Project Description

Lake Manitoba and Lake St. Martin Outlet Channels

Prepared for:

Canadian Environmental Assessment Agency

Submitted by:

Manitoba Infrastructure

January 2018

Manitoba Infrastructure

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Abbreviations

%	Percent
≤	Less than or equal to
°C	Degrees Celsius
AQHI	Air Quality Health Index
ATV	All-Terrain Vehicle
Ca	Calcium
CEAA	Canadian Environmental Assessment Act
CO	Carbon monoxide
CO2	Carbon dioxide
COSEWIC	Committee On the Status of Endangered Wildlife In Canada
dB	Decibel
DFO	Department of Fisheries and Oceans Canada
DO	Dissolved Oxygen
EAP	Environment Act Proposal
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EPP	Environmental Protection Plan
FLIR	Forward Looking Infra-Red
FN	First Nation
FRWCS	Fairford River Water Control Structure
GHG	Greenhouse Gas
GUDI	Groundwater Under the Direct Influence of Surface Water
GWDrill	Provincial Well Record Database
HC-CDWQ	Health Canada – Canadian Drinking Water Quality

HCO3	Bicarbonate
INAC	Indigenous and Northern Affairs Canada
INR	Indigenous and Northern Relations
IPEP	Indigenous and Public Engagement Process
IRTC	Interlake Reserves Tribal Council
km	Kilometre
km/hr	Kilometres per hour
km2	Square kilometre
kV	Kilovolt
LCC	Land Cover Classification
LAA	Local Assessment Area
LiDAR	Light Detection and Ranging
LM&LSMRRC	Lake Manitoba and Lake St. Martin Regulation Review
LMBOC	Lake Manitoba Outlet Channel's
LSMEOC	Lake St. Martin Emergency Outlet Channel
LSMOC	Lake St. Martin Outlet Channel's
m	Metre
m/s	Metres per second
masl	Metres above sea level
mbgl	Metres below ground level
MBCDC	Manitoba Conservation Data Centre
MBESEA	Manitoba Endangered Species and Ecosystems Act
Mg	Magnesium
MI	Manitoba Infrastructure
mm	Millimetre
MMF	Manitoba Metis Federation
MSD	Manitoba Sustainable Development
NAC	Northern Affairs Communities
NO	Nitric oxide
NO2	Nitrogen dioxide
NOx	Nitrogen oxides
O3	Ozone
PD	Portage Diversion

PF	Project Footprint
PM	Particulate Matter
PR	Provincial Road
PSL	Permissible Sound Levels
PTH	Provincial Trunk Highway
RAA	Regional Assessment Area
Reg.	Regulation
RHA	Regional Health Authority
RM	Rural Municipality
ROW	Right of Way
Reg.	Regulation
RQD	Rock Quality Designation
SAR	Species at Risk
SARA	Species At Risk Act
SO2	Sulphur dioxide
SOCC	Species of Conservation Concern
SPT	Standard Penetration Tests
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TK	Traditional knowledge
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USgpd/ft	US gallons per day per foot
WMA	Wildlife Management Area

1 GENERAL INFORMATION AND CONTACTS

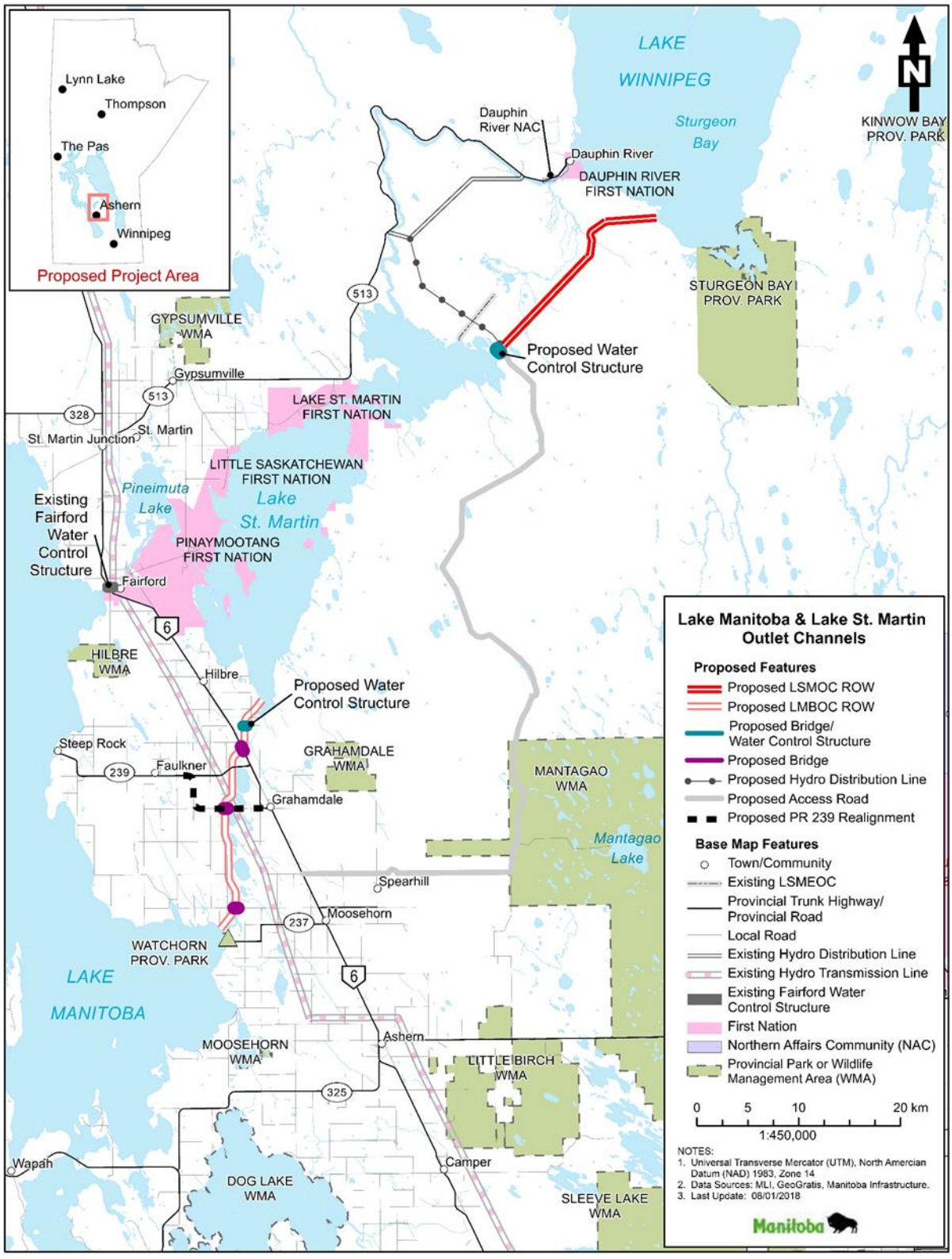
1.1 Nature of the Project and Proposed Location

In 2011, widespread flooding occurred across much of southern Manitoba resulting in unprecedented high inflows into Lake Manitoba and Lake St. Martin. These high flows extended well into the summer and overwhelmed the capacity of the existing system. Lake Manitoba and Lake St. Martin peaked above their desirable operating ranges in 2011 (1.4 meters (m) and 1.7 m, respectively). Subsequent flooding on both lakes resulted in the long-term evacuation of surrounding communities, and the decision to construct the Lake St. Martin Emergency Outlet Channel (LSMEOC). Due to the emergency nature of the project, a federal environmental assessment was not required under Section 7(1)(c) of the *Canadian Environmental Assessment Act* (CEAA). The Province of Manitoba passed an Order-In-Council creating the Lake St. Martin Outlet Channel Authorization Regulation, which exempted the project from licensing under *The Environment Act* C.C.S.M. c. E125.

The existing LSMEOC consists of two discontinuous diversion channels known as Reach 1 and Reach 3 (Map 1). Reach 1 extends from Lake St. Martin into the Big Buffalo Lake wetland area. Reach 3 is located from approximately the mid-point of Big Buffalo Creek extending eastward to Lake Winnipeg. Reach 3 was initially developed due to the need for additional outlet capacity as a result of unprecedented flows along the Dauphin River downstream of Buffalo Creek and the increased potential of frazil ice jamming at the mouth of the Dauphin River. Due to unexpected mild winter conditions the risk of ice jamming was reduced considerably and the operation of Reach 3 was not required. Reach 3 was not fully constructed and has never been operated (KGS 2015). Reach 1 channel began operation in November 2011 and was closed in November 2012. Reach 1 was operated again during July 2014 to August 2015 in response to high water levels on Lake St. Martin.

Manitoba Infrastructure (MI) is proposing the development of a permanent flood control management system for this area to help reduce the effects of future flood events. It will consist of a new diversion channel from Lake Manitoba to Lake St. Martin (Lake Manitoba Outlet Channel) and a new diversion channel, with one water control structure, from Lake St. Martin to Lake Winnipeg (Lake St. Martin Outlet Channel) (Map 1). During high water events, the Lake Manitoba and Lake St. Martin Outlet Channels will allow for better management and control of the water levels on Lake Manitoba and Lake St. Martin by providing additional capacity to divert water from Lake Manitoba through Lake St. Martin and into Lake Winnipeg.

The Lake Manitoba and Lake St. Martin Outlet Channels Conceptual Design – Stage 1 and Stage 2 were completed as part of the Assiniboine River and Lake Manitoba Basins Flood Mitigation Study (KGS 2016). These initial studies evaluated several route location options; geotechnical and environmental baseline field studies provided additional information for final preferred route recommendations.



Map 1. Project Area

The Lake Manitoba Outlet Channel's (LMBOC) design capacity will be 212 cubic metres per second (m^3/s) when operational and will be roughly 23 km long with an up to 100 m wide channel (Map 1). The LMBOC will occur along the center of a 400 m right-of-way that will also contain spoil berms and runoff collection ditches on both sides of the channel (Map 2). The Lake St. Martin Outlet Channel's (LSMOC) capacity will be 326 m^3/s when operational and will be roughly 24 km long with an up to 120 m wide channel (Map 3). The total footprint of the LSMOC, including containment berms and runoff collection ditches, will be located within Crown land and be contained within a width of up to 300 m. If operated continually, the LMBOC and LSMOC could discharge approximately 6.698 billion and 10.269 billion m^3 per year, respectively.

1.2 Proponent Information

1.2.1 Name of the Project

The project name is "Lake Manitoba and Lake St. Martin Outlet Channels" (LMB & LSM OC or the Project).

1.2.2 Name of the Proponent

The proponent of the proposed LMB & LSM OC Project is Manitoba Infrastructure (MI).

1.2.3 Address of the Proponent

The address of the proponent is:

6th Floor - 215 Garry Street
Winnipeg MB R3C 3P3

1.2.4 Chief Executive Officer

The Deputy Minister for MI is:

Mr. Bramwell Strain
450 Broadway
Winnipeg MB R3C 0V8
Office Phone: 204-945-0253
Fax: 204-945-4766
Email: dmmit@leg.gov.mb.ca

1.2.5 Principal Contact Person

The principal contact person for the project is the Project Director:

Mr. Mark Allard, P. Eng.
6th Floor - 215 Garry Street
Winnipeg MB R3C 3P3
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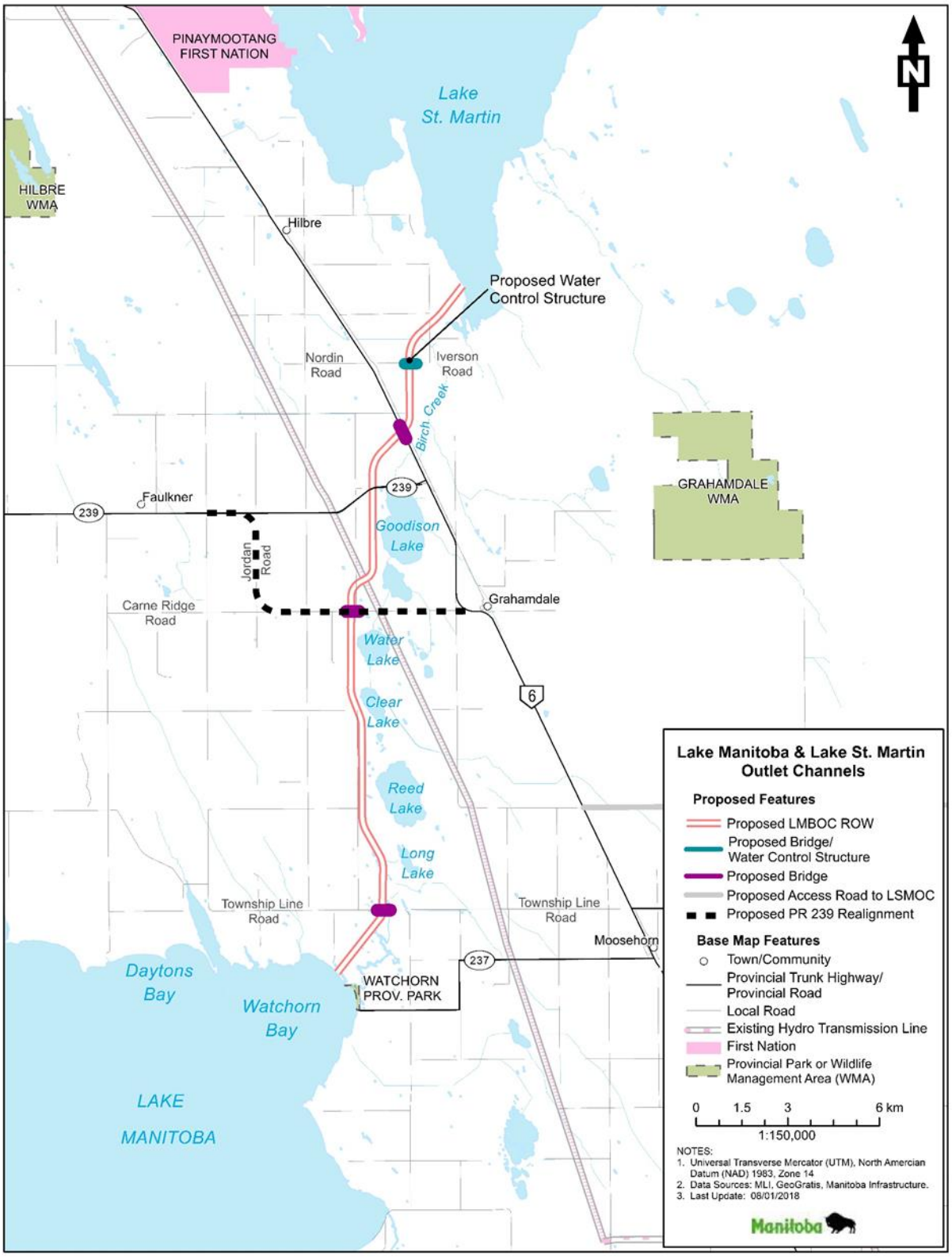
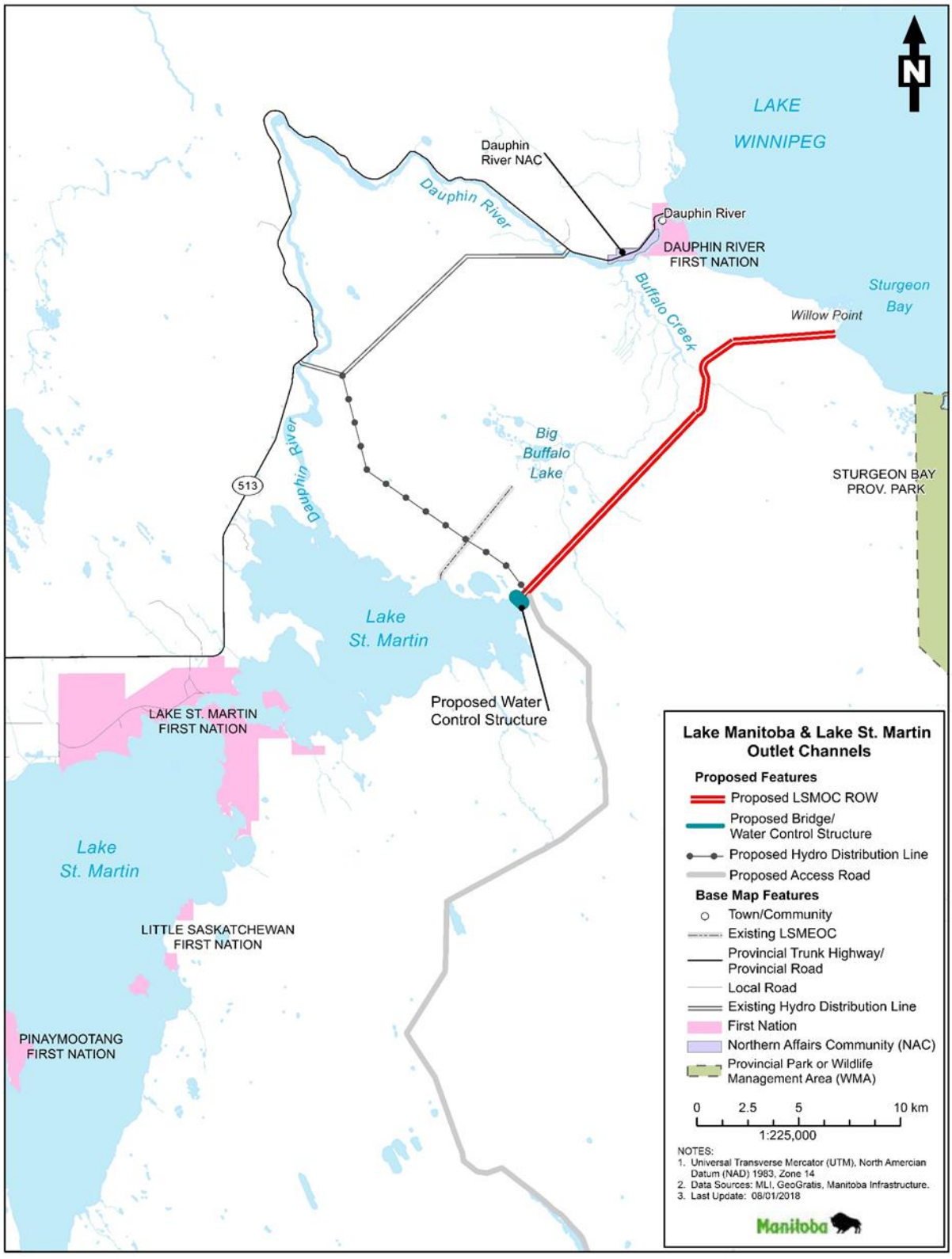
Email: mark.allard@gov.mb.ca



Map 2. Detailed Route - Proposed LMBOC



Map 3. Detailed Route – Proposed LSMOC

1.3 Jurisdictions and Other Parties Consulted

Individual meetings and general information sessions occurred with provincial and federal regulators including:

- Fisheries Branch, Manitoba Sustainable Development (MSD)
- Biodiversity and Endangered Species Section, MSD
- Wildlife Branch, MSD
- Groundwater Section, MSD
- Water Science & Management Branch, MSD
- Agri-Resource, Manitoba Agriculture
- Environmental Approvals Branch, MSD
- Parks and Regional Services, MSD
- Medical Officer of Health, Interlake-Eastern Regional Health Authority (RHA)
- Prairie and Northern Region, Canadian Environmental Assessment Agency (Agency)
- Manitoba Region, Indigenous and Northern Affairs Canada (INAC)
- Fisheries Protection Program, Department of Fisheries and Oceans Canada (DFO)

Indigenous and Public Engagement was first initiated through the review of the Assiniboine River and Lake Manitoba Basin Flood Mitigation Study (KGS 2013). This study introduced channel outlet options for Lake Manitoba and Lake St. Martin while providing information about the larger framework of the flood management options within the Province of Manitoba.

A series of information sessions, including public open houses and stakeholder briefing sessions, were held in June 2013 and December 2014 in Dauphin River, Brandon, and Portage la Prairie. Invitations were mailed out to local, regional, and provincially identified stakeholders, including: municipal representatives; business owners; private citizens; conservation districts; and Indigenous peoples.

An additional open house held in Ashern in September 2014, that focussed on the LMB & LSM OC options, was attended by over 250 people, representing homeowners, farmers/ranchers, and cottage owners, elected officials, business owners, and Indigenous community members. In addition to the representatives mentioned above, the list below includes that attended information sessions:

- Rural Municipality (RM) of Coldwell
- RM of Archie
- RM of Whitehead
- RM of Rockwood
- RM of West Interlake
- RM of Grassland
- RM of Cartier
- RM of Alonsa
- RM of Portage la Prairie
- RM of St. Francois Xavier
- RM of North Cypress-Langford
- RM of Lawrence-Lakeshore
- RM of Victoria
- RM of Westbourne
- RM of Langford
- Town of Minnedosa

- RM of Ste. Rose
- RM of Glenwood
- RM of Cornwallis
- RM of Dauphin
- RM of Archie-Ellice
- RM of Whitehead
- RM of Miniota
- RM of Sifton
- RM of Woodworth
- RM of Ochre River
- RM of Shellmouth-Boulton
- Manitoba Trappers Association
- Town of Russell
- Town of Virden
- Town of Carberry
- City of Portage la Prairie
- City of Dauphin
- City of Brandon
- Manitoba Beef Producers
- Assiniboine Basin Initiative
- Skownan First Nation
- Manitoba Metis Federation
- Tootinaowaziibeeng First Nation

Information sessions were recently held with potentially affected stakeholders in Moosehorn in May and June 2017 to present preferred alignments and obtain additional input on the LMB & LSM OC Project. A public open house was also held in Winnipeg in July 2017.

The Province of Manitoba had individual meetings and/or correspondence with the following Indigenous communities or groups and Northern Affairs Communities (NAC) regarding the LMB & LSM OC Project:

- Assembly of Manitoba Chiefs
- Aghaming NAC
- Berens River First Nation
- Berens River NAC
- Bloodvein First Nation
- Brokenhead First Nation
- Dauphin River First Nation
- Dauphin River NAC
- Ebb and Flow First Nation
- Fisher Bay NAC
- Fisher River Cree Nation
- Hollow Water First Nation
- Interlake Regional Tribal Council
- Kinonjeoshetegon First Nation
- Lake Manitoba First Nation
- Lake St. Martin First Nation
- Little Saskatchewan First Nation
- Little Black River First Nation
- Loon Straits NAC
- Manigotagan NAC
- Manitoba Metis Federation
- Matheson Island NAC
- Misipawistik First Nation
- Norway House Cree Nation
- Norway House NAC
- O-Chi-Chak-Ko-Sipi First Nation
- Peguis First Nation
- Pinaymootang First Nation
- Pine Dock NAC
- Poplar River First Nation
- Princess Harbour NAC
- Sagkeeng First Nation
- Seymourville NAC

1.4 Environmental Assessment Requirements

1.4.1 Canadian Environmental Assessment Act, 2012 (Canada)

The proposed LMB & LSM OC is a designated project under The *Canadian Environmental Assessment Act*, *2012* (CEAA 2012), and therefore is expected to require an environmental

assessment under the authority of the CEAA 2012, subsequent to federal and public review of this Project Description under the provisions of that legislation.

The outlet channels are expected to achieve design flows of more than approximately 200 m^3/s (Section 2.2). The outlet channels will supplement Manitoba's existing flood management infrastructure and are not expected to produce regular annual flow rates. Therefore, section 6 of the *Regulations Designating Physical Activities* pursuant to CEAA 2012 applies:

s. 6 *The construction, operation, decommissioning, and abandonment of a new structure for the diversion of 10 000 000 m^3/year or more a year from a natural body into another natural water body.*

1.4.2 The Environment Act (Manitoba)

The LMB & LSM OC Project requires an Environment Act Licence under *The Environment Act* of Manitoba. The Project will likely be classified as a Class 3 development, under the Classes of Development Regulation, being a flood control project protecting areas greater than 100 km^2.

It is assumed that an environmental assessment will be required under *The Environment Act*. An Environmental Impact Statement (EIS) will be prepared and submitted for review by federal and provincial regulators. As part of the licensing process for MSD, the proponent must submit a complete Environment Act Proposal (EAP) form. The form is checked for completeness then moves onto the screening stage. There are two reviews during the screening stage, including:

- Public Review: EAPs are made available to the public for review in electronic and hard copy format
- Technical Review: EAPs are distributed to a Technical Advisory Committee (TAC), which consists of specialists from provincial and federal governments capable of providing technical expertise

MSD's Environmental Approvals Branch will review all of comments from the public and TAC, and may request additional information from the proponent. In response to valid concerns, the director of Environmental Approvals Branch may make a recommendation to the Minister of MSD to request public hearings held by the Manitoba Clean Environment Commission.

1.5 Other Regulatory Requirements

In addition to the environmental assessment and licensing requirement under CEAA 2012 and *The Environment Act* (Manitoba), permits and approvals will be sought as required for construction activities such as vegetation removal, camp development, burning of cleared vegetation, and quarry development. The proposed Project is in an area that has never been subject to a regional environmental assessment study under CEAA 2012.

A listing of pertinent legislation to the construction of the outlet channels and associated works are presented in Table 1 and described in more detail in Section 4.3. These acts, regulations and policies are anticipated to have linkages to the proposed Project, or to specific project activities. Some legislation, including CEAA 2012, the federal *Fisheries Act*, The *Environment Act* (Manitoba) and *The Crown Lands Act* (Manitoba), set out specific requirements for compliance, including environmental assessment, permitting, and authorization, while others such as the federal *Migratory Birds Convention Act, 1994*, the federal *Species At Risk Act*, the *Transportation of Dangerous Goods Act*, and *The Wildlife Act* (Manitoba) identify prohibitions and require sound environmental management planning, mitigation and consideration of environmental impacts for the project life cycle.

Table 1. Regulatory Requirements of the LMB & LSM OC Project

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
Canadian Environmental Assessment Act, 2012, SC 2012, c 19, s 52	Cost Recovery Regulations (Regs.), SOR/2012-146 Physical Activities, Regulations Designating, SOR/2012-147 Prescribed Information for the Description of a Designated Project Regulations, SOR/2012-148	Identifies and defines activities that are subject to an environmental assessment. Identifies requirements and provides guidance for environmental assessment of designated projects. Project requires environmental assessment and approval.
Canada Water Act, RSC 1985, c C-11	Guidelines for Canadian Drinking Water Quality	Protection of water resources, including water quality.
Fisheries Act, RSC 1985, c F-14	Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations, SOR/2013-191 Aquatic Invasive Species Reg. SOR/2015-121	Protects commercial, recreational or aboriginal fisheries from serious harm. Identifies general prohibitions, fisheries protections and pollution preventions as well as requirements for authorization of works which may cause serious harm to fish prior to construction. Project requires Authorization under Paragraph 35(2)(b).
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 200, c 29	Not applicable	Prevents the extirpation or extinction of wildlife species, provides for plans and strategies to enable the recovery of species listed as a result of human activity 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.
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 and explosives storage and transport will need to be licenced.
The Environment Act, CCSM c E125	Classes of Development Reg. 164/88 Environment Act Fees Reg.168/96 Licensing Procedures Reg. 163/88	Classifies developments and identifies requirements for provincial licencing and environmental assessment. 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.

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
	Notice and Reporting Reg. 126/2010 Onsite Wastewater Management Systems Reg. 83/2003	Defines proper construction and disposal for onsite water management systems. Project requires environmental assessment and Environment Act Licence.
The Crown Lands Act, CCSM c C340	Not applicable	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, CCSM 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.
The Mines and Minerals Act, CCSM c M162	Quarry Minerals Regulation, 1992, Reg.65/92	Identifies and outlines requirements for sustainable development of mineral product exploration and production, including quarrying, in Manitoba. Quarry permits will be required.
The Wildlife Act, CCSM c W130	Not applicable	Designates provincial wildlife lands, regulates licenced harvest of wildlife, and identifies other protections for wildlife in Manitoba.
The Heritage Resources Act, CCSM c H39.1	Heritage Resources Forms Regulation 99/86	Designates heritage sites, and identifies protections for heritage resources and heritage resource sites, including the requirement to conduct a heritage resource impact assessment

Act	Regulations/Policy with Potential Project Implications	Regulatory Objectives, Project Linkages and Permits
The Workplace Safety and Health Act, CC SM c W210	Workplace Safety and Health Regulation 217/2006	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.
The Water Rights Act, CCSM 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 Endangered Species and Ecosystems Act, CCSM c E111	Threatened, Endangered and Extirpated Species Reg. 25/98	Ensures protection of species that are threatened, endangered or of special concern in Manitoba. Conserves and protects threatened and endangered ecosystems in Manitoba and promotes their recovery. Lists threatened, endangered and extirpated species and ecosystems
The Noxious Weeds Act, CCSM 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 Water Resources Administration Act, CCSM c W70	Not applicable	Outlines a framework for the use and administration of water control works, including requirements and processes for approval of operating guidelines.
The Water Protection Act, CCSM c W65	Aquatic Invasive Species Regulation 173/2015 Manitoba Water Quality Standards, Objectives and Guidelines Reg. 196/2011	Provides protection and stewardship of Manitoba's water resources and aquatic ecosystems. Identifies aquatic invasive species and precautions to prevent their spread. Outlines water quality guidelines.
The Wildfires Act, CCSM c W128	Not applicable	Outlines wildfire controls, duties and prohibitions.

1.6 Regional planning context

The LMBOC and LSMOC are not located within a designated regional planning district where environmental or land use plans have been developed. After the 2011 provincial flood event, the Province of Manitoba initiated a study to identify and mitigate potential flood risk

and assess potential options to reduce risk for communities and infrastructure to a number of major rivers and lakes within the Assiniboine River and Lake Manitoba watersheds. These studies include: The 2011 Manitoba Flood Review Task Force, The Lake Manitoba and Lake St. Martin Regulation Review, and The Assiniboine River and Lake Manitoba Basins Flood Mitigation Study (Flood Review Task Force 2013, Lake Manitoba and Lake St. Martin Regulation Review 2013, KGS 2016).

Five years of aquatic-based studies have also occurred in Lake St. Martin and Lake Winnipeg (Sturgeon Bay) in response to the construction and operation of the LSMEOC.

2 PROJECT INFORMATION

2.1 Project Overview

Flood control in southern Manitoba involves a system of major flood control structures, hundreds of kilometers of dikes, community ring dikes and flood protection for homes that raise them to safe flood protection levels. Flood control structures have provided protection for the citizens of Manitoba over the years since their construction. Much of southern Manitoba is flat and prone to flooding, particularly in the spring when the snow melts.

Much of the province benefits from the operation of these structures, along with some downstream impacts. This includes residents of the City of Winnipeg, residents upstream and downstream of the Red River Floodway, people along the Assiniboine River, and residents on Lake Manitoba and downstream through Lake St. Martin to Lake Winnipeg. This is a diverse landscape which include urban centres, agricultural interests, seasonal and permanent residents, Indigenous communities and lands, and municipal governments.

Manitoba's flood protection system is still a work in progress. The "Flood of the Century" in 1997 spurred mitigation measures along the Red River, which are now complete. The "flood without precedent" in 2011 resulted in proposed works and measures around Lake Manitoba and Lake St. Martin. The 2014 flood caused further evaluation, and has resulted in the recommendations of additional structures and control measures. In some of these extreme flood events, flood control structures were pushed to their limits.

During the 2011 "flood without precedent", there was minimal property damage at sites in the Red River Valley where measures were taken to build higher and protect with dikes. However, other parts of the province were directly affected. Thousands of acres of farmland were flooded, and bridges and highways were damaged and people's homes and cottages around Dauphin Lake, Lake Manitoba and Lake St. Martin were damaged or destroyed. Entire communities, including Lake St. Martin First Nation, Little Saskatchewan First Nation, Dauphin River First Nation and Dauphin River were displaced by the 2011 flood and suffered immense damages to residences, schools, and infrastructure.

After the 2011 flood event, the Province of Manitoba commissioned several studies, including: the 2011 Flood Review (Flood Review Task Force, 2013), the Lake Manitoba and

Lake St. Martin Regulation Review (LM&LSMRRC, 2013), and the Assiniboine River & Lake Manitoba Basins Flood Mitigation Study (see: KGS, 2016). The combined effort of this work resulted in a general recommendation to increase output capacity for Lake Manitoba and Lake St. Martin to limit flooding.

To increase output capacity for Lake Manitoba and Lake St. Martin, two conceptual design studies, Stage 1 and Stage 2, were completed (KGS, 2014 and 2015). These studies evaluated several alignment options under varying operational scenarios. Sections 4.1 and 4.2 of the Stage 1 KGS report (2014) presents further detail about the route selection process.

The proposed Project consists of the design, construction and operation of new permanent flood protection infrastructure, the LMBOC and LSMOC and associated works (Maps 1, 2 and 3). Although the proposed Project will work collaboratively and synchronously with existing flood protection infrastructure throughout the Assiniboine River and Lake Manitoba drainage basins, its objective relies on independent operation to relieve flooding in areas that remain vulnerable. As such, the LMB & LSM OC Project is not considered to be an extension or expansion of other flood control measures constructed in Manitoba.

2.2 Provisions of Regulations Designating Physical Activities

If required, the outlet channels will have the capacity during operation to achieve overall flows of more than approximately 200 m^3/s. The LMBOC could attain flows of approximately 6.698 billion m^3 per year, while the LSMOC could achieve flows of approximately 10.269 billion m^3 per year.

The outlet channels will supplement Manitoba's existing flood management infrastructure. They are not expected to produce regular annual flow rates. Therefore, section 6 of the Regulations Designating Physical Activities pursuant to *The Canadian Environmental Assessment Act, 2012* (CEAA 2012) applies to the Project.

2.3 Project Components and Activities

2.3.1 Physical Works Associated with the Designated Project

The Project includes the LMBOC and LSMOC. Each component has a number of associated activities, listed and described below.

1. LMBOC (Map 2)
    a. Excavation of approximately 23 km long diversion channel
    b. Construction of a combined bridge and water control structure
    c. Re-alignment and/or construction of provincial highways and municipal roads, and construction of three bridge structures
    d. Rock quarries
    e. Channel inlet and outlet at lakes
    f. Temporary construction camps and staging areas

2. LSMOC (Map 3)
    a. Excavation of approximately 23 km long diversion channel
    b. Construction of a combined bridge and water control structure
    c. Construction of drop structures
    d. Rock quarries
    e. Temporary construction camps and staging areas
    f. Channel inlet and outlet and lakes
    g. Construction of a 24 kilovolt (kV) distribution line

2.3.2 Anticipated Size and Capacity of the Designated Project

2.3.2.1 Lake Manitoba Outlet Channel

2.3.2.1.1 Outlet Channel

The LMBOC will run northwards from Watchorn Bay on Lake Manitoba to Birch Bay on Lake St. Martin as shown on Map 2. This alignment generally follows low-lying terrain between Lake Manitoba and Lake St. Martin. Key considerations in the selection of this preferred alignment were the natural soil conditions, typified by till deposits. The preferred alignment would be constructed entirely in till deposits (KGS 2014), minimizing potential groundwater impacts. The channel will be approximately 23 km long, with a base width of approximately 12.7 m. The channel design is based on a uniform trapezoid shaped channel with a flat base and 4H:1V side slopes.

The channel is proposed to have an invert elevation (El) of about 242 m at Lake Manitoba and about 239 m at Lake St. Martin. The channel depth from existing ground will vary between 6 m and 12 m, and since the invert of the channel will be lower than water levels in the lakes, there will be standing water in the channel when it is not in operation. Current conceptual design is based on an average channel velocity of 1.3 m/s (in till) and a channel capacity of 212 m^3/s when operated (KGS 2015).

The LMBOC will alter local drainage and affect surface water flows within the drainage area. Realignment of agricultural drains and other surface water sources will be required and incorporated into project design to minimize potential impacts; this information will be provided to regulators prior to construction.

2.3.2.1.2 Water Control Structure

A water control structure is required to control flows through the LMBOC while ensuring that Lake Manitoba water levels remain within their planned range. The water control structure will be located where Iverson Road intersects the channel and will also act as a bridge to provide access to lands east of the channel. Locating the water control structure in the northern third of the route will help reduce the potential for groundwater blowout within the channel (KGS 2015).

Conceptually, the water control structure is expected to have six 9 m wide sluice bays, guides and sill beams for upstream stoplogs, vertical lift gates and downstream stoplogs (Appendix A). When the water control structure is closed, the water level in the channel on the upstream side will be the water level on Lake Manitoba and on the downstream side of structure will be the water level on Lake St. Martin. An ancillary building will be constructed near the spillway to house mechanical and electrical service. The water control structure will require permanent electrical power to raise and lower the gates, as well as to heat the structure to maintain winter operation capability (KGS 2015).

As with the LMBOC, design of the water control structure is ongoing. Revision and optimization will continue until detailed design is finalized. Nonetheless, engineering design will remain consistent with the primary functional principal of providing for an average channel velocity of 1.3 m/s (in till) and a channel capacity of 212 m^3/s (KGS 2015). Conceptual drawings of the water control structural are shown in Appendix A.

2.3.2.1.3 Permanent Bridge Structures

The LMBOC will intersect municipal roads and provincial highways. As such, new bridges will be required to maintain connectivity and access. A total of four new bridges are planned to span the LMBOC. Of the four, one will be combined with the water control structure described in Section 2.3.2.1.2. The other three will be dedicated bridges constructed to maintain connectivity along the following roadways: Township Line Road, realigned Provincial Road (PR) 239 and Provincial Trunk Highway (PTH) 6 (Map 2). Ongoing alignment optimization planning, financial considerations, environmental considerations, and continued discussions with local landowners, stakeholders and RMs will influence the number of crossing structures required and their exact location.

Similarly, channel and bridge design will be conducted synchronously as bridge configuration and channel optimization are interrelated and influence hydraulic efficiencies. All bridge structures will be built to accommodate and withstand anticipated water flows, ice flows, and safe passage of anticipated traffic volumes and vehicle types, including agricultural equipment (KGS 2015). However, the LMBOC will not be deemed navigable and will not be designed to meet clearance requirements for passage of motorboats, sailboats and other powered vessels.

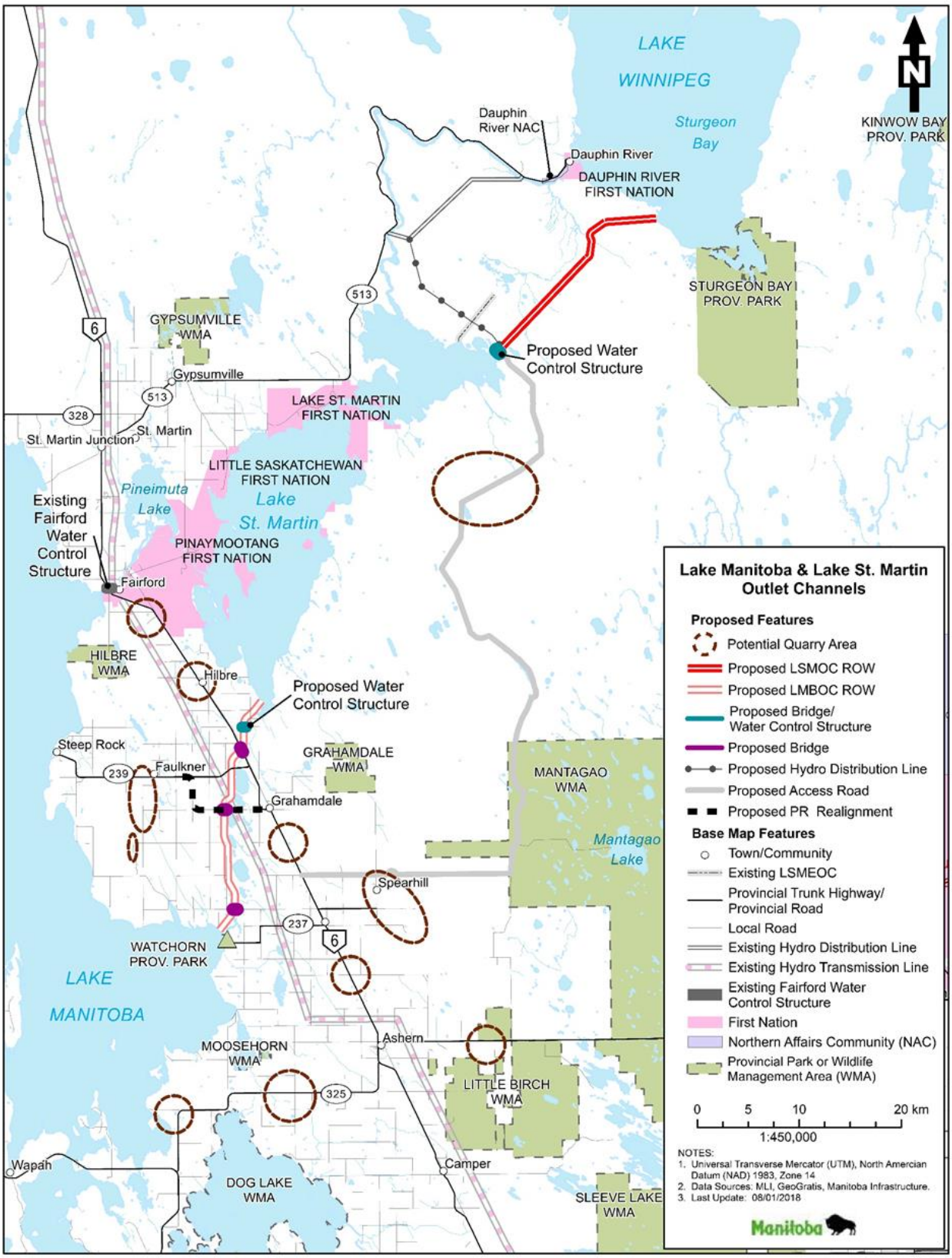
2.3.2.1.4 Rock Quarries

High quality limestone rock will be required for the purposes of riprap to control erosion at several points along the channel. Aggregate produced from quarries will also be used in realigning PR 239. Potential sources will be identified for the contractor's use as shown in Map 4.

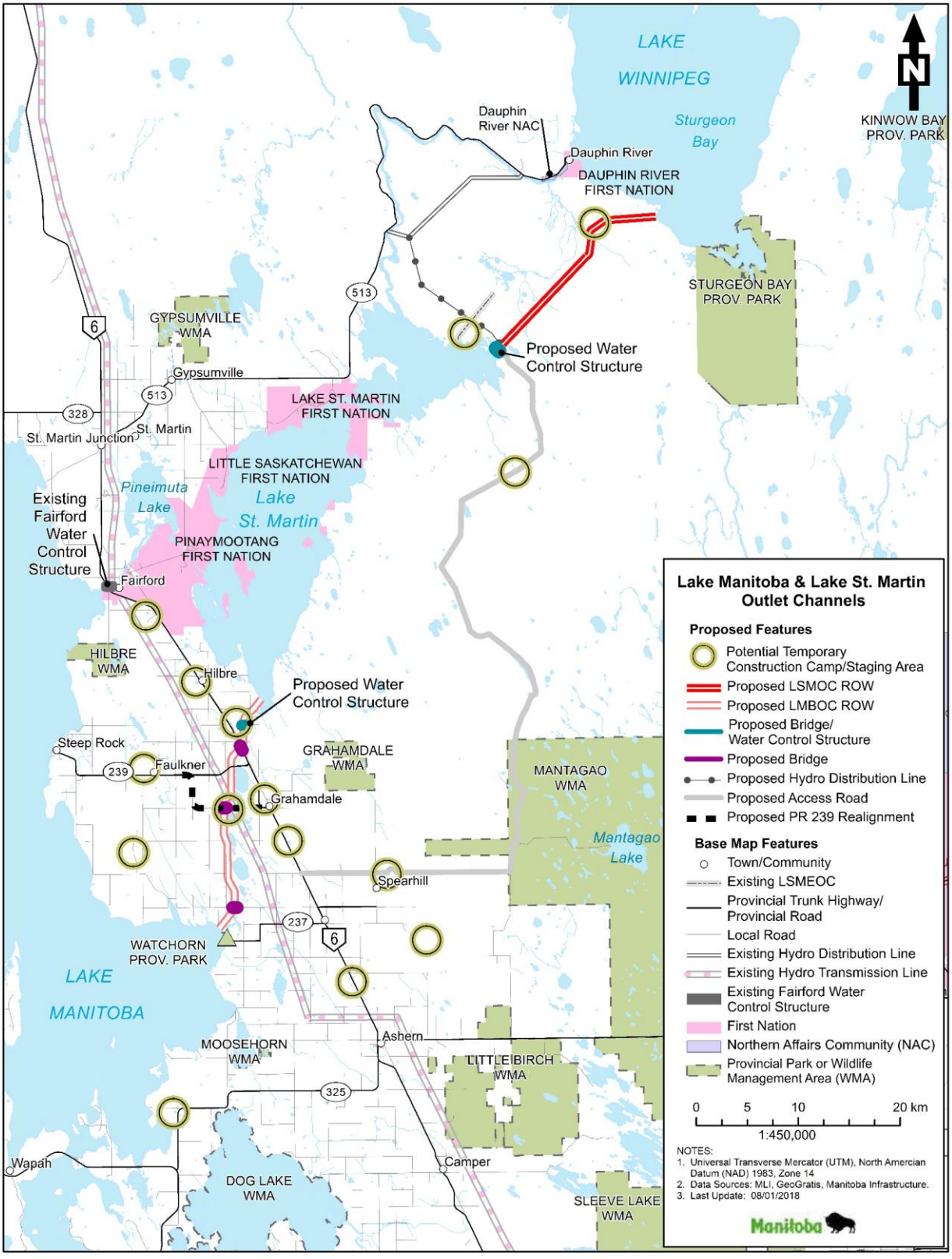
2.3.2.1.5 Temporary Construction Camp and Staging Areas

Contractor staging areas may be used to store materials, maintain and assemble equipment and administer work on the proposed Project. At this stage of design, the exact size and

details of the contractors' work areas are not known. However, potential locations have been indicated on Map 5. A temporary construction camp is not anticipated for the LMBOC.



Map 4. Potential Quarry Areas



Map 5. Potential Temporary Construction Camps/Staging Areas

2.3.2.1.6 PR 239 and Municipal Road Realignments

Realignment of PR 239 and municipal roads may be required in order to accommodate the LMBOC while still allowing for safe, economically feasible, and hydraulically efficient crossing structures across the channel. Realignment of PR 239 will provide opportunities to minimize the number of bridge crossings over the channel. Similarly, sections of municipal road will be reconstructed, realigned or extended for purposes of agricultural activities and residential access.

Ongoing alignment optimization planning, financial considerations, environmental considerations, and continued discussions with local landowners, stakeholders and RMs will influence how and where provincial and municipal roads are realigned. Several options for realignment of PR 239 have been identified. The current preferred option for realignment of these roadways is shown in Map 2.

2.3.2.1.7 Channel Inlet and Outlet at Lakes

The hydraulic profile of the channel will require the lake bottoms to be excavated at the channel inlet and outlet to match proposed channel invert elevations. The excavations will be tapered over a short distance out from shoreline to meet natural lake bed elevations. It is anticipated coffer dams will be required to conduct inlet and outlet work in the dry.

Impacts through a change in shoreline processes and sediment transport will be minimized. The concept of rock groins, artificial islands or other engineered structures are being considered to minimize changes in shoreline morphology.

2.3.2.2 Lake St. Martin Outlet Channels

2.3.2.2.1 Outlet Channel

The LSMOC will run northeast from Lake St. Martin towards Lake Winnipeg through a wetland area, eventually connecting to Reach 3, an existing partially completed diversion channel located east of the approximate midpoint of Buffalo Creek. The outlet channel is proposed to exit at Lake Winnipeg south of Willow Point (Map 3). The LSMOC will alter local drainage and affect surface water flows within the drainage area.

The length of the channel will be approximately 23 km with a base width of about 44 m. The channel will have an invert elevation (EI) of about 241 m at LSM and an EI of about 213 m at Lake Winnipeg. The channel design is based on a uniform trapezoid shaped channel with a flat base and 4H:1V side slopes. The outlet channel will have a capacity of 326 m^3/s and is currently designed to a velocity of approximately 1.0 m/s (KGS 2015).

2.3.2.2.2 Water Control Structure

A water control structure is required to control flows through the LSMOC while ensuring that Lake St. Martin water levels remain within their planned range. A control structure will be constructed at the inlet of the LSMOC and will also act as a bridge to provide access between both sides of the channel. Conceptually, the water control structure is expected to have six bays, each measuring 9 m wide (Appendix A). The water control structure will require electrical power to raise and lower the gates (KGS 2015).

2.3.2.2.3 Drop Structures

The LSMOC requires drop structures to address channel velocity. Up to 12 drop structures may be required; however, ongoing channel optimization planning, environmental and financial considerations will influence the final number and placement of such structures. Design of the drop structures will facilitate fish passage through the outlet of the channel as water levels decrease and prohibit upstream passage of fish into the channel.

2.3.2.2.4 Rock Quarries and Material Borrow Areas

Quarried rock will be required for drop structures and riprap for the purpose of erosion protection at various points along the channel. Aggregate will also be used in realigning PR 239. Potential sources will be identified for the contractor's use as identified in Map 4.

2.3.2.2.5 Temporary Construction Camps and Staging Areas

Construction camps are expected to be required to accommodate over 100 workers. Construction camps of this size typically include: dormitories with washroom and laundry facilities, kitchen and dining facility, office space, water and sewage storage units, parking spaces, and electrical generator units. Several locations are currently under consideration (Map 5).

Contractor staging areas will be used to store materials, maintain and assemble equipment and administer work on the proposed Project. At this stage of design, the exact size and details of the contractors' work areas are not known. Nonetheless, temporary construction camps and staging areas will utilize disturbed areas and existing facilities wherever possible. Potential locations have been indicated on Map 5.

2.3.2.2.6 24 kV Distribution Line

A 15 km long distribution line is proposed to facilitate construction and operation of the LSMOC water control structure on Lake St. Martin Outlet Channel. The distribution line will extend from an existing 24 kV line which runs along PR 513 in order to minimize new line length. Following the construction of the distribution line, the responsibility to maintain and operate the line will be transferred to Manitoba Hydro – care and control of the distribution line and associated right-of-way will fall under Hydro's standard operating procedures.

2.3.2.2.7 Channel Inlet and Outlet at Lakes

The hydraulic profile of the channel will require the lake bottoms to be excavated at the channel inlet and outlets to match proposed channel invert elevations. The excavations will be tapered over a short distance out from shoreline to meet natural lake bed elevations. It is anticipated that coffer dams will be required to conduct inlet and outlet work in the dry.

Impacts through a change in shoreline processes and sediment transport will be minimized. The concept of rock groins, artificial islands or other engineered structures are being considered to minimize changes in shoreline morphology.

2.3.3 Expansion of Existing Infrastructure

The proposed Project includes new outlet channel alignments that will supplement Manitoba's existing flood management infrastructure. The LMBOC and LSMOC will provide additional outflow capacity for Lake Manitoba and Lake St. Martin. The proposed Project is a new development that is not an expansion of existing flood infrastructure in Manitoba.

2.3.4 Activities Incidental to the Project

Subsequent to construction, quarries or borrow sources may become available for use by RMs, contractors or others as material sources for roadway maintenance or other requirements. However, access to these material sources would be regulated through the issuance of quarry permits or leases from Manitoba Growth, Enterprise and Trade.

2.3.4.1 Lake St. Martin Outlet Channel Access Road

Currently, the Lake St. Martin Outlet Channel Access Road consists of 20 km of existing municipal road, 48 km of forestry road, and 36 km of existing winter road. The existing access road will be upgraded to an all season access road and extended to facilitate Manitoba Infrastructure's continued access (i.e.to stage heavy equipment and open and close the channel) to the LSMEOC (Map 1) until the completion of the proposed Lake Manitoba and Lake St. Martin Outlet Channels.

The upgraded access road will then also facilitate construction, operational, and maintenance activities on the LSMOC. Once complete, entrance to the LSMOC area using the access road will be restricted. It will not be publicly accessible and once constructed will only be utilized to facilitate operation and maintenance of the Project and/or the LSMEOC.

The upgrading activities related to the LSMOC access road do not require authorization under CEAA 2012. An Environment Act Proposal under *The Environment Act* (Manitoba) will be submitted prior to the commencement of construction activities on the access road.

2.3.4.2 Existing Lake St. Martin Emergency Outlet Channel

MI is currently exploring options to repurpose the existing LSMEOC, but definitive plans

have not been established. Should it occur and be linked to Project activities or components, MI will incorporate the proposed work or activity into the Project's environmental assessment.

2.4 Emissions, Discharges and Wastes

The emissions, discharges and waste that may be generated by the proposed Project along with proposed mitigation measures for each item are provided in Table 2.

Increased levels of NOx, SO_2, and greenhouse gases (GHGs) may result from equipment and vehicle emissions during construction of the proposed Project and associated components. It is estimated that GHG resulting from the proposed Project will amount to a total of approximately 943,250 tonnes of Carbon Dioxide equivalency (CO_2e). This is a preliminary estimate, and will be further refined and reported in the EIS for the proposed Project. In 2015, Manitoba's total GHG emissions were 20,800,000 tonnes of CO_2e (Environment Canada, 2015).

Table 2. Emissions, Discharges and Waste Generated by the Project

Emission, Discharge or Waste			
Type	**Phase**	**Source**	**Mitigation Plan**
Emission	Construction, Operation and Maintenance	Operation of motorized equipment along the outlet channels	• Efforts will be made to minimize build-up of harmful airborne pollutants such as NO_x, SO_2, and greenhouse gases • Vehicles and equipment will be inspected regularly and properly maintained to reduce emissions • Dust abatement measures will be put in place as required
	Construction and Maintenance	Increased noise levels	• Air compressors will be housed in insulated enclosures to act as effective sound barriers.
Discharge	Construction, Operation and Maintenance	Hazardous and non hazardous substances Spills	• Fuel storage and re-fuelling will occur at a designated location • Appropriate secondary containment will be utilized • Non-petroleum based oils and greases will be used when feasible • Backup generators and their associated diesel fuel tanks will be set upon concrete foundations equipped with catch sumps to prevent spills • Spill response procedures to be utilized

Emission, Discharge or Waste			
Type	**Phase**	**Source**	**Mitigation Plan**
			• Concrete washout areas are to be decommissioned and remediated as required
	Construction and Maintenance	Groundwater Seepage within the outlet channels	• Groundwater seepage water will be discharged into a sediment pond
	Construction	Site Drainage/Surface Runoff	• Road construction will incorporate erosion control methods • Surface runoff will be directed into natural drainage courses
		Erosion and Sediment Control	• Water flow volumes and velocities will be minimized when possible • Riprap energy dissipaters and ditch lining will be installed in areas where possible • Establishing vegetation over disturbed areas where applicable
Waste	Construction and Maintenance	Sanitary waste disposal - construction sites and camps	• Portable toilet facilities and holding tanks will be used • Sewage will be collected regularly and hauled to an sewage treatment facility
		Domestic waste disposal - construction sites and camps	• Domestic waste will be collected and hauled to an existing permitted waste disposal site
	Construction and Maintenance	Industrial waste from construction sites	• Locations for disposal of waste rock and overburden are to be determined

The emissions resulting from the proposed Project are not expected to exceed the Manitoba air quality guidelines. Assuring construction equipment and vehicles are regularly maintained and in good operating condition are among the proposed best management practices to reduce emissions.

2.5 Project Phases and Scheduling

The proposed Project schedule includes four major phases:

1. Planning and Design
2. Pre-construction
3. Construction
4. Operation and Maintenance

It is not anticipated that decommissioning of the Project will be required. Upgrading or rehabilitation to extend the life of the structures will take place as part of major maintenance projects and would depend on structural/historic attributes of the facility as well as economic and financial considerations at the time.

2.5.1 Anticipated Scheduling for Project Phases

2.5.1.1 Planning and Design (2016 - 2019)

Planning and design for the LMBOC and LSMOC includes identifying preferred route alignments for each outlet channel, preliminary and detailed engineering studies and analysis, environmental baseline data collection and environmental assessment. This process includes an Indigenous and Public Engagement Process (IPEP).

2.5.1.2 Pre-Construction (2018 - 2019)

During this stage, the detailed design and contract tendering process will be completed and Environmental Protection Plans (EPPs) finalized. Bridge and water control structure locations will have been selected allowing for the logistical planning and the mobilization of construction equipment, material and supplies, including fuel, generators, trailers, and other provisions. Pertinent output from environmental studies, including mitigation measures and license requirements, will be integrated into the final project design.

Quarry, construction staging areas and temporary construction camp locations will be located, surveyed and flagged.

2.5.1.3 Construction (2019 - 2023)

Construction stage for all project components include the general preparation such as: equipment marshalling; construction camps and staging areas; and rock and quarry area clearing. Requirements for specific construction activities and/or project components are described in more detail below.

Outlet Channels

Construction of the LMBOC and LSMOC will require vegetation clearing and grubbing of the final alignment Right-of-Way (ROW) and excavating the channel to designed depths along the proposed preferred alignments. Clearing consists of the removal of all trees, shrubs and fallen timber. Grubbing is the removal of stumps and root masses, and stripping is the removal of top soil. Once cleared, excavation of the outlet channels within the ROW may proceed year round.

Although the LMBOC intersects existing provincial and municipal roads, construction will not interrupt vehicle traffic. Temporary detours will be utilized to maintain access through the area and will be established prior or simultaneous, to channel excavation and bridge construction. A preliminary assessment of potential socio-economic effects related to access interruption has been conducted, and it was determined that the establishment of detours will mitigate potential effects and maintain access to emergency medical services. A more detailed assessment of socio-economic effects related to the proposed Project will be detailed in the EIS.

Approximately 11 million m^3 and 7.75 million m^3 of material will be removed from the LMBOC and LSMOC respectively. Topsoil will be temporarily stockpiled to later be spread over dikes as a seed bed. Till material will be excavated and placed adjacent to the channel as spoil banks and/or containment dikes. Outlet channels will be excavated in the dry. Final material at the inlets and outlets will only be removed once all channels works are complete, with the final material being released in a slow and controlled fashion to prevent excess sedimentation or scour. This release will also be scheduled with consideration of fish spawning windows for in-water works.

Cofferdams will be required to facilitate shoreline excavation for construction of the inlet and outlet for each of the LMBOC and LSMOC. It is proposed that segments of the Lake Manitoba channel inlet cofferdams may be utilized as permanent groin structures (KGS 2015).

Water Control Structures

Water control structures will be concrete structures spanning the full width of the outlet channels with hydraulically operated gates to control the flow of water as required. Water control structure locations will be excavated to bedrock to provide a secure footing. Water control structures will be constructed in the dry and will only be exposed to water once all concrete has cured and a satisfactory level of construction has been achieved to safely allow exposure to flows. Since water control structures are to be built in the dry, scheduling of work relative to fish spawning windows will not be required. Temporary work platforms are not anticipated to be required to construct these structures. It is anticipated that construction will take place year round.

Bridge Construction

Bridges will span the full width of the outlet channels. While detailed design for bridge structures is not yet complete, they will be comprised of steel or concrete girders, concrete decking, and concrete abutments. Piers are likely to be required due to the length of span and will be armored with riprap. Construction is likely to follow a fairly standardized order, seeing abutments and piers completed first, followed by the decking. As with channel and water control structures, bridges will be built in the dry and as such should not require temporary working bridges or platforms. It is anticipated that construction will take place year round. Since bridges are to be built in the dry, scheduling of work relative to fish spawning windows will not be required.

Hydro Distribution Lines

A 24 kV hydroelectric distribution line will be designed and constructed by Manitoba Hydro, the organization responsible for electrical utilities in the province of Manitoba. A 25 m ROW will be cleared for the distribution line. The distribution line will be erected and energized by Manitoba Hydro.

Erosion and Sediment Control

Erosion and sediment control will be factored into all aspects of Project construction, operation and maintenance. Placement of erosion control management such as silt fence and erosion control blankets will be specified in engineered drawings for the Project and in place for the duration of site specific construction works. While in place, erosion and sediment control products will be inspected repaired and replaced as required.

Detailed erosion and sediment control monitoring programs and best management practices will be developed as a part of detailed design, construction plans and EPPs for the proposed Project. USACE-EM 110-2-1601 guidelines for hydraulic design of flood control channels were incorporated into the conceptual design of the channels, but added erosion and sediment control measures will be implemented as described above for further protection (KGS 2015).

Some of the specifications for the supply and installation of erosion and sediment control products will be taken from Manitoba Infrastructure's Environmental Best Management Practices Manual for Working In and Near Water (2009).

Rock Quarries

New rock quarries may be developed to provide crushed rock and granular materials. These materials are required for construction of drop structures, bridge abutments, riprap, construction camps and other temporary works. Quarries will be located on provincial Crown or private land. The total area required for rock quarries will be estimated during the Design and Pre-Construction phase of the Project. Once required quantities are known, preferred source locations will be identified (Map 4). Prior to development and operation, each quarry will need to be permitted by Manitoba under *The Crown Lands Act* and *The Mines and Minerals Act.* Once permitted, sites may require clearing of land and removal of overburden, followed by drilling and blasting and/or excavation and material processing.

There are no rock crushing and aggregate facilities within reasonable trucking distances and with adequate capacity to support Project construction needs. Accordingly, mobile rock crushing facilities will be required. The source of materials is not known at this time. It is reasonable to assume this equipment will not be grid connected and will come with its own power generation facilities (KGS 2015).

Revegetation

Revegetation will be among the final phases of site specific construction activities for all Project components, but will require planning and site preparation for successful re-establishment of vegetation. Planning includes selection of species likely to be tolerant of site specific conditions. Site preparation includes proper soil shaping, placement and compaction, soil conditioning by use of drag or disk harrows or other equipment as required, erosion protection, and timing to maximize germination and plant establishment.

Temporary Staging Areas and Construction Camps

Construction activities may need to be accommodated by temporary staging areas and construction camps. Camps are likely to be comprised of mobile construction trailer facilities organized in a manner to provide sleeping quarters, living quarters, and dining areas and work spaces for construction crews. Depending on the size and occupancy of the camp, trailers may be equipped with self-contained holding tanks for potable water and septic waste. If not, drinking water may be sourced from wells or delivered by truck from the nearest water treatment facility. Similarly, septic holding tanks may need to be utilized to accommodate occupants. These would be pumped out at regular intervals and disposed of at licensed facilities or lagoons. Remote camps may require diesel generators to power the facilities. However, if located near an existing distribution line, electricity may be supplied from the existing distribution system.

2.5.1.4 Operation and Maintenance

Operation of the LMBOC and LSMOC will be tied to snowmelt, rain and/or surface water flows in the local area and region. Regional floodwater is currently managed by use of the existing Fairford River Water Control Structure (FRWCS). Constructed in 1961 and located on the Fairford River at PTH 6, the FRWCS is currently the only water control structure used to regulate outflows from Lake Manitoba. The LMBOC will provide a secondary mechanisms by which outflows from Lake Manitoba into Lake St. Martin can be regulated.

The Dauphin River is the only natural outflow from Lake St. Martin. The LSMOC would provide a secondary mechanism for regulating outflows from Lake St. Martin.

The Province will operate the LMBOC and LSMOC through the use of hydraulically operated water control structures. Through an extensive review process MI has developed operational guidelines for the LMBOC and LSMOC (Table 3).

Table 3. Operational Guidelines for Lake Manitoba and Lake St. Martin Outlet Channels

Lake Manitoba	
Fairford River Water Control Structure	• The Fairford River Water Control Structure (FRWCS) will be operated to target water levels on Lake Manitoba between 247.0- 247.7 metres above sea level (masl) and Lake St. Martin range between 243.0 – 243.8 masl. It is important to note that Lake Manitoba will occasionally reach 246.9 masl or lower, and 247.8 masl or higher • Under normal operating conditions, outflow from the FRWCS will be set to 50% capacity with no further stop-log (water regulation) adjustments • During recovery from flood conditions on Lake Manitoba (water levels above 247.5 masl), the FRWCS will be kept wide open until Lake Manitoba recedes to the middle of the range (247.3 masl) after which point the FRCWS will be operated to achieve normal outflow

	• For recovery from drought on Lake Manitoba (level below 246.9 masl), the FRWCS will be kept at a 22.7 m^3/s flow rate until Lake Manitoba levels increase to the middle of the range (247.3 masl) after which point the FRWCS will be operated to achieve normal outflow (50% capacity)
Lake Manitoba Outlet Channel	• The outlet channel will be opened to a maximum capacity when Lake Manitoba is above the operating range (247.5 masl) • When the water level on Lake Manitoba recedes below the middle of the regulation range (247.3 masl), the outflow from the LMBOC will be reduced so outflows through the FRWCS and the LMBOC match the inflows into Lake Manitoba • LMBOC will be closed once Lake Manitoba is below 247.3 masl and outflow from the FRWCS exceeds the total inflow into Lake Manitoba • Initial operation of the LMBOC will not be initiated during the period of solid ice cover in the channel (typically from December 1- April 30)
Lake St. Martin	

Lake St. Martin Outlet Channel	• The target regulation range for Lake St. Martin is 242.9-243.8 masl
	• The LSMOC will be opened when Lake St. Martin water level rises above 243.8 masl or when the LMBOC is opened for initial operation and Lake St. Martin is above 242.9 masl
	• During recovery from high water, when the level of Lake St. Martin decreases below 243.8 masl, the outflow from the LSMOC will be reduced to the greater of 50% of channel capacity or the outflow required to assure total outflow from Lake St. Martin matches inflow from the Fairford River and LMBOC
	• If the LMBOC is in operation in November of any year, the LSMOC should be operated so that the total outflow from Lake St. Martin matches inflow from the Fairford River and LMBOC for the duration of winter as much as possible
	• LSMOC will be closed fully when Lake St. Martin drops below 243.2 masl from when ice cover has cleared out of the channel in the spring to October 31
	• During the spring freshet the LSMOC will be operated if the LMBOC has been in operation over the winter under the following conditions:
	  ○ If the Dauphin River outflow plus LSMOC capacity is less than the total inflow into Lake St. Martin, LSMOC will be open to full capacity
	  ○ Otherwise, the LSMOC should be operated so that the total outflow from Lake St. Martin matches inflow from the Fairford River and LMBOC as much as possible
	• Initial operation of the outlet control structure shall <u>not</u> be initiated during the period in which there is solid ice cover in the channel (typically from December 1 – April 30)

3 PROJECT LOCATION

3.1 Location Description

The Project area is located in Manitoba's Interlake Region and within the lands of Treaty 2. The LMBOC would extend from Lake Manitoba northeast to Lake St. Martin; this area is generally located north of the community of Ashern and south of Pinaymootang First Nation. The LSMOC is located between the northeastern most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg.

3.2 Coordinates

Coordinates for major Project components illustrated in Map 1 are shown in Table 4. Locations for some of these components will be finalized during project planning as a part of preliminary engineering and are therefore subject to change.

Table 4. Proposed Project Component Coordinates (NAD 83, UTM)

Project Component			Zone	Easting	Northing
Lake Manitoba Outlet Channel	Inlet		14 U	529841	5681518
	Outlet		14 U	534090	5703781
	Water Control Structure		14 U	532294	5701501
	Municipal Bridges	Iverson Road	14 U	532294	5701501
		Township Line Road	14 U	531408	5683613
		PTH 6	14 U	532037	5699259
		PR 239	14 U	530703	5694339
Lake St. Martin Outlet Channel	Inlet		14 U	557122	5738284
	Outlet		14 U	572725	5751400
	Water Control Structure		14 U	557122	5738284
	Hydro Distribution Line (Start)		14 U	548483	5749379
	Hydro Distribution Line (End)		14 U	557122	5738284

3.3 Site Map/Plan

The LMB & LSM OC site plan, which includes Outlet Channel options for Lake Manitoba and Lake St. Martin, is shown in Maps 1, 2 and 3.

3.3.1 Detailed Site Maps

Maps provided in this document (Maps 1-7) include the information:

- Watercourses and waterbodies

- Bridge crossing locations at Provincial Trunk Highways and Provincial Roads and Municipal Roads
- Linear and other transportation components (including airports, winter roads, and power transmission lines)
- Existing water control structures
- Federal land, including Reserve lands
- Communities, including Dauphin River Indigenous Municipal Community
- Provincial Parks and Designated Protected Areas

3.3.2 Photographs of Work Locations

A series of photographs of the Project area are included in Appendix B. They include representative photos and aerial imagery of the main Project components areas, such as:

- LMBOC area
- Lake Manitoba
- LSMOC area
- Lake St. Martin

Location and orientation information is provided with additional details with the photos in Appendix B.

3.3.3 Proximities

3.3.3.1 Residences and First Nations

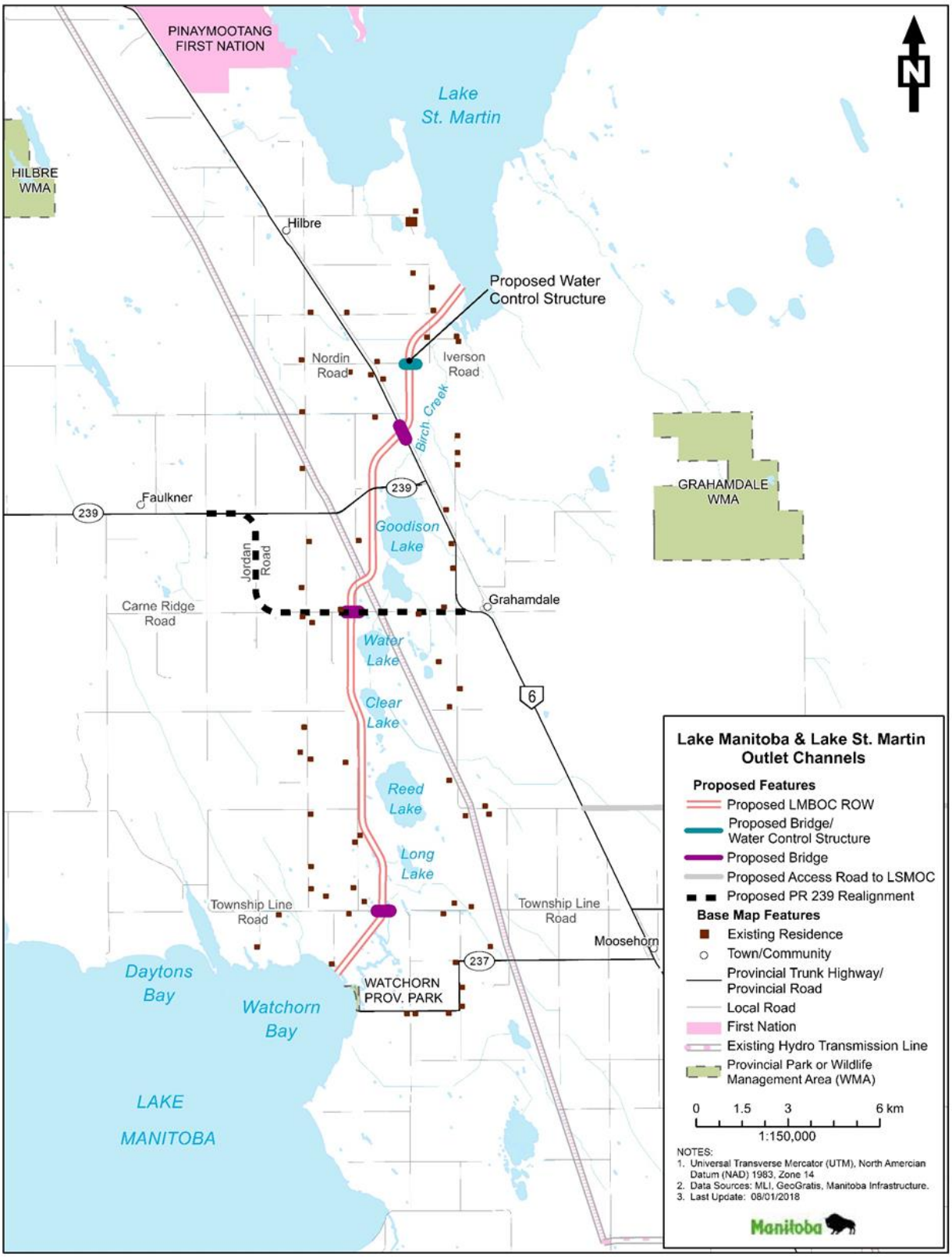
The LSMOC is located entirely on Provincial Crown land; this area is considered semi-remote as there is limited road access, with the nearest permanent residence located approximately 6.1 km away. Dauphin River First Nation and Lake St. Martin First Nation reserve boundaries are located approximately 4.6 km and 12.0 km (respectively) from the LSMOC (Maps 6 and 7).

The LMBOC is located predominantly on private agricultural land and will require land acquisition prior to construction. The nearest privately held residence is approximately 0.5 km from the LMBOC, and there are approximately 66 residences within 3.0 km of the LMBOC. The communities of Moosehorn and Pinaymootang First Nation are located about 10.9 km and 9.3 km (respectively) from the outlet channel (Maps 6 and 7).

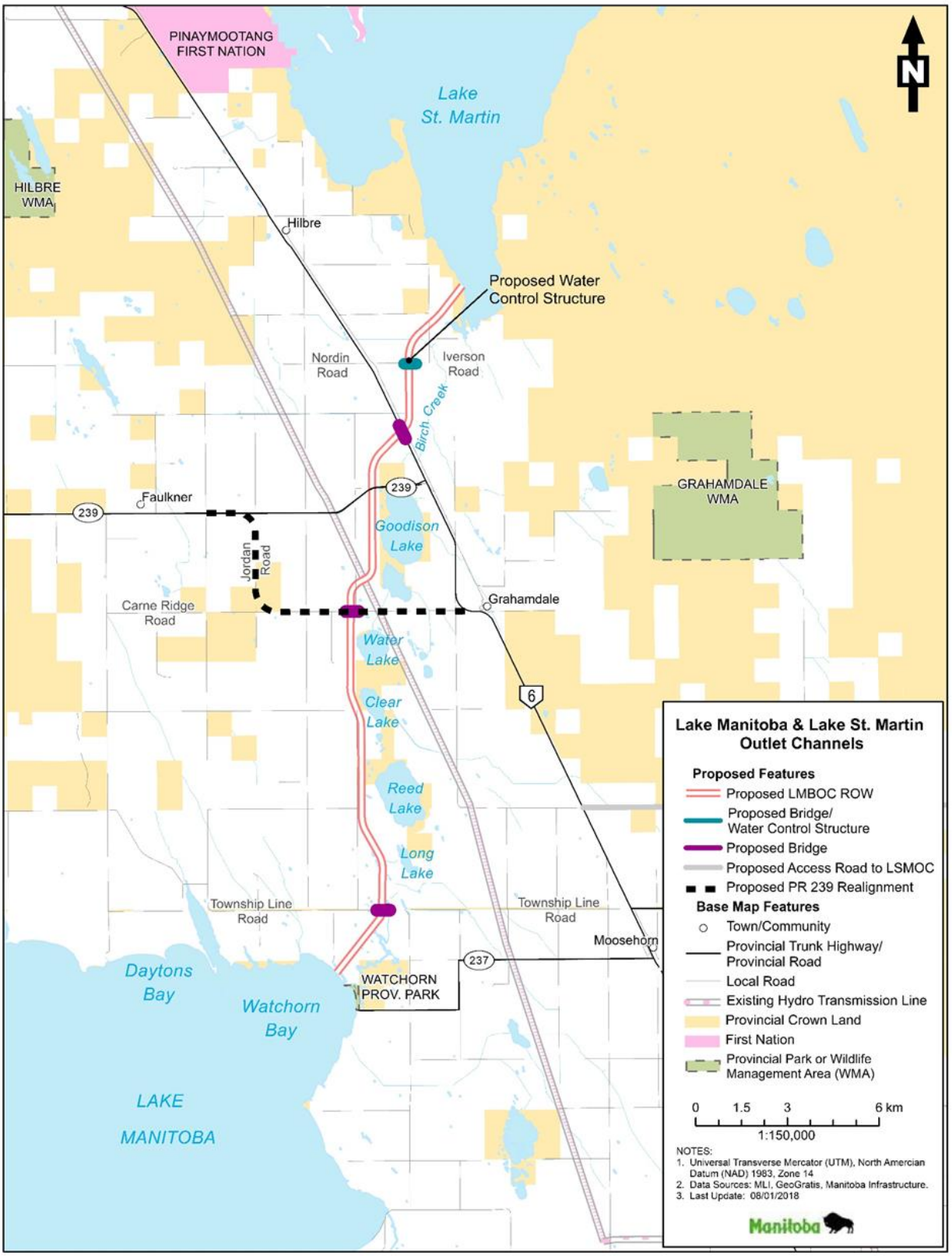
3.4 Land and Water Use

3.4.1 Zoning Designations

Land intersected by the LMB & LSM OC Project is privately owned or as provincial Manitoba (provincial) Crown land.



Map 6. Residences in the Vicinity of the Proposed LMBOC



Map 7. Detailed Route – Proposed LMBOC – Provincial Crown Land

The LMBOC is entirely located within the RM of Grahamdale, intersecting an area identified by the RM as an agricultural rural Area (RM Grahamdale 2016). Most land intersected by the preferred alignment is privately owned and used for agricultural production. Soils in this area have moderate to very severe limitations for arable agriculture; as such, feedlot operations and cattle ranching comprise most agricultural activity (RM Grahamdale 2016).

There are no federal lands intersected by the LMBOC. The remaining lands intersected by the LMBOC are provincial Crown land (Map 7). These parcels are coded as being of forestry, wildlife, natural lands, and or fisheries value but are annually leased for hay production. Privately owned lands would be purchased prior to the start of construction.

The LSMOC is entirely located in provincial Crown land and does not intersect privately owned lands (Map 7). There are no federal lands intersected by the LSMOC.

The Regional Assessment Area (RAA) also includes Provincial Parks, established communities, mineral extraction areas (i.e. quarries and quarry withdrawals), and First Nations. Peguis First Nation has published a comprehensive community plan, and has an identified Community Interest Zone which overlaps with the southeastern portions of the LMB & LSM OC regional assessment area. The Peguis First Nation Community Interest Zone is intersected by existing infrastructure, but will not be directly affected by the LMB & LSM OC Project.

3.4.2 Legal Description

The township and ranges covered and/or partially covered by the LMB & LSM OC Project are listed in Table 5:

Table 5. Township and Ranges Intersected by Lake Manitoba and Lake St. Martin Outlet Channels

Project Feature	Township			
Lake Manitoba Outlet Channel	26-8-W1	27-8-W1	28-8-W1	29-8-W1
Lake St. Martin Outlet Channel	32-5-W1	32-6-W1	33-5-W1	34-4-W1

3.4.3 Land/Water Use, Resource Management and Conservation Plans

Provincial and watershed flood review studies and reports have been completed include: The Lake Manitoba and Lake St. Martin Regulation Review Committee, The Manitoba 2011 Flood Review Task Force, The Lake St. Martin Flood Mitigation Alternative Study, and the Assiniboine River and Lake Manitoba Basins Flood Mitigation Study (Flood Review Task Force 2013, Lake Manitoba and Lake St. Martin Regulation Review 2013, KGS 2016). These reports provide the foundational framework for the conceptual design of the Project.

Currently, twelve (12) Indigenous communities located on Lake Manitoba, Lake St. Martin and Lake Winnipeg have been identified as having used or currently using lands within and adjacent to the Project area to exercise Aboriginal and Treaty Rights. However, none of

these twelve communities have developed land use plans for their traditional territories. MI will work with Indigenous groups to design, construct, and operate the proposed Project in a manner which avoids or minimizes potential adverse residual effects to Aboriginal and Treaty Rights in the area.

There are two Wildlife Management Areas (WMA) located in proximity to the proposed Project (Map 5). WMAs are provincial Crown lands designated as such for the management, enhancement and conservation of wildlife resources in Manitoba under *The Wildlife Act*. The Grahamdale WMA is located about 10 km southeast of Lake St. Martin and west of the LMBOC, the Mantagao WMA is located southeast of Lake St. Martin and east of the LMBOC. Other WMAs (e.g., Little Birch WMA and Hilbre WMA) are located further from the LAA (Map 5).

There are two Provincial Parks in proximity to the proposed Project. Sturgeon Bay Provincial Park is located on the shores of Lake Winnipeg, approximately 25 km northeast of Lake St. Martin and approximately 0.5 km east of the LSMOC. Watchorn Provincial Park is located approximately 0.4 km south of the LMBOC on the shore of Lake Manitoba. Both parks have published management plans which outline their designated classifications, purposes and land uses (MCWS 2013a, MSD 2017a).

The LMB & LSM OC RAA is located in the Interlake forest section; within forest management units 41, 43, and 45. Most of the Project RAA is in the open trapping area Zone 3 with a small portion in the northwest section falling within the Interlake Registered Trap line District.

Lake Manitoba, Lake St. Martin, and Lake Winnipeg support commercial fisheries. The main species under quota restrictions are walleye (*Sander vitreus*), sauger (*Sander canadensis*), lake whitefish (*Coregonus clupeaformis*), northern pike (*Esox lucius*), and goldeye (*Hiodon alosoides*). Fishing seasons are categorized as open water or winter. Summer and fall are the two specified open water seasons on Lake Winnipeg (MCWS, 2013b).

The exact number of buildings including houses, businesses, and industrial buildings in the RAA will be specified in the environmental impact statement (EIS). The LSMOC area is considered semi-remote; there are no residences or businesses located within 5 km of the alignment. It has been determined that there are approximately 135 groundwater wells within 3.0 km of the LMBOC (KGS 2017).

3.4.4 Lands/Resources Used for Traditional Purposes

Studies to engage First Nations to collect Traditional Knowledge (TK) to identify any rights based interests as well as any environmentally sensitive areas that may be associated with the proposed Project are under development. MI has taken several steps since September of 2015 to engage communities that may potentially be affected by flooding in the region. MI is engaging Indigenous groups to collect TK and incorporate any relevant findings as part of the formal environmental assessment process and subsequent project planning stages.

4 FEDERAL INVOLVEMENT

4.1 Financial Support

The cost for the design and construction of the LMB & LSM OC Project will be shared by the Province of Manitoba and Government of Canada. Canada has committed to cost sharing 50% to a total of $247.5 Million through the New Building Canada Fund – Provincial Territorial Infrastructure Component – National Regional Projects. Proceeding an agreement in principle, provincial expenditures will become eligible for cost share.

4.2 Federal Land and Regulatory Requirements

The Project will not directly impact any federal land, including granting of interest in federal land through easement, right of way, or transfer of ownership. The Project will lessen the frequency and extent of potential future flooding on reserve lands.

Specific regulatory requirements requiring application are outlined in Table 6. Project activities will require compliance with federal regulations; these activities will be addressed in the environmental assessment and applicable Project applications. If the Project changes, further compliance or additional applications may be necessary.

Table 6. Federal Regulatory Requirements for the LMB & LSM OC Project

Acts and/or Regulation	Regulatory Body
Canadian Environmental Assessment Act, SC 2012, c.19, s.52	Canadian Environmental Assessment Agency
Canada Water Act, RSC 1985, c C-11,	Environment and Climate Change
Fisheries Act, RSC 1985, c.F-14	Fisheries and Oceans Canada
Fishery (General) Regulations (SOR/93-53)	Fisheries and Oceans Canada
Navigation Protection Act, RSC 1985, c.N-22	Transport Canada
Navigable Waters Works Regulations (CRC, c.1232)	Transport Canada
Migratory Birds Convention Act, 1994, SC 1994, c 22,	Environment and Climate Change
Species at Risk Act, SC 2002, c 29,	Environment and Climate Change
Explosives Act, RSC 1985, c E-17,	Natural Resources Canada

5 ENVIRONMENTAL EFFECTS

The Project is located in central Manitoba in the region referred to as the “Interlake” as it lies between Lake Manitoba and Lake Winnipeg. Baseline studies were conducted to define the existing environment, for use in the environmental assessment of the overall Project, and to establishment of appropriate spatial boundaries.

Spatial boundaries for a project typically include three spatial scales: Project Footprint (PF), Local Assessment Area (LAA) and Regional Assessment Area (RAA); these boundaries will be reassessed and described in the EIS. The PF is the physical space or directly affected area on which the Project components or activities occur. The LAA is the area beyond the PF in which direct and indirect Project effects are measurable; it extends on either side of the LMBOC & LSMOC, Lake St. Martin, and Lake Manitoba near the inlet and Lake Winnipeg near the channel outlet. The RAA roughly includes the area depicted in Map 1.

5.1 Existing Environment

5.1.2 Biophysical Setting

5.1.2.1 Climate

Climate can be defined as the generally prevailing weather conditions of a region throughout the year, and is typically described by variables such as air pressure, cloud cover, humidity, precipitation, hours of sunshine, temperature, wind speed and wind direction. Environment and Climate Change Canada (ECCC) has collected climate normals data for several areas within Canada from 1961 to 1990, 1971 to 2000 and 1981 to 2010. The ECCC weather station closest to the RAA with the most recent climate normals data, i.e., from 1981 to 2010, is located in Lundar, Manitoba. Table 7 summarizes the climate normals (monthly and annual average) data for the Lundar weather station, which is located at Latitude 50°45' N and Longitude 97°56' W at an elevation of 266.7 m.

Table 7. Climate Normals Summary for Lundar, Manitoba (1981-2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average Temperature (^{O}C)	-18.1	-13.5	-6.6	3.3	10.9	16.4	18.3	17.7	11.3	4.4	-6.5	-14.6	1.9
Daily Max (^{O}C)	-12.7	-8.0	-1.3	9.4	17.7	22.8	24.7	24.7	17.7	9.7	-2.1	-9.8	7.7
Daily Min(^{O}C)	-23.6	-18.8	-11.9	-2.9	4.1	9.9	11.9	10.6	4.9	-1.1	-10.8	-19.4	-3.9
Rainfall (mm)	0.0	0.2	5.9	14.8	55.2	80.1	74.8	68.9	45.8	35.7	3.0	1.2	385.5
Snowfall (cm)	16.1	13.5	13.4	11.9	0.4	0.0	0.0	0.0	0.0	5.3	16.3	17.7	94.7

The 30 year climate normals report an average annual temperature of 1.9 degrees Celsius (°C), with a monthly maximum (average) of 18.3°C in July, and a minimum of -18.1°C in January (Government of Canada 2016a). Mean annual precipitation is 480.2 millimetres (mm), of which 385.5 mm falls as rain with the remainder as snow (approximately 20%). Precipitation falls primarily as snow during the winter months, with the greatest snowfalls occurring in November, December and January. Precipitation occurs mainly as rain during the spring, summer and fall seasons, with overall levels of precipitation peaking in June, July and August. The Development Plan for the RM of Grahamdale (2016) states that the climate of Grahamdale can be generalized from weather data collected at Gypsumville and Ashern in the RM of Siglunes. At these locations, the mean annual temperature was cited as 1.1°C, with a mean annual precipitation of 483 mm and average frost-free period of 101 days (RM of Grahamdale 2016).

As no wind data specific to the RAA exists, wind data for the region was based on information collected at the Dauphin, Manitoba Station which is closest to the RAA. Average wind speeds recorded at Dauphin, Manitoba are fairly constant throughout the year, ranging from approximately 14 km/hr (kilometres per hour) to 17 km/hr. There is an average of approximately 13 days per year when wind speeds exceed 50 km/hr, with maximum hourly wind speeds of between 71 km/hr and 89 km/hr and maximum gust speeds between 85 km/hr and 122 km/hr (Weather Network 2016).

The large lakes within and around the RAA have an influence on the climate and weather. The basin size and position of Lake Manitoba, Lake Winnipegosis and Lake Winnipeg result in the creation of lake and land breeze circulations that can cause highly variable winds in the area (ECCC 2016a). The presence of the lakes also influence temperature and precipitation patterns in the area, with sudden storms and snow squalls that can produce strong winds over the land and water (ECCC 2016a). Manitoba's "big three" lakes are known for their rough waters and choppy waves, a feature of the large surface area but shallow depths of these lakes (ECCC 2016a). The presence of the three large, shallow lakes creates the effects of land and lake breezes and evaporative cooling, which can have a direct influence on temperatures experienced on and off shore (ECCC 2016a).

5.1.2.2 Noise

Existing noise and vibration levels in the RAA are expected to be typical of an area characterized by forest, wetland and grassland areas with a transportation corridor and rural centers, cottage areas, and the presence of commercial, recreational and transportation activities. Existing sources of noise and vibration in the RAA include light and heavy vehicles and equipment; quarrying activities; processing activities at the Graymont lime producing plant; farming activities; recreational vehicles and activities (e.g., fishing, boating, hunting, snowmobiling, use of ATVs); occasional air traffic; wind and wave action along shoreline areas. The Canadian National rail line that runs adjacent to PTH 6 and the spurs to Spearhill and Steeprock have been abandoned since 1997 (Transport Canada 2015) and are no longer a source of noise in the RAA.

Sources of noise and vibration near the LMBOC primarily include road use, construction and maintenance activities by light and heavy vehicles and equipment; quarrying activities; farming activities; recreational vehicles and activities (e.g., fishing, boating, hunting, snowmobiling, use of ATVs); occasional air traffic; wind and wave action along shoreline areas; livestock; and wildlife.

Traffic noise objectives have not been established in Manitoba for provincial highways; however, highway traffic noise is regulated by Transport Canada under the Motor Vehicle Safety Regulations (C.R.C., c. 1038) Schedule V.1 – Noise Emissions (Standard 1106), which defines maximum permissible sound levels (PSL) for individual categories of vehicles (Government of Canada 2016b).

Noise levels in the vicinity of a highway typically ranges from 50 to 70 decibels (dB), with noise levels varying with the volume of traffic, speed of the traffic and distance from the roadway. Road construction equipment noise typically ranges between about 76 dB and 89 dB at 15 m from the equipment.

Sources of noise near the LSMOC are primarily limited to boat traffic, snowmobile and ATV use, occasional air traffic, wildlife, and wind or wave action.

Regulation of noise in Manitoba is intended for management of worker exposure to noise levels in occupational environments, and local municipal bylaws established for noise nuisance management in the acoustic environment. Noise control guidelines for land use planning are provided through Manitoba's published *Guidelines for Sound Pollution* for daytime and nighttime acceptable and desirable noise levels in residential areas (MCWS 1992). For residential areas, the maximum desirable level is 55 dB during the day and 45 dB at night. For road construction, the industrial maximum desirable level would be used, which is 70 dB day or night. (Forster 2017).

5.1.2.3 Air Quality

In Manitoba, air quality issues are mostly local in nature and are primarily related to odour and other pollutants such as wind-blown dust released from specific local sources or activities. Emissions from the metal smelters in Flin Flon and Thompson and smoke from forest fires tend to be the most significant sources of air pollution in northern Manitoba (Government of Manitoba 2009). Southern Manitoba has also experienced poor air quality on occasion due to smoke from forest fires or crop residue burning. Air quality within the RAA is affected by the commercial, agricultural, recreational, rural, transportation and urban activities that occur in the region, as well as from forest fires.

The Province of Manitoba and Environment Canada operate air quality monitoring stations in the cities of Brandon, Flin Flon, Thompson, and Winnipeg, Manitoba. The air quality monitoring stations closest to the LAA are located in the City of Winnipeg at 65 Ellen Street and at 299 Scotia Street. Air quality parameters that are monitored include: carbon monoxide (CO); particulate matter less than or equal to (≤) 10 microns (PM_{10}t); particulate

matter ≤ 2.5 microns (PM2.5), nitric oxide (NO); nitrogen dioxide (NO2); nitrogen oxides (NOx); ground level ozone (O3); sulphur dioxide (SO_2); wind direction; and wind speed (Government of Manitoba 2016a).

The Manitoba Ambient Air Quality Criteria (Government of Manitoba 2016b) provides the maximum tolerable, maximum acceptable and maximum desirable concentrations of air pollutants required to protect and preserve air quality for human health.

Environment and Climate Change Canada has also developed the "Air Quality Health Index" (AQHI), an index that is based on the relative risk to human health that can be caused by a combination of common air pollutants (ECCC 2016a). These pollutants include ground-level O_3, PM2.5 and NO_2. The AQHI is measured on a colour-coded scale from 1 to 10+ and the values are also grouped into risk categories (low, moderate, high, very high) to identify the level of risk. The higher the number, the greater the health risk associated with local air quality (ECCC 2016b).

The Province of Manitoba states that "recent monitoring has shown that the health risks associated with air quality for the cities of Brandon and Winnipeg are generally low, with an average AQHI rating of around three or lower in both locations" (Government of Manitoba 2016c). Manitoba's Sustainability Report indicates air quality as being stable in Manitoba based on the data from three reporting stations in Winnipeg, Flin Flon, and Brandon (Government of Manitoba 2009). The AQHI data summarized for Winnipeg for the period from 1987 to 2008 indicates good air quality for the majority of the time (Government of Manitoba 2009).

The RAA is located approximately 200 km northwest of the City of Winnipeg and has a lower density of population and development than the City of Winnipeg and surrounding areas. As such, it is expected that the ambient air quality within the RAA is of similar or higher quality than the ambient air quality for the City of Winnipeg. The RAA for the Project is in a more forested landscape than the City of Winnipeg and is expected to experience a greater frequency of smoke from forest fires and a lesser frequency of fires from burning of agricultural crops. However, the RAA includes and is adjacent to agricultural areas, which may also result in air quality effects due to the burning of crop residues.

The population density and overall amount of development and related activities in the LAA is low compared to more populated urban areas. Existing effects on air quality in the LAA include emissions and dust due to traffic on local municipal, gravel and dirt roads and trails, including ATV and snowmobile activity; naturally occurring or human induced forest fires; emissions and dust from quarrying and quarried rock processing activities; odours, emissions and dust from farming activities; emissions from boating and other water-based activities; emissions from home heating, maintenance and other residential activities; and emissions from intermittent air traffic (Forster 2017).

5.1.2.4 Potential Project Effects on Air Quality, Noise and Climate

Ambient air quality and noise have the potential to be affected or influenced by Project-related construction, operation and maintenance activities (Section 5.2). Blasting, quarrying, operation of construction equipment, increased vehicle traffic and other related activities may contribute to temporary decreases in ambient air quality through the release of GHGs and increased levels of airborne particulate (dust). These activities may also result in temporary increases in localized noise levels. Impacts to ambient air quality and noise may directly and indirectly affect a variety of biophysical and socio-economic receptors. Increased GHG emissions resulting from the operation of construction equipment, light traffic, and engine driven power generation equipment may impact ambient atmospheric conditions that may contribute to climate change.

The majority of these potential effects are expected to occur during construction and would be greatly reduced during operation and maintenance phases. Potential controls or mitigation measures to reduce these impacts could include ensuring that equipment emission and noise controls are in good working order, utilizing dust abatement products or techniques, and timing of operation when working in proximity to sensitive noise receptors. Further assessment of potential effects and identification of avoidance or mitigation measures will be conducted through environmental assessment for the proposed Project.

5.1.3 Geology and Soils

5.1.3.1 Terrain and Topography

The RAA traverses two Ecoregions, the Mid-Boreal Lowlands (148) and the Interlake Plain (155), and four Ecodistricts: Sturgeon Bay (676), Waterhen (718), Gypsumville (720), and Ashern (723) (Smith et al 1998). The LMBOC Local Assessment Area is located within the Ashern (723) Ecodistrict, while the LSMOC LAA is in the Sturgeon Bay Ecodistrict (676).

The Sturgeon Bay (676) Ecodistrict encompasses most of the North Basin of Lake Winnipeg (Smith et al. 1998). The Ecodistrict slopes gently northeastward toward Lake Winnipeg at a slope of about 0.6 m/km, with a mean elevation of about 259 masl (Smith et al. 1998). The physiography in the Ecodistrict is the outcome of Glacial Lake Agassiz's retreat; wave action and iceberg scouring resulted in ridges of coarse-textured small rock (cobble and gravel) and depressions with finer-textured deposits (Smith et al. 1998).

Smith et al. (1998) described the Ecodistrict as being dominated by level peatlands in the western half of the Ecodistrict, and having a prominent north to south ridge and swale land pattern in the eastern half of the Ecodistrict. Local relief among the ridges and swales is cited as being about 0.5 m to 3.0 m, with slopes that range from zero to < 5% on grooved ridges of about 40 m to 800 m wide, separated by swales or depressions up to 800 m wide (Smith et al. 1998).

The Gypsumville (720) Ecodistrict is located in a small area surrounding Lake St. Martin between Lake Winnipeg and Lake Manitoba and has a mean elevation of about 251 metres

above sea level (masl) (Smith et al. 1998). The physiography of the region is mostly level to ridge till plain, partly covered with thin, glaciolacustrine clay deposits.

Smith et al (1998) describes the topography in the Ecodistrict as a northwest-southeast trending, ridge and swale topographic pattern, with grooved ridges ranging from about 400 m to 800 m wide and slopes that are usually less than 5% and range in length from 50 m to over 200 m. Topography within the Ecodistrict includes slopes of zero to 2% that are 50 m to 150 m long, with an overall gentle slope towards the northeast of approximately 0.7 m/km from Lake St. Martin (Smith et al 1998). The land surface in the Ecodistrict slopes gently eastward toward Lake Winnipeg and westward toward Lake Manitoba at approximately 0.6 m/km, with local relief between ridges and swales of approximately 0.5 m to 3.0 m (Smith et al 1998).

The Ashern (723) Ecodistrict is located between Lake Manitoba to the west and Lake Winnipeg to the east and has a mean elevation of about 274 masl (Smith et al. 1998). The Ecodistrict slopes very gently toward Lake Winnipeg and westward toward Lake Manitoba (Smith et al. 1998). The physiography is the outcome of Glacial Lake Agassiz's retreat; wave action and iceberg scouring resulted in ridges of coarse-textured small rock (cobble and gravel) and finer-textured depressions (Smith et al. 1998).

The ground surface of the LMBOC upstream of PTH 6 is relatively flat with an elevation that ranges between 248 and 250 masl over a distance of about 16 km with occasional rises to 252 masl closer to PTH 6. For a distance of about 0.5 km leading towards and away (about 1 km total) from PTH 6 the ground surface elevation is also relatively flat and ranges between 251 and 252 masl. Beginning about 0.5 km downstream of PTH 6, the ground surface elevation drops sharply to 246 masl over a distance of 1 km (about 0.1% slope) and then remains relatively flat between 246 and 248 masl for about 3.5 km before the channel enters Lake St. Martin.

The LMBOC invert slopes at an average of 0.013% beginning at an elevation of about 242 masl at Lake Manitoba and terminating at an elevation of about 239 masl at Lake St. Martin, which results in excavation depths that are expected to generally range between 6 and 12 m. The shallowest excavations will occur at the channel inlet and outlet and the deepest excavations will occur within the vicinity of PTH 6.

The ground surface elevation of the LSMOC typically slopes downwards from Lake St. Martin at about 246 masl to Lake Winnipeg at about 218 masl. The average slope of the ground surface along the channel is about 0.12%; however, frequent deflections in ground surface topography vary the ground surface slope between 0.024% and 0.24%. The ground surface along the channel rises at two locations at an average slope of about 0.14% over a distance of about 1 km.

The LSMOC invert slopes at an average 0.019% between drop structures. Drop structures are required along the channel where the natural topography slopes downwards sharply in order to control flow velocities and minimize transport of sediments and damage to the channel. The Lake St. Martin Channel invert begins at an elevation of about 241 masl at

Lake St. Martin and terminates at an elevation of about 213 masl at Lake Winnipeg, which results in excavation depths that are expected to generally range between 2 m and 5 m. The actual depth of excavation along the channel will vary depending on ground surface and location of drop structures.

5.1.3.3 Potential Project Effects on Terrain and Topography

Project-related activities that may effect or influence terrain or topography and topography during project construction, operation and maintenance mainly include excavation and quarrying (Section 5.2). Potential Project-related effects to terrain and topography, and the identification of controls or mitigation strategies, will be further assessed in the EIS.

5.1.3.2 Geology and Soils

The RAA is located in an area of Manitoba referred to as the “Interlake” region as it lies between Lake Manitoba and Lake Winnipeg. The geology of the RAA is composed of layers of Devonian, Silurian and Ordovician carbonates and sandstone formed during the Paleozoic era that overly or onlap with Precambrian granites or gneisses (Leybourne et al 2007).

The Lake St. Martin area is a region of great geological interest as it was struck by a meteor during the Jurassic, Triassic or Permian period (Lapenskie and Bamburak 2015; Leybourne et al 2007; McCabe 1971). The Lake St. Martin meteorite impacted dolomitic Ordovician to Devonian carbonates, basal sandstones and underlying Precambrian rock formations (Lapenskie and Bamburak 2015; Leybourne et al 2007; McCabe 1971). The Lake St. Martin impact structure was described by McCabe (1971) as a crypto-explosion crater consisting of a crater or hole 22.4 km in diameter and more than about 350 m deep, with a central core of 3.2 to 4.8 km in diameter, consisting of highly shock-metamorphosed Precambrian gneiss that was uplifted by at least about 213 m, and is exposed in the centre of the crater. At the crater rim, lower Paleozoic and Precambrian rocks have been uplifted by about 213 m or more and are exposed in outcrop near The Narrows of Lake St. Martin; beyond the crater rim is a structurally uplifted belt extending for about 22.4 km (McCabe 1971). The geological history of the area also resulted in large deposits of limestone, dolomite and gypsum, many of which have been mined for use as foundations and building structures, aggregate materials, cement, wallboard and Plaster of Paris (Government of Manitoba 2016d).

Over time, areas within the limestone, dolomite and gypsum deposits have become dissolved, forming what is referred to as karst topography, which produces a variety of features such as underground drainage systems, sinkholes and caves (Bilecki 2003). These sinkholes and caves provide wildlife habitat for a variety of species as dens, hibernacula and resting areas (Bilecki 2003).

The Paleozoic boundaries mainly encompass the Interlake Plain (155), Mid-Boreal Lowlands (148), and a small portion of the Lake Manitoba Plain (162) Ecoregions, as defined by Smith et al. (1998), and the RAA is located just south of the localized permafrost

zone (Lockery 1984). The surficial geology can be described as very calcareous, stony (cobble or gravel), water-worked glacial till that is deep to shallow (20-30 m) over limestone bedrock (Smith et al. 1998). Additional information on the regional surficial and bedrock geology is provided in the "*Assiniboine River & Lake Manitoba Basins Flood Mitigation Study LMB & LSM Outlet Channels Conceptual Design - Stage 2*" prepared by KGS Group (2016).

Soils within the LAA are heavily influenced by the geology of the area. Chernozemic dark grey surface horizons result, as well as soils composed of luvisol, brunisol and organic matter (Mills 1984). The soils in the Gypsumville (720) Ecodistrict are typically imperfectly-drained, dark grey chernozems developed on strongly calcareous, loamy to clay glacial till; poorly-drained gleysol and black chernozem soils occur on shallower areas (Smith et al. 1998).

The Ashern (723) Ecodistrict is comprised of dominant soils in the higher ridges that are imperfectly-drained, dark chernozems developed on strongly calcareous, loamy to clay loam glacial till, while the low areas are dominated by poorly-drained gleysols to shallow, slightly decomposed organic soils (Smith et al. 1998). The soils associated with the Sturgeon Bay (676) Ecodistrict are very poorly-drained shallow to deep moderately-decomposed mesisols dominate soils, but local areas of very poorly-drained sphagnum fibrosols and imperfectly-drained brunisols on glacial till ridges also occur (Smith et al. 1998).

5.1.3.2.1 Lake Manitoba Outlet Channel

Geotechnical investigations conducted in 2011, 2015 and 2016 showed that the stratigraphy along the LMBOC generally consisted of a thin layer of organics overlying till materials including clay till, silty clay till, silt till, or sandy clay till with occasional intertill granular deposits, over limestone bedrock (KGS Group 2016). The thickness of the organics along the LMBOC is highly variable, typically ranging between 0.1 and 0.3 m.

The thickness of the till in proximity to the LBMOC typically ranges between 16 and 25 m. The till materials can be generalized into an upper soft and lower dense layer, that are characterized as such as a result of visual inspection, drilling methods and Standard Penetration Tests (SPT). Both till layers typically contain more fine particles (clay, silt) than granular particles (sand, gravel); however, occasional intertill granular deposits were encountered that are generally comprised of sands, gravels, cobbles and boulders with a clayey and/or silty and/or sandy infill matrix.

The underlying dolomitic limestone bedrock was typically encountered at depths between about 16 and 25 metres below ground level (mbgl). The quality of the uppermost occurrence bedrock according to Rock Quality Designation (RQD) Index, which is a quantitative measure of bedrock condition, was typically very poor to poor. The quality of the bedrock typically improved with depth; however, at times the quality of the bedrock remained very poor to poor along the full depth explored. This is typical of limestone

bedrock and indicates that the uppermost limestone bedrock underwent now inactive karstification prior to being later buried by later deposition of overlying sediments.

The bedrock surface elevation longitudinally along the LMBOC typically ranges between 224 and 232 masl; however, is known to occur as high as 236 masl in the vicinity of PTH6. The bedrock surface elevation has been observed to rise laterally to either side of the LMBOC, which suggests that a channel was incised into the bedrock in geologic history along roughly the same alignment but somewhat offset from Birch Creek.

Based on subsurface explorations completed thus far, the invert of the LMBOC is expected to reside entirely within either the upper soft till or the lower dense till.

5.1.3.2.2. Lake St. Martin Outlet Channel

Geotechnical investigations conducted in 2011, 2015 and 2016 showed that the stratigraphy along the LSMOC generally consisted of a thin to thick layer of organics overlying till materials including clay till, silty clay till, silt till, or sandy clay till with occasional intertill granular deposits, over limestone bedrock (KGS Group 2016).

The thickness of the organics along the LSMOC ranges between 0.1 and 6.0 m. The organics are thinnest in areas that are topographically higher and thickest in areas that are topographically low and relatively flat and wet.

The thickness of the till typically ranges between 3 and 13 m. The till materials can be generalized into an upper soft and lower dense layer, that are characterized as such as a result of visual inspection, drilling methods and Standard Penetration Tests (SPT); however, occasional intertill granular deposits were encountered that are generally comprised of sands, gravels, cobbles and boulders with a clayey and/or silty and/or sandy infill matrix.

The underlying dolomitic limestone bedrock was typically encountered at depths between about 3 and 12 mbgl. The quality of the uppermost occurrence bedrock according to Rock Quality Designation (RQD) Index, which is a quantitative measure of bedrock condition, was typically very poor to poor. The quality of the bedrock typically improved with depth; however, at times the quality of the bedrock remained very poor to very poor along the full depth explored. This is typical of limestone bedrock and indicates that the uppermost limestone bedrock underwent now inactive karstification prior to being later buried by later deposition of overlying sediments.

The bedrock surface elevation longitudinally along the LSMOC generally dips from Lake St. Martin at about 232 masl towards Lake Manitoba at about 210 masl; however, rises in the bedrock surface are known to occur.

Based on subsurface explorations completed thus far, the invert of the LSMOC is expected to reside within either the upper soft till, the lower dense till or the bedrock.

5.1.3.3 Potential Project Effects on Geology and Soils

Project-related activities that may effect geology and/or soils during Project construction, operation and maintenance include: excavation, quarrying and blasting, vegetation clearing, improper soil conservation methods, increased light vehicle and construction equipment traffic and accidental spills or malfunctions. These activities have potential to effect soil erosion, bank or slope stabilization, surficial geology, soil compaction, loss of soil resources, and soil contamination. Project operation may also effect geology and soils through increased erosion, sedimentation and bank destabilization caused by increased water flows. Section 5.2 outlines potential linkages between the Project and geology.

Potential Project-related effects to geology and soils and the identification of controls or mitigation strategies will be further assessed in the EIS.

5.1.4 Hydrology

5.1.4.1 Groundwater

The RAA is located within the Manitoba Lowland physiographic region, which is described as an area of gentle relief lying to the east of the Manitoba Escarpment (Betcher et al. 1995). This area is underlain by gently southwestwardly dipping Paleozoic and Mesozoic sediments consisting mainly of carbonate rocks with some clastic and argillaceous units, with bedrock overlain by glacial tills and proglacial lacustrine sediments (Betcher et al. 1995). The major lakes of Manitoba occupy portions of this lowland area.

The principal sources of water in the Ecodistrict are groundwater, and surface water from Lake St. Martin. Groundwater is from shallow sand and gravel aquifers associated with the glacial till deposits (Smith et al. 1998). The surficial deposits within the RAA consist mainly of glacial till, with fairly extensive sand and gravel deposits at the surface being common in the area (Rutulis 1973). The availability and quality of groundwater is dependent upon the presence of shallow aquifers, which are generally sand or sand and gravel lenses (Rutulis 1973). The depth to these aquifers may range from less than 6 m where the sand and gravel deposits are at ground surface, to more than 60 m in low-lying areas where thick clay beds cover the aquifer (Rutulis 1973).

Water quality in the sand and gravel aquifers ranges from fair to excellent (Betcher et al. 1995; Rutulis 1973). Areas where the sand and gravel deposits are at or close to the ground surface and that are probable or existing groundwater sources are susceptible to contamination from surface activities (Rutulis 1973). Flowing artesian well conditions are common in the RAA, in particular along Birch Creek, and in the vicinity of Lake St. Martin (KGS Group 2016). Flowing artesian well conditions also occur in the Dauphin River area and in an area of Buffalo Creek, and were consistent with the field investigation results where artesian flow conditions were encountered up to 2.5 m above ground surface (KGS Group 2016).

Hydrogeological and groundwater studies completed by KGS in 2016 applied a 3.0 km offset distance from the centreline of the LMBOC as a conservative estimate of the potential distance at which adverse effects on groundwater (e.g., drawdown in domestic wells) could be encountered, based on the current knowledge of the aquifer in this region (KGS Group 2016). The groundwater studies included:

- monitoring of water levels via measurement of piezometric pressures in test pits, test holes and wells installed along the LMBOC
- review of the Provincial well record database (GWDrill) to determine existing well locations
- assessment of the potential for basal heave or groundwater blowouts during channel construction and operation
- examination of aquifer drawdown during channel construction and operation;
- assessment of Groundwater Under the Direct Influence of Surface Water (GUDI)
- review of potential changes to Lake St. Martin surface water
- analysis of the potential drainage of surface water bodies near the channel alignment.

Bedrock fracture permeability from various tests ranged between $3.9x10^{-7}$ meters per second (m/s) and $2.4x10^{-4}$ m/s which are comparable to the other hydrogeological studies in karstic aquifers whose permeability ranges are typically 10^{-4} to 10^{-6} m/s. The transmissivity from four pump tests ranged between 0.53 (very low) and 9,8 (low) cubic metres per day (m^3/day)(140 and 2,600 USgpd/ft. [US gallons per day per foot]) which are also within the typical range of well transmissivities in the area, as recorded in the GWDrill database. However, it should be noted that outlier transmissivities of more than 190 m^3/day (50,000 USgpd/ft.) have been documented. These variable well yields are a direct result of the fractured rock conditions, with water yields dependent on the number of fractures intersected by a well and the aperture size, extent, and interconnection to other fractures (KGS Group 2016).

Based on the results of the pumping test, the lower till zone appeared to be directly connected to the bedrock aquifer, with an immediate piezometric pressure response within deep till piezometers. The upper till zone did not respond during pumping tests; however, this observation does not necessarily mean that the upper till is disconnected from the bedrock aquifer, but could indicate that a longer duration of drawdown (pumping) may be required before an observable response. KGS Group (2016) noted that this observed response is typically a function of the low permeability of the till soils.

Groundwater testing results showed that Total Dissolved Solids (TDS) ranged between 390 milligrams per liter (mg/L) and 521 mg/L and water type was generally Mg-Ca-, Ca-Mg-, or Mg-HCO_3 with sodium concentrations less than 40 mg/L. KGS Group (2017) noted that these water parameters are typical and reflective of the bedrock limestone aquifer within the Interlake area. 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).

Discharge of groundwater to the outlet channels is expected to occur given the channel excavation depth, aquifer piezometric pressure conditions, interconnection to the carbonate aquifer, and construction and operational channel conditions (KGS Group 2016). The groundwater quality is considered to be relatively fresh (TDS = 390 to 550 mg/L, Chloride = 2 to 19 mg/L), but may have lower levels of dissolved oxygen (DO) than the surface waters. Groundwater may have lower levels of dissolved oxygen than surface waters. The groundwater system currently naturally discharges to Lake Manitoba and Lake St. Martin; therefore, the volume of groundwater discharge to the surface water bodies is not expected to be greatly increased. There will also be varying amounts of surface water baseflow in the channel during operation, which will provide some degree of dilution of groundwater prior to discharge to Lake St. Martin (KGS Group 2016).

Well testing results shows that TDS ranged between 397 mg/L and 525 mg/L and water type was either Mg-Ca- or Ca-Mg-HCO_3 with sodium concentrations between 14 mg/L and 46 mg/L. One occurrence of sodium concentration in excess of 50 mg/L was encountered and adjusted the water type to Mg-Ca-Na-HCO_3; however, the sodium concentration did not exceed Health Canada – Canadian Drinking Water Quality (HC-CDWQ) limits (FPTC 2017). No *Escherichia coli* (a coliform bacterium) was detected in any of the wells sampled. Total coliform was detected in 3 of the wells sampled with concentrations varying between 2 and 3 MPN/100mL and private users were notified of these results. A baseline groundwater quality program has not been completed along the LSMOC to date and will be part of future work.

Stratigraphy within the LAA can be summarized as organics/surficial soils over till over bedrock. In general, till acts as an aquitard that separates the bedrock aquifer from the surficial water network that interacts more readily with the more complex unconfined (perched) groundwater system. KGS Group (2016) reported that the regional bedrock aquifer flow is easterly towards Lake Winnipeg, as well as westerly toward Lake Manitoba and Lake St. Martin (and Lake Winnipegosis), with local topographically high bedrock with thin (less than 2.5 m) overburden cover acting as regional recharge zones.

Discharge from the aquifer occurs as seepage into streams, marshes, and lakes found throughout the Interlake, natural springs, diffuse flow, and wells. Piezometric pressure of the aquifer is dependent on the location being measured but can be generalized as between about 250 masl and 255 masl in regional recharge zones (i.e. the Fairford River area) and between about 245 masl to 255 masl where the aquifer is confined (i.e. the Birch Creek area). There is sparse historical data available along the LSMOC; however, more recently collected information shows that the regional aquifer levels are on the order of about 245 masl near the north-east end of Lake St. Martin and about 218 masl near Willow Point and Johnson Beach on Lake Winnipeg (near Dauphin River).

Review of the GWDrill database showed records for 135 wells within the 3.0 km of the LMBOC centerline. Many of these wells are used for non-domestic purposes, such as livestock wells, monitoring wells, test holes or may have been decommissioned or abandoned. Based on the preliminary review of the area, it was determined that there are

up to 70 possible residential locations within the 3.0 km offset (KGS 2017). According to KGS (2017), there are no wells shallower than 10 m and no wells not located in the bedrock aquifer within 0.5 km of the LMBOC. Within 3.0 km of the LMBOC, there are 39 wells shallower than 10 m and 12 wells not located within the bedrock aquifer.

Soil strata where wells are not located within the bedrock aquifer include sand and gravel, sandstone and shale. A more detailed door-to-door survey of wells within 3 km of the LMBOC centerline will be completed to refine these Maps. A water quality monitoring program of surface and groundwater will also be implemented in order to develop a more robust baseline of existing water quality and to track the channel's effects during construction and operation. The following general observations were made based on the GWDrill review:

- water supplies are generally drawn from the upper carbonate aquifer (13 m to 25 m depth range)
- flowing artesian conditions were observed at 28 of the 135 wells reviewed
- depth to groundwater is generally shallow (median depth to groundwater of 0.9 m below grade)
- well capacities and aquifer transmissivity are generally low (less than 1,000 USgpd/ft.)

5.1.4.2 Unconfined Aquifer and Watershed

The unconfined aquifer system along both proposed LMBOC and LSMOC alignments interacts more readily with the local watershed, which is comprised of various man made or natural drains, creeks, rivers, ponds, wetlands, and lakes that ultimately flow into either Lake Manitoba or Lake St. Martin. The existing watershed has been shown to typically operate as expected throughout past years, with the occasional outlier event exposing problematic areas, and high and low flow years within the watershed generally corresponding directly to high and low unconfined aquifer levels, respectively, in the area.

Standpipe and vibrating wire piezometers installed within surficial soils along the LMBOC have shown that unconfined aquifer levels can vary between ground surface and up to 3.0 mbgl, with deeper levels being typically encountered in topographically higher areas. Occasionally, artesian pressures were encountered which verifies that the area behaves as a discharge zone for the bedrock aquifer with natural springs and diffuse flow being a regular and natural occurrence.

Surface water testing results showed that TDS ranged between 346 mg/L and 503 mg/L and water type was generally Mg-Ca or Mg-HCO_3 with sodium concentrations typically less than 15 mg/L. The surface water sample collected from Lake Manitoba had a sodium concentration of about 32 mg/L. The surface water sample (and a duplicate) collected from Lake St. Martin had a sodium and chloride concentration of about 97 mg/L and 130 mg/L, which made the water type Na-Mg-Cl-HCO_3. An E. coli concentration of 100 CFU/100mL was detected in the duplicate Lake St. Martin sample. E. coli was not detected in any other

surface water samples using a detection limit of 100 CFU/100 mL. Total coliform was typically detected at concentrations between 100 MPN/100mL and 1,350 MPN/100mL, with two samples below the detection limit of 100 MPN/100mL. Additional groundwater data collection (excluding wells) in the spring of 2017 and 2018 are to be conducted and will expand upon the work completed thus far. A baseline surface water quality program has not been completed along the LSMOC to date and will be part of future work.

As a result of the channels, some existing portions of the watersheds will be effected by intersecting existing flow paths. This could result in the areas downstream of the blockage seeing a water quantity decrease and consequently a lowering of the unconfined aquifer with the opposite being possible upstream of the blockage. Redesign of the watersheds to prevent and/or minimize these effects and consequences will be undertaken as part of the proposed Project.

Containment of water within the channel will take the form of longitudinal dykes along either side of the channels, where required, or the natural soils, depending on the water surface profile within the channels. Under both circumstances, the naturally occurring upper and lower till or excavated and compacted upper and lower till fill will be utilized to construct the channel side slopes and dykes and will line the full length of the channels, as required. The till is estimated to have a maximum hydraulic conductivity in the range of 1×10^{-6} m/s and is expected to behave as a retarder of considerable flow exchanges between the unconfined aquifer and the channels.

5.1.4.3 Potential Project Effects on Groundwater

During the construction of the LMBOC, blowout/basal heave conditions may occur within excavated areas, if the bedrock aquifer groundwater piezometric pressures exceed the confining overburden mass that remains between the channel excavation invert and bedrock surface elevation during excavation (KGS Group 2017; Section 5.2). During operation of the channel, blowout or basal heave/seepage would be expected if these bedrock aquifer pressures exceed the operating channel surface water profile, where it is not confined by sufficient overburden thicknesses. As such, a depressurization program or other construction-based method of accommodating the high aquifer piezometric pressures and associated basal heave/blowout conditions would be required during the construction and operational phases of the Project (KGS Group 2017).

Examination of aquifer drawdown found that drawdown of aquifer groundwater piezometric pressures would be anticipated during channel construction and operation, given the flowing artesian bedrock piezometric pressure conditions, and potential direct connection to the bedrock aquifer via seepage through fractured till due to a possible groundwater blowout (KGS Group 2017). The largest aquifer drawdowns would occur during the construction phase, with drawdown to a level at or below the invert of the channel excavation. The analysis showed a potential maximum of 2.5 m to 4.2 m of drawdown at a 1.0 km distance from the channel during construction, and as much as 6 m to 8 m in the immediate vicinity of the channel excavation.

During normal channel operation, upstream of the Control Structure (and assuming the Control Structure is closed), aquifer drawdown in the range of 1.5 m could be anticipated at 1 km from the channel, and in the range of 3 m downstream of the Control Structure at a distance of 1 km (KGS Group 2017). These drawdowns would be greater in the areas closest to the channel and water control structure. This potential drawdown effect could have an effect on the available capacity of the local supply wells. Additional information on the methods and parameters used for the preliminary assessment of potential aquifer drawdown is provided in KGS Group 2017.

The invert of the LMBOC is expected to remain entirely within or above the till aquitard. Accordingly, assessment for groundwater which is under the direct influence of surface water (GUDI) showed that the most likely pathway for surface water to enter the bedrock aquifer would be via channel blowout, which is expected to be managed by installing a series of wells along the channel whose purpose would be local aquifer depressurization by active (mechanical) means during construction and passive means during operation. The area around the LMBOC is within a natural aquifer discharge zone; as such, the direction of flow from the aquifer into the channel is expected to provide protection against GUDI in the event of an unexpected connection between the channel and the aquifer.

Other pathways for bedrock aquifer GUDI over the long term, despite reducing blowout potential, include complex interconnection of the till and fracture flow within the bedrock, and the possibility of an adjacent well user pumping heavily from a directly interconnected and transmissive fracture or bedding plane parting within the bedrock, which could result in the draw of surface water from the channel. A connection between the bedrock aquifer and the channel increases the vulnerability of the aquifer to contamination by surface water, which can lead to contamination of local groundwater resources, and could potentially affect domestic wells located within the 3.0 km offset area of the LMBOC. The potential for this GUDI mechanism can be reduced by completing additional subsurface explorations and further optimizing the channel alignment to avoid shallow occurrences of bedrock. Contingency designs will also be developed, which may include grouting and/or dense local groundwater monitoring, to monitor water quality at select locations along and offset from the channel alignment.

The depth of the surficial soils and till along the LSMOC channel are thinner than along the LMBOC, therefore significant lengths of the channel base are expected to reside within the bedrock. The LSMOC is located within a natural aquifer discharge zone with no known wells within the LAA; therefore, the potential risk of GUDI is considered minimal.

5.1.4.4 Surface Water Hydrology

Major named watercourses and waterbodies in the RAA from west to east include (Maps 1-3): Portage Bay and Watchorn Bay in Lake Manitoba; Fairford River; Lake Pineimuta; Lake St. Martin; Reed, Clear and Goodison lakes; Birch Creek; Dauphin River; Little Buffalo Lake; Big Buffalo Lake; Buffalo Creek; Sturgeon Bay in Lake Winnipeg; and a number of named and unnamed creeks, ponds and small lakes that are located throughout the RAA.

The Assiniboine River & Lake Manitoba Basins Flood Mitigation Study LMB & LSM Outlet Channels Conceptual Design - Stage 2 studies and report prepared by KGS Group (2016) included flood routing studies that examined historical flows and lake levels for Lake Manitoba and Lake St. Martin. Data were presented for the period of record from 1961 to 2014, which therefore includes the flood routing effects of the FRWCS and the Portage Diversion (PD) as these structures were operational since 1961 and 1970, respectively.

Based on review of the hydrographs and data presented in the Stage 2 report (KGS Group 2016), lake levels in Lake Manitoba for the period of record ranged from a minimum of about 247 masl (810.3 feet) in 2003 to a maximum of about 249.1 masl (817.1 feet) in 2011. The Lake Manitoba and Lake St. Martin Regulation Review Committee cited the long-term, average level of Lake Manitoba as 247.6 masl (812.2 feet) (LM&LSMRRC 2013). In Lake St. Martin, lake levels ranged from a minimum of about 242.3 masl (794.8 feet) in 1965 to a maximum of about 245.5 masl (805.5 feet) in 2011 for the same period of record (1961 to 2014) (KGS Group 2016).

The Fairford River monthly mean flows for the period of record from 1912 to 2015 have ranged from a minimum of zero flow in the winter months of 1960 and 1961, to a maximum flow of 610 m^3/s in July 2011. Table 8 provides a summary of the maximum, minimum and mean flows on the Fairford River from 1912 to 2015.

Table 8. Summary of Fairford River Flows in Cubic Metres per Second from 1912 to 2015

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Max	392	364	350	339	430	560	610	577	525	476	447	422	415
Min	0	0	0	0	0	0	1.8	1.84	0.65	0	1.22	0	1.75
Mean	72.5	73	75.4	89.6	120	140	140	116	93.8	86.7	84.7	77.8	98

Source: Government of Canada – Water Office 2016c.

There were no historical flows or water level data available for Harrison Creek, Watchorn Creek or Birch Creek. Estimates of flow for these creeks can be derived from the drainage area, channel slope and flow conditions observed during the 2015 and 2016 aquatics field studies and reported in the EIS if needed.

5.1.4.5 Surface Water Quality

The Water Quality Management Section of MSD carries out a long-term water quality monitoring network on major streams, rivers and lakes in Manitoba, including several lake and river sampling stations in the Lake Manitoba watershed and in Lake St. Martin (MSD 2017b). There are three long-term lake monitoring stations: two stations are located on Lake Manitoba, at Delta Marsh and at the Narrows, and a third station is located on the Fairford River at PTH 6 (LM&LSMRRC 2013). In addition, two other lake monitoring stations were added at Lundar and St. Ambroise in 2011, and the frequency of sampling was increased during the 2011 flood (LM&LSMRRC 2013). River monitoring is conducted at three long-term stations located on three of the major rivers of the Lake Manitoba

watershed: the Waterhen River at PR 328, the Whitemud River at PTH 16, and the Assiniboine River. The frequency of sampling at the river monitoring stations was increased during the 2011 flood, and water quality was also sampled in Lake St. Martin at three locations – the North Basin, the Narrows and the South Basin (LM&LSMRRC 2013).

In addition to water quality sampling and monitoring, MSD investigated the potential relationship between water levels in Lake Manitoba and water quality, using average concentrations of total phosphorus (TP) and total nitrogen (TN) as the basis for the examination of water quality. Lake Manitoba average TP levels from 1992 to 2011 as measured at the Delta Marsh station ranged from about 0.045 milligrams per litre (mg/l) to about 0.13 mg/l, with the highest concentration observed in the 2011 sampling (LM&LSMRRC 2013). Lake Manitoba average TN levels from 1992 to 2011 as measured at the Delta Marsh station ranged from about 0.09 mg/l to about 1.8 mg/l, with the highest concentration observed in the 1999 sampling (LM&LSMRRC 2013).

The Portage Diversion is the largest source of phosphorus to Lake Manitoba when it is flowing. In 2011, more than 60% of the TP load to Lake Manitoba was transported by the Portage Diversion (LM&LSMRRC 2013). TP was elevated at Delta Marsh in 2011, as well as in other wet years, but an increase in average TP was not found in the water quality sampling done at the station located at the Narrows in Lake Manitoba (LM&LSMRRC 2013).

The Waterhen River was identified as the largest source of TN to Lake Manitoba; in 2011. Nearly 60% of the TN load to Lake Manitoba was transported by the Waterhