's surface, such as in a stream, river, lake, or reservoir.

Wetland: Refers to:

> (a) a marsh, bog, fen, swamp or ponded shallow water, and
>
> (b) low areas of wet or water-logged soils that are periodically inundated by standing water and that are able to support aquatic vegetation and biological activities adapted to the wet environment in normal conditions.

Wetland restoration: The practice of restoring water levels and/or the function of a wetland that has been altered, degraded, impaired, or lost.

1.0 INTRODUCTION

Wetlands are recognized by the Province of Manitoba as integral components of a watersheds, providing numerous flood control and ecological benefits. Manitoba's Water Strategy (Manitoba, 2003) outlines how wetland enhancement and restoration are important conservation goals. The objective of Manitoba's water conservation planning is to conserve and manage the lakes, rivers, groundwater and wetlands of Manitoba so as to protect the ability of the environment to sustain life and provide environmental and economic benefits, along with other values to existing and future generations. The Made-in-Manitoba Climate and Green Plan (Manitoba Sustainable Development, 2017) identifies wetlands and watersheds as a keystone to Manitoba's plan; it emphasizes the importance of protecting wetlands and watersheds to preserve habitat and wildlife and to provide natural drainage features in a time of climate change and flooding. Wetland enhancement and restoration are among the measures being adopted as a component of natural and green infrastructure and the potential carbon offset programs (Manitoba Sustainable Development, 2017). The steps being taken by the Province, and more specifically by Manitoba Transportation and Infrastructure with respect to the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project), are consistent with to *The Water Rights Act* C.C.S.M. c. W80 (WRA) and provide formalized protection for wetlands in Manitoba.

1.1 Purpose and Objectives

The purpose and objectives of this Wetland Compensation Plan (WCP) was outlined in the Lake Manitoba and Lake St. Martin Outlet Channels Project Environmental Impact Statement (EIS; MI, 2020) submitted by Manitoba Transportation and Infrastructure in March 2020. This plan describes the process by which wetlands that will be affected by Project construction and operation will qualify for mitigation, monitoring and/or compensation. Section 4.0 of this plan also provides an overview with respect to the follow-up and monitoring of wetlands that are planned to occur along and adjacent to the Project development area (PDA).

The overall objectives of the WCP are to:

- Outline Manitoba Transportation and Infrastructure's approach for wetland compensation as it pertains to this Project.
- Summarize the key findings of the wetland mapping and field investigations (WSP, 2020a) as they pertain to the determination of wetlands that qualify for compensation.
- Describe legislated approach to wetland compensation in Manitoba.
- Outline follow-up and monitoring measures to be adopted for other wetlands that do not meet the criteria as requiring wetland compensation.

1.2 Background

The Project is a flood mitigation project located approximately 220 kilometres (km) northwest of the City of Winnipeg (Figure 1) and consists of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) and the Lake St. Martin Outlet Channel (LSMOC). Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239 that follows an existing municipal road for much of its length and is bordered by agricultural lands (primarily cropland or pasture uses), and other ancillary infrastructure. The Project is located within and extends northeast of the Rural Municipality (RM) of Grahamdale in Manitoba's Interlake region, an area within the Boreal Plains Ecozone.

The LMOC will extend approximately 24 km from Watchorn Bay on Lake Manitoba northeast to Birch Bay on Lake St. Martin in an area characterized by agricultural lands. The terrain is generally flat, with a distinct north to south trending drumlinoid or ridged and swale topography formed from subglacial deposition, with slopes of 1 percent (%) to 3% (WSP, 2020a). Ridges are generally well drained with upland forest vegetation, while the swales are poorly drained and support wetland communities (Figure 2).

The LSMOC extends about 24 km between the northeastern most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg (Figure 3). There is currently all-season road access from Provincial Trunk Highway 6 to the Project site. The LSMOC and the proposed distribution line are on Crown lands (within Treaty 2 lands) in the southern part of the Mid-Boreal Lowland Ecoregion, an area smoothed by clay, silt and sand glacial deposits that support poorly drained flat bogs and horizontal fens (WSP, 2020a).

The Project EIS indicated that no wetland class will be lost from the region and made the following key statements regarding wetlands pertinent to this WCP:

- The effects from the LMOC and PR 239 realignment will be offset by wetland compensation (as per Manitoba legislation).
- Wetlands south of Lake St. Martin will undergo further wetland mapping – this occurred in 2020 and was extended to include all PDAs (WSP, 2020a).
- Monitoring of the effectiveness of wetland-related mitigation measures will occur.

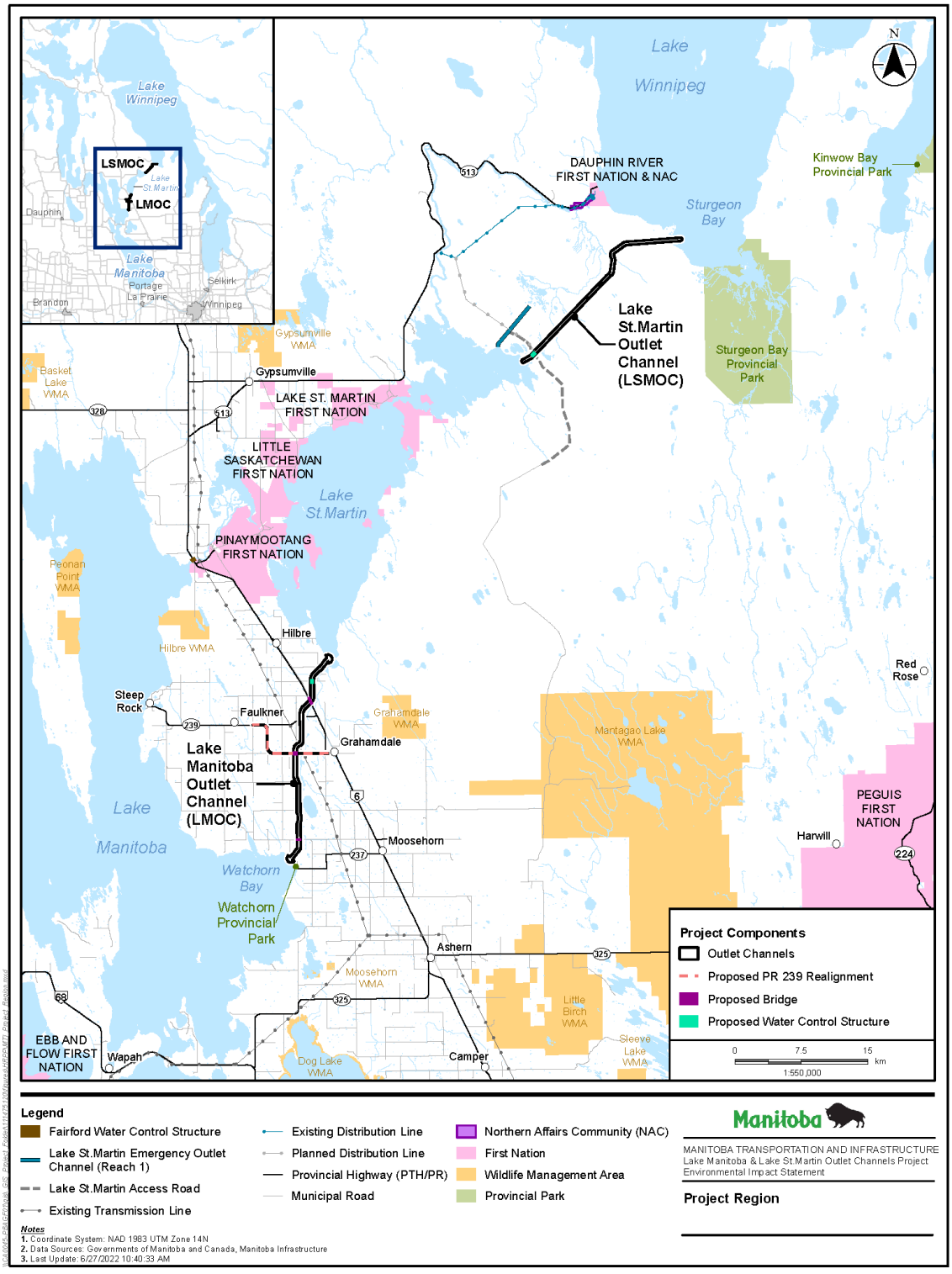


Figure 1: Project Area

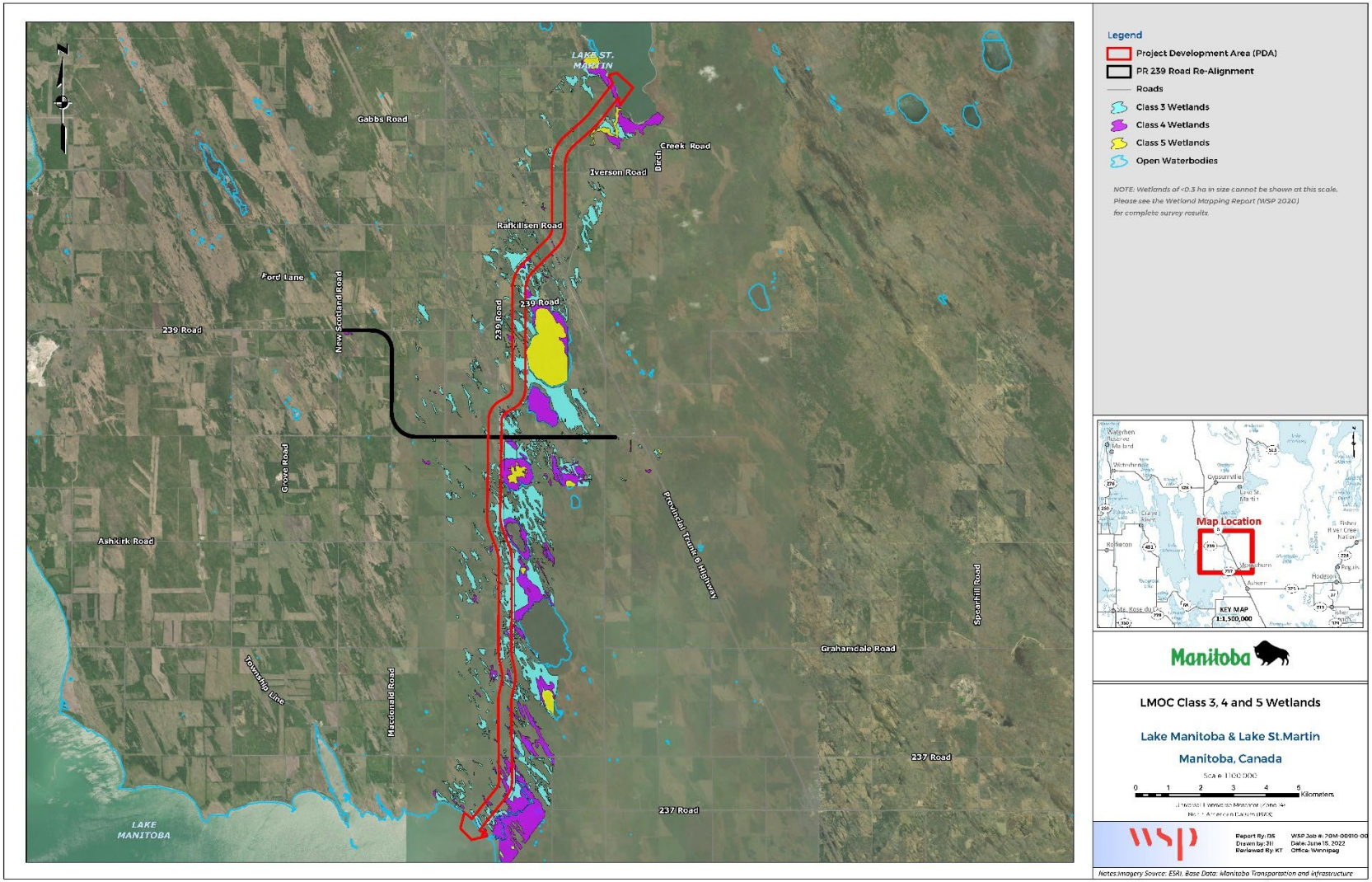


Figure 2: Wetlands in the LMOC Area

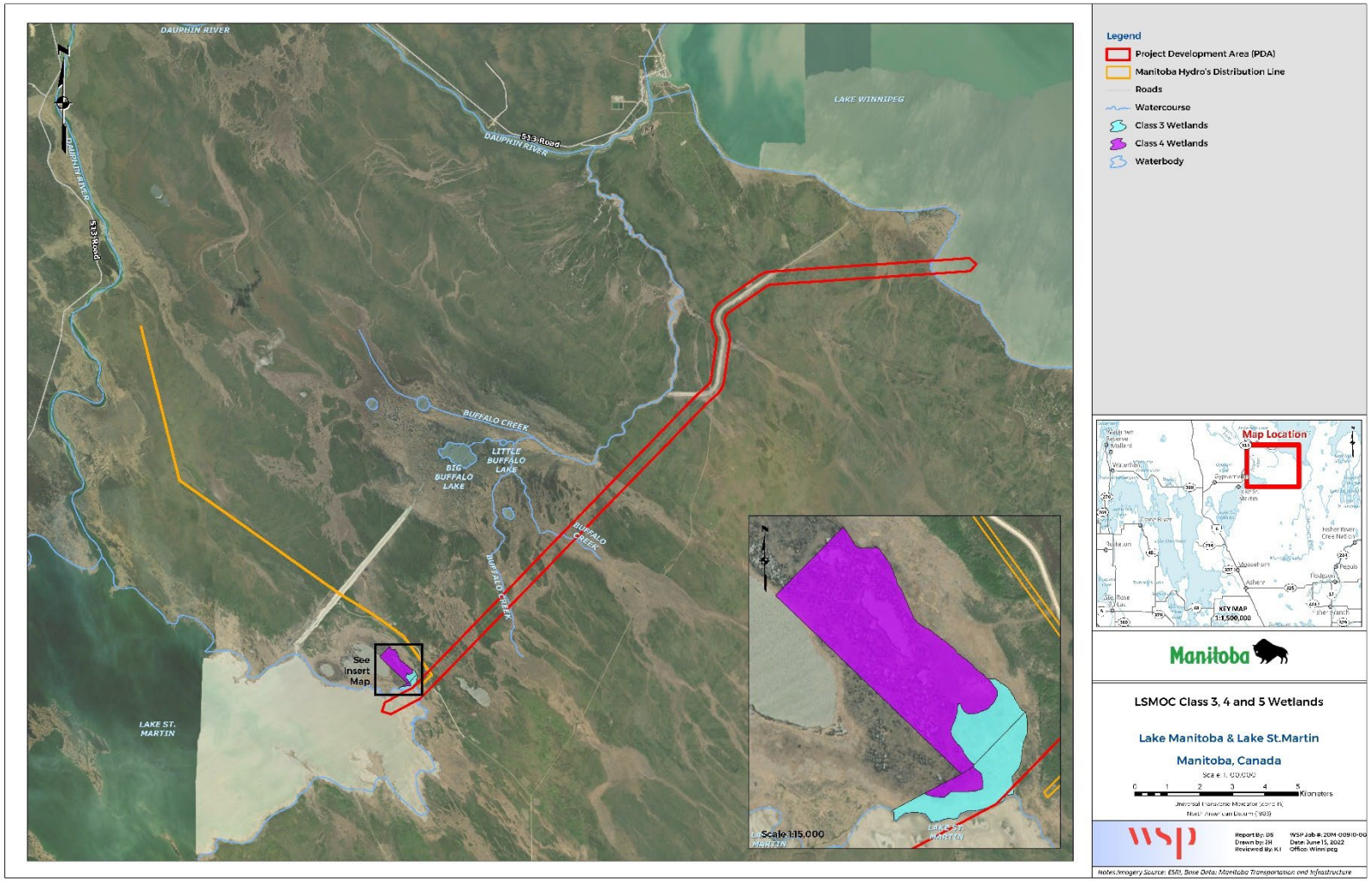


Figure 3: Wetlands in the LSMOC Area

1.3 Regulatory Requirements

The proposed Project is a designated project under the *Canadian Environmental Assessment Act*, 2012 (CEAA, 2012), and therefore requires an Environmental Assessment. Pursuant to section 15(d) of the CEAA, 2012, the Impact Assessment Agency of Canada is the authority responsible for federal review of the proposed Project and they issued Guidelines for the Preparation of an EIS for the Project. Other key federal legislation, under which approvals may be required, includes the Fisheries Act, *Canadian Navigable Waters Act* (formerly the *Navigation Protection Act*), *Migratory Birds Convention Act* and *Species at Risk Act*.

The proposed Project is considered a 'Class III' development under the Classes of Development Regulation (164/88) of *The Environment Act* (Manitoba) and therefore requires an *Environment Act* Licence. The Environmental Approvals Branch of Manitoba Environment, Climate and Parks, Environmental (MECP, formerly Manitoba Sustainable Development) is the authority responsible for provincial review of the proposed Project and they provided EIS Guidelines for the Project. In addition to addressing the EIS Guidelines, provincial permits will be required under several acts to address various Project activities, such as *The Crown Lands Ac*t (camp development on provincial Crown lands), *The Mines and Minerals Act* (quarry development), *The Wildfires Act* (burning) and *The Dangerous Goods Handling and Transportation Act* (petroleum storage tanks). Additional information is available in the Construction Environmental Management Program (CEMP, Appendix 1).

Under *The Transportation Infrastructure Act* (TIA) and *The Water Resources Administration Act* (WRAA), Manitoba Transportation and Infrastructure is responsible for the construction and operation of water control, drainage, and transportation infrastructure. The delivery of some of these projects occur in areas where wetland habitat is present and wetland impacts are unavoidable (Manitoba Natural Resources and Manitoba Highways and Transportation, 1998).

In 2019, *The Water Rights Act* (WRA) was amended to streamline drainage and water resource management and includes a goal of no net loss of wetlands. The Act describes the measures associated with licensing system to water use and allocation primarily for agricultural, industry, and municipal users. For water control works that require licensing under the *Water Rights Act*, the Act indicates that "prescribed" classes of wetlands require specific actions to ensure no net loss of wetland benefits. Prescribed classes of wetlands requiring specific actions are established in the Water Rights Regulation (section 4.1(1)) as Class III wetlands (Manitoba, 2018). Water control works outside of the agricultural region of Manitoba that require authorization under WRA are assessed on a case-by-case basis to determine whether or not Class III wetlands will be altered by the proposed works. If Class III wetlands will be altered by a water control work that requires licencing then the requirements of section 5.1 of the Act must be met.

Under *The Water Rights Act*, Manitoba Transportation and Infrastructure is not required to seek approval for works related to water rights, diverting water or diversions. However, the wetland compensation guidance in the Act will be used by the Project as instruction regarding wetland compensation. The Act sets out requirements for restoration, enhancement, and/or compensation of prescribed wetlands that are lost or altered by the construction, operation and maintenance of a project. Potential wetland impacts could also include reduction in the physical size or a change that would affect the wetland classification (e.g., a change

to hydrology that would alter duration of inundation). In general, provincial wetland compensation can accomplished in two ways:

- Financial compensation to an approved service provider as designated in the *Water Rights Act*, such as the Manitoba Habitat Heritage Corporation (MHHC) for the purposes of restoring or enhancing wetlands.
- Implementation of wetland restoration or enhancement projects in a location specified or approved by the Minister of Conservation & Climate.

1.4 Roles and Responsibilities

Table 1 identifies key roles and responsibilities associated with planning, development and implementation of the WCP. Manitoba Transportation and Infrastructure hired Independent consultants to conduct an assessment of wetlands. That information was integrated into the Project EIS and more recently associated with follow-up wetland assessment and documentation in support of the WCP.

Currently, Manitoba Transportation and Infrastructure is evaluating options to satisfy the objectives for provincial no-net loss of wetlands. Potential projects may include protection, enhancement, restoration, and/or compensation for prescribed wetlands (Class III, IV and/or V wetlands). Roles and responsibilities for each project will be identified when projects are formalized.

Table 1: Key Roles Associated with Implementation of Wetland Compensation

Role	Organization	Responsibility
Project Owner / Proponent	Manitoba Transportation and Infrastructure	Assure provincial wetland policies and legislative objectives are met Assure completion of identified protection, restoration, and/or enhancement projects Complete payment for identified compensation projects
Wetland Investigation and Assessment	Independent Consultant(s)	Wetland quantification and categorization
Approved Wetland Service Provider	MHHC	Approved by Minister to perform wetland restoration or enhancement projects under the *Water Rights Act*.
***Water Rights Act* Review**	Manitoba Environment, Climate and Parks (MECP)	Review WCP prior to implementation

1.5 Indigenous Engagement

Manitoba Transportation and Infrastructure is committed to and in the process of ongoing engagement and consultation with Indigenous rights-holders and other stakeholders that are potentially affected by the Project. Detailed Environmental Management Program (EMP) review discussions that include this WCP will, through such measures as virtual open house events and EMP-specific questionnaires, provide ongoing engagement opportunities that facilitate EMP finalization.

1.6 Related Documents

The following project documents, additional to the Project EIS, also contain wetland-related topics and details, but not necessarily included in this WCP:

- Surface Water Management Plan (SWMP) and associated monitoring;
- Groundwater Management Plan (GWMP) and associated monitoring;
- Vegetation Monitoring as outlined in the Revegetation Management Plan (RVMP);
- Wildlife Monitoring Plan (WMP); and
- Wetland Monitoring Plan (WetMP).

2.0 WETLAND DELINEATION

This section outlines how wetlands were assessed and identifies key characteristics of those that move forward for compensation. The process of compensation associated with those wetlands is described in Section 3.0. Wetland delineation involves determining and defining the wetlands that would be directly affected by the construction and operation of the Project. Manitoba Transportation and Infrastructure engaged an independent consultant to delineate and quantify the loss of these wetlands that are intersected by the PDA. The wetland delineation information developed from mapping and field investigations in 2020 provides a refinement of earlier work (WSP 2020a; MI 2020). This information was subsequently interpreted with consideration of *The Water Rights Act* in developing the best approach to compensate for wetlands potentially affected by the Project (Section 3.0).

2.1 Methodology

This section summarizes the methods used in wetland delineation described more fully in the Wetland Field Report developed on the basis of fieldwork and mapping conducted in 2020 (WSP 2020a).

2.1.1 Information Sources and Mapping

The delineation of wetland types that initially occurred in support of the Project EIS included vegetation mapping for the PDA, the vegetation and wetland local assessment area (LAA) (1 km beyond the Project footprint) and regional assessment area (RAA, 5 km beyond the Project footprint). Mapping used two publicly available data sources:

- The Enhanced Wetland Mapping, produced by Ducks Unlimited Canada (DUC, c. 2018)
- The Earth Observation for Sustainable Development (EOSD) Land Cover Classification (LCC) (Wulder and Nelson, 2003)

Both data sets offered continuous mapping of the LMOC and LSMOC study areas, which were derived from relatively coarse scale satellite data (about 1:50,000 scale). Final mapping was at a similarly coarse scale (about 1:50,000). While satisfactory for the purposes of the Project EIS, more detailed delineation of wetlands at a higher resolution was obtained in 2020 on the PDA and adjacent lands to refine the wetland impact analysis and facilitate compensation planning for wetland loss.

Mapping incorporated orthoimagery and available light-detection and ranging (LIDAR) data within a 1.5 km area extending from the PDA centreline. The fine resolution of this data facilitated the mapping of wetland and upland areas at 1:5,000 scale, leading to improved accuracy and increased confidence in wetland and upland community delineation and characterization (WSP 2020a). Wetland mapping was initially completed using automated GIS classification techniques that combined Sentinel 2, orthoimagery, Manitoba Transportation and Infrastructure LIDAR (1 metre [m] resolution) and national digital elevation model terrain data to delineate and classify wetlands and upland land cover. The assessment of wetlands included drainage

systems and depressions that may collect surface water; these depressions were then classified using the imagery sources (Sentinel 2 and orthoimagery) to identify wetland classes.

Wetland identification and mapping was performed using a hierarchical approach, based on analysis of satellite imagery, topographic indices generated from terrain data, and field observations. As a first step, probable wetland areas were identified from a pixel-based classification of multispectral Sentinel 2 data (10 m resolution). Spectral data was used to calculate the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI), two key indicators of wetland vegetation and soil moisture. Classification was then performed using a Random Forest algorithm with the following input variables: red, green, and blue bands, infrared band, NDVI and NDWI. In addition to the spectral band indices, indices from the terrain LIDAR dataset were extracted. Two indices were included in the classification: Topographic Wetness Index and the Depth to Water Index.

Wetland delineation was extracted from select areas that were then assessed during the late summer vegetation surveys conducted in August 2020. This data allowed assessment of the accuracy of the delineations and to confirm wetland classes along the survey area. A second object-based classification was performed to evaluate wetland classes, using a series of descriptive statistics extracted from previous satellite and topographic layers. A final verification was performed using visual interpretation of the orthoimagery and field ground truthing data to ensure accuracy of wetland classification and delineation.

2.1.2 Field Verification

Field confirmation of wetland mapping included both ground truthing surveys and visual checks (WSP 2020a). Ground truthing surveys were completed during the early (July 6-12, 2020) and late summer (August 6- 12, 2020) to determine wetland and terrestrial plant community composition. Early summer data provided initial training points for wetland classification and both early and late data were used to confirm initial and final stages of wetland and upland classifications. An aerial check of the initial mapping by helicopter survey (visual checks) along the PDA during late summer plant surveys also helped to confirm mapped (spatial) delineations. During aerial surveys, broad zones of habitats were checked, as well as specific wetland sites. Specific wetlands were also checked in more detail during the aerial surveys (visual and ground check surveys), to confirm differentiations among forested and marsh wetland classes. In total, ground truthing checked 120 sites, representing each mapped wetland and upland type within each of the Project components (i.e., LSMOC, LMOC, Manitoba Hydro's distribution line, and PR 239 re-route).

2.1.3 Wetland Classification System

The Stewart and Kantrud (1971) system and the Canadian Wetland Classification System (National Wetlands Working Group, 1997) were both used to develop a merged classification system (Appendix 1, Table 1-1). The combination allowed identification of the marshes in the southern Project areas (LMOC and PR239) and the organic and swamp peatland types in the northern areas (LSMOC and the power distribution line). As the Steward and Kantrud system is currently used in Manitoba's wetland compensation process, this approach facilitates analyses and discussions regarding offsets for wetland impacts.

The five classes of wetlands in Schedule C of the WRA are based on definitions provided in Stewart and Kantrud (1971) and are intended for the glaciated prairie region. A document on the MECP website helps to further explain the classification system and its application to the agricultural region of Manitoba (https://www.manitoba.ca/sd/pubs/water/water_rights/mb_wetlands_classification_key.pdf). For upland habitats, forests were classified using the Manitoba Forest Ecosystem Classification system (Zoladeski, et al., 1995). Waterbodies and anthropogenic land cover types followed the LCC for Manitoba (Wulder and Nelson, 2003).

2.2 Results

Appendix 1 (Table 1-2 to Table 1-5) provides an evaluation of wetland habitat maps, as verified through field investigations. Table 2 provides a summary of the results with respect to the Class III, IV and V wetland types that are being considered for compensation under the WRA. Table 2 indicate that the most common wetland habitat types intersected by the LMOC are Class III marshes (197.9 hectares [ha], or 19.2% of habitat types intersected by the LMOC PDA when considering terrestrial and wetland habitat types; WSP, 2020a). A small amount (1.1 ha) of Class III wetlands is intersected by the PR 239 realignment.

Peatlands and swamp predominate in the LSMOC area, where horizontal fens and stream fens represent collectively represent 63% of habitat types intersected (37% and 26%, respectively; WSP, 2020a). Peatlands and swamps represent 31% of habitat types intersected by the proposed distribution power line to extend from PR 513 to the LSMOC water control structure. By definition, peatlands are not Class III, IV or V wetlands. Schedule C of *The Water Rights Act* defines Class III wetlands as those holding surface water for a period between one month and three months (in average years). Although peatlands have high water tables, this is not in the form of surface water and they do not have high water tables for only 3 months. Peatlands are typically not dry at any time of the year. Class III wetlands are also defined as those wetlands with gleysolic soils. Peatlands do not have gleysolic soils. Finally, Class III wetlands frequently have shallow marsh vegetation, such as emergent wetland grasses, sedges and rushes. Peatlands do not have shallow marsh vegetation; they have black spruce, tamarack, shrubs, sphagnum moss – vegetation typical of bogs or fens.

Table 2: Class III, IV and V Wetlands Intersected by Project Components

Project Component	Class III	Class IV	Class V	Total Area (ha)
LMOC	197.9	38.4	0.8	237.1
PR 239	1.1	0.7	0.0	1.8
LSMOC	0.1	0.0	0.0	0.1
Distribution Power Line	0.0	0.0	0.0	0.0
Total Area (ha)	199.1	39.1	0.8	239.0

3.0 WETLAND COMPENSATION

This section outlines the process involved in developing a WCP, and considers wetland classification described in Section 2.0 (Table 2). As with many jurisdictions, Manitoba's Wetland Policy framework requires avoidance, minimization, and compensation. To the extent possible, avoidance and minimization of effects to wetlands have been considered during earlier stages of Project planning (e.g. location of Project components). As required by the *Water Rights Act,* compensation described in this section will focus on prescribed wetlands, i.e., wetlands defined as Class III, IV, or V according to the Stewart and Kantrud (1971). These are wetland classes that have been particularly threatened in agricultural areas across Manitoba.

3.1 Process

The overall process that will be used to develop the specific wetland compensation projects can be generally described in 5 steps outlined below and describe in the text that follows:

1. Wetland mapping, classification and assessment for appropriate project areas.
2. Information sharing and discussions with Indigenous rights-holders, and the public.
3. Development of enhancement and restoration projects and the determination of compensation.
4. Continued discussions and information sharing.
5. Implementation of wetland compensation project plans.

Step 1 – Wetland Delineation and Investigation

Wetland delineation investigation and evaluation as described further in Section 2.0 involves:

- Identify, map and conduct field investigations of wetlands that are intersected by or otherwise adjacent to the Project PDA
    - Occurred initially through baseline surveys and mapping for the Project to support the Project EIS and followed up with more detailed mapping and site investigations to characterize wetlands (MI 2020, WSP 2020a).
- Classify wetland using both the Steward & Kantrud Wetland Classification System and the Manitoba Wetland Assessment Method
    - Conducted by WSP (2020a) for the Project.

Step 2 – Information Sharing

Initial information sharing will be accomplished by:

- Posting and sharing the draft WCP with Indigenous rights-holders, and public stakeholders:
  - The WCP includes Manitoba Transportation and Infrastructure's current understanding of current and available information.
  - Providing resources and opportunity for virtual meetings to present and discuss the plan.
  - Facilitate public access to related supporting documents including field investigation reports.
  - The WCP was posted to the Manitoba Transportation and Infrastructure website in December 2020 and discussion with Indigenous rights-holders, other stakeholders and the public occurred prior to and, particularly, after the posting of this information.

Step 3 – Wetland Compensation Approach

This section outlines the steps that will be taken by Manitoba Transportation and Infrastructure with respected to Class III, IV and V wetlands that may be impacted by the Project. Manitoba Transportation and Infrastructure will be considering restoration, enhancement and financial compensation projects to meet its wetland compensation obligations.

- Wetland compensation ratios - Compensation ratios will be applied to Class III, IV, and V wetlands.
  - *The Water Rights Act* indicates that "prescribed" classes of wetlands require specific actions to address no net loss of wetland benefits. The wetland compensation ratios are identified in the Water Rights Regulation (C.C.S.M.c. W80) (Manitoba, 2018) and are conditional on the wetland classification and the applied compensation method.

The compensation ratios for prescribed wetlands are listed in Table 3.

Table 3: Wetland Compensation Ratios for Restoration and Enhancement

Action	Ratio
Restore or enlarge an existing wetland	2:1
Enhance or permanent legal protect	3:1

- Restoration and enhancement projects will be the preferred approach over financial compensation, although it should be understood that objectives of restoration and/or enhancement projects may also include:
  - Increase the size of the existing wetland
  - Improve hydric soil functions, hydrology and vegetation of a wetland and the uplands surrounding the wetland
  - Provide permanent legal protection to wetland or wetland enhancements
  - Through enhancement and/or restoration projects to reduce financial compensation

- Since the completion of wetland field investigations in 2020, Manitoba Transportation and Infrastructure has begun the process of identifying potential enhancement and restoration projects.
    - In the WCP questionnaire and within consultation and engagement meetings, Manitoba Transportation and Infrastructure requested feedback from rights-holders and Project stakeholders on suitable wetland enhancement, restoration and/or protection project ideas outside the PDA, and in the LAA and RAA. The following feedback that has been received to date pertains to suggested locations for compensation projects:
        - Local regions, including the entire area extending from LSMOC north to the Saskatchewan and McBeth Points, east to Fisher Bay and further east to include the entire Washow-Fisher Peninsula, south to PR 325, and the LMOC area
        - Large areas of Manitoba
        - Riparian wetlands (Lake Winnipeg wetlands and downstream in the Nelson River).
        - Upper Assiniboine River and Lake Manitoba watersheds
    - The determination of compensation projects will consider input from Indigenous rights-holders, regulators and other stakeholders through the EAC. Manitoba Transportation and Infrastructure began a study that evaluates local and regional crown land that may also include potential for enhancement, restoration and/or protection. The criteria to assess potential parcels for eligibility as a suitable compensation project will at minimum include:
        - Topography
        - Existing Habitat/hydrological connectivity
        - Wetland Size
        - Known Species at Risk use
        - Vegetation zone distribution
        - Duration of surface water in more than 10% of the wetland
        - Disturbance in or immediately adjacent the wetland
        - Wildlife habitat quality and associated potential for wildlife use
        - Connectivity to fish habitat/fish-bearing waters
        - Water quality improvement
        - Groundwater discharge/recharge
        - Wetland uniqueness
        - Culturally important species and areas
        - Recreation/Education potential
    - When enhancement and restoration projects have been identified, Manitoba Transportation and Infrastructure will determine if additional financial compensation is also required.
    - Compensation funds are to be provided to an approved service provider. Manitoba Environment Climate and Parks are responsible to determine what organization qualify as service providers under the WRA.

- Using the compensation ratios in Table 3, funds may be transferred to an approved service provider that can effectively perform wetland restoration or enhancement projects.
- Manitoba Transportation and Infrastructure will endeavor to support approved service provider(s) by assuring wetland-relevant information is submitted with the compensation transfer.

Step 4 - Information Sharing Continued

Continue to share updated and current information in the following manner:

- As a way to finalize the WCP, continue to post and share the updated plan with Indigenous rights-holders, and public stakeholders
  - Providing resources and opportunity for virtual meetings to present and discuss the new compensation plans
  - Facilitate public access to related supporting documents including field investigation reports
- Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders in the Project area and the RM of Grahamdale with respect to the establishment of an Environmental Advisory Committee (EAC). Manitoba Transportation and Infrastructure will utilize this platform to identify potential wetland creation, restoration or enhancement projects; this will include information on the location of sites and the process for delivering the compensation project.

Step 5 – Wetland Compensation Plan Implementation

Depending on the nature and need of each wetland compensation project, individual implementation plans will likely be required.

- As wetland compensation projects are formalized, develop implementation plans that identify appropriate project phases including: planning, construction/activities, and monitoring.
- Individual project schedules will be developed which when compiled will demonstrate the length of time it will take to complete the Projects overall wetland compensation requirements.

Manitoba Infrastructure and Transportation will continue to engage and consult with Indigenous rights-holders and the RM of Grahamdale and work with the EAC towards development of an effective process for wetland compensation. These compensation projects are anticipated to occur over several years, some of which may be initiated during the construction phase.

3.2 Wetlands Requiring Compensation

Based on recent field investigations and the current environmental assessment, this section describes the types and area of wetland that are currently included for consideration in the WCP. Manitoba Transportation and Infrastructure is committed to applying the mitigations to minimize Project-related wetland impacts as identified in the Project EIS.

Table 2 provides a summary of the evaluation of wetland habitat maps, as verified through field investigations (Section 2.1). Table 2 illustrates that Class III wetlands represent 83.3% of all wetlands identified, followed by 16.4% for Class IV and 0.2% for Class V. Of the Class III wetlands, 99.4% are located on the LMOC, 0.5% on PR239, and 0.1% on LSMOC. This includes areas of 197.9 ha, 1.1 ha, and 0.1 ha in each of the respective project components. Of the Class IV wetlands identified, 98.2% was located on LMOC and 0.8% on PR239. This includes 38.4 ha and 0.7ha in each of the respective project components. Class V wetlands were only identified in the LMOC, including 0.8ha. Class IV and V wetlands have not been identified along the PDA for the LSMOC. Prescribed wetlands were not identified along the distribution power line (Figure 1 and Figure 3).

4.0 FOLLOW-UP AND MONITORING

Follow-up and monitoring is a key component of the ongoing environmental assessment of wetlands potentially affected by the Project. The WetMP provides details with regard to follow-up and monitoring. The WetMP includes an integrated sampling design for several environmental parameters (e.g., surface water, ground water, vegetation and wildlife) to determine whether and how wetlands are being affected by the Project. The WetMP is designed and will be implemented in a manner that is consistent with section 9 of the Impact Assessment Agency of Canada's (formerly Canadian Environmental Assessment Agency) EIS Guidelines for the Project (CEAA 2018), which states: the purpose of the program is to verify the accuracy of predictions and the effectiveness of mitigation measures, and to assure that proper measures and controls are in place in order to decrease the potential for environmental degradation during all phases of Project development. Additionally, monitoring associated with the SWMP, GWMP, RVMP, and WMP will provide results that inform or otherwise bolster the information base developed on wetlands through the WetMP. The results of that monitoring will inform the need for additional or refinements to mitigation measures with respect to wetlands.

Verification of wetland-related predictions identified in the Project EIS will primarily involve testing key predictions to verify that mitigation measures implemented as part of Project construction and operation are functioning as intended. Regular reporting and review of results from environmental assessment verification monitoring can be used to determine whether further review or adaptive modification to measures specified in the CEMP, Operation Environmental Management Program (OEMP), and associated environmental management plans are required.

Compliance-related monitoring (Project EIS Volume 1, Chapter 3, Appendix 3F; MI, 2020) will involve inspecting construction sites to assure that mitigation measures identified in the CEMP, OEMP and associated environmental plans are being implemented and are functioning as intended on a site-specific scale (e.g. surface water management and the potential influence on adjacent wetlands). Environmental compliance monitoring, and regular site inspection will also help to identify unanticipated adverse environmental effects resulting from Project activities, and will enable timely proactive or reactive response in order to avoid, minimize or mitigate these potential effects at a site-specific scale.

The results from environmental compliance monitoring and environmental assessment verification monitoring may provide information that identifies the need for and means of adaptively managing unanticipated environmental effects related to the Project. The general approach for development of the Project's EMP, and the specific management and monitoring plans that comprise it, provides a proactive means of adaptively managing unanticipated adverse environmental Project effects. Draft environmental management and monitoring plans are being revised and updated in conjunction with ongoing engineering design, and ongoing input received from potentially affected Indigenous rights-holders and other stakeholders.

Overall, Manitoba Transportation and Infrastructure's proposed approach to environmental management, environmental monitoring, reporting, review, and ongoing engagement is meant to further assist in identifying and addressing potential information gaps, uncertainties related to potential effects, implementation of mitigation, and continual review and improvement on environmental performance.

Environmental management and monitoring plans have been shared with Indigenous rights-holders and public stakeholders that may potentially be affected by the Project. The results of ongoing engagement with will inform the further development of the plans. The WCP and other plans will be finalized after the receipt of required Provincial and Federal regulatory approvals.

5.0 REFERENCES

Canadian Environmental Assessment Act, 2012. Accessed at: https://laws-lois.justice.gc.ca/eng/acts/C-15.21/page-1.html

Canadian Navigable Waters Act. Accessed at: https://laws-lois.justice.gc.ca/eng/acts/n-22/

Crown Lands Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/c340e.php

Dangerous Goods Handling and Transportation Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/_pdf.php?cap=d12

DUC (Ducks Unlimited Canada). 2018. Enhanced Wetland Mapping

Environment Act (Manitoba). Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/e125e.php

Fisheries Act. Accessed at: https://laws-lois.justice.gc.ca/eng/acts/f-14/

Manitoba. 2003. The Manitoba Water Strategy. April 2003. Accessed at: http://digitalcollection.gov.mb.ca/awweb/pdfopener?smd=1&did=10676&md=1#:~:text=The%20objective%20of%20Manitoba's%20water,to%20existing%20and%20future%20generations.

Manitoba. 2018. A proposed regulation under The Water Rights Act. A streamlined and balanced approach to drainage and water retention in Manitoba. Presentation to Association of Manitoba Municipalities, Annual Convention. November 28, 2018. Based on information available at: https://www.gov.mb.ca/sd/consultations/pdf/proposed_regulation_consultation.pdf

MI (Manitoba Infrastructure) 2020. Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. March 9, 2020.

Manitoba Sustainable Development. 2017. A Made-in Manitoba Climate and Green Plan. Hearing from Manitobans. Accessed at: https://www.gov.mb.ca/asset_library/en/climatechange/climategreenplandiscussionpaper.pdf

Manitoba Sustainable Development. 2020. Wetland classification key. Available from: https://www.gov.mb.ca/sd/pubs/water/water_rights/mb_wetlands_classification_key.pdf

Manitoba Natural Resources and Manitoba Highways and Transportation. October 13, 1998. Submission to the Interdepartmental Planning Board. Subject: Establishing a formalized Habitat Mitigation/Compensation Program.

Migratory Birds Convention Act, 1994. Accessed at: https://www.canada.ca/en/services/environment/wildlife-plants-species/migratory-birds/migratory-birds-convention-act.html

Mines and Minerals Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/m162e.php

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 pp.

Stewart, R.E. and H.A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

Species at Risk Act. Accessed at: https://laws.justice.gc.ca/eng/acts/S-15.3/

Sustainable Watersheds Act. 2017. Accessed at: https://web2.gov.mb.ca/bills/41-3/pdf/b007.pdf

Water Rights Act C.C.S.M. c. W80 WRAA. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/w080e.php

Transportation Infrastructure Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/t147ei.php

WSP. 2020a. Lake Manitoba and Lake St. Martin Outlet Channel Project: Preconstruction environmental field work – wetlands (CONS15843). Winnipeg, Manitoba.

WSP. 2020b. Lake Manitoba and Lake St. Martin Outlet Channel Project: Preconstruction environmental field work – vegetation (CONS15843). Winnipeg, Manitoba.

Water Resources Administration Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/w070ei.php

Wildfires Act. Accessed at: https://web2.gov.mb.ca/laws/statutes/ccsm/w128e.php

Wulder, M. and Nelson, T. (2003). EOSD Land Cover Classification Legend Report. Version 2. NRCAN, Canadian Forest Service. Victoria, BC.

Zoladeski, C.A., Wickware, G.M., Delorme, R.J., Sims, R.A., and Corns, I.G.W. (1995). Forest ecosystem classification for Manitoba. Field Guide. Canada Northern Forestry Centre, Special Report No. 12. Hull, QC

APPENDIX 1

Wetland Types and Area Potentially Affected by the Project (WSP 2020a)

Table 1-1: Project Merged Land Cover Classification System and Habitat Descriptions for Class III, IV and V Wetlands

Classification	Description
Marsh[1]	
Class II	Temporary graminoid/forb mineral wetland with wet meadow plant community; surface water is present for a short period of time after snowmelt or a heavy rainfall.
Class III	Seasonal graminoid/forb mineral wetland with shallow wetland plant community; surface water is present throughout the majority of the growing season, but is typically dry by the end of summer.
Class IV	Semi-permanent graminoid/forb mineral wetland with deep wetland community; surface water is present for most or all of the year, except in periods of drought.
Class V	Permanent graminoid/forb mineral wetland with open water community; surface water is present throughout the year.
Peatland	
Bog[2]	
Basin Bog	Topographically confined peatland with poor nutrients and level surface; water input limited to snowmelt, rain and local surface run-off.
Fen[2]	
Basin Fen	Topographically confined peatland; water inputs consisting of snowmelt, rain, surface runoff, and groundwater.
Horizontal Fen	Uniformly vegetated peatland on broad depressions or plains; water inputs consisting of snowmelt, rain, surface runoff, and groundwater.
Shore Fen	Peatland situated adjacent to lakes or ponds with firmly anchored surface peat; water inputs consisting of snowmelt, rain, surface runoff, groundwater and surface flow.
Stream Fen	Peatland located in main channel or along banks of permanent or semi-permanent streams; water inputs consisting of snowmelt, rain, surface runoff, groundwater and surface flow.

Classification	Description
Swamp[2]	
Basin Swamp	Topographically confined shrubby or treed wetland with less than 40 cm of organic soil.
Lacustrine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along the shores of permanent ponds or lakes; water level affected by lake during high water periods.
Lagg Swamp	Sloping shrubby or treed wetland with less than 40 cm of organic soil occurring between upland mineral terrain and peatlands.
Riverine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along banks of rivers and permanent and intermittent streams; subject to flooding when stream or river waters are high.
Unconfined Flat Swamp	Broad shrubby or treed wetland with less than 40 cm of organic soil among other kinds of wetlands with poorly defined edges.
Water Bodies[3]	
Water Bodies	Consists of all open water including lakes, rivers, streams, ponds and lagoons.

Notes:

1 Prairie Pothole Wetland Classification System, Stewart and Kantrud (1971)

2 Canadian Wetland Classification System (National Wetlands Working Group, 1997)

3 Manitoba LLCC is based on the EOSDLCC system (Wulder and Nelson, 2003)

Table 1-2: Wetland Classification within the LMOC PDA

Broad Land Cover Category	Land Cover Class	Total Area In the PDA (ha)	Compensation Area (ha)
Marsh	Class II	68.0	N/A
	Class III	197.9	197.9
	Class IV	38.4	38.4
	Class V	0.8	0.8
Swamp	Basin Swamp	47.8	N/A
	Lacustrine Swamp	0.8	N/A
Total Wetlands		353.7	237.1

Table 1-3: Wetland Classification within the PR 239 Re-route PDA

Broad Land Cover Category	Land Cover Class	Total Area In the PDA (ha)	Compensation Area (ha)
Marsh	Class II	4.1	N/A
	Class III	1.1	1.1
	Class IV	0.7	0.7
Swamp	Basin Swamp	3.2	N/A
Total Wetlands		9.1	1.8

Table 1-4: Wetland Classification within the LSMOC PDA

Broad Land Cover Category	Land Cover Class	Total Area In the PDA (ha)	Compensation Area (ha)
Marsh	Class III	0.1	0.11
Peatland	Basin Bog	114.1	N/A
	Basin Fen	40.9	N/A
	Horizontal Fen	333.3	N/A
	Shore Fen	4.8	N/A
	Stream Fen	232.5	N/A
Swamp	Basin Swamp	3.8	N/A
	Lacustrine Swamp	10.7	N/A
	Lagg Swamp	11.5	N/A
	Unconfined Flat Swamp	18.1	N/A
Total Wetlands		769.7	0.1

Table 1-5: Wetland Classification in the Power Distribution Line PDA

Broad Land Cover Category	Wetland Class	Total Area In the PDA (ha)	Compensation Area (ha)
Peatland	Basin Bog	0.2	N/A
	Basin Fen	2.2	N/A
	Horizontal Fen	1.8	N/A
	Stream Fen	0.2	N/A
Swamp	Lacustrine Swamp	0.1	N/A
	Lagg Swamp	4.1	N/A
	Riverine Swamp	0.9	N/A
	Unconfined Flat Swamp	4.6	N/A
Total Wetlands		14.2	0

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Wildlife Monitoring Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS V

1.0 INTRODUCTION 6

1.1 Purpose 6

1.2 Objectives 7

2.0 REGULATORY REQUIREMENTS 8

2.1 Federal Requirements 8

2.2 Provincial Requirements 8

3.0 PUBLIC COMMUNICATIONS AND ENGAGEMENT 9

4.0 PROJECT OVERVIEW 10

5.0 POTENTIAL PROJECT EFFECTS ON WILDLIFE 11

5.1 Change in Habitat 11

5.2 Change in Mortality Risk 11

5.3 Change in Movement 12

6.0 MITIGATION 13

7.0 FOLLOW-UP AND MONITORING 15

7.1 Monitoring: Change in Habitat 15

7.2 Monitoring: Change in Mortality Risk 16

7.2.1 Mortality Reporting 16

7.2.2 Access Monitoring 17

7.2.3 Summary 18

7.3 Monitoring: Change in Movement 19

7.3.1 Winter Track Survey 19

7.3.2 Remote Camera Survey 21
7.3.3 Summary 22
8.0 ADAPTIVE MANAGEMENT 24
9.0 SCHEDULE 25
10.0 REPORTING PROTOCOLS 27
11.0 REFERENCES 28
APPENDIX 1 30
APPENDIX 2 32

List of Tables

Table 1: Management Plans Addressing Wildlife Mitigation Measures Committed to in the Project EIS and Information Requests

Table 2: Monitoring Criteria for Change in Mortality Risk

Table 3: Monitoring Criteria for Change in Movement

Table 4: Proposed Schedule for Wildlife Monitoring Activities1,2

Table 2-1: Recommended Setback Distances and Restricted Activity Periods for the Lake Manitoba and Lake St. Martin Outlet Channels Project

List of Figures

Figure A: EMP Process

Figure 1-1: Project Overview Map

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information, professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Wildlife Monitoring Plan (WMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase



Figure A: EMP Process

LIST OF ACRONYMS

AMP	Access Management Plan
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
cm	centimetre
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EPP	Environmental Protection Plan
EWMP	Eastern whip-poor-will Habitat Management Plan
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
MECP	Manitoba Environment, Climate and Parks
MESEA	Manitoba's *Endangered Species and Ecosystems Act*
mm	millimetre
OEMP	Operation Environmental Management Program
PDA	Project development area
PER	Project Environmental Requirements
PR	Provincial Road
RHMP	Red-headed Woodpecker Habitat Management Plan
ROW	right-of-way
RVMP	Revegetation Management Plan
SAR	species at risk
SARA	*Species at Risk Act*
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan

1.0 INTRODUCTION

1.1 Purpose

The Wildlife Monitoring Plan (WMP) is a component of the overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Permanent Outlet Channel Project (the Project). The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

The purpose of the WMP is to describe the monitoring activities that will be undertaken to address follow-up requirements identified in Volume 5, Section 12 of the Project Environmental Impact Statement (EIS). Follow-up requirements are actions implemented to verify key environmental assessment predictions, to reduce potential adverse effects on wildlife and their habitat(s), and to confirm compliance with regulatory requirements. For the wildlife and wildlife habitat valued component, monitoring will be carried out during the construction and operation phases of the Project and includes consideration of species that have been listed as culturally important by Indigenous rights-holders.

The wildlife assessment identified potential changes to wildlife habitat, mortality risk, and movement during construction and operation of the Project. As indicated, this WMP will be implemented as part of the EMP, which is described in the EMP Framework document and summarized in Section 3.7 of the Project EIS. The EMP prescribes measures and practices to avoid or reduce adverse environmental effects on wildlife (e.g., clearing outside of the primary nesting period for migratory birds, and use of buffers for wildlife and sensitive wildlife habitat). This WMP provides details on how predicted changes to habitat, mortality risk, and movement will be verified and how the effectiveness of mitigation strategies will be evaluated.

In summary, this document describes:

- regulatory requirements
- potential Project effects on wildlife
- Project-specific wildlife mitigation
- monitoring and adaptive management
- schedule and reporting protocols

1.2 Objectives

The monitoring criteria established for the WMP were informed by concerns raised through the Project EIS review and subsequent information requests received from federal and provincial regulators, Indigenous rights-holders and stakeholders. For example, the survey methods outlined in this plan facilitate the sampling of species identified by Indigenous rights-holders to have importance, such as: moose, beaver, marten, otter, lynx, and waterfowl. Thus, the monitoring criteria reflect measurable and meaningful parameters to verify key Project EIS predictions and to evaluate the effectiveness of mitigation measures. The objectives of the WMP are to:

- verify Project EIS predictions and evaluate the effectiveness of mitigation strategies for the environmental effects on wildlife and wildlife habitat (i.e., change in habitat, mortality risk, and movement), particularly as they relate to uncertainty in the assessment; and
- establish a framework for adaptive management that can be used to modify or enhance mitigation strategies for wildlife and wildlife habitat.

2.0 REGULATORY REQUIREMENTS

The Project EIS has been submitted to the Canadian Environmental Assessment Agency (now Impact Assessment Agency of Canada), pursuant to the *Canadian Environmental Assessment Act* (*CEAA*)*, 2012*, and to Manitoba Environment, Climate and Parks (MECP) as an *Environment Act* Proposal, pursuant to requirements of *The Environment Act* (Manitoba). The relevant federal and provincial regulatory requirements are described below.

2.1 Federal Requirements

As defined under the CEAA *2012*, monitoring and follow-up is required to verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate potential adverse environmental effects (CEAA 2012).

The *Species at Risk Act* (SARA) provides protection for species at risk (SAR) in Canada that are listed on Schedule 1. The legislation provides a framework to facilitate recovery of species listed as threatened, endangered, or extirpated and to prevent species listed as special concern from becoming threatened or endangered. SARA provides protection for both SAR and their critical habitat by prohibiting: 1) the killing, harming, or harassing of endangered or threatened SAR (sections 32 and 36 of SARA); and 2) the destruction of critical habitat of an endangered or threatened SAR (sections 58, 60, and 61 of SARA; Government of Canada 2002).

2.2 Provincial Requirements

The *Endangered Species and Ecosystems Act* (MESEA) provides protection to threatened and endangered ecosystems, as well as the flora and fauna SAR in Manitoba. *MESEA* facilitates the management and development of recovery strategies for special concern, threatened, endangered, and extirpated or extinct species to prevent further declines and promote recovery. MESEA-listed species are those that, “are of ecological, educational, aesthetic, historical, medical, recreational and scientific value to Manitoba and the residents of Manitoba” (Government of Manitoba 2015, 2019).

The Wildlife Act provides general provisions for regulating the activities relating to the take and trade of wild animals in Manitoba. A “wild animal" is defined as “an animal or bird of a species or type listed in Schedule A or declared by the regulations to be a wild animal”, and includes select amphibian, reptile and mammal species and most bird species (including those not protected under the *Migratory Bird Convention Act, 1994*) known to exist in Manitoba (Government of Manitoba 2000). *The Wildlife Act* includes protection for bird species not already afforded protection under the *Migratory Birds Convention Act, 1994* (Schedule A, Division 6), and as such, all bird species in Manitoba are considered protected by law.

3.0 PUBLIC COMMUNICATIONS AND ENGAGEMENT

The development of the WMP, and other plans that form part of the EMP, considers the comments, concerns and issues expressed through letters, emails, discussions with community elected official, community meetings, and open houses with Indigenous rights-holders, Traditional Knowledge and Traditional Land and Resource Use studies, stakeholder meetings, questionnaires, and the Project website, as documented in Chapter 5 of the Project EIS. It also considers on-going involvement with the rights-holders, through the Indigenous engagement and consultation process since the completion of the Project EIS. Manitoba Transportation and Infrastructure has undertaken and maintained engagement efforts with regulatory agencies, Indigenous rights-holders, stakeholders, and the public throughout the development of the Project and welcomes members of the public to submit questions or comments throughout the process.

Manitoba Transportation and Infrastructure will continue to engage with rights-holders, stakeholders and the public. Project updates will be discussed to solicit community feedback and collaboration on Project related items. This includes discussions on the wildlife mitigations and monitoring programs presented in this WMP Two mechanisms established to facilitate input include the Complaint Resolution Process and the Project Environmental Advisory Committee (EAC).

Like other plans that form the EMP, the WMP is a working document that has incorporated relevant environmental effects and mitigation measures that are identified and reflect up-to-date inputs through public, stakeholder, and rights-holder engagement and consultation. As demonstrated in the Indigenous Consultation and Stakeholder Engagement Report (ICSER; Project EIS Appendix 5C), the content and implementation of these plans will be discussed with potentially affected rights-holders, enabling an opportunity to provide input and feedback. The WMP and other environmental management plans will be finalized based on input obtained from potentially affected rights-holders, and from any relevant environmental regulatory approval conditions.

4.0 PROJECT OVERVIEW

The Project will provide a permanent flood control mitigation system for Lake Manitoba and Lake St. Martin for alleviating flooding in the Lake St. Martin region. As discussed, this will be accomplished through construction of the LMOC - a new outlet channel from Lake Manitoba to Lake St. Martin, and the LSMOC - a new outlet channel from Lake St. Martin to Lake Winnipeg (LSMOC). These new channels will allow for floodwaters to be moved more quickly through Lake Manitoba and Lake St. Martin into Lake Winnipeg. The Project will result in less flooding and reduced lake levels on Lake St. Martin. Other works include re-alignment of PR 239 and a hydroelectric distribution line for operation of the LSMOC water control structure (Appendix 1, Figure 1-1).

The WMP falls within the verification step of the EMP process described in the Preface. The Project EMP contains several plans that prescribe measures and practices to avoid and reduce Project-related adverse environmental effects. For wildlife, other notable plans include the Project Environmental Requirements (PERs), Environmental Protection Plan (EPP), Revegetation Management Plan (RVMP), as well as Red-headed Woodpecker and Eastern Whip-poor-will Habitat Management Plans (RHMP and EWMP). The habitat mitigation plans include the respective species-specific monitoring commitments and monitoring; therefore, they are not discussed further in this WMP. The PERs contain general and site-specific mitigation measures and monitoring commitments associated with regulatory compliance (e.g., avoiding harm to migratory bird nests) while mitigation measures related to the wildlife monitoring activities are outlined within this WMP.

5.0 POTENTIAL PROJECT EFFECTS ON WILDLIFE

The following section describes the predicted effects on wildlife and wildlife habitat, as described in the Project EIS. The Project EIS includes baseline data gathered in 2016 (EEI 2017a and b), where Manitoba Transportation and Infrastructure supplemented the data by completing additional wildlife field investigations in 2020 (WSP 2020), 2021, and 2022. This WMP considers information from both the Project EIS (including baseline data) and recent field investigations, where available.

5.1 Change in Habitat

Project construction will remove terrestrial and aquatic habitat used by migratory birds, SAR, and other wildlife. However, with mitigation and reclamation/channel revegetation, estimates of habitat loss will be reduced. Construction noise and activity may deter wildlife, including SAR and migratory birds, from using areas within and adjacent to the active construction areas for the short-term, with animals returning to the area when disturbance ceases. Positive effects are predicted during operation and are expected to mainly benefit the Lake St. Martin Important Bird Area (Project EIS, Vol 3, Figure 8.3B-8) and its waterbird colonies through reduced flooding and erosion of shorelines, islands, and nests. Other wildlife such as muskrats, ducks, grebes, loons, and geese that occupy or nest amongst marshy lake shores are also expected to benefit from reduced flooding on Lake St. Martin.

The Project may have indirect effects on wetlands located adjacent to the LMOC and LSMOC. The channels may alter surface water drainage flows, causing changes to soil moisture regimes and hydrologic function upgradient and downgradient of the channels. As a result, wetlands may become wetter or dryer depending on their location relative to the channels. Changes to wetlands including wildlife SAR (e.g., yellow rail, least bittern, and northern leopard frog) will be monitored as part of the Wetland Monitoring Plan (WetMP; see Section 7.2).

5.2 Change in Mortality Risk

During construction, there is potential for increased wildlife mortality risk due to vehicular collision and encounters with construction equipment. Clearing outside of the sensitive breeding period for migratory birds and adherence to mitigation measures outlined in the EPP are expected to reduce mortality risk for wildlife.

During operation and maintenance, the outlet channel right-of-way (ROW) have the potential to increase predator and hunter/trapper efficiency by providing access along an open, continuous, linear corridor. Prey species encountering the outlet channels may be at a greater risk to predation, due to improved access along the open ROWs. Cover plantings (i.e., escape or concealment cover) may reduce this risk once established along parts of the ROW edges (see RVMP).

Although most wildlife species will be able to cross the channels during operation, wildlife mortality risk will be higher for species attempting to cross the channels during high flow periods. The outlet channel ROWs, and to a lesser extent the electrical distribution line, have the potential to increase mortality risk by providing a travel corridor that increases hunting/trapping and predator efficiency. Access to Project infrastructure, including the outlet channel itself, as well as the inlet, outlet and control structures, will be restricted post-construction as per the Access Management Plan (AMP). Restricting public access and adding cover plantings along edges of ROWs to reduce sight lines and provide escape cover is predicted to reduce mortality risk to wildlife. The PR 239 realignment may also increase mortality risk for wildlife; however, it is not expected to exceed existing risk associated with the current PR 239 alignment.

5.3 Change in Movement

The outlet channel ROWs have the potential to alter wildlife movement, particularly during construction and during flood events, when the channels are conveying floodwater. Terrestrial wildlife movements may be affected during flood events, which could limit dispersion of wildlife across the channel(s) for the short-term. The ROWs will be revegetated and include additional cover plantings in strategic locations to facilitate wildlife movement across the outlet channels. Movement of most wildlife, including elk (*Cervus canadensis*), furbearers, migratory birds, SAR, and species of conservation concern are not expected to change during gates closed (i.e., non-operational period), although some literature has shown that moose (*Alces alces*) response to linear features can be variable (Bartzke et al. 2015). The PR 239 realignment may affect wildlife movement; however, it is not expected to differ substantially from effects currently associated with the existing PR 239 alignment.

6.0 MITIGATION

The Project EIS lists multiple mitigation measures to reduce potential Project effects on wildlife (Sections 8.3.6.2 to 8.3.6.4). Some of these measures will be implemented and monitored during construction and/or operation as part of compliance monitoring while others will be the focus of environmental effects and mitigation monitoring. Table 1 summarizes the wildlife mitigation measures that will be monitored as part of the environmental management plans.

Table 1: Management Plans Addressing Wildlife Mitigation Measures Committed to in the Project EIS and Information Requests

Potential Effect	Mitigation Objective	Mitigation Measure (s)	Management or Monitoring Plan
Change in Habitat	Reduce loss of red-headed woodpecker nesting habitat	Add nesting structures on edge of LMOC ROW	RVMP; RHMP
	Maintain native vegetation (e.g., grassland and areas of shrubland) along outlet channels	Revegetate with a native and agronomic seed mix; weed control	RVMP
	Maintain wetland function for wildlife including SAR	Outside drains; rewatering options	WetMP
Change in Mortality Risk	Reduce wildlife collision risk with Project vehicles	Reduced travel speeds; use multi-passenger vehicles; signs to increase awareness	PERs (i.e., PER 2.11.1)
	Reduce disturbance to denning wildlife	Apply species specific setbacks to sensitive wildlife features, such as bear dens, and furbearer dens during species-specific avoidance periods (Appendix 2, Table 2-1) if encountered prior to or during construction	PERs (2.11.1); WMP (Appendix 2, Table 2-1)
	Provide escape cover for wildlife; reduce sight lines	Cover plantings (i.e., shrubs) along edges of LMOC and LSMOC ROWs	RVMP
	Reduce access to LMOC and LSMOC	Gated access road to LSMOC; signage and fencing (both temporary and permanent)	AMP

Potential Effect	Mitigation Objective	Mitigation Measure (s)	Management or Monitoring Plan
Change in Mortality Risk (cont'd)	Reduce potential to affect migratory bird nests and bat roosts	Clearing outside of the breeding and roosting period (April 1-August 31); setbacks/terrestrial buffers for sensitive wildlife features (e.g., nests, dens)	PERs 2.5.1 and 2.16; WMP Appendix 2, Table 2-1
	Reduce potential to affect nesting birds and other less mobile wildlife	During operation, where necessary, mowing of the LMOC and LSMOC ROWs will be delayed until after July 15th so grassland birds can complete a nesting cycle. This will also benefit culturally important species such as rabbits and fawns inhabiting the ROWs.	RVMP
	Reduce potential to affect migratory birds and SAR nesting within existing quarries	Existing quarry sites that become active during the migratory bird breeding season (April 1- August 31) will be investigated for the presence of migratory bird nests (e.g., swallow colonies, common nighthawk nests) prior to quarry reactivation; setbacks/terrestrial buffers would be applied as appropriate	Quarry Management Plan; PERs (2.11.1, 2.14.1); WMP Appendix 2, Table 2-1
	Reduce potential to affect beaver during dam removal	Hand or mechanical clearing of dam	PER 2.5.8
Change in Movement	Facilitate movement of wildlife across channels	Channel design will have 5:1 slopes; use of small diameter (<100 millimetres [mm]) rock in channel armouring; cover plantings along edges of LMOC and LSMOC ROW	WMP (Section 7.3); CEMP; RVMP

7.0 FOLLOW-UP AND MONITORING

As described in Section 1.2, the WMP will be used to verify Project EIS predictions and evaluate the effectiveness of mitigation strategies for the key environmental effects. A detailed description for each of the monitoring criteria, as they relate to change in habitat, mortality risk, and movement, is provided in the subsequent sub-sections.

7.1 Monitoring: Change in Habitat

The Project will disturb lands and remove vegetation through clearing and grubbing, excavation of the LMOC and LSMOC, local drainage construction, and road construction/realignment. Revegetation will be completed in some of these areas to provide erosion and sediment control and to mitigate effects on wildlife and vegetation. Predictions in the Project EIS state that revegetation measures outlined in the RVMP will provide habitat for some wildlife along the outlet channels. These measures include establishing perennial native grass groundcover on spoils, dykes, and slopes of the LMOC and LSMOC; shrubs, snags, and woody debris along portions of the LMOC ROW edges; and, shrubs and trees along portions of the LSMOC ROW edges (RVMP). Revegetation will occur during construction, after earth works are completed in year 2 or year 3, depending on the ROW segment (see RVMP, Table 1). Vegetation monitoring will occur during the growing period for 2 years post revegetation along LMOC and for 3 years post revegetation along LSMOC (RVMP).

Use of wildlife habitat enhancements (i.e., planted shrubs and trees, installed snags) will be monitored as part of the SAR habitat mitigation plans, although some information will be collected as part of the Wildlife Monitoring Plan (see Section 7.3). The RHMP summarizes residual Project effects, habitat enhancement, and monitoring commitments for red-headed woodpecker in the LMOC region. The EWMP summarizes residual Project effects, habitat enhancements, and monitoring commitments for eastern whip-poor-will in the LSMOC and LMOC regions.

The Project has the potential to indirectly affect wetlands adjacent to the outlet channels due to altered drainage flows (e.g., wetlands to the east of the LMOC). Altered drainage patterns along the east side of the LMOC, for example, could reduce habitat for migratory birds and SAR dependent on open water habitats and increase it for others that prefer shallower habitats or habitats less frequently flooded. Residual effects to wetland functions could alter the habitat effectiveness for wetland-dependent wildlife species, including migratory birds and SAR; however, the extent of the potential effects was noted as uncertain in the Project EIS.

The WetMP has been developed to monitor for direct and indirect effects of the Project on wetlands and wetland function along the LMOC and LSMOC. In the WetMP, the selection for candidate wetland monitoring sites focused on locations where wetland function could be measurably affected, and where potential Project-related effects may occur on groundwater and surface water, in consideration of other Project monitoring objectives/plans/locations (e.g., Surface Water Management Plan, Groundwater Management Plan) to help inform detailed design, proximity to locations of previous baseline monitoring sites, and areas of concern to regulators, Indigenous rights-holders, and other stakeholders. The Plan includes determining

baseline site conditions and the monitoring of wetland form, function, water quality, wildlife and SAR (e.g., yellow rail, least bittern, and northern leopard frog). The Plan includes control and potentially affected wetland sites for the LMOC across different wetland classes. These sites will be monitored in spring and fall prior to Project construction, during construction, and for five years after construction.

7.2 Monitoring: Change in Mortality Risk

The Project has potential to increase vehicle- and equipment-related wildlife mortality risk during the construction phase and increase human/predator wildlife mortality risk to harvested species (e.g., moose, rabbit), due to increased access. The increase in vehicle- and equipment-related mortality risk is expected to be low, whereas an increase in mortality risk resulting from increased access is uncertain. Monitoring will allow for the evaluation of the effectiveness of mitigation measures identified in the Project EIS and EPP, and implementation of additional measures if an increase in mortality rates or elevated access rates are observed in certain locations.

7.2.1 Mortality Reporting

Rationale

Wildlife mortality reporting will be used to evaluate the effectiveness of mitigation measures designed to reduce traffic- and equipment- -related mortality risk during the construction of the Project. Monitoring criteria for a change in mortality risk is summarized in Section 7.2.3.

Objective

The objective of mortality reporting is to gather data on Project-related wildlife mortality.

Measurable Parameter

The measurable parameter for mortality monitoring is the number of Project-related wildlife mortality events (Section 7.2.3).

Design

Mortality reporting will be completed continuously during the construction phase of the Project for all Manitoba Transportation and Infrastructure and contractor personnel working within the Project development area (PDA) and local assessment area, where measurable direct effects are most likely to occur.

Methods

All Manitoba Transportation and Infrastructure Project and contractor personnel will be informed during initial Project orientation of the expectation to report all mortality events to Manitoba Transportation and Infrastructure. A form will be developed by Manitoba Transportation and Infrastructure to collect relevant information about the mortality event (e.g., location, time of day, species) and annual summaries will be developed.

Frequency

Mortality reporting will occur continuously during the construction phase of the Project (Table 2)

Decision Triggers / Thresholds for Action

More than five large (e.g., ungulates, predators) or ten small wildlife species mortality events per year.

- Action: Provide MECP Conservation Officer with GPS location and circumstances as incidents are detected and report survey results to MECP regional wildlife biologist/manager through annual data reports.
- Action: take measures to identify high risk zones with signage and implement speed restrictions.

7.2.2 Access Monitoring

Rationale

Access monitoring will be used to evaluate the effectiveness of mitigation measures designed to reduce wildlife mortality risk that may result from increased access by humans and predators (e.g., coyote [*Canis latrans*] and gray wolf [*Canis lupus*]). Access monitoring will not report on mortality events as described for mortality reporting (Section 7.2.1) but instead will report on number of human and predator detections where access is improved. Monitoring criteria for a change in mortality risk is summarized in Section 7.2.3.

Objective

The objective of access monitoring is to gather data on human and predator activity at access points along the outlet channel ROWs.

Measurable Parameters

The measurable parameter for access monitoring will be the number of human and predator access events/month at monitoring site (Section 7.2.3).

Design

Remote cameras (e.g., Reconyx™ Hyperfire™ PC900 [Reconyx 1997]) will be deployed year-round along strategic access points along the LMOC and LSMOC PDAs where humans and predators (e.g., coyote, gray wolf) are most likely to access and/or travel along the ROWs.

Methods

Surveys will use a standardized operating procedure for both deployment and data analysis, and will be completed in concert with the remote camera survey (Section 7.3.2) when possible. Camera locations will be at least 1 kilometre (km) apart (unless on opposite sides of the LMOC and LSMOC) to maintain independent sampling. Cameras will be installed at approximately 1.2 metres (m) above ground to optimize capture rates for the range mammal species that can trigger the sensors. Vegetation that might interfere with the field of view will be removed during installation and maintained during the subsequent maintenance (e.g., battery change, height adjustment to account for snow accumulation) and data download visits (i.e., every four months).

All photographs will be transferred to a central database and analyzed using photo analysis software (e.g., Reconyx MapView Professional™ [Reconyx 2010]). Each photograph is analyzed individually, and if a human or predator is identified as the cause of the trigger, a unique event is created. Each event will be classified by

human/species, vehicle type, number, age, and gender, as applicable. The start of a new camera event occurs when there is a change in human or wildlife species or a gap of 2 minutes between events when no photos are captured. Three photos are classified per event. The length of each event is determined by calculating the time between the first and last observation of an animal passing a camera. For each event, a single photo will be 'tagged' as the best representation of the event attributes (i.e., species, abundance, age, and gender). Photos that are triggered by environmental conditions (e.g., wind, vegetation, shadows) are analyzed but not classified as an event unless a human or predator was present. The number of events will be summarized by event type (human or predator) for each camera location and treatment.

Frequency

Access monitoring will be completed continuously during the operation phase of the Project for six years post-construction.

Decision Trigger / Thresholds for Action

Significant increase in human or predator access.

- Action: Consider adding or altering mitigation at outlet channel access points and report survey results to MECP regional wildlife biologist/manager through annual data reports.

7.2.3 Summary

A summary of the monitoring criteria for change in mortality risk is provided in Table 2. A summary of scheduled monitoring commitments is provided in Section 9.0.

Table 2: Monitoring Criteria for Change in Mortality Risk

Monitoring Objective	Method	Monitoring Metrics	Project Phase	Duration	Frequency
Evaluate the effectiveness of mitigation strategies implemented to reduce mortality risk	Mortality reporting	Mortality events per year	Construction	Years 1-3	Continuous
	Access monitoring	Events per month	Operation	Years 1-6	Continuous

7.3 Monitoring: Change in Movement

Operation of the outlet channels will, at times, present a semi-permeable barrier for some wildlife species (e.g., ungulates, furbearers) that limits their ability to move across the outlet channels. The Project EIS states that while wildlife may avoid crossing the outlet channels during flood events, most species will be able to cross when channels are not conveying floodwater. The prediction that wildlife movement will not be impeded outside of flood events is based on channel design, such as use of 5:1 side slopes, use of small diameter (<100 mm) rock armouring, and low flows. In addition, mitigation measures, such as the addition of cover plantings, and have been developed to facilitate wildlife movement along and across the outlet channels.

To address public concern and uncertainty regarding wildlife movement along and across the outlet channels, wildlife movement monitoring will be undertaken using a winter track survey and a remote camera survey to determine if mitigation measures (i.e., cover plantings, use of small diameter armouring rock) facilitate (i.e., do not hinder) movement of wildlife including moose, elk, white-tailed deer, Canada lynx (*Lynx canadensis*), fisher (*Pekania pennanti*), and American marten (*Martes americana*). Monitoring criteria for a change in movement is summarized in Section 7.3.3.

7.3.1 Winter Track Survey

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to reduce the potential for adverse effects on wildlife movement (i.e., cover plantings and absence of riprap to facilitate movement). The winter track survey will be used to assess the effectiveness of these mitigation measures on facilitating wildlife crossing the outlet channels in winter. The survey will include examining the number of tracks that cross the ROW relative to the areas of the ROW where mitigation has and has not been applied. It is expected, for example, that more tracks will be observed in areas with the mitigation measures than without. This survey will provide information on a wide range of wildlife species, including culturally important species such as American marten , fisher, Canada lynx, moose, elk, and gray wolf (*Canis lupus*) having potential to interact with the LMOC and/or LSMOC during the winter months. The survey will include investigating mammal use of Dauphin and Fairford rivers located west of LSMOC and LMOC, respectively. Lastly, surveys will also provide incidental information into how humans and predators (e.g., gray wolf) access and interact with the outlet channel ROWs.

Objectives

The objectives of the winter track survey are to assess the effectiveness of channel mitigation measures in facilitating wildlife movement and compare crossing rates to the Dauphin and Fairford rivers during the winter.

Measurable Parameter

The measurable parameter for the aerial winter track survey is the number of wildlife track crossings/km/wildlife species (Section 7.3.3).

Design

Surveys will be undertaken along the LMOC and LSMOC ROWs to confirm crossing events relative to mitigation treatments and adjacent habitat types. Surveys will also be completed in areas adjacent to the outlet channels (for regional context), including along the centerline of the Dauphin and Fairford Rivers as comparisons and/or reference areas.

Methods

Surveys will follow standardized aerial survey protocols (ASRD 2015) and will be completed twice per winter to account for seasonal variation in wildlife movements. Surveys will be completed using a helicopter and a two-person team with the primary observer in the front left seat, and the secondary observer/data recorder in the rear right. Surveyors will focus on an area within 100 m of the helicopter in which all wildlife and tracks will be recorded. Surveys will be flown < 100 m above ground level at approximately 50 km/hour (altitude and speed will vary depending on conditions) during periods of good environmental conditions:

- wind <30 km/hour
- cloud ceiling >150 m
- precipitation not exceeding a light, intermittent snowfall
- absence of fog
- during periods of adequate daylight (from one half hour after sunrise to one half hour before sunset)
- with a snow base of ≥25 centimetres (cm; MCWS 2015, unpublished).

To identify mammal tracks in the snow during aerial surveys, surveys are typically undertaken within two to three days after a snowfall event (5-10 cm; BC MOELP 1998).

A handheld GPS will be used to collect a track log that recorded coordinates at one-second intervals. Upon observation of a mammal track or individual, the data recorder will record the species, number of tracks, and number of individuals, along with the associated time (hh:mm:ss) which will be used to extract a matching coordinate from the GPS track log. The helicopter may slow down or circle back to obtain a more accurate location for the observation. The georeferenced data will be summarized and mapped using ArcGIS® (ESRI 2012). Other wildlife detected during winter track surveys will be recorded as incidental observations.

Frequency

Surveys will be undertaken during the first year of construction and in years 2, 4, and 6 during operation, twice per year (early winter and late winter).

Decision Triggers / Thresholds for Action

Ungulate and/or predator crossings are observed but furbearers are not despite mitigation.

- Action: Review results from remote camera survey and consider if additional mitigation measures are required to enhance wildlife movement. Report survey results to MECP regional wildlife biologist/manager through annual data reports.

Wildlife crossings are not observed along the outlet channel ROWs despite mitigation.

- Action: Review results from remote camera survey and consider if additional mitigation measures are required to enhance wildlife movement. Report survey results to MECP regional wildlife biologist/manager through annual data reports.

7.3.2 Remote Camera Survey

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to reduce the potential for adverse effects on wildlife movement (i.e., cover plantings and absence of riprap to facilitate movement). The remote camera survey will be used to assess the effectiveness of these mitigation measures by examining the number of wildlife photo events along the ROW relative to the areas of the ROW where mitigation has been applied. It is expected, for example, that a greater number of photograph events will be observed in closer proximity to the mitigation measures. This survey will build upon baseline surveys and will provide information on a wide range of wildlife species (e.g., American marten, fisher, Canada lynx, moose, elk, gray wolf) interacting with the LMOC and LSMOC year-round. The survey will also provide incidental information on how predators (e.g., wolves, coyotes) interact with the outlet channel ROWs.

Objective

Assess the effectiveness of mitigation measures in facilitating wildlife movement across channels.

Measurable Parameter

The measurable parameter for the remote camera survey is the number of photograph events/species and number of mammal crossings (Section 7.3.3).

Design

Remote cameras (e.g., Reconyx™ Hyperfire™ PC900 [Reconyx 1997]) will be deployed along the LMOC and LSMOC PDA using a randomly stratified design that incorporates the mitigation treatment (active mitigation vs. control sites) and side of the outlet channel (east or west). Cameras will be placed near the water line and along the edges of the ROWs. Cameras may also be placed on Project infrastructure (e.g., inlet structures, bridge) to obtain time-lapse photographs of the wetted channel and local mammal movements.

Methods

Surveys will be undertaken using a standardized operating procedure for both deployment and data analysis. Camera locations will be at least 500 m apart (unless on opposite sides of the outlet channels) to maintain independent sampling and installed at roughly breast height (1.2 m) to optimize the range of mammals that can trigger the sensors and to allow for snow depth during the winter months. Vegetation, if present will be cleared/trimmed from the line-of-sight for each camera during installation and maintained during subsequent maintenance and data download visits (i.e., every four months). Wildlife detected during camera deployment and retrieval will be recorded as incidental observations.

All photographs will be transferred to a central database and analyzed using photo analysis software (e.g., Reconyx MapView Professional™ [Reconyx 2010]). Each photograph is analyzed individually, and if wildlife is identified as the cause of the trigger a unique event is created. Wildlife captured in each event are classified by species, number, age, and sex, if possible. The start of a new camera event occurs when there is a change in wildlife species or a gap of one hour between events when no photos are captured. Three photos are classified per wildlife event. The length of each event is determined by calculating the time between the first and last observation of an animal passing a camera. For each event, a single photo is classified as the best representation of the event attributes (i.e., species, abundance, age, sex). Photos that are triggered by environmental conditions (e.g., wind, vegetation, shadows) are analyzed but not classified as an event unless an animal was present. The species and number of events will be summarized for each camera location and treatment.

Frequency

Cameras will be deployed following the completion of channel ROW revegetation. The cameras will monitor wildlife use in years 2, 4, and 6, post-construction.

Decision Triggers / Thresholds for Action

Ungulate and/or predator crossings are observed but furbearers are not despite mitigation.

- Action: Review results from remote camera survey and consider if additional mitigation measures are required to enhance wildlife movement. Report survey results to MECP regional wildlife biologist/manager through annual data reports.

Wildlife crossings are not observed along the outlet channel ROWs despite mitigation.

- Action: Review results from winter track survey and consider additional mitigation measures to enhance wildlife movement. Report survey results to MECP regional wildlife biologist/manager through annual data reports.

7.3.3 Summary

A summary of the monitoring criteria for change in movement is provided in Table 3. A summary of scheduled monitoring commitments is provided in Section 9.0.

Table 3: Monitoring Criteria for Change in Movement

Monitoring Objective	Method	Monitoring Metrics	Project Phase	Duration	Frequency
Assess mammal movement across the outlet channels and evaluate the effectiveness of mitigation strategies used to facilitate movement	Winter track survey	Number and location of wildlife crossing events	Construction and Operation	First year of construction and years 2, 4, and 6 post-construction	Twice each winter
	Remote camera survey	Number of photo events	Operation	3 years (years 2, 4, and 6 post-construction)	Continuous

8.0 ADAPTIVE MANAGEMENT

Adaptive management is a structured and systematic process focused on improving environmental management by using lessons learned to reduce uncertainty while updating policies and practices (British Columbia Ministry for Forests and Range 2015). Adaptive management allows for the flexibility to identify and implement new mitigation measures or to modify existing ones (CEAA 2015).

The initial steps in this adaptive management framework involve developing and implementing wildlife mitigation measures as committed to in the Project EIS. Wildlife mitigation measures will be monitored as described in Section 7.0, and their effectiveness evaluated and documented as part of the reporting requirement (Section 10.0). During this process, if mitigation measures are deemed deficient, a root cause analysis would be undertaken to understand how they failed to meet objectives. Regulators, rights-holders, and other stakeholders may be engaged during this evaluation and review period to identify next steps and/or adaptive measures. Should adaptive measures be implemented, monitoring and reporting would continue as described.

9.0 SCHEDULE

The proposed schedule for all Project-related wildlife monitoring described in Section 7.0, is summarized in Table 4. Although these activities are planned to commence in 2022/23, this schedule is subject to change and contingent upon federal (i.e., CEAA 2012) and provincial (i.e., *The Environment Act* license) approvals.

Table 4: Proposed Schedule for Wildlife Monitoring Activities1,2

Residual Effect	Key Monitoring Activity	Project Phase								
		Construction			Post-construction					
		Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Change in Mortality Risk	Mortality reporting									
	Access monitoring									
Change in Movement	Aerial track survey									
	Remote camera survey									

Notes:

[1] Gray cells indicate when monitoring activities are planned

[2] The proposed schedule is pending regulatory approvals

10.0 REPORTING PROTOCOLS

Annual monitoring reports summarizing activities results will be developed and provided to the Impact Assessment Agency of Canada and MECP At the completion of the monitoring program, annual reports will be summarized into one final Wildlife Monitoring Report.

11.0 REFERENCES

ASRD (Alberta Sustainable Resource Development). 2015. Aerial ungulate survey protocol manual. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, AB.

Bartzke, G., R. May, E. Solberg, C. Rolandsen, and E. Roskaft. 2015. Differential barrier and corridor effects of power lines,roads and rivers on moose (*Alces alces*) movements. Available at: https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1890/ES14-00278.1

BC MOELP (British Columbia Ministry of Environment, Lands and Parks. 1998. Inventory methods for wolf and cougar. Standards for components of British Columbia's biodiversity No. 34. Ministry of Environment, Lands and Parks. Victoria, BC.

British Columbia Ministry of Forests and Range. 2015. Defining Adaptive Management [online]. Available from: https://www.for.gov.bc.ca [accessed October 2020].

CEA Agency (Canadian Environmental Assessment Agency). 2012. Operational Policy Statement. Follow-up Programs under the *Canadian Environmental Assessment Act*.

CEA Agency. 2015. Practitioners Glossary for the Environmental Assessment of Designated Projects Under the Canadian Environmental Assessment Act, 2012 [online]. Available from: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-glossary-environmental-assessment-designated-projects-under-canadian-environmental-assessment-act-2012.html [accessed October 2020].

EEI (EcoLogic Environmental Inc.). 2017a. Lake Manitoba outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.

EEI (EcoLogic Environmental Inc.). 2017b. Lake St. Martin outlet channel: wildlife technical report. Prepared for M. Forster Enterprises. Winnipeg, MB.Fenton, M.B., and R.M.R. Barclay. 1980. Myotis lucifugus. 142 Mammalian Species, pp. 1-8. Available at: https://www.jstor.org/stable/pdf/3503792.pdf. Accessed on: January 14, 2021.

Government of Canada. 2002. *Species at Risk Act*. Available at: http://laws-lois.justice.gc.ca/eng/acts/s-15.3/FullText.html. Accessed June 2019.

Government of Manitoba. 2017. Forestry management guidelines for terrestrial buffers. Available at: Manitoba Conservation (gov.mb.ca). Accessed June 2022.

Government of Manitoba. 2000. The Wildlife Act. Available at: https://web2.gov.mb.ca/laws/statutes/ccsm/w130e.php. Accessed June 2022.

MB CDC (Manitoba Conservation Data Centre). 2021. Recommended development setback distances and restricted activity periods for birds by wildlife feature type. Available at: https://www.manitoba.ca/fish-wildlife/cdc/pubs/mbcdc-bird-setbacks-nov2021.pdf. Accessed June 2022.

Manitoba Hydro. 2015. Assessment of potential effects on wildlife and wildlife habitat *In* Environmental Impact Statement for the Manitoba-Minnesota Transmission Project. Available at: https://www.hydro.mb.ca/projects/mb_mn_transmission/pdfs/eis/mmtp_eis_chapter09_wildlife_and_wildlife_habitat.pdf. Accessed June 2019.

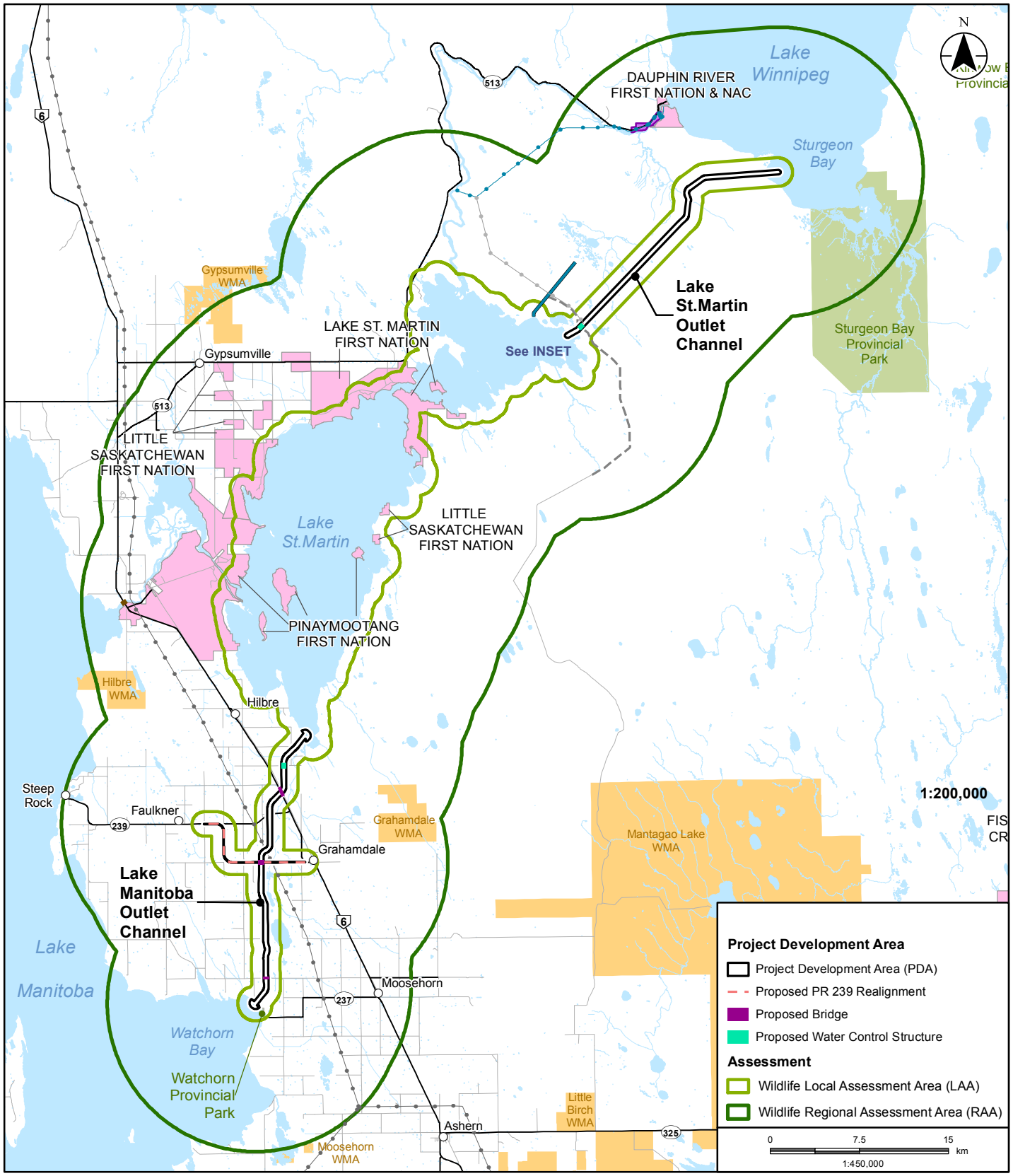
MCWS (Manitoba Conservation and Water Stewardship). 2015. Unpublished environmental parameters for aerial wildlife survey. Manitoba Conservation and Water Stewardship, Wildlife Branch, Winnipeg, MB.

Reconyx. 2010. MapView professional image management user guide. Available at: https://www.reconyx.com/img/file/MapViewUserGuide.pdf. Accessed October 2020.

WSP. 2020. Lake Manitoba and Lake St. Martin Outlet Channel Project: preconstruction environmental field work. Winnipeg, MB.

APPENDIX 1

Figures



Legend

- Fairford Water Control Structure
- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Existing Transmission Line
- Existing Distribution Line
- Planned Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Northern Affairs Community (NAC)
- First Nation
- Wildlife Management Area
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure, Stantec Consulting
3. Last Update: 6/22/2022 12:52:30 PM

Manitoba Stantec

Manitoba Transportation and Infrastructure
Lake Manitoba & Lake St.Martin Outlet Channels Project

Project Overview Map

Figure 1-1

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APPENDIX 2

Tables

Table 2-1: Recommended Setback Distances and Restricted Activity Periods for the Lake Manitoba and Lake St. Martin Outlet Channels Project

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (m)[2]		
Common Name	Scientific Name			Low	Medium	High
American badger[a]	*Taxidae taxus*	Active den	Year round	100	500	500
Black bear[b]	*Ursus americanus*	Active den	Year round	150	150	150
Little brown myotis[a,c]	*Myotis lucifugus*	Roost	May 1 – August 31	100	500	500
Northern myotis[a,c]	*Myotis septentrionalis*	Roost	May 1 – August 31	100	500	500
Bat cave[d]	-	Cave	Year round	200	200	200
Wolverine[e]	*Gulo*	Den	Year round	100	250	500
Mineral lick[b]	-	Mineral lick	Year round	120	120	120
Denning species (e.g., red fox, coyote, gray wolf, American marten, fisher, least weasel)[c]	-	Active den	Year round	50	50	50
American white pelican	*Pelecanus erythrorhynchos*	Nesting colony	April 1 – August 31	500	750	1,000
Bald eagle	*Haliaeetus leucocephalus*	Active or traditional nest site	March 15 – July 15	250	500	1,000
Bank swallow	*Riparia*	Nesting colony	May 15 – July 31	50	150	300
Barn swallow	*Hirundo rustica*	Nest site	May 15 – Sept. 30	50	150	300

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (m)[2]		
Common Name	Scientific Name			Low	Medium	High
Barred owl	*Strix varia*	Active or traditional nest site	March 15 - July 15	250	500	1,000
Bobolink	*Dolichonyx oryzivorus*	Nest site	May 15 – August 15	100	250	400
Boreal Owl	*Aegolius funereus*	Nest Site	March 1 - July 15	250	500	1,000
Canada warbler	*Cardellina canadensis*	Nest site	May 1 – July 31	200	300	450
Common nighthawk	*Chordeiles minor*	Nest site	May 1 – August 31	100	200	500
Double-crested cormorant	*Phalacrocorax auritus*	Nesting colony	April 1 – August 31	400	500	750
Eastern whip-poor-will	*Antrostomus vociferous*	Nest site	May 15 – July 16	100	200	500
Eastern wood-pewee	*Contopus virens*	Nest site	May 15 – August 15	50	150	300
Golden-winged warbler	*Vermivora chrysoptera*	Nest site	May 15 – August 6	200	300	450
Great gray owl	*Strix nebulosa*	Active or traditional nest site	Feb. 15 – July 15	250	500	1,000
Grebes	-	Nesting colony	May 15 – July 15	100	200	400
Gulls/terns	-	Nesting colony	May 1 – July 15	400	500	750
Herons	-	Nesting colony	April 1 – August 31	400	500	750

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (m)[2]		
Common Name	Scientific Name			Low	Medium	High
Horned grebe	*Podiceps auratus*	Nest site	May 1 – Sept. 15	100	200	400
Least bittern	*Ixobrychus exilis*	Nest site	May 1 – July 31	100	200	400
Northern hawk owl	*Surnia ulula*	Nest site	Feb. 15 – July 15	250	500	1,000
Osprey	*Pandion haliaetus*	Nest site	May 1 – August 15	500	1,000	1,000
Olive-sided flycatcher	*Contopus cooperi*	Nest site	May 1 – August 31	50	150	300
Piping plover	*Charadrius melodus*	Active or traditional nest site	April 15 – August 15	200	400	600
Red-headed woodpecker	*Melanerpes erythrocephalus*	Nest site	April 15 – August 15	50	100	200
Rusty blackbird	*Euphagus carolinus*	Nest site	May 1 – July 31	50	150	300
Sharp-tailed grouse	*Tympanuchus phasianellus*	Lek	Mar 15 - May 15	200	500	1000
Short-eared owl	*Asio flammeus*	Nest site	April 15 – Sept. 15	200	300	500
Trumpeter swan	*Cygnus buccinator*	Nest site	April 1 – July 31	500	750	1,000
Yellow rail	*Coturnicops noveboracensis*	Nest site	May 1 – July 15	100	150	350
Northern leopard frog[a]	*Lithobates pipiens*	Hibernaculum and breeding habitat	Year round	10	200	500
Red-sided garter snake[b]	*Thamnophis sirtalis*	Hibernaculum	Year round	200	200	200

Species or Feature[1]		Key Wildlife Feature	Restricted Activity Period	Recommended Setback Distance by Disturbance Category (m)[2]		
Common Name	Scientific Name			Low	Medium	High
Snapping turtle[3, a]	*Chelydra serpenine*	Nest site	March 15 – June 30	0	400	400

Notes:

1 Recommended setback distances and restricted activity periods are derived from MB CDC's Recommended Development Setback Distances from Birds document (MB CDC 2021) unless otherwise specified (see a-c below)

[a] – Saskatchewan Ministry of Environment's Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017)

[b] – Manitoba Hydro's Manitoba-Minnesota Transmission Project Construction EPP (Manitoba Hydro 2015)

[c] – Core maternity roost period for bats as defined by Fenton and Barclay (1980) and Barclay (1982 and 1984)

[d] – Manitoba's Forest Management Guidelines for Terrestrial Buffers (Government of Manitoba 2017)

[e] – Environment Canada's Petroleum Industry Activity Guidelines for Wildlife SAR in the Prairie and Northern Region (Environment Canada 2009)

2 Low: foot traffic, occasional/infrequent/short-term small vehicle (<1 ton) or ATV use; medium: trucks>1 ton, regular/frequent/long-term small vehicle (<1 ton) or ATV use; High: road, distribution line, or outlet channel construction, forest harvest, rock crushing, asphalt batching, quarry or gravel pit operation

3 snapping turtle: Low disturbance category considered as foot traffic only, all other activities (i.e., occasional/infrequent/short-term small vehicle (<1 ton) or ATV use considered medium disturbance).

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Red-headed Woodpecker Habitat Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS V

1.0 INTRODUCTION 1

1.1 Background and Purpose 1

1.2 RHMP Development Process 1

1.3 Project Overview 2

1.4 Project Interaction with Red-Headed Woodpecker Habitat 2

1.5 Red-headed Woodpecker and Decadent Tree Survey 2

1.5.1 Objectives 2

1.5.2 Methods 3

1.5.3 Results 4

2.0 MITIGATION GOALS AND OBJECTIVES 7

3.0 GENERAL PROJECT MITIGATION 8

4.0 OUTLET CHANNEL RIGHT-OF-WAY HABITAT MITIGATION 9

4.1 Revegetation Prescriptions 9

4.2 Nest Structure Mitigation 11

4.2.1 Salvaged Decadent Trees 11

5.0 MONITORING AND FOLLOW-UP 13

5.1 Red-headed Woodpecker Nest Survey 13

5.2 Red-headed Woodpecker Point-count Survey 14

5.3 Nest Structure Inspection 15

5.4 Habitat Monitoring 16

6.0 ADAPTIVE MANAGEMENT 17

7.0 REFERENCES 18

7.1 Literature Cited 18

7.2 Personal Communication 19

APPENDIX 1 20

APPENDIX 2 23

APPENDIX 3 58

List of Tables

Table 1: Summary of Confirmed and Possible Red-headed Woodpecker Nesting Trees

Table 2: Monitoring Criteria for the Red-headed Woodpecker Surveys

Table 2-1: Decadent Tree Survey Results 2021

Table 3-1: Decadent Trees to be Salvaged

Table 3-2: Decadent Tree Reinstallation Locations

List of Figures

Figure A: EMP Process

Figure 1: Schematic of LMOC ROW

Figure 1-1: Project Overview Map

Figure 1-2: Proposed LMOC Red-headed Woodpecker Habitat Mitigation Areas - Overview

Figure 2-1: Breeding Red-headed Woodpecker Survey Overview

Figure 2-2: Decadent Tree Survey Results 2021

Figure 2-3: Decadent Tree Survey Results 2021

Figure 2-4: Decadent Tree Survey Results 2021

Figure 2-5: Decadent Tree Survey Results 2021

Figure 2-6: Decadent Tree Survey Results 2021

Figure 2-7: Decadent Tree Survey Results 2021

Figure 2-8: Decadent Tree Survey Results 2021

Figure 2-9: Decadent Tree Survey Results 2021

Figure 2-10: Decadent Tree Survey Results 2021

Figure 2-11: Decadent Tree Survey Results 2021

Figure 2-12: Decadent Tree Survey Results 2021

Figure 2-13: Decadent Tree Survey Results 2021

Figure 2-14: Decadent Tree Survey Results 2021

Figure 2-15: Decadent Tree Survey Results 2021

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information, professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Red-headed Woodpecker Habitat Management Plan is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

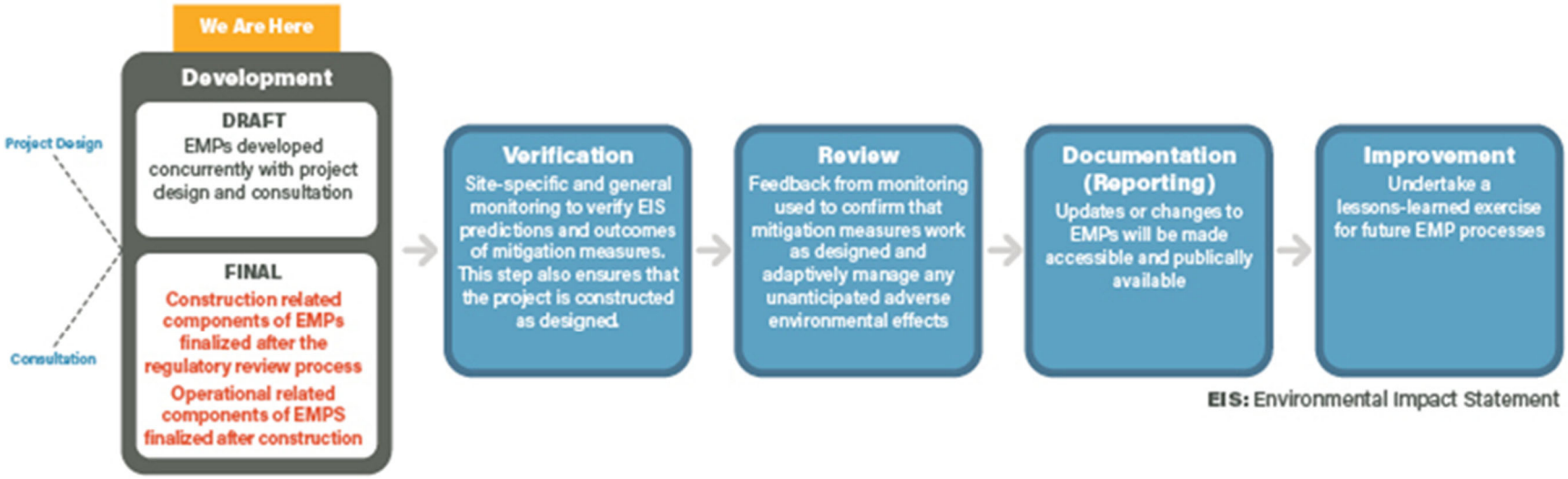


Figure A: EMP Process

LIST OF ACRONYMS

%	percent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ha	hectares
HMA	habitat mitigation area
km/h	kilometres per hour
LAA	local assessment area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
m^2	square metres
MARD	Manitoba Agriculture and Resource Development
MECP	Manitoba Environment, Climate and Parks
PDA	Project development area
PR	Provincial Road
RHMP	Red-headed Woodpecker Habitat Mitigation Plan
RM	Rural Municipality
ROW	right-of-way
RVMP	Revegetation Management Plan
SAR	Species at Risk
the Project	Lake Manitoba and Lake St. Martin Outlet Channels Project

1.0 INTRODUCTION

1.1 Background and Purpose

The Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project) proposed by Manitoba Transportation and Infrastructure overlaps potential critical habitat for red-headed woodpecker (*Melanerpes erythrocephalus*), listed as endangered under the federal *Species at Risk (SAR) Act* (Government of Canada 2021). Red-headed woodpecker is a cavity-nesting woodpecker that breeds in open deciduous forest or forest edges, and open habitats (e.g., grasslands or pastures containing windrows) where mature or dead trees are available for nesting (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2007, Environment and Climate Change Canada [ECCC] 2021). In 2021, a federal recovery strategy was developed to provide guidance aimed at halting and reversing the population decline of red-headed woodpecker and identifying critical habitat (ECCC 2021).

The recovery strategy identifies 10 x 10 km critical habitat squares throughout this species' Manitoba range (ECCC 2021). These standardized spatial units are used to identify known areas containing confirmed breeding evidence and potential critical habitat. The Project overlaps with one of these squares along the Provincial Road (PR) 239 realignment west of the Lake Manitoba Outlet Channel (LMOC; ECCC 2021; Appendix 1, Figure 1-1). Construction within the Project development area (PDA; i.e., Project footprint) will require clearing of forested habitats that may support red-headed woodpecker habitat but not critical habitat as defined in the species recovery strategy (ECCC 2021; Section 1.4).

Despite no evidence that critical breeding habitat will be directly affected by the Project, Manitoba Transportation and Infrastructure is using a precautionary approach and committing to additional mitigation measures (as described in Chapter 12.7 of the Project Environmental Impact Statement [EIS]), to reduce potential Project-related effects to red-headed woodpecker habitat.

The purpose of this Red-headed Woodpecker Habitat Mitigation Plan (RHMP) is to describe the red-headed woodpecker habitat mitigation and monitoring activities that will be implemented along the LMOC outlet channel right-of-way (ROW).

1.2 RHMP Development Process

Development of the RHMP was influenced by both the LMOC engineering design and revegetation plans, and red-headed woodpecker habitat preferences as described in the species recovery strategy (ECCC 2021). The RHMP has continued to evolve and develop in consultation with regulators, stakeholders, and Indigenous rights-holders, with feedback received and addressed either in the RHMP or during meetings and presentations (MTI 2021b; MTI 2021c). As new information becomes available, the RHMP will be updated with additional detail regarding the proposed red-headed woodpecker habitat mitigation described in Section 3.2.2. For example, results from 2021 red-headed woodpecker and decadent tree surveys were used to refine the number and location of areas that will receive habitat enhancements.

1.3 Project Overview

The Project will develop a permanent flood control mitigation system for Lake Manitoba and Lake St. Martin for alleviating flooding in the Lake St. Martin region. This will be accomplished through construction of a new outlet channel from Lake Manitoba to Lake St. Martin (LMOC) and a new outlet channel from Lake St. Martin to Lake Winnipeg (Lake St. Martin Outlet Channel [LSMOC]). These new channels will allow for floodwaters to be moved more quickly through Lake Manitoba and Lake St. Martin into Lake Winnipeg. The Project will result in less flooding and reduced lake levels on Lake St. Martin. Other works include re-alignment of PR 239 and a hydroelectric distribution line for operation of the LSMOC (Appendix 1, Figure 1-1).

1.4 Project Interaction with Red-Headed Woodpecker Habitat

The Project (i.e., part of the PR 239 realignment ROW) overlaps 35.4 hectares (ha) of the 20,000-ha red-headed woodpecker critical habitat square (0.2 percent [%]); 19.8 ha of which is open deciduous forest, a preferred broad habitat type. Existing land cover data indicates that the Project will result in the direct loss of 1.7 ha of old growth (41 to 80 years) deciduous forest, which suggests the potential loss of decadent trees (potential red-headed woodpecker nest trees) may be minor. Point count surveys completed in 2020 did not reveal the presence of the species where the PR 239 realignment overlaps the critical habitat square (WSP 2020). Additionally, based on Environment and Climate Change Canada data, the only red-headed woodpecker critical habitat polygons known to occur within the local assessment area (LAA) are located greater than 600 m from the PR 239 realignment (ECCC pers. comm. 2020). The Project is not expected to interact with these known critical habitat polygons because of the distance between them. The combination of this data suggests that the Project does not interact with critical habitat.

Red-headed woodpecker are known to occur in areas outside of the critical habitat square, including in the LMOC PDA. Baseline surveys conducted for the Project (EEI 2017; WSP 2020) confirmed the presence of breeding woodpeckers at four locations along the LMOC PDA, and one active nest tree north of Reed Lake that has since fallen over.

1.5 Red-headed Woodpecker and Decadent Tree Survey

In 2021, a field survey program was completed in support of the RHMP, with a focus on evaluating the relative abundance and distribution of breeding red-headed woodpeckers and their habitats within the LMOC PDA ROW).

1.5.1 Objectives

The objectives of the survey program were to:

- Estimate the number and location of red-headed woodpecker breeding pairs occupying the LMOC PDA.
- Determine the number and location of suitable decadent trees that could be salvaged from red-headed woodpecker habitat along the LMOC PDA for use as restorative habitat post-construction.

1.5.2 Methods

The 2021 field survey program contained two separate survey components:

1. a *Breeding Red-headed Woodpecker Survey* to identify forest stands occupied by breeding red-headed woodpecker; and
2. a *Decadent Tree Survey* to quantify the number, and generally identify the location, of decadent trees in forest stands occupied by breeding adults.

1.5.2.1 Breeding Red-headed Woodpecker Survey

The Breeding Red-headed Woodpecker Survey was undertaken in mature deciduous forest stands, as identified by species-specific habitat mapping used in the Project EIS (MI 2020), near known snag and/or nest locations (EEI 2017) within the LMOC PDA (Appendix 2, Figure 2-1 and Photo 1), and where aerial imagery suggested the presence of deciduous trees. The total area targeted by the survey was 152 ha of potential red-headed woodpecker habitat intersected by the PDA. Two replicate surveys were completed during the peak breeding season using a removal sampling design (i.e., once the species was detected at a site, it was not re-surveyed). Two teams of two observers completed the first survey replicate from June 23 to 28, 2021, and one team of two observers completed the second survey replicate from July 7 to 10, 2021.

The Breeding Red-headed Woodpecker Survey followed a standardized ten-minute point-count survey protocol (Ralph et al. 1995) that incorporated a call-broadcast component shown to increase the detection probability for woodpecker species (e.g., BC RIC 1999; Baumgardt et al. 2013; Wisconsin DNR 2013). The sequence of broadcast calls used a five-minute passive listening/viewing period, followed by a three-minute active call-broadcast period (rotation between 30 seconds of red-headed woodpecker calls and drumming and 30 seconds of silence), and completed with a two-minute passive listening/viewing period. Surveys were undertaken under the authority of Manitoba Agriculture and Resource Development (MARD) SAR Permit No. SAR21012.

Surveys were completed using a digital data collection application specifically designed for point-count surveys. A total of 57 locations were surveyed for breeding red-headed woodpecker near patches of potential red-headed woodpecker habitat (i.e., open deciduous forest or forest edges, and grasslands or pastures containing windrows; COSEWIC 2007; ECCC 2021) located on and/or immediately adjacent to the LMOC PDA (Appendix 2, Figure 2-1). Survey sites were located a minimum of 300 metres (m) apart to reduce the likelihood of counting the same individuals more than once. Surveys were completed during periods of suitable weather (i.e., clear visibility, wind ≤20 kilometres per hour (km/h), temperature >0°C, and precipitation not exceeding a light, intermittent drizzle) and started at sunrise and ended within 4.5 hours of sunrise (Bibby et al. 2000). The resulting species detection data are summarized by survey site and mapped relative to the Project in order to provide an understanding of the presence and distribution of red-headed woodpecker.

Confirmed red-headed woodpecker nest trees identified during point count surveys were georeferenced, photographed and left undisturbed. General characteristics of nest trees were documented including approximate tree height, dbh, presence of cavities, height of nest cavity, and other relevant site conditions.

1.5.2.2 Decadent Tree Survey

The Decadent Tree Survey was used to identify decadent trees, as defined in the federal red-headed woodpecker recovery strategy (deciduous trees ≥ 18 centimetres [cm] dhb that are also dead or dying or trees with one or more large [≥ 13 cm] dead or dying limbs; ECCC 2021), along the LMOC PDA. The survey was undertaken in 13 forest stands with confirmed breeding red-headed woodpecker activity (as established by the *Breeding Red-headed Woodpecker Survey*) and in seven randomly selected deciduous forest stands. A total of twenty forest stands (approximately 25% of all deciduous forest stands within the PDA) were surveyed from June 23 to 28 and from July 7 to 10, 2021.

For relatively small forest stands (≤ 10,000 square metres [m^2]), the entire forest stand was surveyed to identify the location and number of suitable decadent trees present. For larger stands (> 10,000 m^2), a standardized circular plot method (11.28 m radius plot [400 m^2 plot]; White 2013) was used to survey a representative 4,800 m^2 portion of the stand (12 plots per stand).

Surveys were completed using a digital data collection application specifically designed for decadent tree/snag surveys. This application georeferenced the location of decadent trees and logged information on decadent tree characteristics such as tree health and condition, trunk integrity, approximate tree height, trunk dbh, presence of cavities, height of cavities, if present, and other relevant tree characteristics. All decadent trees surveyed and recorded received a unique Decadent Tree ID using the same naming convention: **S***xx*-**T***xx*, where **S***xx* is the forest stand ID (previously administered) and **T***xx* is the tree ID (administered in the field). All decadent trees were identified in the field in two ways:

1. using flagging tape tied around the trunk of the tree and the Decadent Tree ID labelled on the tape using permanent marker; and
2. a more permanent copper tree tag nailed to the north side of the trunk of the tree with the Decadent Tree ID labelled the tag by engraving it with a pen.

The resulting Decadent Tree Survey data are summarized correlative to relevant tree characteristics and mapped relative to the Project to provide an understanding of the presence and distribution of decadent trees on the LMOC PDA.

1.5.3 Results

1.5.3.1 Breeding Red-headed Woodpecker Survey

The Breeding Red-headed Woodpecker Survey resulted in 15 sites with detections of one or more breeding individuals. With the exception of one survey site, all red-headed woodpeckers detected during point count surveys were within the PDA, and in or near forest patches targeted by the survey. An additional seven incidental observations of the species were made outside of the early morning survey window.

All 14 of the sites along the PDA with confirmed breeding activity had one or more individuals detected during the first survey period (June 23 to June 28, 2021) and 12 of the 14 (86%) detections occurred during the active call-broadcast survey period (i.e., after the passive 5-minute survey period).

1.5.3.2 Decadent Tree Survey

The Decadent Tree Survey was completed in 20 forest stands located within the LMOC PDA (Appendix 2, Figure 2-1 to Figure 2-15 and Photo 3). Of the 20 stands, 13 supported red-headed woodpecker (one large stand had two detections of breeding individuals). See Appendix 2, Table 2-1 for a complete copy of the data collected for the Decadent Tree Survey.

A total of 414 decadent trees were identified in the 20 surveyed forest stands. An additional 4 decadent trees were observed outside the targeted deciduous forest stands and surveyed incidentally. Notable summary statistics regarding the surveyed decadent trees are provided below.

- The number of decadent trees observed in the surveyed deciduous forest stands ranged from 0 to 89, with an average of 21 decadent trees per stand or 30.9 trees/ha.
- The mean dbh of the surveyed decadent trees was 24 cm.
- 185 (44%) of the surveyed decadent trees were dead; 43 (10%) were in poor health; 95 (23%) were in fair health; and 95 (23%) were in relatively good health.
- 65 (16%) of the surveyed decadent trees had one or more cavities.
- Of the surveyed decadent trees with cavities, 56% were trembling aspen (*Populus tremuloides*), 31% were balsam poplar (*Populus balsamifera*), 2% were white birch (*Betula papyrifera*), 1% were bur oak (*Quercus macrocarpa*), 1% were Manitoba maple (*Acer negundo*), and 8% were unidentifiable species due to substantial decay.

Observations of a red-headed woodpecker entering a decadent tree cavity confirmed that at least 1 red-headed woodpecker nesting tree exists on the PDA. Another 3 possible nesting trees were identified on the PDA based on red-headed woodpeckers calling from, flying to and from, and/or sitting on a decadent tree with a nesting cavity. These observations are summarized in Table 1.

A visit to the red-headed woodpecker nesting tree identified on the PDA during 2016 baseline surveys (14N 530725E 5689963N; EEI 2017) revealed that it had fallen over and was no longer viable for nesting (Appendix 2, Photo 4).

Table 1: Summary of Confirmed and Possible Red-headed Woodpecker Nesting Trees

Nesting Evidence	Tree Characteristics				Stand Characteristics		Photo No.
	Species	Health	Height (m)	dbh (cm)	Stand Area (ha)	No. Decadent Trees	
Confirmed	Trembling Aspen	Dead	3	18.5	0.4	8	5
Possible	Trembling Aspen	Fair	20	30	0.7	26	6
Possible	N/A (advanced decay)	Dead	9	29	0.7	26	7
Possible	Trembling Aspen	Poor	11	27	1.1	89	8

2.0 MITIGATION GOALS AND OBJECTIVES

The goal of the RHMP is to enhance breeding habitat opportunities for red-headed woodpecker along the LMOC ROW. This will be achieved by employing the mitigation measures and adaptive management techniques outlined in the RHMP during the construction and operation phases of the Project.

Specific objectives are to:

- Describe revegetation prescriptions (i.e., shrub plantings) and vegetation management practices that provide habitat opportunities for red-headed woodpecker, while adhering to requirements for the safe operation and maintenance of the Project (Section 3.0).
- Describe LMOC ROW habitat mitigation, including erecting salvaged snags and/or decadent trees and artificial nest structures (Section 4.0).
- Describe how revegetation prescriptions and nest structure occupancy by red-headed woodpecker will be monitored to verify the effectiveness of mitigation measures (Section 5.0).

3.0 GENERAL PROJECT MITIGATION

Construction of the outlet channels will require clearing of the 400 m-wide ROW and parts of the PR 239 realignment ROW, but mitigation measures outlined in the Project Environmental Requirements (PERs) will reduce potential effects to red-headed woodpecker and their habitats. These include:

- A decadent tree survey was completed in June and July 2021 (see Section 1.5), prior to vegetation clearing activities which will be used to assess the prevalence of decadent trees in the PDA while also identifying candidate trees for salvage (Section 3.2.2).
- Treed habitats within the PDA will be retained where safe and technically feasible to do so.
- Clearing will not be scheduled to occur between April 1 and August 31 to avoid disturbance to nesting birds and other wildlife (ECCC 2018).
- If clearing is scheduled to occur within the nesting period (April 1 to August 31), a nest survey will be undertaken by a qualified wildlife biologist if warranted. In the event an active nest is found, it will be subject to site-specific mitigation measures (i.e., clearly marked protective buffer around the nest and/or non-intrusive monitoring).
- The provincially recommended setback distance for vegetation clearing and construction activities of 200 m from an active red-headed woodpecker nest will be adhered to between April 15 to August 15 (MB CDC 2015).

To promote establishment of a healthy vegetation cover for the Project and to allow for the proper function of water flow, the following measures are part of the maintenance program during the operations phase:

- Maintenance of the vegetation cover in areas where erosion might be present.
- Ongoing mowing of the outside drain to promote drainage.
- Occasional mowing of shrubs and trees that encroach on berms to maintain channel hydraulic function.
- Ongoing weed control.

4.0 OUTLET CHANNEL RIGHT-OF-WAY HABITAT MITIGATION

Habitat mitigation for red-headed woodpecker includes both revegetation prescriptions (and subsequent maintenance during the operation phase, as outlined in the Revegetation Management Plan [RVMP) and nest structure replacement that are described in greater detail in the following sections.

4.1 Revegetation Prescriptions

The goal of the RVMP is to revegetate upland areas of the outlet ROWs in a manner that promotes the establishment of grassland communities consisting of native and agronomic grasses and forbs along the LMOC. To protect structural integrity and maintain hydrological function, shrubs and trees are discouraged from growing along the channel and on spoil piles/berms, but are acceptable in peripheral areas of the ROW (Figure 1). Figure 1 below identifies where shrubland prescriptions may be added to a schematic cross section of the LMOC. Revegetation prescriptions involving native shrub plantings will provide habitat for wildlife including red-headed woodpecker as this species nests in open deciduous forests and forages in open grassland and shrubland habitat (ECCC 2021). For the purposes of the RHMP, red-headed woodpecker habitat mitigation areas (HMAs) are those areas where shrub plantings and installation of decadent trees/snags and/or nest boxes are planned along the LMOC ROW (i.e., along the peripheral edges the ROW that lie adjacent to deciduous forest [Figure 1; Appendix 1, Figure 2-2). A total of 20 proposed HMAs have been identified for red-headed woodpecker habitat enhancement along LMOC (Appendix 1, Figure 2-2).

Native plant species will be used to revegetate the LMOC ROW where possible, including native shrubs within the HMAs. The ROW outside of the HMAs will be revegetated with herbaceous plant species only (e.g., native grasses; see RVMP). Revegetation activities will occur in spring or fall depending on the construction schedule and if applied in the fall, prescriptions may require adjustments to improve survivability of seed during winter for herbaceous cover (see RVMP).

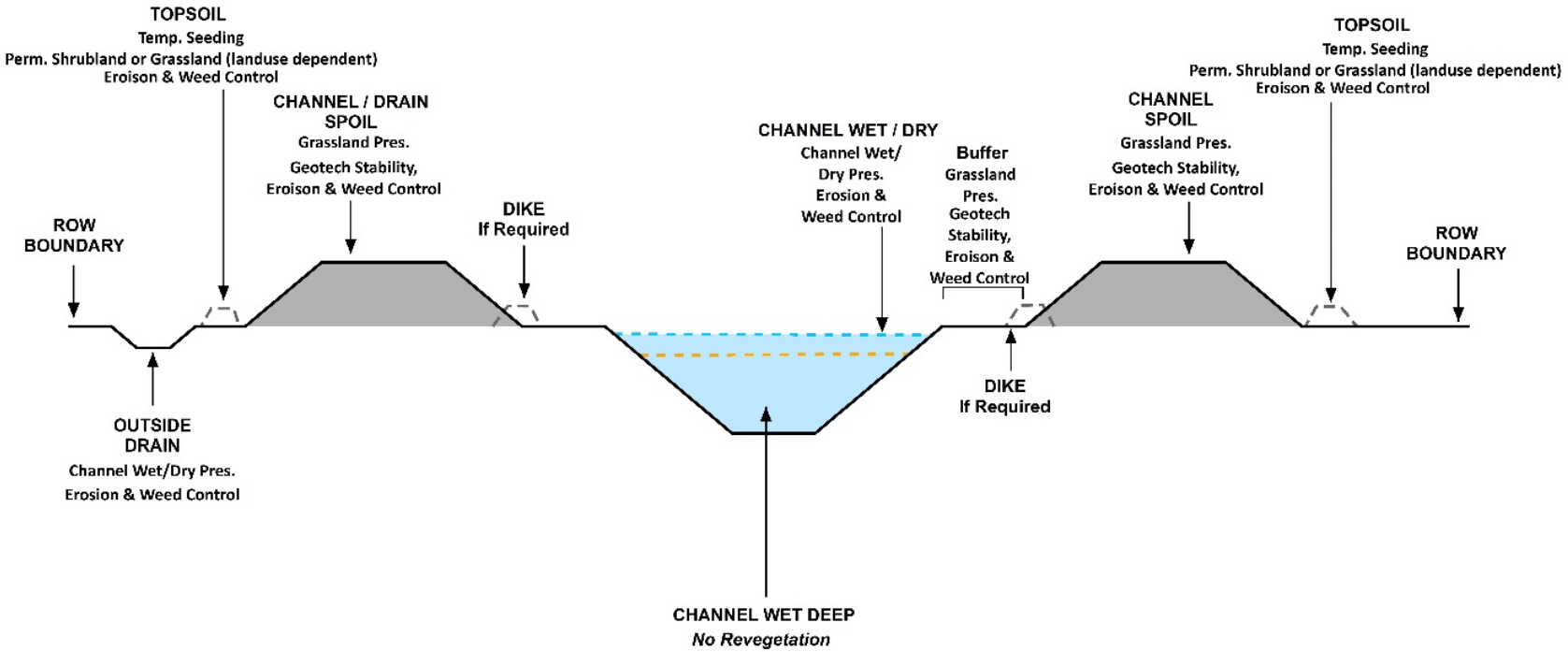


Figure 1: Schematic of LMOC ROW

Figure 1. Schematic illustrating the main components of the LMOC ROW. The HMAs will be located between the ROW boundary and outer edge of the outside drain (as shown on the left of the diagram) and between the ROW boundary and outer edge of the channel soil berm or topsoil berm (as shown on the right of the diagram).

4.2 Nest Structure Mitigation

Red-headed woodpecker habitat will be enhanced using nest structure mitigation that incorporates the identification, salvage, and installation of snags and decadent trees and the addition of artificial nest structures which are described in greater detail below.

4.2.1 Salvaged Decadent Trees

A total of 85 decadent trees will be salvaged during ROW clearing and stored off-site until construction has been completed. Appendix 3, Table 3-1 contains a list of the 85 decadent trees to be salvaged that were identified as being suitable at the time of writing; however, if trees become unsuitable or unavailable over time, suitable alternatives meeting the criteria described below may be salvaged. Salvage of 85 trees considers loss due to damage or decay while in storage or during transportation. Salvaged trees will include the one red-headed woodpecker nest trees identified during surveys that are in good to fair condition, while two other nest trees that were dead and decaying will not be salvaged (Section 1.5.3). The remaining 83 trees were identified by selecting those with the largest available dbh and the following criteria:

- minimum tree height of 10 m
- overall tree condition is good or fair, but excluding trees with unknown or poor trunk condition
- presence of one or more existing cavities

Installation of salvaged decadent trees will include measures to reduce the likelihood of decadent trees falling over, such as attaching decadent trees to treated wooden posts; NRCS 2008) and integrity monitoring (Section 5.3). A total of 40 salvaged decadent trees will be installed in 20 HMAs (i.e., two per HMA) along the LMOC ROW (Appendix 1, Figure 1-2; Appendix 2, Figure 2-2 to Figure 2-15; Appendix 3, Table 3-2).

Artificial Nesting Structures

Artificial nesting structures will provide cavities for nesting red-headed woodpecker by installing wooden nest boxes in the HMAs within the ROW adjacent to where mature deciduous forest habitats occur. Nest boxes, known to be used by woodpecker species (e.g., McComb and Noble 1981) including red-headed woodpeckers (e.g., Grabber and Grabber 1977, Kale II and Maehr 1990), will be constructed and installed on the reinstalled decadent trees where there are no existing cavities, or existing cavities are below 5 m above ground level.

Should they be required, nest box will be installed between 5 to 9 m above ground level on the tree and facing away from the prevailing winds. Nest boxes will be made of wood from slow rotting tree species (cedar is preferred; avoid treated wood) and built to the following specifications (CWF 2022), including:

- Entrance hole diameter: 6 cm
- Height of hole above floor: 25 cm
- Floor panel: 15 x 15 cm
- Roof panel: 15 x 20 cm
- Width of wall panels:15 cm
- Height of wall panels: 140 cm

- Sides cut at an angle to have a front-sloping roof
- Drain holes in the floor and vent holes under the roof
- Filled with wood shavings prior to installation

5.0 MONITORING AND FOLLOW-UP

To assess the effectiveness of the implementation of the RHMP, monitoring activities within the HMAs will include a red-headed woodpecker nest survey and an associated nest structure inspection. In response to feedback received from ECCC, a red-headed woodpecker point-count survey will also be completed within reference habitats in the LAA and regional assessment area (RAA) to provide a regional comparison of breeding occurrence. Surveys at HMAs will use passive methods as recommended by ECCC, to avoid disturbing birds using nest structures. The three types of post-construction surveys are described in greater detail below.

5.1 Red-headed Woodpecker Nest Survey

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to provide habitat enhancements for wildlife, including red-headed woodpecker. The red-headed woodpecker survey will be used to assess the effectiveness of these mitigation measures by examining the habitat use in the HMAs.

Objective

The objective of the red-headed woodpecker survey is to understand if red-headed woodpeckers occupy salvaged decadent trees and artificial nesting structures placed within or adjacent to the HMAs.

Measurable Parameter

The measurable parameter for the red-headed woodpecker nest survey is occupancy of salvaged decadent trees or artificial nesting structures by breeding red-headed woodpecker (i.e., number of nest structures used for nesting relative to the number available).

Design

Red-headed woodpecker surveys will occur at all HMAs where salvaged decadent trees or artificial nesting structures have been installed.

Methods

The red-headed woodpecker nest survey at the HMAs will follow a standardized 30-minute point-count survey protocol that will passively evaluate whether the HMAs are occupied by breeding red-headed woodpeckers (Dudley and Saab 2003). This approach was recommended by ECCC as it reduces the likelihood of disturbing birds nesting in the structures. Other wildlife detected during nest surveys will be recorded as incidentals. Surveys will be completed on two separate occasions during the breeding season (May 21 to July 21; MB BBA 2012) , using a removal sampling design (i.e., once the species is detected at a site, it is not re-surveyed).

The resulting data will be summarized by HMA and mapped relative to the Project to provide an understanding of the presence and distribution of red-headed woodpecker and in relation to mitigation measures.

Frequency

The red-headed woodpecker nest survey will be completed twice during the peak breeding period described above. Surveys will be undertaken during years 1 to 6 post-construction.

Decision Trigger / Threshold for Action

Fewer than 20% of the HMAs, including the adjacent forest stand(s), do not contain breeding red-headed woodpeckers.

- Action: Consider adding naturalized nest boxes (i.e., constructed from locally sourced timber) and/or girdling mature trees adjacent to the PDA to increase densities of decadent trees (e.g., Kilgo and Vukovich 2013) and report results to Manitoba Environment, Climate and Parks (MECP) regional wildlife biologist/manager through annual data reports.

5.2 Red-headed Woodpecker Point-count Survey

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to provide habitat enhancements for red-headed woodpecker (i.e., HMAs). The Red-headed woodpecker Point-count Survey will be used to provide a regional context for comparing the abundance and distribution of the species in reference habitats to the results of the red-headed woodpecker nest survey in the HMAs.

Objective

The objective of the Red-headed woodpecker Point-count Survey is to characterize the occupancy of breeding red-headed woodpecker habitats within reference areas in the LAA and RAA that will provide a regional context for comparing to the effectiveness of HMAs (Section 5.1).

Measurable Parameter

The measurable parameter for the red-headed woodpecker point-count survey is occupancy of habitat patches within reference habitats (i.e., number of habitat patches used for nesting relative to the number surveyed).

Design

Surveys will occur in a random sample of reference habitats within the LAA and RAA.

Methods

Surveys in reference habitats will follow a standardized ten-minute point-count survey protocol (Ralph et al. 1995) that incorporate a call-broadcast component shown to increase the detection probability for woodpecker species (e.g., BC RIC 1999, Baumgardt et al. 2013, Wisconsin DNR 2013). The sequence of calls will use a five-minute passive listening/viewing period, followed by a three-minute active call-broadcast

period (rotation between 30 seconds of red-headed woodpecker calls and drumming and 30 seconds of silence), and completed with a two-minute passive listening/viewing period. Surveys will be conducted during periods of suitable weather (i.e., clear visibility, wind ≤20 km/h, temperature >0°C, and precipitation not exceeding a light, intermittent drizzle) and start at sunrise and ending no later than 4.5 hours after sunrise (Bibby et al. 2000).

Surveys will be completed on two separate occasions during the breeding season (May 21 to July 21; MB BBA 2012), using a removal sampling design (i.e., once the species is detected at a site, it is not re-surveyed). Other wildlife detected during point-count surveys will be recorded as incidentals.

Frequency

The red-headed woodpecker point-count survey will be completed twice during the peak breeding period and concurrently with the Red-headed woodpecker Nest Surveys (Section 4.1). Surveys will be undertaken during years 1-6 post-construction.

5.3 Nest Structure Inspection

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to provide habitat enhancements for wildlife, including red-headed woodpecker. The nest structure inspection will be used to assess the effectiveness of these mitigation measures by monitoring the structural integrity of salvaged decadent trees and artificial nest boxes.

Objective

The objective of the nest structure inspection is to understand if the salvaged decadent trees and artificial nesting structures placed within or adjacent to the HMAs remain structurally sound and available for breeding red-headed woodpecker.

Measurable Parameter

The measurable parameter for the nest structure inspection is a pass/fail for nest structure integrity and availability.

Design

The nest structure surveys will occur at all HMAs where salvaged decadent trees or artificial nesting structures have been installed.

Methods

The nest structure inspection will use visual confirmation by a qualified biologist to assess whether the salvaged decadent trees and artificial structures are structurally sound and available (i.e., they remain in place and upright). Notable structural concerns or losses will be reported to Manitoba Transportation and Infrastructure immediately. The assessment of each structure will include detailed documentation of the findings and photographs. Wildlife detected during nest structure surveys will be recorded as incidentals.

Frequency

The nest structure survey will be completed once per year prior to the breeding season (April 1). Surveys will be undertaken during years 1-6 post-construction.

Decision Triggers / Thresholds for Action

Over 25% of salvaged decadent trees have compromised structural integrity or have become unavailable.

- Action: Consider replacing the salvaged trees or replacing them with artificial nesting structures and report survey results to MECP regional wildlife biologist/manager through annual data reports.

Over 25% of artificial nesting structures have compromised structural integrity or have become unavailable.

- Action: Consider adding new artificial nesting structures and report survey results to MECP regional wildlife biologist/manager through annual data reports.

A summary of the monitoring criteria for the red-headed woodpecker is provided in Table 2.

Table 2: Monitoring Criteria for the Red-headed Woodpecker Surveys

Monitoring Objective	Method	Monitoring Metric	Project Phase	Duration	Frequency
Evaluate the effectiveness of mitigation measures for red-headed woodpecker	Red-headed woodpecker nest survey	Species occurrence	Operation	Years 1 to 6 post-construction	Twice during the peak breeding period
	Red-headed woodpecker point-count survey	Species occurrence	Operation	Years 1 to 6 post-construction	Twice during the peak breeding period
	Nest structure inspection	Structure availability and integrity	Operation	Years 1 to 6 post-construction	Once prior to the breeding period

5.4 Habitat Monitoring

Habitat monitoring will be undertaken as part of the monitoring activities outlined in the RVMP for the LMOC (Section 8) and LSMOC (Section 14).

6.0 ADAPTIVE MANAGEMENT

Adaptive management is a structured and systematic process focused on improving environmental management by using lessons learned to reduce uncertainty while updating policies and practices (British Columbia Ministry of Forests and Range 2015). Adaptive management allows for the flexibility to identify and implement new mitigation measures or to modify existing ones (CEA Agency 2015).

Adaptive management will be incorporated into the habitat monitoring described above and as part of the adaptive management process outlined in the RVMP (Section 9; MI 2020). As part of the adaptive management process, the ability of salvaged decadent trees to satisfy the intended goals and objectives will be evaluated. If salvaged decadent trees are assessed as ineffective based on these criteria, a root cause analysis of why a measure failed to meet the intended objective will be conducted. This type of analysis helps to prevent similar future failures, but also encourages critical thinking and documentation as part of continued learning.

7.0 REFERENCES

7.1 Literature Cited

Baumgardt, J., J. Sauer, and K. Nicholson. 2013. Occupancy modeling of woodpeckers: maximizing detections for multiple species with multiple spatial scales. *Journal of Fish and Wildlife Management* 5(1):198–207.

BC RIC (British Columbia Resource Inventory Committee). 1999. Inventory methods for woodpeckers. Standards for components of British Columbia's biodiversity No. 19. Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/woodml20.pdf?bcgovtm=CSMLS. Accessed November 2020.

Bibby, C.J., N.D. Burgess, D.A. Hill, and S. Mustoe. 2000. Bird census techniques. Second edition. Academic Press, London.

British Columbia Ministry of Forests and Range. 2015. Defining Adaptive Management [online]. Available from: https://www.for.gov.bc.ca [accessed October 2020].

CEA Agency (Canadian Environmental Assessment Agency). 2015. Practitioners glossary for the environmental assessment of designated projects under the *Canadian Environmental Assessment Act, 2012* [online]. Available from: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-glossary-environmental-assessment-designated-projects-under-canadian-environmental-assessment-act-2012.html [accessed October 2020].

CWF (Canadian Wildlife Federation). Build and maintain nesting and roosting boxes. Available at: Canadian Wildlife Federation: Build and Maintain Nesting and Roosting Boxes (cwf-fcf.org). Accessed April 2022.

Dudley, J. and V. Saab. 2003. A field protocol to monitor cavity-nesting birds . Res. Pap. RMRS-RP-44. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p.

EEI (Ecologic Environmental Inc). 2017. Lake Manitoba outlet channels wildlife technical report. Prepared for M. Forster Enterprises by EcoLogic Environmental Inc, Wildlife, Aquatic & Geomatics Consulting.

ECCC (Environment and Climate Change Canada). 2018. General nesting periods of migratory birds. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html. Accessed November 2020.

ECCC. 2021. Recovery strategy for the red-headed woodpecker (*Melanerpes erythrocephalus*) in Canada 2021. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. viii + 118 pp.

Government of Canada. 2021. Species at risk public registry. Available at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html. Accessed April 2021.

Kale II, H. W. and D. S. Maehr. 1990. Florida's birds: a handbook and reference. Sarasota, FL: Pineapple Press.

Kilgo, J. and M. Vukovich. 2013. Can snag creation benefit a primary cavity nester: response to an experimental pulse in snag abundance. *Biological Conservation* 171: 21-28.

MB BBA (Manitoba Breeding Bird Atlas). 2012. Red-headed woodpecker (*Melanerpes erythrocephalus*). Available at: https://www.birdatlas.mb.ca/speciesatrisk/species/RedheadedWoodpecker/species.htm. Accessed March 2021.

MB CDC (Manitoba Conservation Data Centre). 2015. Recommended development setback distances from birds. Available at: https://www.gov.mb.ca/sd/pubs/conservation-data-centre/mbcdc_bird_setbacks.pdf. Accessed November 2020.

McComb, W.C., and R.E. Noble. 1981. Nest-box and natural-cavity use in three mid-south forest habitats. Journal of Wildlife Management 45: 93-101.

MI (Manitoba Infrastructure) 2020. Lake Manitoba and Lake St. Martin Outlet Channels Project EIS. March 9, 2020.

MI. 2021a. Memorandum – MI meeting with IAAC and ECCC: wildlife mitigation and monitoring (March 18, 2021). Winnipeg, MB.

MI. 2021b. Memorandum – MI meeting with IAAC and ECCC: technical IR review (March 4, 2021). Winnipeg, MB. Ralph, C. John; Sauer, John R.; Droege, Sam, technical editors. 1995. Monitoring Bird Populations by Point Counts. Gen. Tech. Rep. PSW-GTR-149. Albany, CA: Pacific Southwest Research Station, Forest Service, US. Department of Agriculture; 187 p.

White, J. 2013. A best practices guide for generating forest inventory attributes from airborne laser scanning data using the area-based approach (Version 2.0). Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Centre.

Wisconsin DNR. 2013. Red-headed woodpecker (*Melanerpes erythrocephalus*) species guidance. Available at: https://dnr.wi.gov/files/PDF/pubs/er/ER0702.pdf. Accessed November 2020.

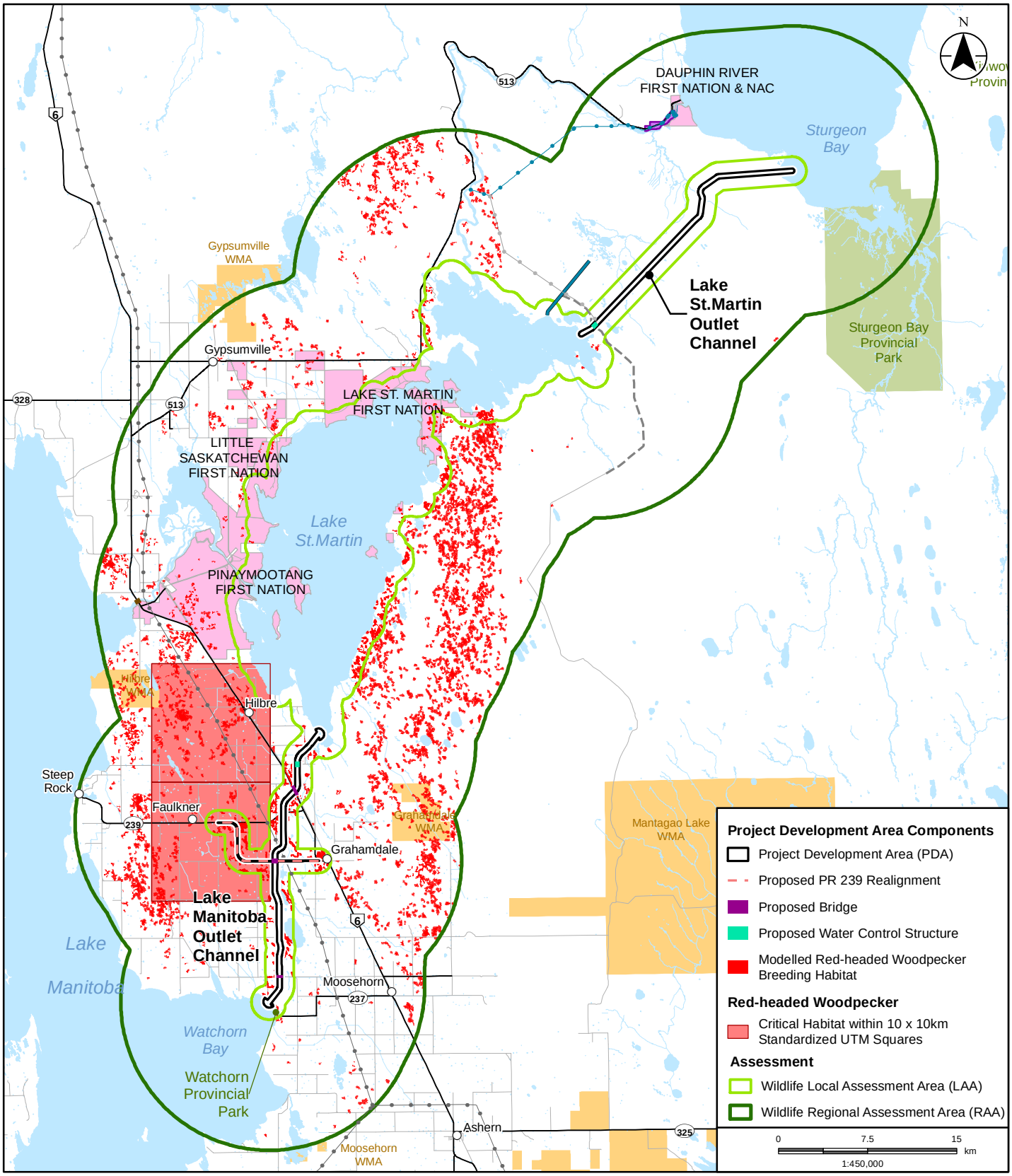
WSP. 2020. Lake Manitoba and Lake St. Martin Outlet Channel Project Preconstruction Environmental Field Work – Wildlife (Cons15843).

7.2 Personal Communication

ECCC (Environmental and Climate Change Canada). 2020. Spatial data for establishment of red-headed woodpecker critical habitat in Manitoba. Manitoba Infrastructure, Winnipeg, MB on May 1, 2020.

APPENDIX 1

Figures



Legend

- Fairford Water Control Structure
- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Existing Transmission Line
- Existing Distribution Line
- Planned Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Northern Affairs Community (NAC)
- First Nation
- Wildlife Management Area
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure, Environment and Climate Change Canada
3. Last Update: 6/22/2022 9:08:29 AM

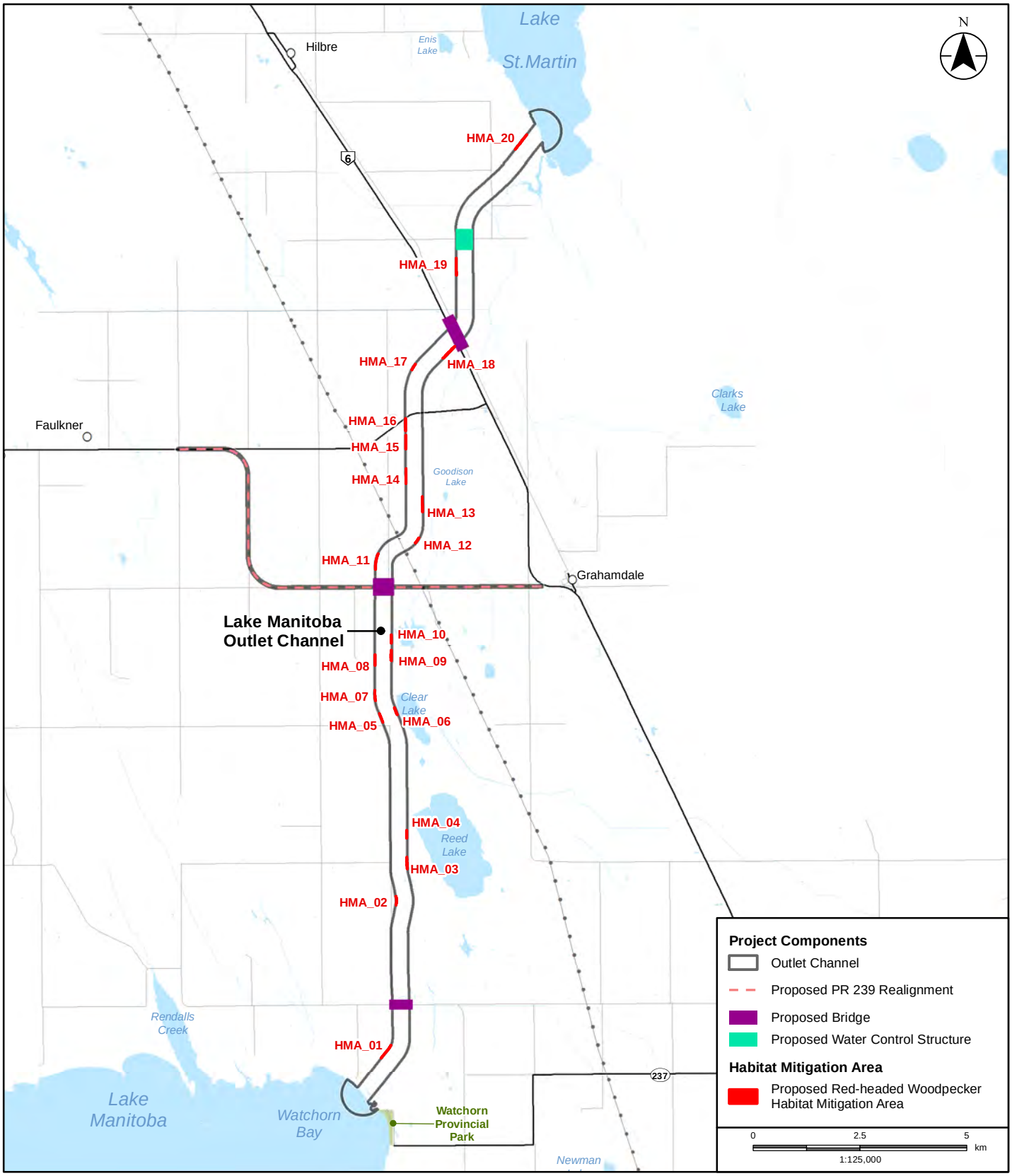
Manitoba

Manitoba Transportation and Infrastructure
Lake Manitoba & Lake St.Martin Outlet Channels Project

Project Overview Map

Figure 1-1

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Legend

- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure
3. Last Update: 6/21/2022 3:51:48 PM

Manitoba

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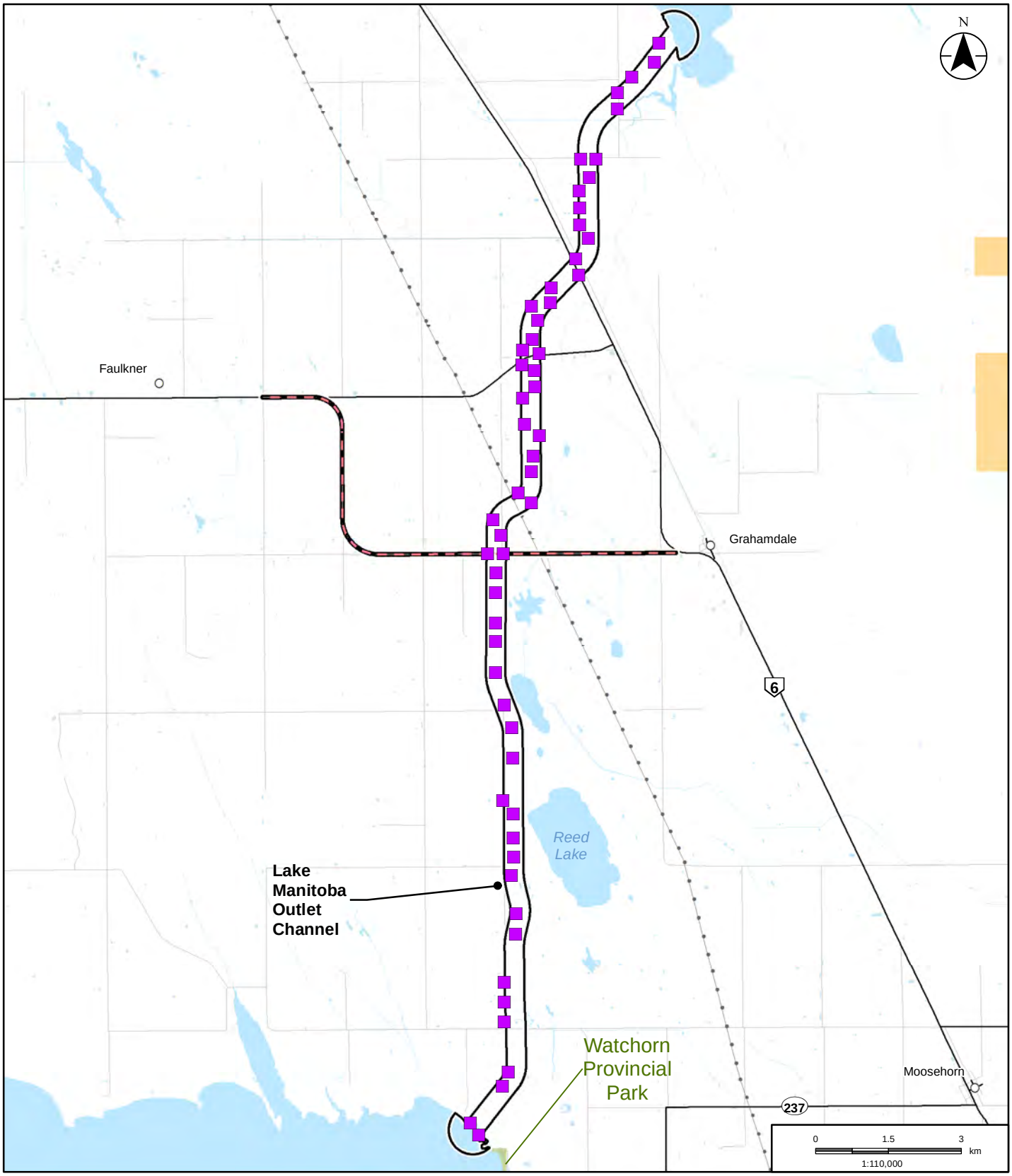
Proposed LMOC Red-headed Woodpecker Habitat Mitigation Areas - Overview

Figure 1-2

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APPENDIX 2

Red-headed Woodpecker and Decadent Tree Survey: Figures



Legend

- Breeding Red-headed Woodpecker Survey Location

Project Development Area

- Project Development Area (PDA)
- Proposed PR 239 Realignment

Base Data

- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road

- Wildlife Management Area
- Provincial Park

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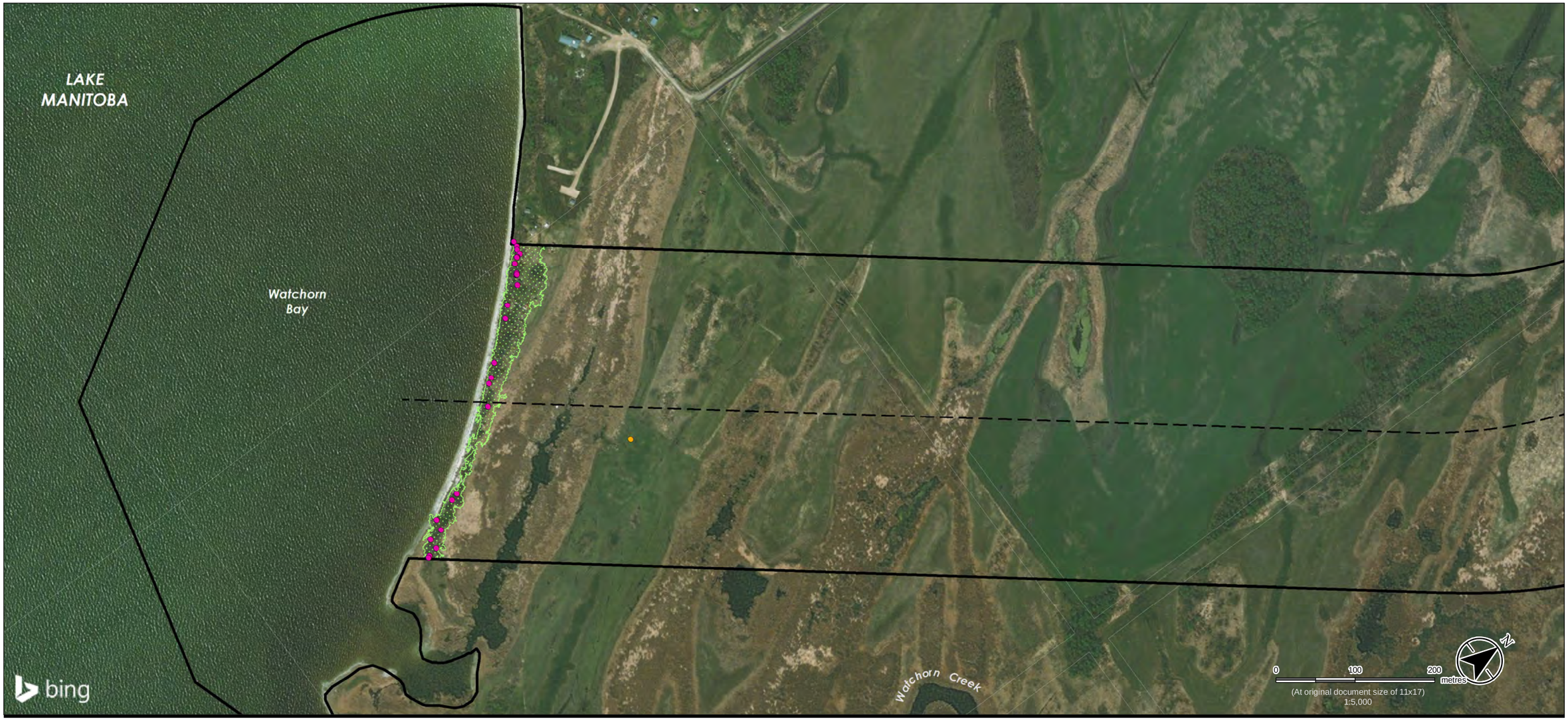
Breeding Red-headed Woodpecker Survey Overview

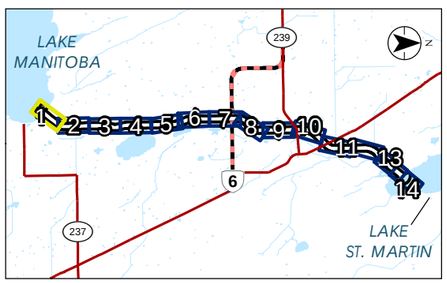
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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure, Stantec Consulting
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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Incidental Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
3. Background Imagery: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

Manitoba | Stantec

Project Location
Near Lake Manitoba & Lake St.Martin
Manitoba

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TR by DR on 2022-06-22

Client/Project
111475120 REVG
Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

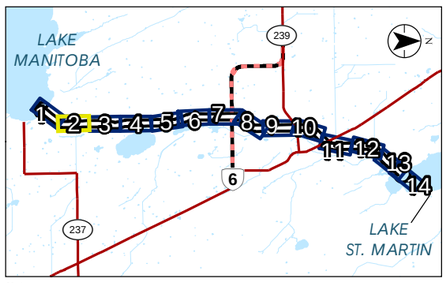
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Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Project Location
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Manitoba

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Client/Project
111475120 REVG
Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

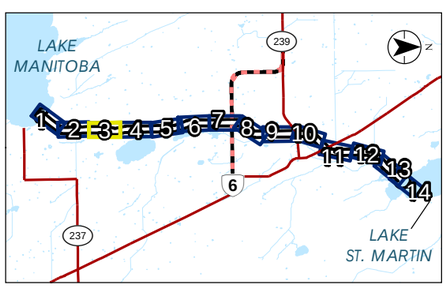
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2-3

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Manitoba Stantec

Project Location
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Manitoba

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Client/Project
111475120 REVG
Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

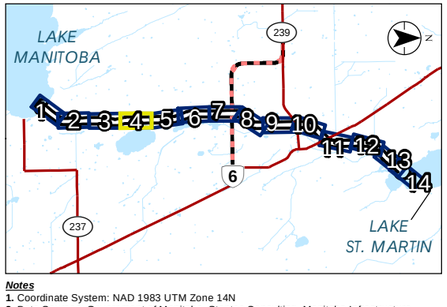
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Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Manitoba

Stantec

Project Location
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Manitoba

Prepared by ADC on 2022-06-22
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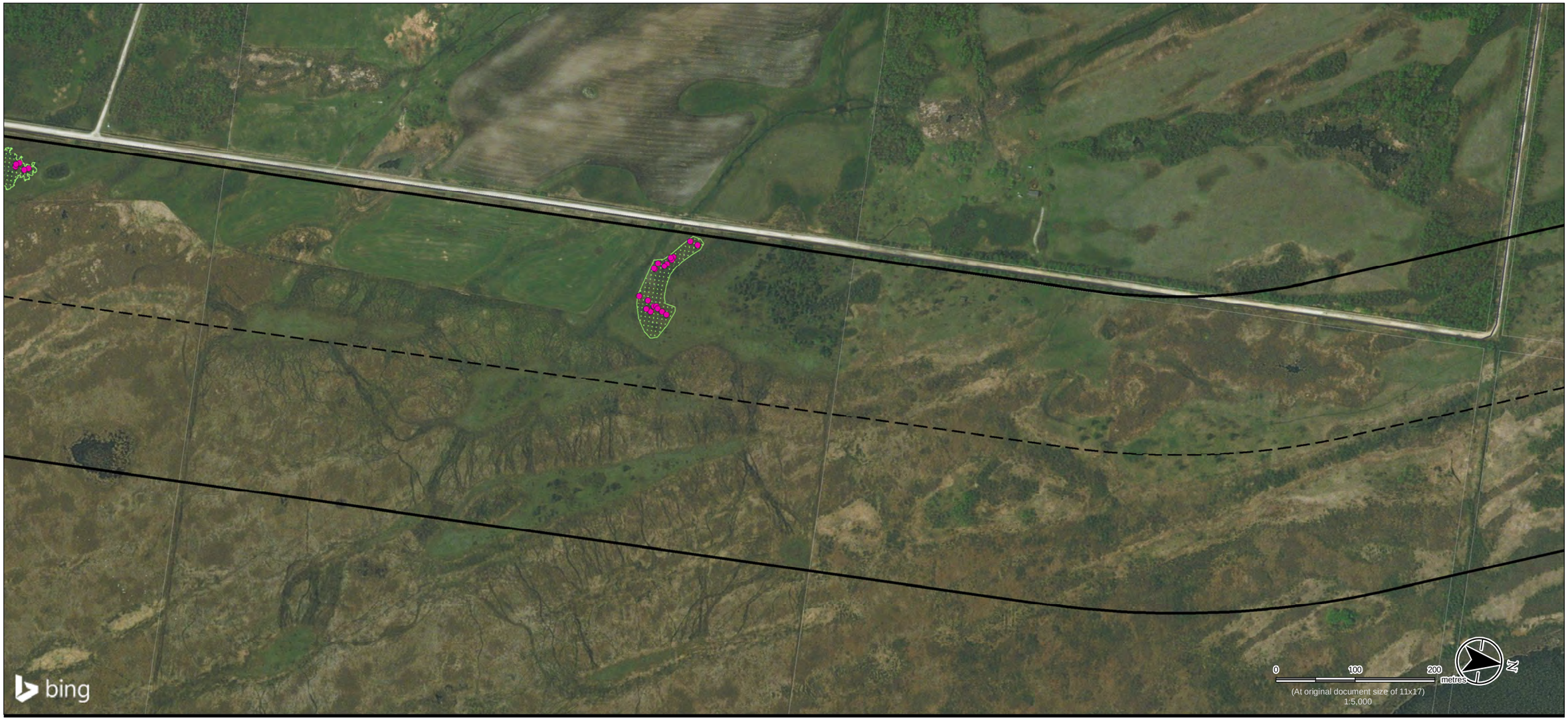
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

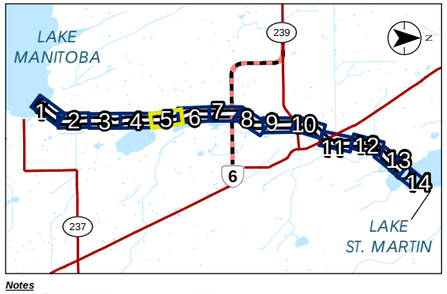
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2-5

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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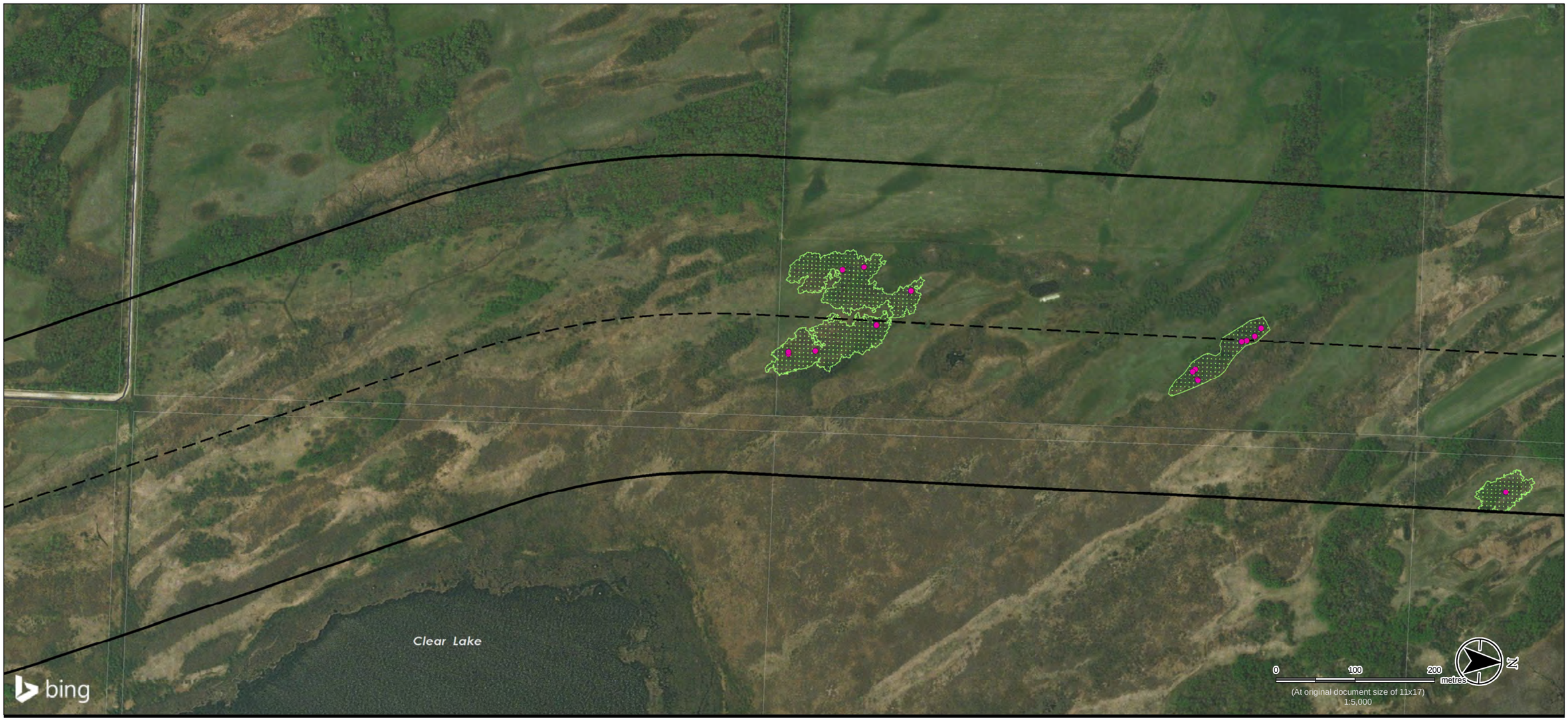
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

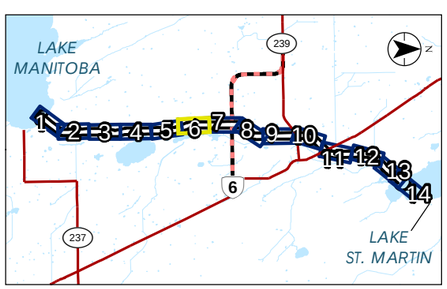
Figure No.
2-6

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Red-headed Woodpecker Surveys

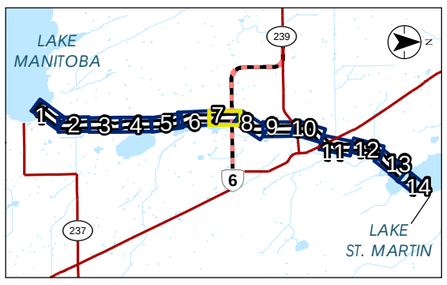
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Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Proposed PR239 Realignment
- Proposed Bridge Location
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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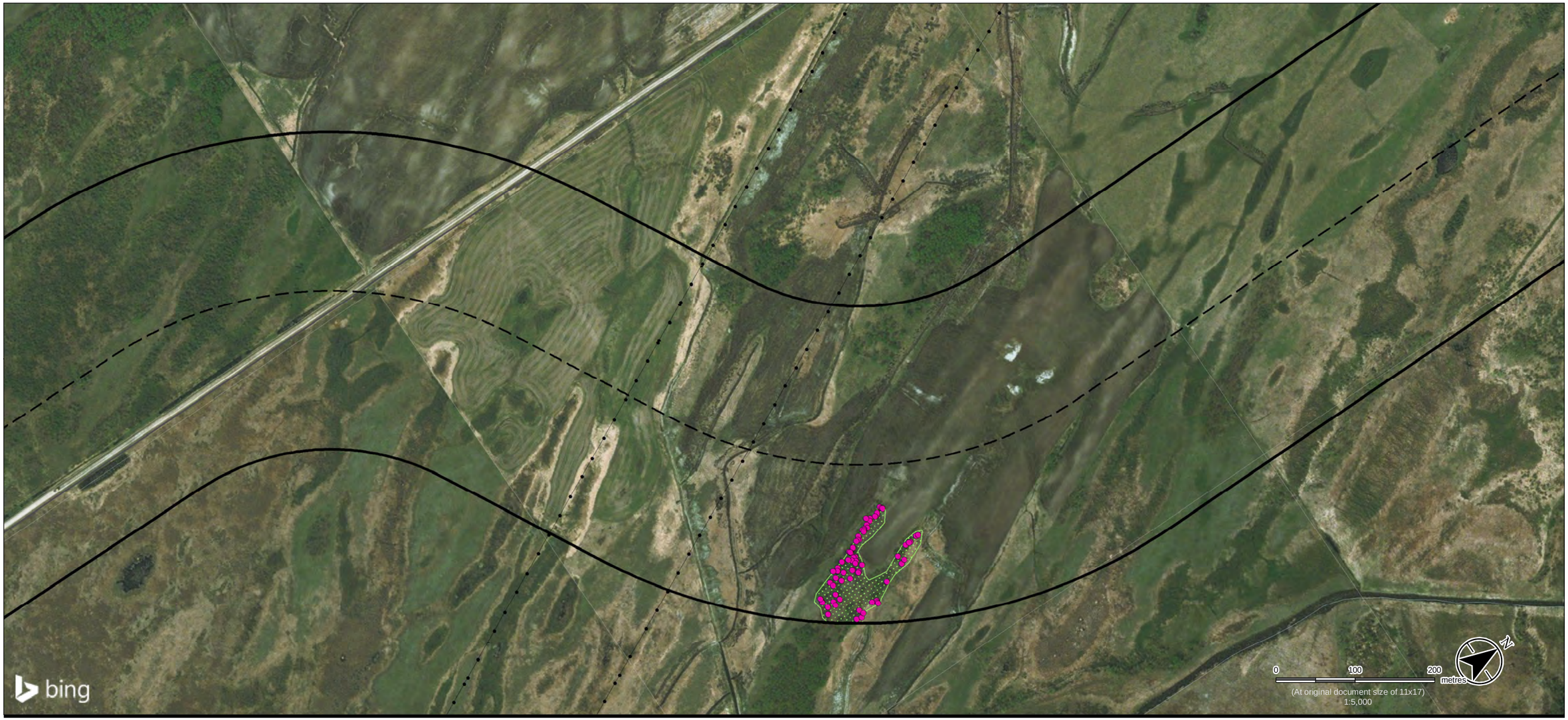
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

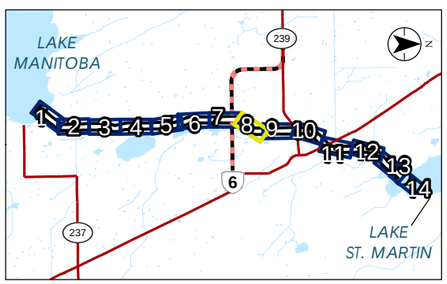
Figure No.
2-8

Title
Decadent Tree Survey Results 2021

G:_GIS_Project_Folder\111475120\figures\hwo_fieldwork\MI_RHWO_Decadent_Tree_Detail_REVG.mxd — Revised: 2022-06-22 By: mdhughes

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Existing Transmission Line
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Project Location
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

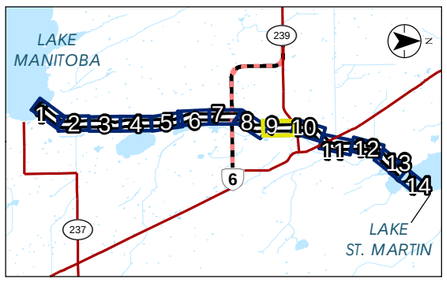
Figure No.
2-9

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Highway
- Quarter Sections

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

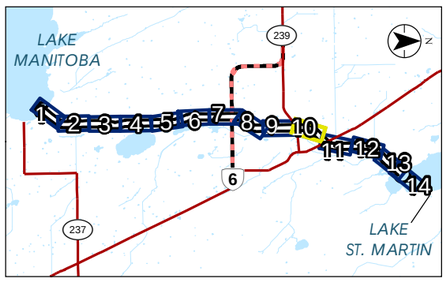
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2-10

Title
Decadent Tree Survey Results 2021

C:\ GIS Project Folder\111475120\figures\hwo fieldwork\MXD\ RHWO Decadent Tree Detail_REVG.mxd Revised: 2022-06-22 By: mslithgow

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Highway
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Red-headed Woodpecker Surveys

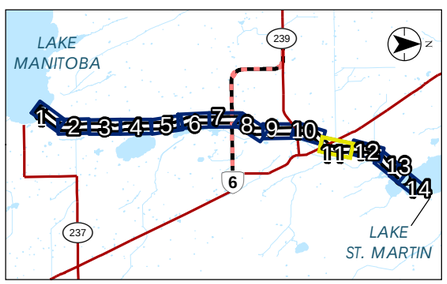
Figure No.
2-11

Title
Decadent Tree Survey Results 2021

G:\GIS Project Folder\111475120\figures\hwo fieldwork\MXD RHWO Decadent Tree Detail REVG.mxd Revised: 2022-06-22 By: mailhughes

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Highway
- Major Road
- Quarter Sections

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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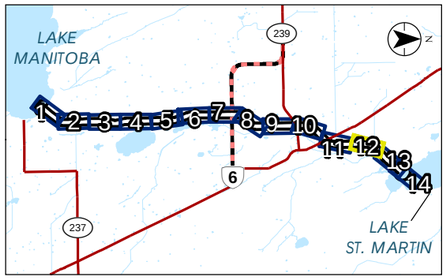
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2-12

Title
Decadent Tree Survey Results 2021

G:\GIS Project Folder\111475120\figures\hwo fieldwork\MXD RHWO Decadent Tree Detail REVG.mxd Revised: 2022-06-22 By: mathuglhes

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Incidental Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.
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Manitoba Stantec

Project Location
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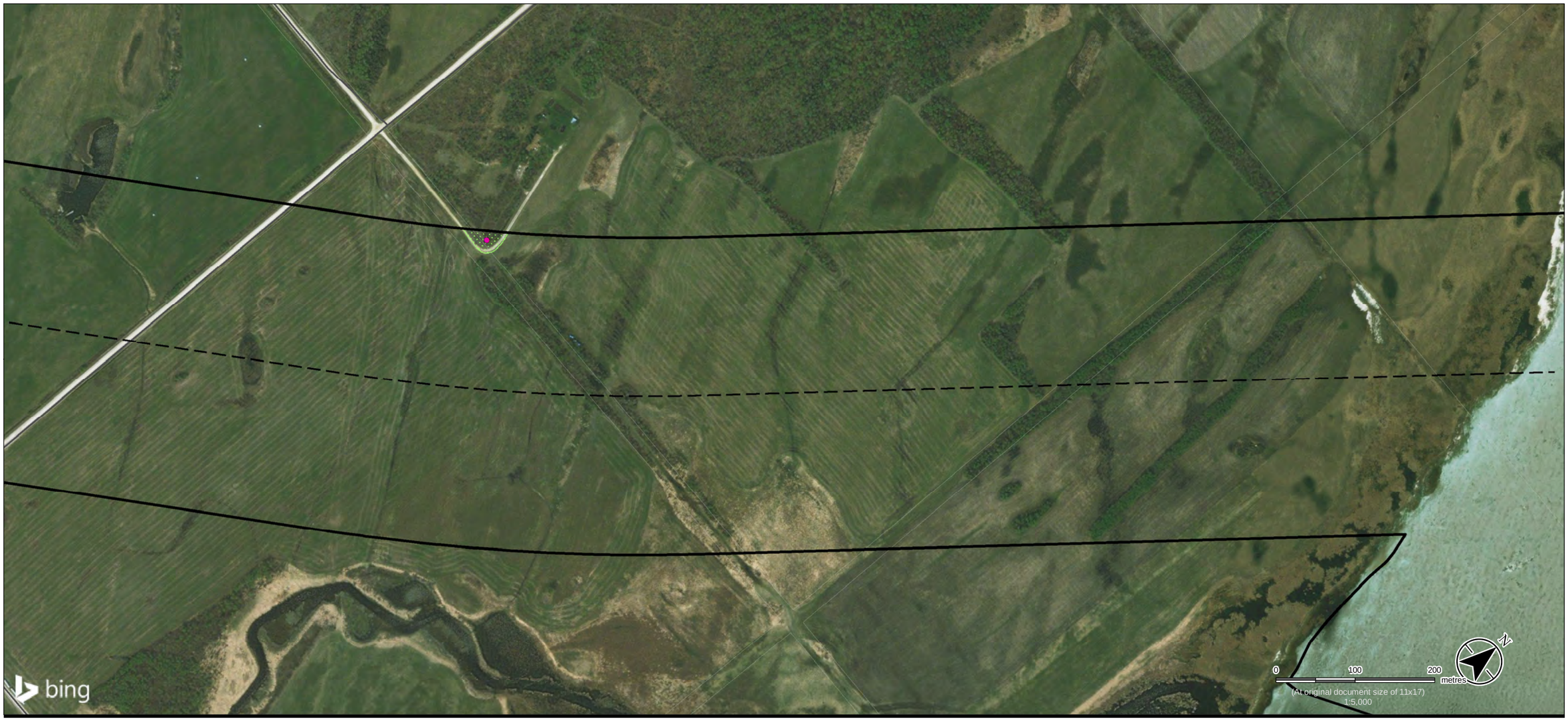
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

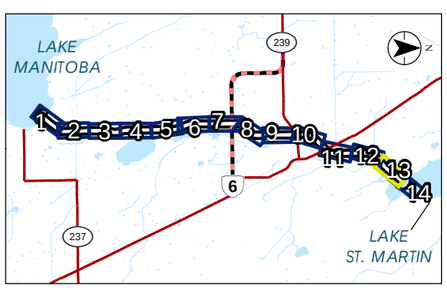
Figure No.
2-13

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Major Road
- Quarter Sections
- Decadent Tree Location
- Surveyed Forest Stand

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Data Sources: Government of Manitoba, Stantec Consulting, Manitoba Infrastructure, Government of Manitoba, EcoLogic Environmental Inc.

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Manitoba Stantec

Project Location
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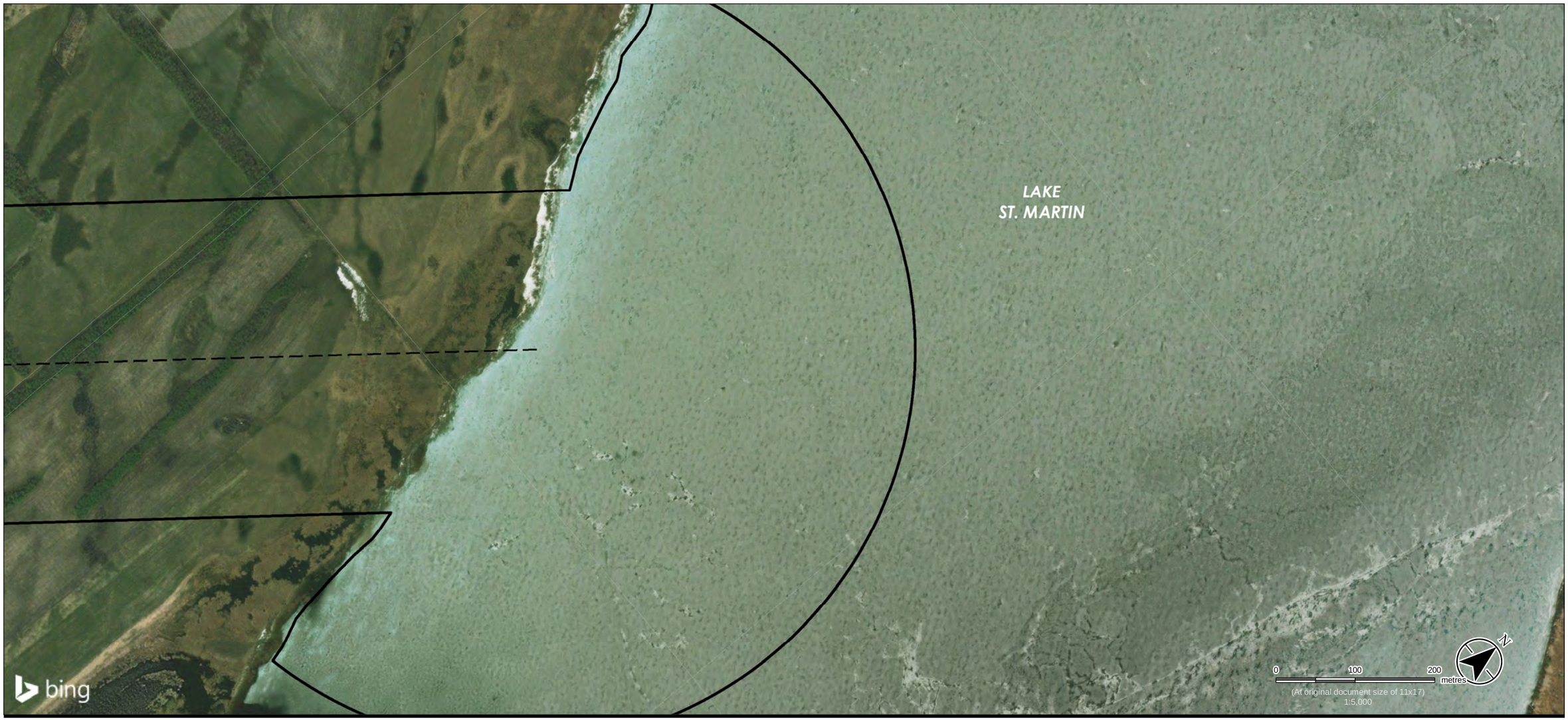
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Manitoba Transportation and Infrastructure
Lake Manitoba Outlet Channel
Red-headed Woodpecker Surveys

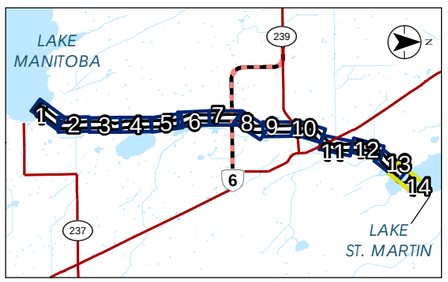
Figure No.
2-14

Title
Decadent Tree Survey Results 2021

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Legend

- Lake Manitoba Outlet Channel (LMOC) Project Development Area
- LMOC Approximate Centerline
- Quarter Sections

Notes

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Figure No.
2-15

Title
Decadent Tree Survey Results 2021

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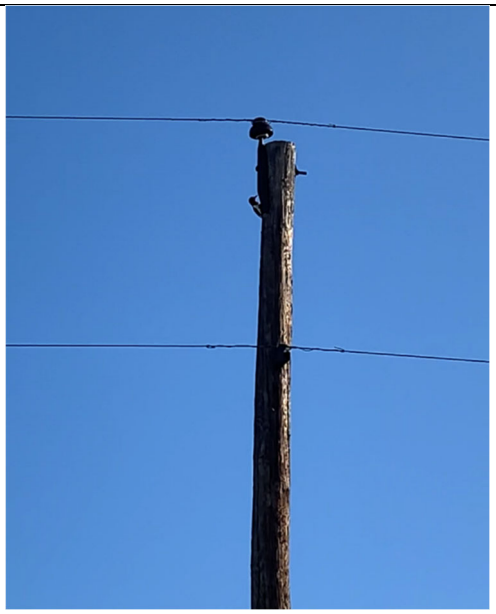
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Red-headed Woodpecker and Decadent Tree Survey: Photographs



Photograph 1

View of red-headed woodpecker habitat on the PDA (14N 532372E 5701506N).



Photograph 2

View of red-headed woodpecker observation on the PDA (14N 532372E 5701506N).



Photograph 3

View of Decadent Tree Survey in progress (14N 532149E 5701638N)



Photograph 4

View of historical red-headed woodpecker nesting tree (EEI 2017; 14N 530725E 5689963N).



Photograph 5

View of confirmed red-headed woodpecker nesting tree (14N 530674E 5682826N).



Photograph 6

View of potential red-headed woodpecker nesting tree (14N 530866E 5685510N).



Photograph 7

View of potential red-headed woodpecker nesting tree (14N 530871E 5685508N).



Photograph 8

View of potential red-headed woodpecker nesting tree (14N 532370E 5701612N).

Decadent Tree Survey: Data

Table 2-1: Decadent Tree Survey Results 2021

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S01	T01	-	67	D	D	D	SO	75	12	N	-	-	N	Y	Y	529779	5681687
FS	S01	T02	MM	35	F	F	F	SO	5	11	N	-	-	N	Y	Y	529787	5681686
FS	S01	T03	-	20	D	D	D	SO	40	-	N	-	-	N	N	N	529790	5681685
FS	S01	T04	-	35	D	D	D	SO	60	13	N	-	-	N	N	N	529796	5681684
FS	S01	T05	MM	42	G	F	F	SO	25	-	N	-	-	N	Y	N	529797	5681679
FS	S01	T06	MM	40	D	D	D	SO	25	12	N	-	-	N	Y	Y	529797	5681678
FS	S01	T07	-	25	D	D	D	SO	30	10	N	-	-	N	Y	Y	529802	5681671
FS	S01	T08	WB	45	D	D	D	SO	15	10	N	-	-	N	N	N	529814	5681666
FS	S01	T09	WB	55	D	D	D	SO	15	10	N	-	-	N	Y	Y	529816	5681664
FS	S01	T10	WB	47	D	D	D	SO	10	8	N	-	-	N	Y	Y	529816	5681665
FS	S01	T11	WB	28	D	D	D	SO	10	10	N	-	-	N	Y	Y	529815	5681665
FS	S01	T12	-	53	D	-	D	SO	50	4	Y	3	N	Y	Y	Y	529827	5681658
FS	S01	T13	WB	24	P	-	D	SO	5	10	N	-	-	N	N	N	529839	5681633
FS	S01	T14	WB	35	D	-	D	SC	15	-	N	-	-	N	N	N	529852	5681621
FS	S01	T15	WB	65	F	D	D	SO	25	15	Y	11	S	N	Y	N	529888	5681577
FS	S01	T16	-	58	P	D	D	SO	30	12	Y	6	S	N	Y	Y	529901	5681562
FS	S01	T17	-	64	D	-	D	SO	60	6	N	-	-	N	N	N	529905	5681555
FS	S01	T18	WB	27	D	-	D	SO	5	6	N	-	-	N	N	N	529927	5681537
FS	S01	T19	-	55	D	-	D	SO	20	8	N	-	-	N	N	N	529993	5681440
FS	S01	T20	-	47	D	D	D	SC	25	-	N	-	-	N	N	N	529996	5681431
FS	S01	T21	-	30	D	D	D	SO	-	7	0	-	-	0	Y	Y	530004	5681400
FS	S01	T22	-	39	P	P	P	SC	40	-	N	-	-	N	N	N	530018	5681397
FS	S01	T23	-	24	D	-	D	SO	10	3	N	-	-	N	N	N	530020	5681380
FS	S01	T24	-	32	F	D	D	SO	20	13	N	-	-	N	N	N	530035	5681366
FS	S01	T25	-	29	F	D	D	-	5	13	N	-	-	N	Y	N	530037	5681364
FS	S01	T26	MM	25	P	R	P	SC	10	10	N	-	-	N	Y	N	530033	5681379
FS	S01	T27	BO	20	D	D	D	SO	5	5	N	-	-	N	Y	Y	530067	5681658

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S02	T01	TA	19	D	D	D	SO	60	4	Y	2	W	N	Y	Y	530615	5682796
FS	S02	T02	TA	20	D	D	D	SO	60	3.5	N	-	-	N	Y	Y	530614	5682797
FS	S02	T03	TA	18	D	D	D	O	20	4	N	-	-	N	Y	Y	530616	5682805
FS	S02	T04	BP	23	D	D	D	SO	25	4	Y	3.5	W	Y	Y	Y	530645	5682831
FS	S02	T06	TA	19	D	D	D	O	20	2.5	N	-	-	N	Y	Y	530630	5682830
FS	S02	T07	BP	20	D	D	D	SO	40	5	N	-	-	N	Y	Y	530642	5682823
FS	S02	T08	TA	20	F	F	F	SC	15	10	N	6	S	Y	Y	Y	530629	5682817
FS	S02	T09	TA	18.5	D	D	D	SO	40	3	N	2.75	N	N	Y	Y	530675	5682826
FS	S04	T01	TA	20	F	F	F	O	10	7	N	-	-	N	N	N	530822	5685588
FS	S04	T02	TA	20	D	D	D	O	10	11	N	-	-	N	Y	N	530822	5685590
FS	S04	T03	TA	20	D	D	D	O	25	12	N	-	-	N	N	N	530822	5685589
FS	S04	T04	TA	25	F	P	F	O	5	-	N	-	-	N	N	N	530835	5685594
FS	S04	T05	TA	20	F	P	F	O	5	-	N	-	-	N	N	N	530841	5685598
FS	S04	T06	TA	22	D	D	D	O	10	-	N	-	-	N	Y	N	530840	5685600
FS	S04	T07	TA	25	-	F	F	O	5	20	N	-	-	N	N	N	530846	5685595
FS	S04	T08	TA	18	F	P	P	O	10	9	Y	8	-	Y	Y	N	530847	5685599
FS	S04	T09	TA	22	D	D	D	O	5	-	N	-	-	N	Y	N	530853	5685585
FS	S04	T10	TA	30	F	F	F	O	10	-	Y	5	N	N	Y	N	530849	5685580
FS	S04	T11	-	27	D	R	D	O	25	5	Y	4	W	N	Y	Y	530836	5685581
FS	S04	T12	TA	34	D	D	D	O	30	13	Y	6	W	Y	Y	Y	530834	5685577
FS	S04	T13	TA	27	F	F	F	O	25	12	Y	10	N	N	N	N	530887	5685587
FS	S04	T14	-	31	D	R	D	O	10	4	N	-	-	N	Y	N	530885	5685583
FS	S04	T15	TA	27	G	F	F	O	10	20	Y	4	E	N	Y	N	530870	5685572
FS	S04	T16	-	25	D	D	D	O	10	12	N	-	-	N	Y	N	530843	5685562
FS	S04	T17	BP	22	D	D	D	O	30	15	Y	8	S	Y	Y	N	530878	5685545
FS	S04	T18	TA	25	D	D	D	O	5	14	N	-	-	N	Y	N	530894	5685529
FS	S04	T19	TA	24	D	D	D	O	20	14	N	-	-	N	N	N	530878	5685516
FS	S04	T20	-	23	D	D	D	O	20	14	N	-	-	N	N	N	530873	5685514

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S04	T21	TA	30	G	F	F	O	10	20	Y	8	W	Y	Y	N	530866	5685511
FS	S04	T22	-	29	D	R	D	O	25	9	Y	4	E	Y	Y	Y	530872	5685509
FS	S04	T23	BP	30	D	D	D	O	20	16	N	-	-	N	Y	N	530875	5685504
FS	S04	T24	TA	19	D	D	D	O	10	13	N	-	-	N	N	N	530882	5685502
FS	S04	T25	-	26	D	D	D	O	20	14	Y	3	S	Y	Y	N	530885	5685511
FS	S04	T26	TA	27	G	F	G	O	30	18	Y	4	N	Y	N	N	530889	5685518
FS	S06	T01	TA	26	G	P	F	O	35	15	N	-	-	N	Y	N	530730	5686022
FS	S06	T02	TA	18	D	D	D	O	10	-	N	-	-	N	N	N	530731	5686024
FS	S06	T03	TA	21	G	P	F	O	30	14	Y	-	-	N	N	N	530733	5686022
FS	S06	T04	TA	20	D	D	D	O	40	12	N	-	-	N	N	N	530732	5686021
FS	S06	T05	TA	21	F	P	P	O	20	12	N	-	-	N	N	N	530742	5686037
FS	S06	T06	TA	18	D	R	D	O	40	8	N	-	-	N	Y	Y	530737	5686041
FS	S06	T08	TA	19	D	D	D	O	20	12	N	-	-	N	N	N	530731	5686033
FS	S06	T09	-	22	D	D	D	O	10	10	N	-	-	N	Y	N	530716	5686059
FS	S06	T10	TA	20	D	D	D	O	5	9	N	-	-	N	Y	N	530706	5686056
FS	S06	T11	TA	20	D	D	D	O	20	8	N	-	-	N	Y	N	530706	5686059
FS	S06	T12	TA	24	F	P	P	O	10	14	N	-	-	N	Y	N	530701	5686063
FS	S06	T13	TA	22	D	D	D	O	5	12	N	-	-	N	Y	N	530705	5686079
FS	S06	T14	TA	30	G	G	G	O	5	17	N	-	-	N	N	N	530709	5686083
FS	S06	T15	TA	26	D	R	D	O	50	-	N	-	-	N	Y	N	530698	5686097
FS	S06	T16	TA	20	D	D	D	O	5	11	N	-	-	N	Y	N	530696	5686089
P	S10	T01	BP	32	G	F	F	O	15	11	Y	7	-	Y	Y	N	530645	5688077
P	S10	T02	BP	30	F	F	F	O	20	13	N	-	-	N	Y	N	530646	5688055
P	S10	T03	TA	20	P	P	P	O	25	9	N	-	-	N	Y	N	530703	5687987
P	S10	T04	BO	35	G	D	D	O	5	22	N	-	-	N	N	N	530756	5687954
P	S10	T05	BO	33	G	D	F	O	5	20	N	-	-	N	N	N	530756	5687950
P	S10	T06	TA	22	F	P	P	O	15	13	N	-	-	N	N	N	530821	5687969
P	S10	T07	-	25	D	D	D	SO	20	18	N	-	-	N	Y	N	530832	5687929

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S101	T01	TA	25	P	D	P	O	10	12	N	-	-	N	Y	N	530798	5687666
FS	S101	T02	TA	18	D	D	D	O	10	12	N	-	-	N	Y	N	530799	5687662
FS	S102	T01	TA	18	F	P	P	O	5	9	N	-	-	N	Y	N	530549	5689134
FS	S102	T02	TA	19	D	D	D	O	30	-	N	-	-	N	Y	N	530552	5689144
FS	S102	T03	-	22	P	P	P	O	5	-	N	-	-	N	N	N	530571	5689116
FS	S102	T04	BP	-	D	D	D	O	5	-	N	-	-	N	Y	N	530575	5689115
FS	S102	T05	BP	22	P	P	P	O	5	7	N	-	-	N	Y	N	530572	5689113
FS	S102	T06	BP	22	F	P	P	O	40	-	N	-	-	N	Y	N	530581	5689109
FS	S102	T07	BP	19	P	P	P	O	10	8	N	-	-	N	Y	N	530584	5689107
FS	S102	T08	BP	26	P	P	P	O	5	10	N	-	-	N	N	N	530582	5689098
FS	S102	T09	BP	18	D	R	D	O	50	3	N	-	-	N	Y	N	530590	5689095
FS	S102	T10	BP	23	P	P	P	O	20	8	N	-	-	N	Y	N	530589	5689094
FS	S102	T11	BP	20	G	F	F	O	10	5	Y	3	S	N	N	N	530626	5689081
FS	S102	T12	BP	24	D	R	D	O	30	3	N	-	-	N	N	N	530630	5689093
FS	S102	T13	BP	20	-	D	D	O	30	13	N	-	-	N	Y	N	530636	5689101
FS	S102	T14	BP	18	D	D	D	O	10	10	N	-	-	N	Y	N	530636	5689104
FS	S102	T15	BP	25	F	P	P	O	30	11	Y	5	S	N	N	N	530639	5689106
FS	S102	T16	BP	19	D	D	D	O	15	11	N	-	-	N	Y	N	530642	5689112
FS	S102	T17	BP	23	D	R	D	O	20	-	N	-	-	N	Y	N	530645	5689118
FS	S102	T18	BP	22	D	D	D	O	5	9	N	-	-	N	Y	N	530644	5689098
FS	S102	T19	BP	28	G	F	F	O	40	17	N	-	-	N	N	N	530641	5689092
FS	S103	T01	BP	23	P	P	P	O	10	9	Y	2	N	N	Y	N	530366	5691580
FS	S103	T02	BP	24	D	D	D	O	5	11	N	-	-	N	Y	N	530376	5691572
FS	S103	T03	TA	20	D	R	D	O	20	7	N	-	-	N	Y	N	530382	5691562
FS	S103	T04	TA	20	P	F	P	O	10	12	N	-	-	N	Y	N	530384	5691556
FS	S103	T05	BP	21	D	D	D	O	20	14	N	-	-	N	N	N	530421	5691499
FS	S103	T06	-	18	D	D	D	O	5	9	Y	5	N	N	Y	N	530424	5691496
FS	S103	T07	TA	24	D	D	D	O	10	13	N	-	-	N	Y	N	530435	5691503

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S103	T08	TA	26	G	P	F	O	10	14	N	-	-	N	Y	N	530434	5691502
O	S104a	T21	TA	37	G	F	G	O	75	12	Y	5	W	N	Y	Y	532196	5701636
O	S104a	T22	BP	20	D	D	D	O	50	9	Y	1	S	Y	Y	Y	532191	5701653
O	S104a	T23	BP	22	F	P	F	SO	25	8	Y	5	S	N	Y	Y	532183	5701618
FS	S104a	T24	BP	19	G	F	G	SO	40	8	Y	3	S	N	Y	Y	532147	5701636
FS	S104a	T25	BP	20	G	F	G	SO	50	9	N	-	-	N	Y	Y	532148	5701632
FS	S104a	T26	BP	19	D	D	D	SO	5	8	N	-	-	N	Y	Y	532145	5701626
FS	S104a	T27	BP	20	F	F	F	SO	10	6	N	-	-	N	Y	Y	532143	5701627
FS	S104a	T28	BP	22	D	D	D	SO	10	7	Y	2	S	Y	Y	Y	532137	5701628
FS	S104a	T29	TA	22	G	P	F	SO	25	6	N	-	-	N	Y	Y	532141	5701634
FS	S104a	T30	BP	19	D	D	D	SO	10	8	N	6	E	Y	Y	Y	532136	5701638
FS	S104a	T31	BP	19	F	P	F	SO	50	10	Y	3	N	Y	N	N	532138	5701641
FS	S104a	T32	BP	20	D	D	D	SO	5	5	Y	1.5	S	N	Y	Y	532124	5701655
FS	S104a	T33	TA	25	D	D	D	SO	25	7	Y	1	W	Y	N	N	532130	5701629
FS	S104a	T34	BP	18	G	F	G	SO	40	8	N	-	-	N	Y	Y	532123	5701620
FS	S104a	T35	BP	22	D	D	D	SO	25	6	N	6	E	Y	N	N	532126	5701616
FS	S104a	T36	BP	19.5	G	D	P	O	50	8	N	-	-	N	Y	N	532110	5701641
FS	S104a	T37	TA	21	P	D	D	O	30	10	N	-	-	N	Y	Y	532117	5701641
FS	S104a	T38	TA	27	G	P	F	SO	10	9	N	-	-	N	Y	Y	532111	5701628
FS	S104a	T39	TA	24	D	D	D	SO	5	10	N	-	-	N	Y	Y	532108	5701630
FS	S104a	T40	TA	27	P	P	P	O	35	10	N	-	-	N	Y	Y	532099	5701644
FS	S104a	T41	BP	22	D	D	D	SO	50	8	N	-	-	N	Y	Y	532104	5701631
FS	S104a	T42	TA	28	G	F	P	O	10	12	N	-	-	N	N	N	532106	5701634
FS	S104a	T43	BP	23	D	D	D	SO	25	5	N	-	-	N	Y	Y	532100	5701613
FS	S104a	T44	BP	18.5	F	F	F	O	20	11	N	-	-	N	Y	N	532092	5701632
FS	S104a	T45	BP	18	G	F	G	SO	15	10	N	8	W	N	Y	Y	532103	5701620
FS	S104a	T46	TA	18	G	F	F	O	5	9	N	-	-	N	N	N	532098	5701630
FS	S104a	T47	BP	19	G	F	F	O	5	9	N	-	-	N	N	N	532093	5701623

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S104a	T48	TA	19	G	F	G	SO	30	8	N	-	-	N	Y	Y	532105	5701601
FS	S104a	T49	BP	19	F	-	D	O	10	3	N	-	-	N	Y	N	532100	5701620
FS	S104a	T50	TA	22	G	G	G	O	50	-	N	-	-	N	Y	Y	532097	5701610
FS	S104a	T51	TA	20	D	D	D	O	25	11	N	-	-	N	Y	Y	532088	5701617
FS	S104a	T52	TA	19	F	P	P	O	25	7	N	-	-	N	Y	Y	532105	5701603
FS	S104a	T53	BP	20	D	D	D	SO	10	4	N	-	-	N	Y	Y	532096	5701589
FS	S104a	T54	TA	22	D	D	D	SO	10	5	N	1	S	Y	Y	Y	532095	5701589
FS	S104a	T55	BP	18.5	G	P	F	O	1	8	N	-	-	N	Y	N	532089	5701583
FS	S104a	T56	TA	20	D	D	D	O	5	10	Y	6	S	N	Y	Y	532089	5701562
FS	S104a	T57	BP	19	G	F	G	O	0	8	N	-	-	N	Y	Y	532080	5701587
FS	S104a	T58	TA	21	G	P	P	O	10	10	N	-	-	N	Y	N	532088	5701551
FS	S104a	T59	TA	23	D	D	D	SO	10	8	N	-	-	N	Y	Y	532128	5701564
FS	S104a	T60	TA	27	D	D	D	SO	5	8	N	-	-	N	Y	Y	532131	5701561
FS	S104a	T61	TA	21	F	D	P	O	20	11	N	-	-	N	N	N	532102	5701553
FS	S104a	T62	TA	20	D	-	D	O	30	2	N	-	-	N	Y	Y	532084	5701542
FS	S104a	T63	TA	27	F	F	F	SO	10	-	N	-	-	N	Y	Y	532138	5701551
FS	S104a	T64	TA	20	F	P	F	O	50	-	N	-	-	N	Y	Y	532113	5701545
FS	S104a	T65	TA	24	-	F	F	O	25	11	N	-	-	N	Y	Y	532087	5701542
FS	S104a	T66	TA	25	P	P	P	O	15	12	N	-	-	N	Y	Y	532091	5701526
FS	S104a	T67	TA	18	D	D	D	O	5	10	N	-	-	N	Y	Y	532112	5701547
FS	S104a	T68	TA	24	P	D	D	O	25	12	N	-	-	N	Y	Y	532092	5701530
FS	S104a	T69	TA	24	D	D	D	O	15	-	N	-	-	N	Y	Y	532095	5701525
FS	S104a	T70	BP	20	D	D	D	O	75	6	N	-	-	N	Y	Y	532109	5701540
FS	S104a	T71	TA	29	P	P	F	O	60	12	N	-	-	N	Y	Y	532090	5701524
FS	S104a	T72	TA	26	P	D	D	O	60	12	N	-	-	N	Y	Y	532092	5701523
FS	S104a	T73	BP	23	D	D	D	O	25	6	N	-	-	N	Y	Y	532102	5701546
FS	S104a	T74	TA	23	D	D	D	O	5	6	N	-	-	N	Y	Y	532101	5701538
FS	S104a	T75	TA	21	D	D	D	O	5	10	N	-	-	N	Y	Y	532099	5701543

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S104a	T76	TA	27	F	P	D	O	70	13	N	-	-	N	Y	Y	532099	5701527
FS	S104a	T77	TA	23	G	P	F	O	25	10	N	-	-	N	N	Y	532103	5701524
FS	S104a	T78	TA	18	D	D	D	O	20	8	N	-	-	N	Y	Y	532127	5701526
FS	S104a	T79	TA	29	D	D	D	O	5	10	N	-	-	N	Y	Y	532144	5701526
FS	S104a	T80	TA	19	G	P	F	O	30	10	N	-	-	N	N	N	532134	5701531
FS	S104b	T01	BP	20	D	D	D	O	75	8	Y	6	W	Y	Y	Y	532393	5701618
FS	S104b	T02	TA	23	G	P	F	O	50	10	N	-	-	N	Y	Y	532394	5701619
FS	S104b	T03	TA	24	G	F	F	SO	50	12	N	-	-	N	Y	Y	532411	5701626
FS	S104b	T04	BP	24	G	P	F	SO	25	10	N	3	N	N	Y	Y	532411	5701626
FS	S104b	T05	TA	21	G	F	G	SO	75	12	Y	6	S	N	Y	Y	532421	5701625
FS	S104b	T06	TA	22	G	P	F	SO	50	10	N	-	-	N	Y	Y	532421	5701630
FS	S104b	T07	BP	20	D	D	D	SO	5	5	N	-	-	N	Y	Y	532413	5701633
FS	S104b	T08	BP	21	G	F	G	SO	50	10	N	7	W	N	Y	Y	532415	5701646
FS	S104b	T09	BP	20	D	D	D	SO	50	5	Y	4.5	S	N	Y	Y	532419	5701645
FS	S104b	T10	BP	22	D	D	D	SO	25	5	N	-	-	N	Y	Y	532420	5701640
FS	S104b	T100	TA	26	G	F	G	O	5	10	N	-	-	N	Y	Y	532396	5701635
FS	S104b	T101	BP	22	D	D	D	O	50	8	N	-	-	N	Y	Y	532376	5701650
FS	S104b	T102	BP	22	G	F	G	O	50	10	Y	8	N	Y	Y	Y	532367	5701645
FS	S104b	T103	BP	25	D	D	D	O	10	10	N	-	-	N	Y	Y	532366	5701638
FS	S104b	T104	BP	22	G	F	G	O	10	10	N	-	-	N	Y	Y	532364	5701635
FS	S104b	T105	BP	28	D	D	D	SO	25	6	Y	6	N	N	Y	Y	532373	5701657
FS	S104b	T106	BP	22	D	D	D	O	25	7	N	7	W	N	Y	Y	532378	5701668
FS	S104b	T107	BP	25	G	F	G	O	15	10	N	-	-	N	Y	Y	532378	5701665
FS	S104b	T108	TA	27	G	P	F	O	50	11	Y	3.5	S	N	Y	N	532371	5701613
FS	S104b	T109	BP	22	D	D	D	O	50	3	N	2.5	N	N	Y	Y	532381	5701672
FS	S104b	T11	TA	30	G	F	G	SO	25	12	N	-	-	N	Y	Y	532424	5701644
FS	S104b	T110	BP	23	G	F	G	O	10	10	Y	5	W	Y	Y	Y	532393	5701677
FS	S104b	T111	TA	32	G	F	G	O	25	12	N	-	-	N	Y	Y	532395	5701682

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S104b	T112	BP	18	D	D	D	SO	40	10	Y	2	N	Y	Y	Y	532400	5701684
FS	S104b	T113	BP	20	D	D	D	O	25	6	Y	3	E	Y	Y	Y	532405	5701685
FS	S104b	T114	BP	18	G	P	F	O	15	8	N	-	-	N	Y	Y	532387	5701665
FS	S104b	T115	BP	21	G	F	G	O	5	9	N	-	-	N	Y	Y	532415	5701675
FS	S104b	T116	BP	22	G	F	G	O	40	10	N	-	-	N	N	N	532409	5701680
FS	S104b	T117	BP	20	G	F	G	O	10	10	N	-	-	N	Y	Y	532410	5701674
FS	S104b	T118	BP	21	D	D	D	O	15	10	N	8	N	Y	Y	Y	532413	5701690
FS	S104b	T119	BP	22	G	D	F	O	25	11	N	-	-	N	Y	Y	532407	5701681
FS	S104b	T12	BP	18	G	P	F	SO	50	10	N	-	-	N	Y	Y	532430	5701657
FS	S104b	T120	BP	23	D	-	D	O	40	5.5	Y	4	S	N	Y	N	532408	5701686
FS	S104b	T121	BP	25	G	P	F	O	15	10	N	-	-	N	Y	Y	532410	5701695
FS	S104b	T122	BP	18.5	D	D	D	O	30	10	N	-	-	N	Y	N	532392	5701711
FS	S104b	T123	BP	20	D	D	D	O	15	10	N	-	-	N	Y	Y	532394	5701703
FS	S104b	T124	BP	20	G	F	G	O	15	9	N	3	N	Y	Y	Y	532393	5701700
FS	S104b	T125	TA	33	G	P	F	O	40	12	N	2	E	Y	Y	Y	532392	5701709
FS	S104b	T126	TA	22.5	P	-	D	O	20	4	N	-	-	N	Y	Y	532384	5701682
FS	S104b	T127	TA	28	G	P	F	O	50	12	Y	9	N	N	Y	Y	532388	5701705
FS	S104b	T128	BP	20	D	D	D	O	35	-	N	4	W	N	Y	Y	532403	5701664
FS	S104b	T129	BP	27	D	D	D	O	10	6	N	-	-	N	Y	Y	532368	5701707
FS	S104b	T13	BP	24	D	D	D	SO	5	-	N	-	-	N	Y	Y	532411	5701651
FS	S104b	T130	BP	32	D	D	D	O	10	6	N	-	-	N	Y	Y	532370	5701705
FS	S104b	T131	BP	22	F	P	F	O	10	11	Y	8	S	N	Y	Y	532398	5701664
FS	S104b	T132	BP	20	G	P	F	O	50	8	N	7	W	N	Y	Y	532364	5701697
FS	S104b	T133	TA	28	D	D	D	O	60	4	N	-	-	N	Y	Y	532368	5701689
FS	S104b	T134	TA	30	G	F	G	O	10	12	N	-	-	N	Y	Y	532356	5701696
FS	S104b	T135	BP	19	G	P	F	O	10	8	Y	2	E	Y	Y	Y	532342	5701704
FS	S104b	T136	TA	25	G	P	F	O	25	9	N	-	-	N	Y	Y	532342	5701706
FS	S104b	T137	BP	20	P	P	P	O	30	9	Y	2	E	Y	Y	Y	532356	5701694

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S104b	T138	TA	24	G	F	G	O	25	10	N	-	-	N	Y	Y	532335	5701693
FS	S104b	T139	BP	18	D	D	D	O	25	10	N	-	-	N	Y	Y	532339	5701688
FS	S104b	T14	BP	24	G	F	G	SO	60	10	N	-	-	N	Y	Y	532424	5701652
FS	S104b	T140	BP	24	D	D	D	O	70	10	N	-	-	N	Y	Y	532345	5701690
FS	S104b	T141	TA	26	P	P	P	O	10	10	N	-	-	N	Y	Y	532341	5701690
FS	S104b	T142	BP	20	D	D	D	O	20	8	N	-	-	N	Y	Y	532361	5701679
FS	S104b	T143	BP	18.5	D	D	D	O	20	-	N	-	-	N	N	N	532361	5701677
FS	S104b	T144	BP	22	D	D	D	O	50	6	N	5	E	N	Y	Y	532337	5701684
FS	S104b	T145	BP	22	D	D	D	O	40	8	N	6	E	Y	Y	Y	532351	5701675
FS	S104b	T146	TA	21	G	F	G	O	40	9	N	-	-	N	Y	Y	532346	5701660
FS	S104b	T147	TA	24	G	F	G	O	50	12	N	-	-	N	Y	Y	532382	5701656
FS	S104b	T148	BP	21	D	D	D	O	20	8	Y	5	W	N	Y	Y	532386	5701658
FS	S104b	T149	BP	19	D	D	D	O	40	7	N	-	-	N	Y	Y	532389	5701661
FS	S104b	T15	BP	26	D	D	D	SO	20	4	N	-	-	N	Y	Y	532428	5701645
FS	S104b	T16	TA	22	G	P	F	SO	50	-	N	-	-	N	Y	Y	532432	5701658
FS	S104b	T17	BP	22	G	F	F	SO	75	10	N	-	-	N	Y	Y	532423	5701669
FS	S104b	T18	BP	27	D	D	D	SO	10	8	Y	7	W	Y	Y	Y	532410	5701660
FS	S104b	T19	TA	20	D	D	D	SO	50	10	N	3	S	N	Y	Y	532416	5701675
FS	S104b	T20	BP	18	F	P	F	SO	20	7	N	-	-	N	Y	Y	532417	5701682
FS	S104b	T81	BP	23	G	P	F	SO	50	10	N	-	-	N	Y	Y	532404	5701662
FS	S104b	T82	BP	23	G	P	F	SO	40	10	N	-	-	N	Y	Y	532414	5701678
FS	S104b	T83	BP	20	G	F	G	SO	10	11	N	-	-	N	Y	Y	532419	5701681
FS	S104b	T84	BP	18	D	D	D	SO	15	12	N	-	-	N	Y	Y	532418	5701684
FS	S104b	T85	BP	20	D	D	D	O	0	8	Y	4	N	N	Y	Y	532413	5701694
FS	S104b	T86	BP	20	D	D	D	O	0	8	Y	1	W	Y	Y	Y	532416	5701694
FS	S104b	T87	BP	26	D	D	D	SO	25	4	N	-	-	N	Y	Y	532414	5701657
FS	S104b	T88	TA	32	G	F	G	O	50	12	Y	4	S	N	Y	Y	532409	5701653
FS	S104b	T89	TA	35	G	F	G	O	15	12	N	-	-	N	Y	Y	532402	5701647

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S104b	T90	BP	21	D	D	D	SO	15	5	N	3	N	Y	Y	Y	532407	5701652
FS	S104b	T91	BP	20	D	D	D	SO	50	9	N	-	-	N	Y	Y	532440	5701632
FS	S104b	T92	TA	25	D	D	D	SO	10	10	N	-	-	N	Y	Y	532441	5701618
FS	S104b	T93	TA	27	G	F	G	O	50	12	N	-	-	N	Y	Y	532433	5701598
FS	S104b	T94	BP	20	G	F	G	SO	50	12	Y	6	S	Y	Y	Y	532423	5701610
P	S104b	T95	TA	23	D	R	D	O	70	4	N	-	-	N	Y	Y	532453	5701632
FS	S104b	T96	BP	20	D	D	D	SO	80	6	Y	3	N	N	Y	Y	532424	5701607
FS	S104b	T97	BP	22	G	P	F	SO	90	10	N	-	-	N	Y	Y	532409	5701606
FS	S104b	T98	BP	19	G	P	F	SO	90	10	N	5	W	Y	Y	Y	532408	5701603
FS	S104b	T99	TA	22	G	F	G	O	5	10	N	-	-	N	Y	Y	532398	5701641
P	S12	T01	TA	24	G	P	F	O	5	12	Y	9	W	N	N	N	530580	5688296
P	S12	T02	TA	23	G	P	F	O	10	12	N	-	-	N	N	N	530583	5688290
P	S12	T03	TA	19	G	F	F	O	10	8	N	-	-	N	N	N	530575	5688283
P	S12	T04	TA	21	P	D	D	O	20	-	N	-	-	N	Y	N	530577	5688279
P	S12	T05	TA	20	F	R	D	O	50	-	N	-	-	N	Y	N	530581	5688279
P	S12	T06	BP	22	G	F	F	O	5	13	N	-	-	N	N	N	530572	5688249
P	S12	T07	BP	20	F	D	P	O	20	15	N	-	-	N	N	N	530566	5688231
P	S12	T08	BP	20	D	D	D	O	15	14	N	-	-	N	Y	N	530565	5688230
P	S12	T09	BP	22	D	R	D	O	20	-	N	-	-	N	Y	N	530565	5688230
P	S12	T10	-	26	D	R	D	O	20	7	Y	7	S	N	Y	N	530581	5688205
P	S12	T11	TA	26	G	F	F	O	5	11	N	-	-	N	N	N	530583	5688201
P	S12	T13	TA	29	G	F	F	O	5	13	N	-	-	N	Y	N	530556	5688176
P	S12	T14	-	28	D	R	D	O	10	-	N	-	-	N	N	N	530554	5688177
P	S12	T15	BP	35	F	D	D	O	30	22	N	-	-	N	N	N	530553	5688171
P	S12	T16	TA	30	G	P	F	O	30	20	N	-	-	N	N	N	530553	5688166
P	S12	T17	BP	35	P	F	P	O	30	14	N	-	-	N	Y	N	530552	5688125
P	S12	T18	TA	28	D	R	D	O	40	7	N	-	-	N	Y	Y	530562	5688120
P	S12	T19	BP	20	P	F	P	O	30	14	N	-	-	N	N	N	530572	5688051

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
P	S12	T20	TA	32	G	G	G	O	30	13	N	-	-	N	Y	N	530551	5687992
P	S12	T21	TA	27	F	P	P	O	20	12	N	-	-	N	N	N	530557	5687931
P	S35	T01	-	24	D	R	D	O	50	3	N	-	-	N	Y	Y	530338	5691136
P	S35	T02	-	22	D	R	D	O	30	7	Y	6	N	N	Y	N	530384	5691095
P	S35	T03	BP	35	F	F	F	O	50	17	Y	7	N	Y	Y	N	530312	5691076
P	S35	T04	TA	33	G	F	G	O	25	20	N	-	-	N	N	N	530317	5691049
P	S35	T05	TA	22	D	R	D	O	25	10	N	-	-	N	Y	N	530420	5691020
P	S35	T07	-	20	D	R	D	O	20	5	N	-	-	N	Y	N	530425	5690986
P	S35	T07	-	20	D	R	D	O	20	3	N	-	-	N	N	N	530423	5690986
FS	S37	-	-	-	-	-	-	-	-	-	N	-	-	N	N	N	530558	5691897
P	S42	T01	BP	23	D	R	D	SC	60	4	N	-	-	N	Y	N	530257	5693176
P	S42	T02	TA	25	F	P	P	SC	40	14	N	-	-	N	Y	N	530267	5693177
P	S42	T03	TA	24	G	G	G	SC	25	14	N	-	-	N	N	N	530264	5693176
P	S42	T04	TA	35	G	P	F	C	75	17	N	-	-	N	Y	N	530266	5693173
P	S42	T05	-	28	D	R	D	SC	75	4	Y	-	-	N	Y	Y	530265	5693170
FS	S44	T01	BP	20	D	D	D	SO	10	4	Y	3	N	Y	Y	Y	530241	5693755
FS	S44	T02	TA	23	G	P	F	SO	5	5.5	N	-	-	N	Y	Y	530234	5693769
FS	S44	T03	TA	17	-	F	F	SO	0	8	N	-	-	N	N	Y	530241	5693770
FS	S44	T04	BP	22	G	P	F	SC	5	8	N	-	-	N	Y	Y	530243	5693777
FS	S44	T05	BP	22	D	D	D	SO	15	4	N	-	-	N	Y	Y	530237	5693782
FS	S44	T06	BP	28	P	G	P	SO	25	6	N	-	-	N	Y	Y	530235	5693780
FS	S44	T06	BP	20	F	D	F	SC	0	6	Y	1.5	N	Y	Y	Y	530239	5693790
FS	S44	T07	BP	29	G	D	F	SO	20	4	N	-	-	N	Y	Y	530245	5693796
FS	S44	T08	BP	24	G	D	F	SO	10	4	Y	4	N	N	Y	Y	530253	5693792
FS	S44	T09	BP	23	G	D	F	SC	25	8	N	-	-	N	Y	Y	530253	5693777
FS	S44	T10	BP	21	G	F	F	SC	10	9	N	-	-	N	Y	Y	530251	5693771
FS	S48	T01	TA	19	G	F	G	SC	5	5	N	-	-	N	Y	Y	531090	5694585
FS	S48	T02	TA	19	G	F	G	SC	10	7	N	-	-	N	N	N	531093	5694585

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S48	T03	TA	19	G	F	G	SC	50	10	N	-	-	N	N	N	531094	5694586
FS	S48	T04	TA	19	G	F	G	SC	0	10	N	-	-	N	Y	Y	531095	5694578
FS	S48	T05	TA	19	G	F	G	SC	5	6	N	-	-	N	Y	Y	531097	5694573
FS	S48	T06	TA	23	F	G	F	SO	0	-	N	-	-	N	N	Y	531096	5694577
FS	S48	T07	TA	28	D	D	D	SO	5	4	N	-	-	N	N	N	531095	5694566
FS	S48	T08	TA	27	P	D	P	O	5	4	N	1.5	E	Y	Y	Y	531098	5694564
FS	S48	T09	TA	18	G	F	G	SO	0	10	N	-	-	N	Y	Y	531093	5694562
FS	S48	T10	TA	34	P	P	P	O	0	3.5	N	-	-	N	Y	Y	531103	5694557
FS	S48	T11	TA	28	G	P	F	SO	10	9	N	-	-	N	Y	Y	531100	5694559
FS	S48	T12	TA	19	G	F	G	SO	5	-	N	-	-	N	Y	Y	531102	5694553
FS	S48	T13	TA	21	G	G	G	O	5	5	N	-	-	N	Y	Y	531103	5694552
FS	S48	T14	TA	19	G	G	G	SO	0	10	N	-	-	N	Y	Y	531102	5694550
FS	S48	T15	TA	20	G	F	G	SO	0	9	N	-	-	N	Y	Y	531105	5694550
FS	S48	T16	TA	22	G	G	G	O	0	7	N	-	-	N	Y	N	531106	5694542
FS	S48	T17	TA	30	D	D	D	SO	10	8	N	-	-	N	Y	Y	531110	5694540
FS	S48	T18	TA	27	G	P	P	SO	50	8	N	-	-	N	Y	Y	531110	5694538
FS	S48	T19	TA	18	D	D	D	O	80	5	N	-	-	N	Y	Y	531110	5694536
FS	S48	T20	TA	27	G	F	G	SO	10	10	Y	3	S	N	Y	Y	531115	5694528
FS	S48	T21	TA	23	P	P	P	O	15	5	Y	2	S	Y	Y	Y	531118	5694522
FS	S48	T22	TA	26	G	F	G	SO	20	10	N	-	-	N	Y	Y	531116	5694521
FS	S48	T23	TA	27	G	F	G	SO	10	10	N	-	-	N	Y	Y	531117	5694522
FS	S48	T24	TA	25	G	G	G	O	0	10	N	-	-	N	N	N	531125	5694524
FS	S48	T25	TA	25	D	D	D	SC	25	10	N	-	-	N	Y	Y	531128	5694495
FS	S48	T26	TA	24	G	F	G	SC	0	10	N	-	-	N	Y	Y	531132	5694519
FS	S48	T27	TA	28	F	F	F	O	15	11	Y	2	S	N	Y	Y	531130	5694522
FS	S48	T28	TA	18	G	G	G	SO	5	10	N	-	-	N	Y	Y	531125	5694522
FS	S48	T29	TA	27	P	F	P	SO	0	-	N	-	-	N	Y	Y	531139	5694525
FS	S48	T30	TA	22	G	G	G	SO	10	10	N	-	-	N	Y	Y	531126	5694518

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S48	T31	TA	19	G	P	F	SO	10	8	N	-	-	N	Y	Y	531143	5694518
FS	S48	T32	TA	25	G	F	G	SO	5	8	N	-	-	N	Y	Y	531144	5694516
FS	S48	T33	TA	24	G	P	F	SC	15	10	N	-	-	N	Y	Y	531124	5694514
FS	S48	T34	TA	20	G	F	G	SO	25	9	N	-	-	N	Y	Y	531121	5694507
FS	S48	T35	TA	24	G	G	G	O	20	10	N	-	-	N	Y	N	531125	5694498
FS	S48	T36	TA	24	F	D	P	SC	15	10	N	-	-	N	Y	Y	531144	5694516
FS	S48	T37	TA	20	G	F	G	SO	5	-	N	-	-	N	Y	Y	531138	5694512
FS	S48	T38	TA	18	G	F	G	SO	0	-	N	-	-	N	Y	Y	531137	5694511
FS	S48	T39	TA	21	D	D	D	SC	5	10	N	-	-	N	Y	Y	531134	5694500
FS	S48	T40	TA	25	D	D	D	SC	0	7	N	-	-	N	Y	Y	531145	5694503
FS	S48	T41	TA	23	G	F	G	SO	15	-	N	-	-	N	Y	Y	531128	5694495
FS	S48	T42	TA	19	F	D	P	SO	0	6	N	-	-	N	Y	Y	531125	5694491
FS	S48	T43	TA	22	G	F	G	SO	0	10	N	-	-	N	Y	Y	531134	5694489
FS	S48	T44	TA	22	G	F	G	SO	0	-	N	-	-	N	Y	Y	531141	5694493
FS	S48	T45	TA	24	G	F	G	SO	0	-	N	-	-	N	Y	Y	531135	5694479
FS	S48	T46	TA	19	G	F	G	SO	10	10	N	-	-	N	Y	Y	531140	5694480
FS	S48	T47	TA	19	G	F	F	SO	0	10	N	-	-	N	Y	Y	531151	5694477
FS	S48	T48	TA	23	G	F	G	SO	5	-	N	-	-	N	Y	Y	531159	5694478
FS	S48	T49	BO	27	F	F	F	SC	10	10	N	-	-	N	Y	Y	531157	5694470
FS	S48	T50	TA	23	F	F	F	SO	0	8	N	-	-	N	Y	Y	531162	5694469
FS	S48	T51	TA	20	D	D	D	SO	20	5	N	-	-	N	Y	Y	531159	5694460
FS	S48	T52	TA	20	D	D	D	SO	50	6	N	-	-	N	Y	Y	531149	5694458
FS	S48	T54	TA	20	F	P	P	SO	0	9	Y	2	E	Y	Y	Y	531150	5694457
FS	S48	T55	TA	19	D	D	D	SO	0	10	N	-	-	N	Y	Y	531145	5694458
FS	S48	T56	TA	23	G	P	F	SC	0	10	N	-	-	N	Y	Y	531167	5694455
FS	S48	T57	TA	21	F	P	F	SO	25	12	N	-	-	N	Y	Y	531192	5694481
FS	S48	T58	BO	34	D	D	D	SO	25	6	Y	1.5	W	Y	Y	Y	531194	5694488
FS	S48	T59	TA	24	F	P	F	SC	0	10	N	-	-	N	Y	Y	531185	5694490

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S48	T60	TA	22	D	D	D	O	15	7	N	-	-	N	Y	Y	531190	5694493
FS	S48	T61	TA	19	D	D	D	SO	0	3	N	-	-	N	Y	Y	531186	5694516
FS	S48	T62	TA	18	D	D	D	SO	0	8	N	-	-	N	Y	Y	531189	5694515
FS	S48	T63	TA	20	G	F	G	SO	0	10	N	-	-	N	Y	Y	531190	5694515
FS	S48	T64	TA	24	D	-	D	O	60	2	N	-	-	N	Y	Y	531185	5694510
FS	S48	T65	TA	19	D	D	D	SO	0	10	N	-	-	N	Y	Y	531174	5694540
FS	S48	T66	TA	23	F	G	F	O	30	10	N	-	-	N	Y	Y	531165	5694568
FS	S48	T67	TA	30	G	F	G	SO	0	10	N	-	-	N	Y	Y	531155	5694569
FS	S48	T68	TA	26	F	P	P	SO	0	5	N	-	-	N	Y	Y	531148	5694585
FS	S48	T69	TA	25	G	F	G	O	10	10	N	-	-	N	Y	Y	531163	5694573
FS	S48	T70	TA	23	G	P	F	SO	10	8	N	-	-	N	Y	Y	531148	5694592
FS	S48	T71	TA	22	F	P	F	SO	0	-	N	-	-	N	Y	Y	531148	5694590
FS	S48	T72	TA	27	F	P	F	SO	15	10	N	-	-	N	Y	Y	531146	5694602
FS	S48	T73	TA	25	F	D	P	O	40	3	N	-	-	N	Y	Y	531146	5694605
FS	S67	-	-	-	-	-	-	-	-	-	N	-	-	N	N	N	531098	5698550
FS	S69	T01	TA	22	G	F	G	SO	5	10	N	-	-	N	N	Y	531505	5698888
FS	S69	T02	TA	20	G	F	G	O	10	10	N	-	-	N	N	Y	531505	5698893
FS	S69	T03	TA	20	G	F	G	O	25	10	N	-	-	N	N	Y	531506	5698897
FS	S69	T04	TA	21	G	F	G	O	10	10	N	-	-	N	Y	Y	531506	5698891
FS	S69	T05	TA	20	G	P	F	O	20	10	N	-	-	N	N	Y	531503	5698898
FS	S69	T06	TA	20	G	D	F	O	0	10	N	-	-	N	Y	Y	531503	5698896
FS	S69	T07	TA	19	G	G	G	O	20	10	N	-	-	N	N	N	531497	5698914
FS	S69	T08	TA	25	G	F	G	SC	50	10	N	-	-	N	Y	Y	531511	5698901
FS	S69	T09	TA	22	G	F	G	SO	0	10	N	-	-	N	Y	Y	531496	5698913
FS	S69	T10	TA	19	G	F	G	SO	50	10	N	-	-	N	Y	Y	531495	5698921
FS	S69	T11	TA	19	G	F	G	SO	5	10	N	-	-	N	Y	Y	531491	5698915
FS	S69	T12	TA	20	G	F	G	SO	5	10	N	-	-	N	Y	Y	531491	5698916
FS	S69	T13	TA	19	G	F	G	SO	20	10	N	-	-	N	Y	Y	531489	5698914

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S69	T14	TA	20	G	F	G	SO	75	10	N	-	-	N	Y	Y	531485	5698915
FS	S69	T15	TA	23	G	G	G	C	20	12	N	-	-	N	N	N	531486	5698908
FS	S69	T16	TA	20	G	F	G	SO	80	-	N	-	-	N	Y	Y	531484	5698913
FS	S69	T17	TA	19	G	F	G	SO	5	10	N	-	-	N	Y	Y	531486	5698916
FS	S69	T18	TA	19	G	F	G	SO	5	10	N	-	-	N	Y	Y	531488	5698917
FS	S69	T19	TA	25	G	G	G	C	10	12	N	-	-	N	N	N	531483	5698904
FS	S69	T20	TA	18	G	F	G	SO	5	10	N	-	-	N	Y	Y	531487	5698919
FS	S69	T21	TA	21	G	F	G	SO	15	10	N	-	-	N	Y	Y	531483	5698917
FS	S69	T22	TA	27	G	G	G	C	5	12	N	-	-	N	N	N	531484	5698900
FS	S69	T23	TA	24	G	F	G	SO	60	10	N	-	-	N	Y	Y	531479	5698919
FS	S69	T24	TA	28	G	F	G	SC	15	10	N	-	-	N	Y	Y	531481	5698911
FS	S69	T25	TA	22	G	F	G	SC	25	10	N	-	-	N	Y	Y	531485	5698899
FS	S69	T26	TA	22	G	F	G	SC	25	10	N	-	-	N	Y	Y	531485	5698898
FS	S69	T27	TA	22	G	F	G	SC	0	10	N	-	-	N	Y	Y	531481	5698898
FS	S69	T28	TA	21	G	F	G	SC	15	10	N	-	-	N	Y	Y	531481	5698896
FS	S69	T29	TA	29	G	F	F	SC	15	10	N	-	-	N	Y	Y	531483	5698893
FS	S77	T01	TA	24	D	D	D	SO	10	15	N	-	-	N	Y	N	532418	5701001
FS	S77	T02	TA	27	F	P	F	SC	10	15	N	-	-	N	N	N	532418	5701001
FS	S77	T03	TA	24	D	D	D	SO	10	15	N	-	-	N	Y	N	532413	5701005
FS	S77	T04	-	24	D	R	D	SO	5	5	N	-	-	N	Y	Y	532408	5701005
FS	S77	T05	-	23	G	F	F	SO	5	9	N	-	-	N	N	N	532405	5701008
FS	S77	T06	TA	22	D	D	D	SO	10	13	N	-	-	N	Y	N	532399	5701008
FS	S77	T07	-	18	D	R	D	SO	10	5	N	-	-	N	Y	N	532405	5701013
FS	S77	T08	TA	20	D	R	D	SC	25	5	N	-	-	N	Y	N	532409	5701016
FS	S77	T09	TA	28	F	F	F	SO	30	-	N	-	-	N	Y	N	532354	5701080
FS	S77	T09	TA	24	D	D	D	SO	5	15	N	-	-	N	Y	N	532308	5701207
FS	S77	T10	TA	25	D	D	D	SO	10	-	N	-	-	N	N	N	532307	5701203
FS	S77	T12	TA	27	D	D	D	SC	25	-	N	-	-	N	Y	N	532305	5701203

Survey Type[1]	Stand ID	Tree ID	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
					Trunk	Canopy	Overall										Easting	Northing
FS	S77	T13	BP	35	G	P	F	SO	10	-	N	-	-	N	Y	N	532304	5701224
FS	S79	-	-	-	-	-	-	-	-	-	N	-	-	N	N	N	533076	5703140

NOTES:

"-" indicates no value available

[1] Survey Type = FS (full stand), P (plot), or O (opportunistic)

[2] Tree Species = BO (bur oak [*Quercus macrocarpa*]), BP (balsam poplar [*Populus balsamifera*]), MM (Manitoba maple [*Acer negundo*]), TA (trembling aspen [*Populus tremuloides*]), or WB (white birch [*Betula papyrifera*])

[3] DBH = diameter at breast height

[4] Condition = D (dead), P (poor), F (fair), or G (good)

[5] Understory = O (open: short herbaceous/grazed), SO (semi-open: tall herbaceous/short shrub), SC (semi-closed: tall shrub < 2 m with openings), or C (closed: dense shrub >2 m)

[6] CWD (%) = percent coarse woody debris within 3 m of the decadent tree

[7] Cavity orientation = N (north), E (east), S (south), or W (west)

[8] Coordinate datum: NAD83 UTM Zone 14N

APPENDIX 3

Decadent Tree Salvage Tables

Table 3-1: Decadent Trees to be Salvaged

Tree ID[1]	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
			Trunk	Canopy	Overall										Easting	Northing
S01-T02	MM	35	F	F	F	SO	5	11	N	-	-	N	Y	Y	529787	5681686
S04-T13	TA	27	F	F	F	O	25	12	Y	10	N	N	N	N	530887	5685587
S04-T15	TA	27	G	F	F	O	10	20	Y	4	E	N	Y	N	530870	5685572
S04-T21	TA	30	G	F	F	O	10	20	Y	8	W	Y	Y	N	530866	5685511
S04-T26	TA	27	G	F	G	O	30	18	Y	4	N	Y	N	N	530889	5685518
S06-T01	TA	26	G	P	F	O	35	15	N	-	-	N	Y	N	530730	5686022
S06-T03	TA	21	G	P	F	O	30	14	Y	-	-	N	N	N	530733	5686022
S06-T14	TA	30	G	G	G	O	5	17	N	-	-	N	N	N	530709	5686083
S10-T01	BP	32	G	F	F	O	15	11	Y	7	-	Y	Y	N	530645	5688077
S10-T02	BP	30	F	F	F	O	20	13	N	-	-	N	Y	N	530646	5688055
S10-T05	BO	33	G	D	F	O	5	20	N	-	-	N	N	N	530756	5687950
S102-T19	BP	28	G	F	F	O	40	17	N	-	-	N	N	N	530641	5689092
S103-T08	TA	26	G	P	F	O	10	14	N	-	-	N	Y	N	530434	5691502
S104a-T21	TA	37	G	F	G	O	75	12	Y	5	W	N	Y	Y	532196	5701636
S104a-T31	BP	19	F	P	F	SO	50	10	Y	3	N	Y	N	N	532138	5701641
S104a-T77	TA	23	G	P	F	O	25	10	N	-	-	N	N	Y	532103	5701524
S104b-T02	TA	23	G	P	F	O	50	10	N	-	-	N	Y	Y	532394	5701619
S104b-T03	TA	24	G	F	F	SO	50	12	N	-	-	N	Y	Y	532411	5701626
S104b-T04	BP	24	G	P	F	SO	25	10	N	3	N	N	Y	Y	532411	5701626
S104b-T05	TA	21	G	F	G	SO	75	12	Y	6	S	N	Y	Y	532421	5701625
S104b-T06	TA	22	G	P	F	SO	50	10	N	-	-	N	Y	Y	532421	5701630
S104b-T100	TA	26	G	F	G	O	5	10	N	-	-	N	Y	Y	532396	5701635
S104b-T102	BP	22	G	F	G	O	50	10	Y	8	N	Y	Y	Y	532367	5701645
S104b-T104	BP	22	G	F	G	O	10	10	N	-	-	N	Y	Y	532364	5701635

Tree ID[1]	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
			Trunk	Canopy	Overall										Easting	Northing
S104b-T107	BP	25	G	F	G	O	15	10	N	-	-	N	Y	Y	532378	5701665
S104b-T108	TA	27	G	P	F	O	50	11	Y	3.5	S	N	Y	N	532371	5701613
S104b-T11	TA	30	G	F	G	SO	25	12	N	-	-	N	Y	Y	532424	5701644
S104b-T110	BP	23	G	F	G	O	10	10	Y	5	W	Y	Y	Y	532393	5701677
S104b-T111	TA	32	G	F	G	O	25	12	N	-	-	N	Y	Y	532395	5701682
S104b-T116	BP	22	G	F	G	O	40	10	N	-	-	N	N	N	532409	5701680
S104b-T119	BP	22	G	D	F	O	25	11	N	-	-	N	Y	Y	532407	5701681
S104b-T121	BP	25	G	P	F	O	15	10	N	-	-	N	Y	Y	532410	5701695
S104b-T125	TA	33	G	P	F	O	40	12	N	2	E	Y	Y	Y	532392	5701709
S104b-T127	TA	28	G	P	F	O	50	12	Y	9	N	N	Y	Y	532388	5701705
S104b-T131	BP	22	F	P	F	O	10	11	Y	8	S	N	Y	Y	532398	5701664
S104b-T134	TA	30	G	F	G	O	10	12	N	-	-	N	Y	Y	532356	5701696
S104b-T138	TA	24	G	F	G	O	25	10	N	-	-	N	Y	Y	532335	5701693
S104b-T14	BP	24	G	F	G	SO	60	10	N	-	-	N	Y	Y	532424	5701652
S104b-T147	TA	24	G	F	G	O	50	12	N	-	-	N	Y	Y	532382	5701656
S104b-T17	BP	22	G	F	F	SO	75	10	N	-	-	N	Y	Y	532423	5701669
S104b-T81	BP	23	G	P	F	SO	50	10	N	-	-	N	Y	Y	532404	5701662
S104b-T82	BP	23	G	P	F	SO	40	10	N	-	-	N	Y	Y	532414	5701678
S104b-T88	TA	32	G	F	G	O	50	12	Y	4	S	N	Y	Y	532409	5701653
S104b-T89	TA	35	G	F	G	O	15	12	N	-	-	N	Y	Y	532402	5701647
S104b-T93	TA	27	G	F	G	O	50	12	N	-	-	N	Y	Y	532433	5701598
S104b-T94	BP	20	G	F	G	SO	50	12	Y	6	S	Y	Y	Y	532423	5701610
S104b-T97	BP	22	G	P	F	SO	90	10	N	-	-	N	Y	Y	532409	5701606
S104b-T99	TA	22	G	F	G	O	5	10	N	-	-	N	Y	Y	532398	5701641
S12-T01	TA	24	G	P	F	O	5	12	Y	9	W	N	N	N	530580	5688296

Tree ID[1]	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
			Trunk	Canopy	Overall										Easting	Northing
S12-T02	TA	23	G	P	F	O	10	12	N	-	-	N	N	N	530583	5688290
S12-T06	BP	22	G	F	F	O	5	13	N	-	-	N	N	N	530572	5688249
S12-T11	TA	26	G	F	F	O	5	11	N	-	-	N	N	N	530583	5688201
S12-T13	TA	29	G	F	F	O	5	13	N	-	-	N	Y	N	530556	5688176
S12-T16	TA	30	G	P	F	O	30	20	N	-	-	N	N	N	530553	5688166
S12-T20	TA	32	G	G	G	O	30	13	N	-	-	N	Y	N	530551	5687992
S35-T03	BP	35	F	F	F	O	50	17	Y	7	N	Y	Y	N	530312	5691076
S35-T04	TA	33	G	F	G	O	25	20	N	-	-	N	N	N	530317	5691049
S42-T03	TA	24	G	G	G	SC	25	14	N	-	-	N	N	N	530264	5693176
S42-T04	TA	35	G	P	F	C	75	17	N	-	-	N	Y	N	530266	5693173
S48-T20	TA	27	G	F	G	SO	10	10	Y	3	S	N	Y	Y	531115	5694528
S48-T22	TA	26	G	F	G	SO	20	10	N	-	-	N	Y	Y	531116	5694521
S48-T23	TA	27	G	F	G	SO	10	10	N	-	-	N	Y	Y	531117	5694522
S48-T24	TA	25	G	G	G	O	0	10	N	-	-	N	N	N	531125	5694524
S48-T26	TA	24	G	F	G	SC	0	10	N	-	-	N	Y	Y	531132	5694519
S48-T27	TA	28	F	F	F	O	15	11	Y	2	S	N	Y	Y	531130	5694522
S48-T30	TA	22	G	G	G	SO	10	10	N	-	-	N	Y	Y	531126	5694518
S48-T33	TA	24	G	P	F	SC	15	10	N	-	-	N	Y	Y	531124	5694514
S48-T35	TA	24	G	G	G	O	20	10	N	-	-	N	Y	N	531125	5694498
S48-T43	TA	22	G	F	G	SO	0	10	N	-	-	N	Y	Y	531134	5694489
S48-T49	BO	27	F	F	F	SC	10	10	N	-	-	N	Y	Y	531157	5694470
S48-T56	TA	23	G	P	F	SC	0	10	N	-	-	N	Y	Y	531167	5694455
S48-T59	TA	24	F	P	F	SC	0	10	N	-	-	N	Y	Y	531185	5694490
S48-T66	TA	23	F	G	F	O	30	10	N	-	-	N	Y	Y	531165	5694568
S48-T67	TA	30	G	F	G	SO	0	10	N	-	-	N	Y	Y	531155	5694569

Tree ID[1]	Tree Species[2]	DBH (cm)[3]	Tree Condition[4]			Understory[5]	CWD (%)[6]	Tree Height (m)	Cavities Present (Y/N)	Cavity Height (m)	Cavity Orientation[7]	Multiple Cavities (Y/N)	Peeling Bark (Y/N)	Decaying (Y/N)	Coordinates[8]	
			Trunk	Canopy	Overall										Easting	Northing
S48-T69	TA	25	G	F	G	O	10	10	N	-	-	N	Y	Y	531163	5694573
S48-T72	TA	27	F	P	F	SO	15	10	N	-	-	N	Y	Y	531146	5694602
S69-T01	TA	22	G	F	G	SO	5	10	N	-	-	N	N	Y	531505	5698888
S69-T08	TA	25	G	F	G	SC	50	10	N	-	-	N	Y	Y	531511	5698901
S69-T15	TA	23	G	G	G	C	20	12	N	-	-	N	N	N	531486	5698908
S69-T19	TA	25	G	G	G	C	10	12	N	-	-	N	N	N	531483	5698904
S69-T22	TA	27	G	G	G	C	5	12	N	-	-	N	N	N	531484	5698900
S69-T23	TA	24	G	F	G	SO	60	10	N	-	-	N	Y	Y	531479	5698919
S69-T24	TA	28	G	F	G	SC	15	10	N	-	-	N	Y	Y	531481	5698911
S69-T29	TA	29	G	F	F	SC	15	10	N	-	-	N	Y	Y	531483	5698893
S77-T02	TA	27	F	P	F	SC	10	15	N	-	-	N	N	N	532418	5701001

NOTES:
"-" indicates no value available

[1] Each tree has been identified using a metal tag with the corresponding unique Tree ID.
[2] Tree Species = BO (bur oak [*Quercus macrocarpa*]), BP (balsam poplar [*Populus balsamifera*]), MM (Manitoba maple [*Acer negundo*]), TA (trembling aspen [*Populus tremuloides*]), or WB (white birch [*Betula papyrifera*])
[3] DBH = diameter at breast height
[4] Condition = F (fair) or G (good) [5] Understory = O (open: short herbaceous/grazed), SO (semi-open: tall herbaceous/short shrub), SC (semi-closed: tall shrub < 2 m with openings), or C (closed: dense shrub >2 m)
[6] CWD (%) = percent coarse woody debris within 3 m of the decadent tree
[7] Cavity orientation = N (north), E (east), S (south), or W (west)
[8] Coordinate datum: NAD83 UTM Zone 14N

Table 3-2: Decadent Tree Reinstallation Locations

HMA ID[1]	Reinstallation Location ID[1]	Coordinates[3]	
1	a	530375	5682425
	b	530551	5682655
2	a	530685	5685976
	b	530687	5686124
3	a	530941	5686838
	b	530940	5687045
4	a	530934	5687580
	b	530936	5687628
5	a	530358	5690263
	b	530319	5690364
6	a	530694	5690451
	b	530655	5690546
7	a	530194	5690785
	b	530185	5690931
8	a	530189	5691604
	b	530190	5691756
9	a	530569	5691704
	b	530571	5691883
10	a	530573	5692146
	b	530573	5692199
11	a	530202	5693865
	b	530212	5694004
12	a	531152	5694439
	b	531186	5694483

HMA ID[1]	Reinstallation Location ID[1]	Coordinates[3]	
13	a	531302	5695182
	b	531300	5695409
14	a	530916	5695862
	b	530914	5696061
15	a	530909	5696676
	b	530909	5696852
16	a	530907	5697095
	b	530907	5697201
17	a	531081	5698525
	b	531109	5698568
18	a	531913	5698870
	b	531997	5698957
19	a	532092	5700778
	b	532090	5700985
20	a	533525	5703700
	b	533707	5703932

Notes:

[1] Two salvaged trees to be reinstalled per Habitat Mitigation Area (i.e., in locations ‘a’ and ‘b’).

[2] Coordinate datum: NAD83 UTM Zone 14N

LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Eastern Whip-poor-will Habitat Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS V

1.0 INTRODUCTION 1

1.1 Background and Purpose 1

1.2 Project Overview 1

1.3 Project Interaction with Eastern Whip-poor-will Habitat 2

2.0 OBJECTIVE 3

3.0 PROJECT MITIGATION 4

3.1 General Project Mitigation Measures 4

3.2 Outlet Channel Right-of-way Habitat Mitigation Areas 4

4.0 MONITORING AND FOLLOW-UP 7

4.1 Eastern Whip-poor-will Survey 7

4.2 Habitat Monitoring 8

4.2.1 Adaptive Management 8

5.0 REFERENCES 9

APPENDIX 1 10

APPENDIX 2 15

List of Tables

Table 1: Monitoring Criteria for the Eastern Whip-poor-will Survey

Table 2-1: Biophysical Attributes of Critical Habitat for Eastern Whip-poor-will[1]

List of Figures

Figure A: EMP Process

Figure 1: Schematic of LMOC ROW

Figure 2: Schematic of LSMOC ROW

Figure 1-1: Project Overview Map

Figure 1-2: Eastern Whip-poor-will Nesting and Foraging Habitat

Figure 1-3: LMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

Figure 1-4: LSMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders, and the public. It has been prepared using existing environmental and engineering information, professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Eastern whip-poor-will Habitat Management Plan (EWMP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under the *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

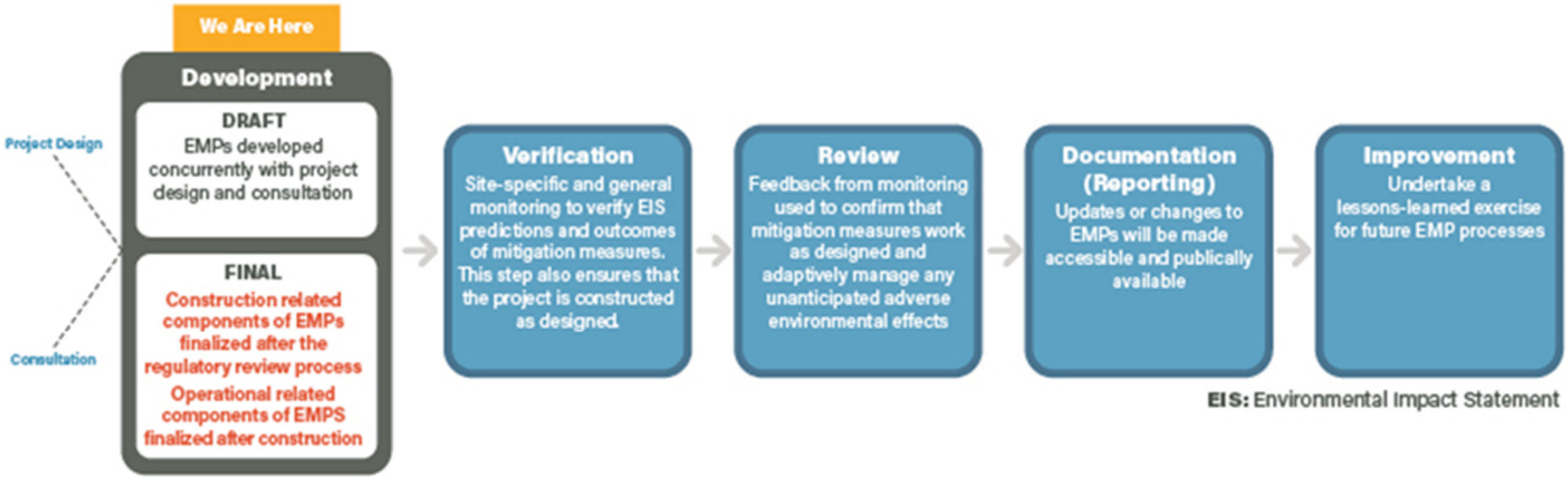


Figure A: EMP Process

LIST OF ACRONYMS

ARU	autonomous recording units
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
EHMP	Eastern whip-poor-will Habitat Management Plan
EIS	Environmental Impact Statement
ha	hectares
HMA	habitat mitigation area
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
PDA	Project development area
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Outlet Channels Project
RM	Rural Municipality
RVMP	Revegetation Management Plan
ROW	right-of-way

1.0 INTRODUCTION

1.1 Background and Purpose

The Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project) proposed by Manitoba Transportation and Infrastructure overlaps potential critical habitat for eastern whip-poor-will (*Caprimulgus vociferus*), listed as threatened under the federal *Species at Risk Act* (Government of Canada 2020). Eastern whip-poor-will is a ground-nesting aerial insectivore that typically breeds in a variety of mature forest habitats, preferring well-drained sites that are structurally suitable with forest openings for nesting and foraging (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2009, Environment and Climate Change Canada [ECCC] 2018a). In 2018, a federal recovery strategy was developed to provide guidance aimed at halting and reversing the population decline of eastern whip-poor-will and identifying critical habitat (ECCC 2018a).

The recovery strategy identifies multiple 10 by 10 kilometres (km) critical habitat squares throughout this species' Manitoba range. These standardized spatial units are used to identify known areas containing confirmed breeding evidence and potential critical habitat. The Project overlaps with one of these squares (14UNC53) at the Lake St. Martin Outlet Channel (LSMOC) inlet and associated distribution line (ECCC 2018a; Appendix 1, Figure 1-1). Construction in the Project development area (PDA, i.e., Project footprint) will require clearing of forested habitats that may support habitat for eastern whip-poor-will, but not critical habitat as defined in the species recovery strategy (ECCC 2018a; Appendix 1; Section 1.3).

As described in Chapter 12.7 of the Project Environmental Impact Statement (EIS), Manitoba Transportation and Infrastructure is using the precautionary approach and committing to additional mitigation measures to reduce potential Project-related effects to eastern whip-poor-will habitat, despite no evidence that critical breeding habitat will be directly affected by the Project.

The purpose of Eastern Whip-poor-will Habitat Management Plan (EHMP) is to describe the habitat management and monitoring activities that will be implemented along the outlet channel right-of-way (ROW).

1.2 Project Overview

The Project will develop a permanent flood control mitigation system for Lake Manitoba and Lake St. Martin for alleviating flooding in the Lake St. Martin region. This will be accomplished through construction of a new outlet channel from Lake Manitoba to Lake St. Martin (Lake Manitoba Outlet Channel [LMOC]) and a new outlet channel from Lake St. Martin to Lake Winnipeg (LSMOC). These new channels will allow for floodwaters to be moved more quickly through Lake Manitoba and Lake St. Martin into Lake Winnipeg. The Project will result in less flooding and reduced lake levels on Lake St. Martin during flood conditions. Other works include re-alignment of Provincial Road (PR) 239 and a hydroelectric distribution line for operation of the LSMOC water control structure (Appendix 1, Figure 1-1).

1.3 Project Interaction with Eastern Whip-poor-will Habitat

The LSMOC and distribution line PDA overlaps 149.6 hectares (ha) of an eastern whip-poor-will critical habitat square near the northern part of Lake St. Martin (Appendix 1, Figure 1-2). Approximately 23.0 ha (15.4%) of overlap consists of upland habitats (e.g., forest) on imperfectly drained or poorly drained soils. Clearing of the LSMOC PDA would result in the loss of this habitat, which based on Project EIS modeling of biophysical attributes outlined in the recovery strategy, is not considered critical habitat for eastern whip-poor-will (ECCC 2018a; Appendix 2, Table 2-1). The closest modelled eastern whip-poor-will habitat was identified within the southeastern portion of the critical habitat square, which is located over 5 km from the LSMOC PDA (Appendix 1, Figure 1-2).

2.0 OBJECTIVE

The objective of the EHMP is to understand how eastern whip-poor-will are distributed along, and adjacent to, the outlet channel ROWs following Project construction, including the application of revegetation prescriptions and vegetation management practices, that provide habitat opportunities for eastern whip-poor-will.

3.0 PROJECT MITIGATION

3.1 General Project Mitigation Measures

Construction of the outlet channels will require clearing of the 400 metre (m)-wide ROWs and the 30 m-wide distribution line, but mitigation measures outlined in the Project Environmental Requirements (PERs) will reduce potential effects to eastern whip-poor-will and their habitats. These include:

- Treed habitats within the ROW will be retained where safe and technically feasible to do so.
- Clearing will not occur between April 1 and August 31 to avoid disturbance to nesting birds and other wildlife (ECCC 2018b).
- If clearing is scheduled to occur within the nesting period (April 1 to August 31), a nest survey may be undertaken by a qualified wildlife biologist if warranted. In the event an active nest is found, it will be subject to site-specific mitigation measures (i.e., clearly marked protective buffer around the nest and/or non-intrusive monitoring).
- The provincially recommended setback distance of 300 m from an active eastern whip-poor-will nest will be adhered to for vegetation clearing and construction activities between May 15 to July 16 (MB CDC 2021).
- Revegetation activities will occur in spring or fall depending on the construction schedule and, if applied in the fall, prescriptions may require adjustments to improve survivability of seed during winter for herbaceous cover (see Revegetation Management Plan [RVMP]).

To promote establishment of a healthy vegetation cover for the Project and to allow for the proper function of water flow the following measures are part of the maintenance program during the operations phase:

- maintenance of the vegetation cover in areas where erosion might be present.
- ongoing mowing of the outside drain to promote drainage.
- occasional mowing of shrubs and trees that encroach on berms to maintain channel hydraulic function.
- ongoing weed control.

3.2 Outlet Channel Right-of-way Habitat Mitigation Areas

The goal of the RVMP is to revegetate upland areas of the outlet ROWs in a manner that promotes the establishment of grassland communities consisting of native and agronomic grasses and forbs along the LMOC, as well as perennial native grass groundcover along the LSMOC. Portions of the LSMOC cleared but not heavily disturbed will be encouraged to naturally regenerate. To protect structural integrity and maintain hydrological function, shrubs and trees are discouraged from growing along the channel and on spoil piles/berms but are acceptable at the base of spoil piles in peripheral areas of the ROW (Appendix 1, Figure 1-3). Figure 1 and Figure 2 identify where shrubland prescriptions may be added to a schematic cross section of the LMOC and LSMOC, respectively. Revegetation prescriptions involving shrub plantings will provide habitat for wildlife including eastern whip-poor-will, as this species nests in forests with well-drained soils and forages in open habitats containing shrubs and herbaceous plants (Appendix 2). For the purposes of

the EHMP, eastern whip-poor-will habitat mitigation areas (HMAs) are those areas where shrub plantings are planned in the upland portions of the LMOC and LSMOC ROWs (i.e., adjacent to the channel berms and in areas adjacent to forest habitats; Figure 1 and Figure 2; Appendix 1, Figure 1-3, and Figure 1-4). Shrub enhancements in the eastern whip-poor-will critical habitat square will be done in proximity to deciduous forest on imperfectly drained soil (Appendix 1, Figure 1-4).

Native plant species will be used to revegetate the ROWs where possible, including native shrubs within the HMAs. The ROW outside of the HMAs will be revegetated with a native and agronomic seed mix designed to allow for potential future haying, as well as include native wildflowers to provide pollinator habitat (see RVMP).

Figure 1 schematic illustrates the main components of the LMOC ROW. The HMAs will be located between the ROW boundary and outer edge of the outside drain (as shown on the left of the diagram) and between the ROW boundary and outer edge of the channel soil berm or topsoil berm (as shown on the right of the diagram).

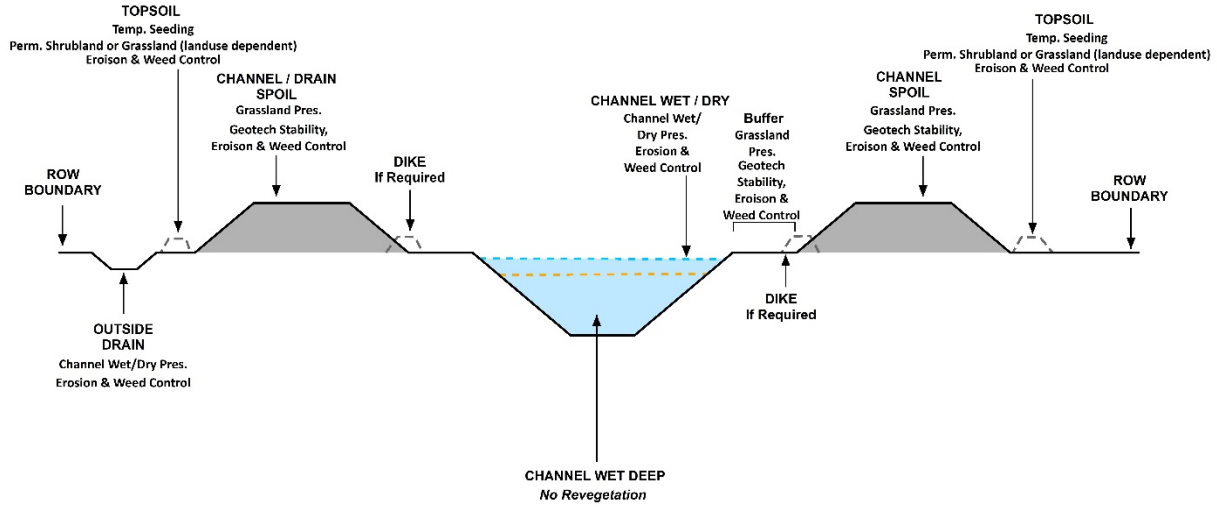


Figure 1: Schematic of LMOC ROW

Figure 2 schematic illustrates the main components of the LSMOC ROW. The HMAs will be located between the ROW boundary and outside edge of the channel spoil berm (as shown on the left of the diagram) and between the ROW boundary and outer edge of the outside drain (as shown on the right of the diagram).

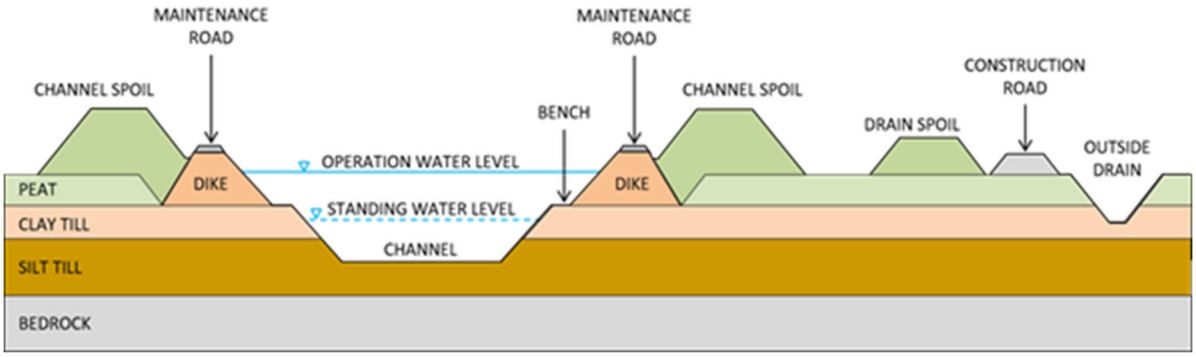


Figure 2: Schematic of LSMOC ROW

4.0 MONITORING AND FOLLOW-UP

To assess the effectiveness of the implementation of the EHMP, monitoring activities within the HMAs will include an eastern whip-poor-will survey and an associated habitat survey which are described in greater detail below.

4.1 Eastern Whip-poor-will Survey

Rationale

Mitigation measures have been incorporated into the design of the outlet channels to provide habitat enhancements for wildlife; but benefits to eastern whip-poor-will are anticipated to be limited. However, the eastern whip-poor-will survey will be used to evaluate, if present, the distribution of eastern whip-poor-will, and adjacent to, the outlet channel ROWs following Project construction.

Objective

The objective of the eastern whip-poor-will survey is to understand if eastern whip-poor-will occupy habitats in, or adjacent to the HMAs, and along portions of the distribution line near the LSMOC.

Measurable Parameter

The measurable parameter for the eastern whip-poor-will survey is habitat occupancy by eastern whip-poor-will.

Methods

Eastern whip-poor-will surveys will occur at a subset of randomly selected HMAs. Surveys will follow a standardized survey protocol (Knight 2018) using autonomous recording units (ARUs); Wildlife Acoustics Song Meter SM4; Wildlife Acoustics 2020). ARU spacing may be less than the suggested 1.6 km, but no less than 800 m, as habitat occupancy of the species within the survey area is the parameter of interest and independence of sites may still be maintained with reduced spacing.

Surveys will occur over a 14-day period that will coincide with the eastern whip-poor-will breeding season and within 7 days of the full moon in late-June to early-July (Knight 2018), which will meet the objectives outlined above while also providing a design for ongoing monitoring efforts. The peak calling time for eastern whip-poor-will is for 90 minutes from 0.5 hours after sunset until 1.5 hours after sunset (Knight 2018). The ARUs will be programmed to collect three 6-minute audio recordings every 30 minutes during this peak period every evening (i.e., 18 minutes of audio per day). Wildlife detected during ARU deployment and retrieval will be recorded as incidental observations.

Upon retrieval of the ARUs, the data files will be processed using commercial software (e.g., Kaleidoscope Pro [Wildlife Acoustics 2019]) that automatically scans data files for the species of interest using a reference library; a qualified biologist will review and validate a sample of the results for false-negative and false-positive results. Eastern whip-poor-will detections will be summarized by site and mapped relative to the Project to provide an understanding of the presence and distribution of potential suitable breeding habitat within the survey area.

Frequency

The eastern whip-poor-will survey will be completed daily during the peak breeding period described above. Surveys will be undertaken in years 2, 4, and 6, post-construction.

Decision Trigger / Threshold for Action

There are no decision triggers or thresholds for action proposed for the eastern whip-poor-will survey as potential benefits to the species resulting from habitat enhancements are not anticipated to be measurable.

A summary of the monitoring criteria for the eastern whip-poor-will is provided in Table 1.

Table 1: Monitoring Criteria for the Eastern Whip-poor-will Survey

Monitoring Objective	Method	Monitoring Metric	Project Phase	Duration	Frequency
Evaluate Project effects on eastern whip-poor-will	Eastern whip-poor-will survey	Species occurrence	Operation	Post-construction Years 2, 4, 6	Daily during the peak breeding period

4.2 Habitat Monitoring

Habitat (i.e., shrub and tree) monitoring will be undertaken as part of the monitoring activities outlined in the RVMP for the LMOC (Section 8) and LSMOC (Section 14).

4.2.1 Adaptive Management

Adaptive management will be incorporated into the habitat monitoring described above and as part of the adaptive management process outlined in the RVMP (Section 9). Such measures will factor in input from Indigenous rights-holders, stakeholders, and regulators.

5.0 REFERENCES

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009. COSEWIC assessment and status report on the whip-poor-will (*Caprimulgus vociferous)* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 28 pp.

ECCC (Environment and Climate Change Canada). 2018a. Recovery strategy for the eastern whip-poor-will (*Antrostomus vociferus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vi + 107 pp.

ECCC. 2018b. General nesting periods of migratory birds. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html. Accessed November 2020.

Government of Canada. 2020. Species at risk public registry. Available at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html. Accessed November 2020.

Knight, E. 2018. Canadian nightjar survey protocol. Available at: http://wildresearch.ca/wp-content/uploads/2015/10/National-Nightjar-Survey-Protocol-WildResearch.pdf. Accessed October 2020.

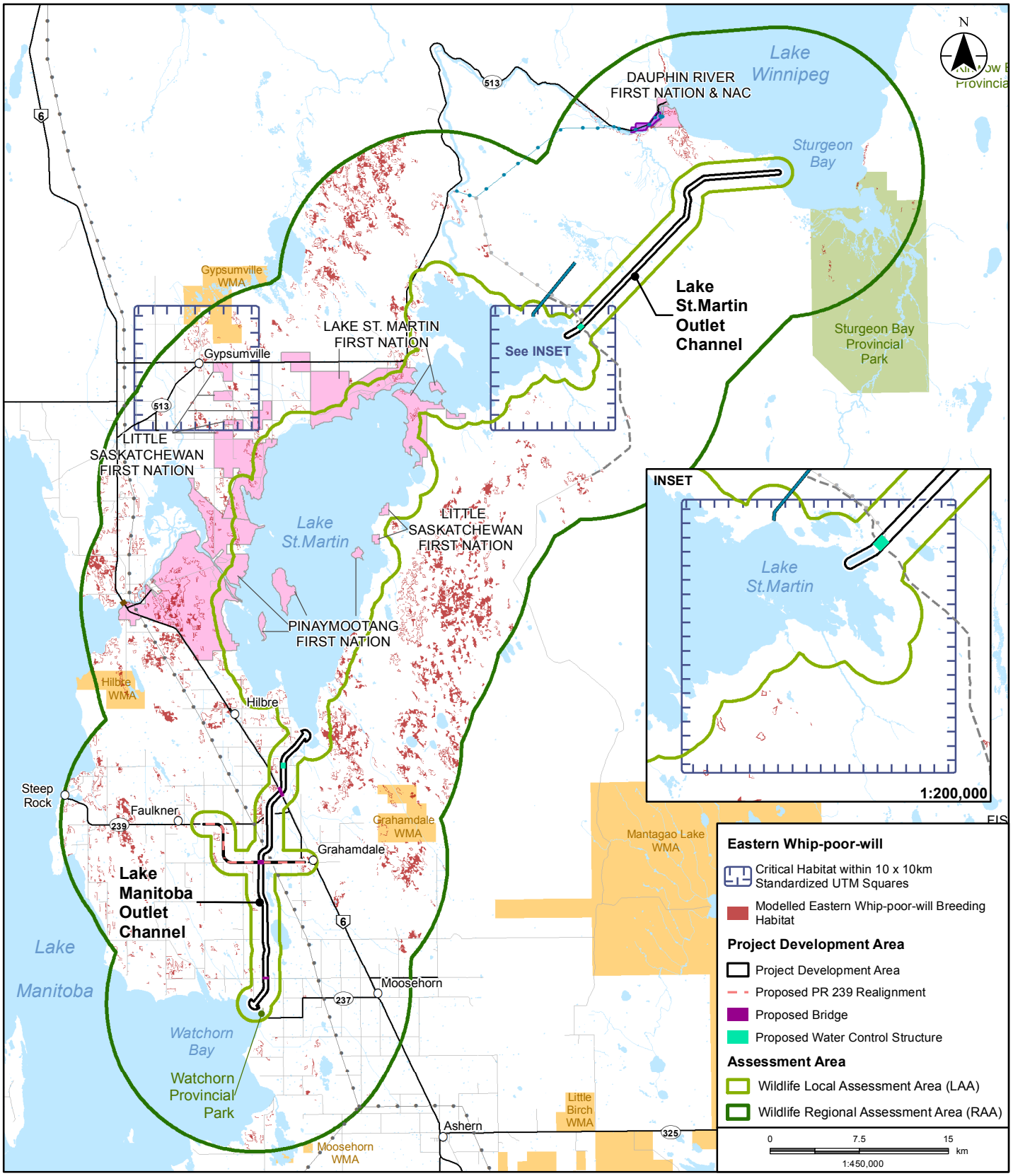
MB CDC (Manitoba Conservation Data Centre). 2021 Recommended development setback distances and restricted activity periods for birds by wildlife feature type. Available at: https://www.manitoba.ca/fish-wildlife/cdc/pubs/mbcdc-bird-setbacks-nov2021.pdf. Accessed June 2022.

Wildlife Acoustics. 2019. Kaleidoscope pro 5 user guide. Available at: https://www.wildlifeacoustics.com/uploads/user-guides/Kaleidoscope-User-Guide.pdf. Accessed October 2020. Accessed October 2020.

Wildlife Acoustics. 2020. Song meter SM4 bioacoustic recorder user guide. Available at: https://www.wildlifeacoustics.com/uploads/user-guides/SM4-BAT-FS-USER-GUIDE-20200116.pdf. Accessed October 2020.

APPENDIX 1

Figures



Legend

- Fairford Water Control Structure
- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Existing Transmission Line
- Existing Distribution Line
- Planned Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Northern Affairs Community (NAC)
- First Nation
- Wildlife Management Area
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure, Stantec Consulting
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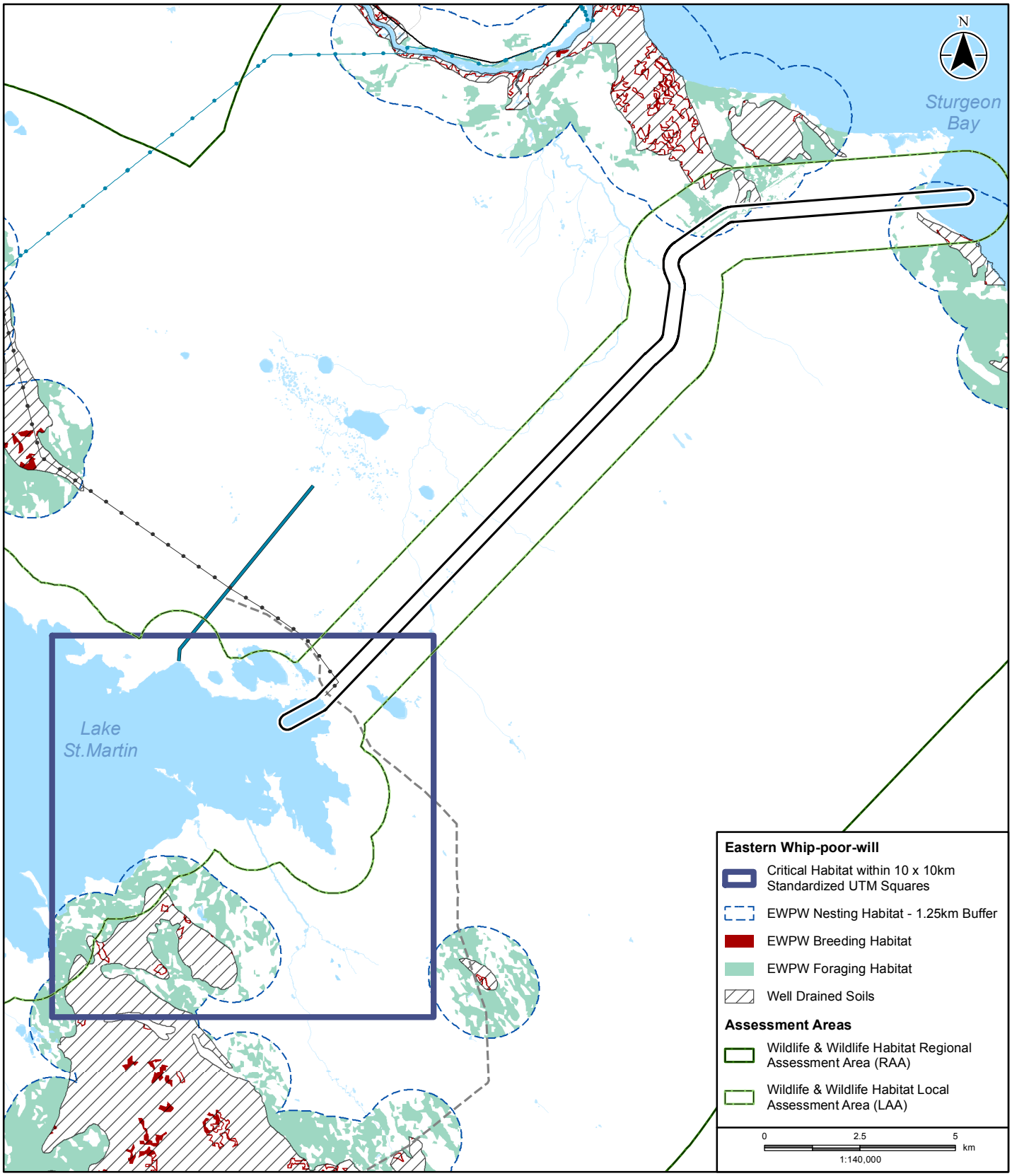
Manitoba Stantec

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Lake Manitoba & Lake St.Martin Outlet Channels Project

Project Overview Map

Figure 1-1

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Legend

- Project Development Area
- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Planned Distribution Line
- Existing Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road

Notes

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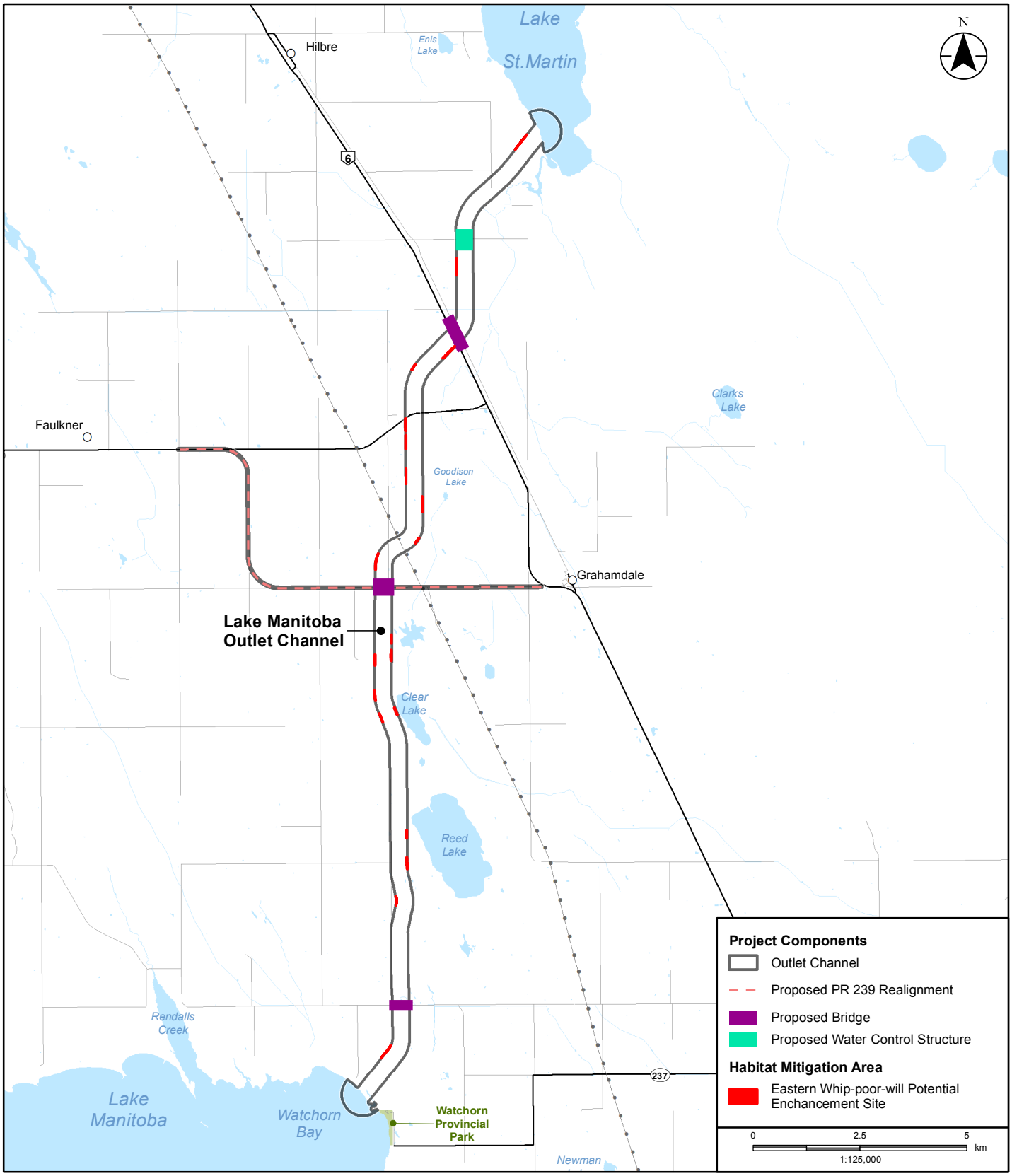
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Lake Manitoba & Lake St.Martin Outlet Channels Project

Eastern Whip-poor-will Nesting and Foraging Habitat

Figure 1-2

G:_GIS_Project_Folder\111475120\figures_EMP\sWildlife\111475120_EWPW01_REVE_Habitat_LSMOC_8x11.mxd



Legend

- Existing Transmission Line
- Provincial Highway (PTH/PR)
- Municipal Road
- Provincial Park

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure
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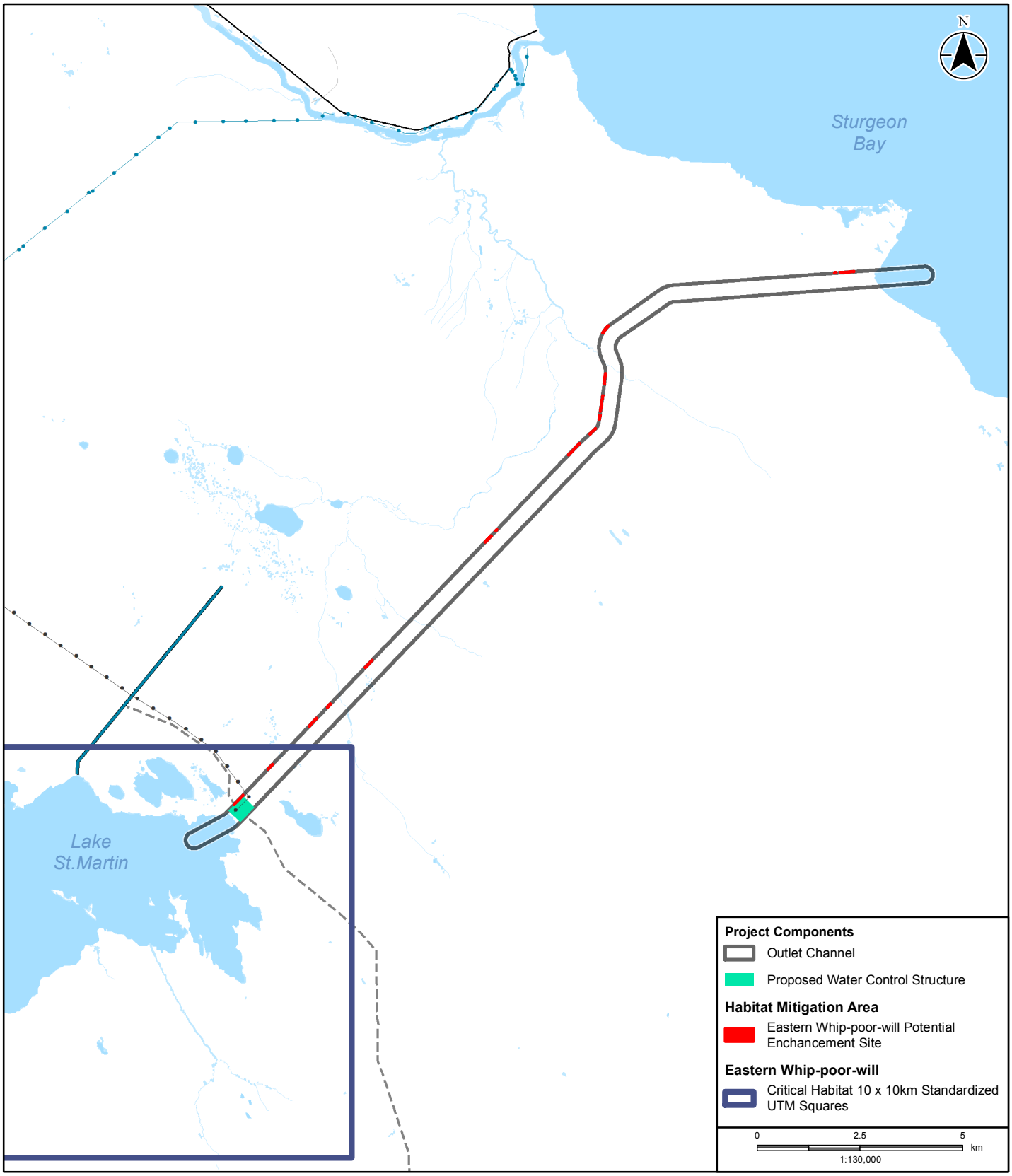
Manitoba

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LMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

Figure 1-3

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Legend

- Lake St.Martin Emergency Outlet Channel (Reach 1)
- Lake St.Martin Access Road
- Planned Distribution Line
- Existing Distribution Line
- Provincial Highway (PTH/PR)
- Municipal Road

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure
3. Last Update: 6/21/2022 3:43:33 PM

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Manitoba Transportation and Infrastructure
Lake Manitoba & Lake St.Martin Outlet Channels Project

LSMOC Eastern Whip-poor-will Habitat Mitigation Areas Overview

Figure 1-4

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APPENDIX 2

Biophysical Attributes of Critical Habitat for Eastern Whip-poor-will

Table 2-1: Biophysical Attributes of Critical Habitat for Eastern Whip-poor-will[1]

Components of Habitat Suitability	Biophysical Attributes
Regional context	Forests (e.g., deciduous, mixedwood, coniferous, treed wetlands) and open habitats (e.g., shrublands, fallow fields, regeneration following fires or clear-cuts, rock and sand outcrops; shrubby wetlands) form a mosaic
Habitats suitable for both nesting and foraging	A.1 Forests with sparse to moderate tree cover or open habitats **AND** A.2 Sparse to moderate shrub and herbaceous cover **AND** A.3 Well-drained soils (e.g., sand, sandy-loam) ▯ *Within an atlas square, includes all corresponding areas of 3 ha or more*
Habitats suitable for nesting only **[*must be adjacent* ***to foraging habitats*]**	A.4 Forests with a dense tree cover **AND** A.5 Sparse to moderate shrub and herbaceous cover **AND** A.6 Well-drained soils (e.g., sand, sandy-loam) ▯ *Within an atlas square, includes all corresponding areas up to 30 m on the interior side of the forest edge*

Components of Habitat Suitability	Biophysical Attributes
Habitats suitable for foraging only ***[must be adjacent to nesting habitats]***	A.7 Forests with sparse tree cover or open habitats **AND** A.8 Dense shrub cover **AND** A.9 Soil drainage is deficient *Within an atlas square, includes all corresponding areas up to 1,250 m from the edge with suitable nesting habitat* **OR** A.10 Agricultural land with scattered shrubs or trees (e.g., hedgerows) that can be used as perches *Within an atlas square, includes all corresponding areas*

Note:

[1] from the federal recovery strategy for the eastern whip-poor-will (ECCC 2018a).

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OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Complaint Resolution Process

June 30, 2022

Manitoba
Transportation and Infrastructure

TABLE OF CONTENTS

DISCLAIMER I

PREFACE II

LIST OF ACRONYMS AND GLOSSARY OF TERMS V

Acronyms v

Glossary of Terms v

1.0 INTRODUCTION 1

1.1 Project Overview 2

2.0 COMPLAINT RESOLUTION PROCESS 3

2.1 Initiation 3

2.2 Records and Tracking 3

2.3 Investigation 4

2.4 Resolution 4

2.5 Timelines and Notifications 4

APPENDIX 1 5

List of Figures

Figure A: EMP Process

Figure 1: Complaint Response Protocol Diagram

DISCLAIMER

This document was developed to support the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from the engagement and consultation process, the Environmental Assessment process, Project planning activities, and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans that occur after Project approvals are received will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Complaint Resolution Process (CRP) is one component of the overall Environmental Management Program (EMP) framework, which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Project Environmental Impact Statement (EIS), the requirements and conditions of the provincial licence issued under *The Environment Act*, the federal Decision Statement issued under The *Canadian Environmental Act 2012*, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied as described further in individual environmental management and monitoring plans.

Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with Indigenous rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the EAC will coordinate Indigenous Environmental Monitors and communications during the construction period and will be working with Indigenous rights-holders and stakeholders on its structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring

plans, sharing plan-specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders and stakeholders would be informed and could provide meaningful input into Project planning. The original draft EMP plans and questionnaires that were posted on the Project website for public review and comment are being replaced by the second draft of each plan as it becomes available. Feedback and recommendations received were used to update the current version of the draft plans, which are posted to the Project website at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* provincial licence, *The Canadian Environmental Assessment Act 2012* federal Decision Statement conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes. Until such time, these plans will remain in draft form.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

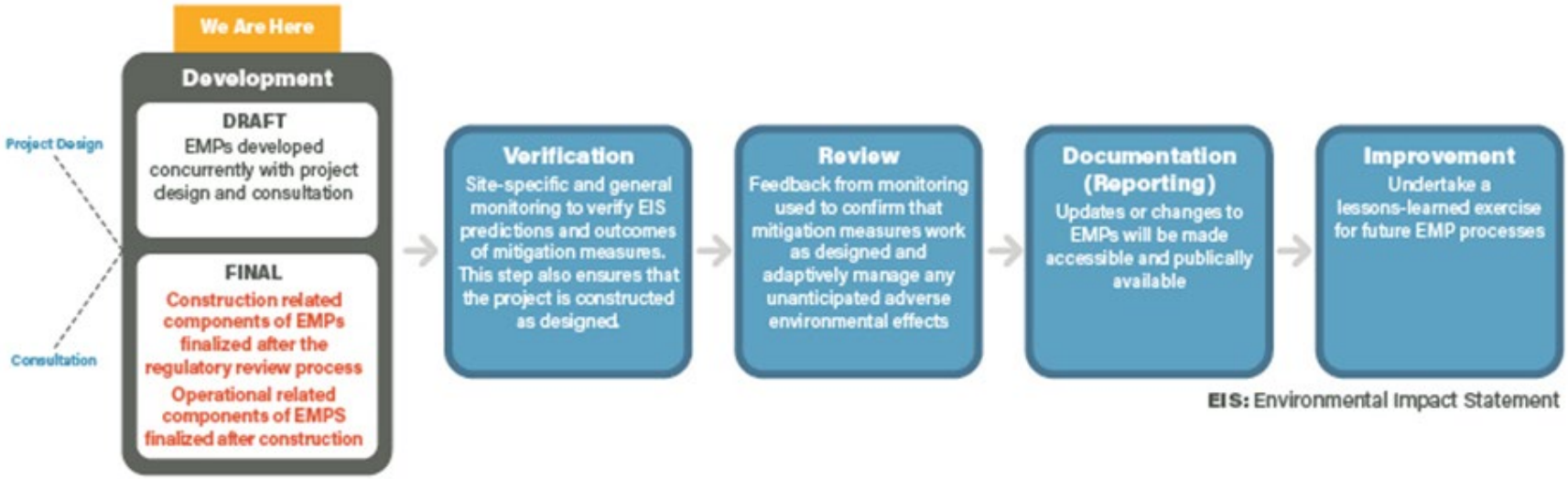


Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

CEMP	Construction Environmental Management Program
CRP	Complain Resolution Process
EAC	Environmental Advisory Committee
EIS	Environmental Impact Statement
EMP	Environmental Management Process
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
OEMP	Operation Environmental Management Program
PR	Provincial Road
the Project	Lake Manitoba and Lake St. Martin Outlet Channels Project
RM	Rural Municipality
WCS	Water Control Structure

Glossary of Terms

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation or maintenance activities, and includes all subcontractors and affiliates.

Environmental Monitor: Refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Rights-holders: include First Nations, Metis Communities and other Indigenous communities who hold Aboriginal or Treaty rights that are protected under section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing or gathering rights.

1.0 INTRODUCTION

Manitoba Transportation and Infrastructure is developing a series of environmental management plans and monitoring plans as part of the Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the Project). These plans are being developed to provide mitigation measures and Best Management Practices to be applied during Project planning, construction, operation and maintenance activities to avoid or reduce potential adverse effects. The plans outline monitoring activities that will be undertaken to document environmental conditions, guide mitigation and adaptive management measures, and undertake Project activities such that they are carried out in compliance with applicable environmental legislation and licensing requirements and have considered and incorporated input received from Indigenous rights-holders and other Project stakeholders.

Manitoba Transportation and Infrastructure has developed a process to manage Project-related complaints should they occur. This Complaint Resolution Process (CRP) outlines the methods to receive and document complaints, records management, and process tracking, as well as the process for complaint notification, investigation, and resolution. The CRP is illustrated in Figure 1 and will be in place during the construction and operation phases of the Project and will be used to assist Contractors and Manitoba Transportation and Infrastructure to resolve Project-related issues related to Manitoba Transportation and Infrastructure's environmental management and monitoring plans. However, measures for emergency response, including spills, wildfire, and other accidents or malfunctions are to be addressed by onsite personnel pertaining to contractor submittals and other requirements outlined in the Project Environmental Requirements, but imminent or perceived emergencies identified by others can be reported as part of this process as well.

Although the CRP is designed to address potential Project effects that were not successfully mitigated, or where mitigation failed and resulted in an undesired effect to the environment or people, the CRP is not intended to act as a substitute or replacement for section 35 Crown Consultation, and related concerns, nor is it intended to replace other communications regarding Project progress and updates.



Figure 1: Complaint Response Protocol Diagram

1.1 Project Overview

The Project will involve the development of a permanent flood control mitigation system for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region. This will be accomplished through construction of a new outlet channel from Lake Manitoba to Lake St. Martin (Lake Manitoba Outlet Channel; LMOC) and a new outlet channel from Lake St. Martin to Lake Winnipeg (Lake St. Martin Outlet Channel). These new channels will allow for floodwaters to be moved more quickly through Lake Manitoba and Lake St. Martin into Lake Winnipeg and will result in less flooding and reduced lake levels on Lake Manitoba and Lake St Martin than is currently experienced. Other works include construction of new bridges to maintain access across the LMOC, Water Control Structures (WCS) to manage flows through each channel, re-alignment of Provincial Road (PR) 239 and a hydroelectric distribution line for operation of the Lake St. Martin Outlet Channel WCS.

2.0 COMPLAINT RESOLUTION PROCESS

2.1 Initiation

The CRP will be initiated upon the submission and receipt of a Project-related complaint, including from any person, Indigenous rights-holders, or from the Rural Municipality (RM) of Grahamdale or other stakeholders. An email-based complaint submission process will be used for the Project and will be outlined on the Project's website – https://www.gov.mb.ca/mit/wms/lmblsmoutlets/. The Project website will indicate the information that should be included within the email submission, including:

- Complainant Name and Contact Information
- Description of event or issue
- Date and time of event or when issue was noticed
- Location of event or issue

In addition, a toll-free number that is available 24-hours per day will be available for reporting emergency situations related to groundwater, spills or releases, fish kills, or residential flooding.

2.2 Records and Tracking

Manitoba Transportation and Infrastructure will assign a tracking number and a complaint resolution lead person immediately upon receipt of a Project-related complaint. The complaint resolution lead will be responsible for the development of the Project Complaint Form (Appendix 1) that will be used to document information throughout the CRP.

The complaint resolution lead will contact the complainant (preferably by telephone, but may also be via email) to communicate the tracking number for future correspondence and to confirm and collect specific information for input into the Project Complaint Form, which will include:

- Tracking number
- Complainant name and contact Information (optional)
- Complaint Resolution Lead name and contact information
- Date and time of when complaint was received
- Date and time of event or when issue was noticed
- Location of issue or event
- Description of issue or event
- Other relevant information (e.g., weather conditions, photographs)

Project Complaint Forms will be updated throughout the CRP and will be available to the applicable regulatory agencies upon request.

2.3 Investigation

Complaint investigation may include the following steps:

- Contacting the complainant to acquire additional information
- Collecting information related to the issue or event through interviews and/or correspondence with Indigenous rights-holders, stakeholders, regulators, contractors, and Project personnel
- Determining the need for monitoring based on the type of issue and implementing additional monitoring activities, as required
- Determining if the Project is operating within environmental legislation and licensing requirements and/or adhering to Project commitments
- Coordinating the implementation of corrective actions
- Corresponding with regulatory bodies, if required
- Updating the Project Complaint Form throughout the investigation

2.4 Resolution

Based on an investigation by Manitoba Transportation and Infrastructure (or its designate), if the Project or a Project activity is found to be in compliance with the applicable environmental and licensing requirements and/or Project commitments, the complaint will be considered resolved; however, it should be noted that mitigation, monitoring, or other considerations may be required.

If the Project is found to be out of compliance with the applicable environmental and licensing requirements and/or Project commitments, Manitoba Transportation and Infrastructure will implement corrective action, as required to transition to compliant status (e.g., in compliance with regulatory requirements, conditions of approval, and/or Project commitments).

When a complaint is resolved, the Project Complaint Form and tracking number will be closed. The complainant and any applicable rights-holders, stakeholders and regulators will be notified of the resolution.

2.5 Timelines and Notifications

Timelines for addressing the complaint will be variable and depend on the nature of the complaint, urgency, the need for monitoring (if required), and where applicable, technical challenges associated with the implementation of corrective actions. Effort will be made to initiate corrective actions expeditiously.

Emergency situations will be investigated immediately upon the receipt of a complaint.

APPENDIX 1

Project Complaint Form

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Project Complaint Form

Complaint Details and Information

Complainant Name _____

Complainant Email Address _____

Complainant Phone Number _____

Complainant Mailing Address _____

Complainant Postal Code _____

Tracking Number _____

Date _____

Time _____

Description of Event or Issue

Date of Event or Issue _____ Time of Event or Issue _____

Describe the Event or Issue

Is there any other relevant information you would like to provide (e.g., weather conditions)?

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Investigative Results

Complaint Resolution Lead

Resolution Lead Name	Resolution Lead Email Address	Resolution Lead Phone Number

Correspondence Tracking Table

Date	Time	Contact Information	Communication Method	Description	Follow-up Action Required (Y/N)
			Choose one		
			Choose one		
			Choose one		
			Choose one		
			Choose one		
			Choose one		

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Investigative Results

Investigation Results

Suspected Root Cause

Were there any secondary causes?

Corrective Action

Proposed Immediate Action/s

Proposed Action/s for Long-Term Solution

Additional Remarks

Completed by:

Date: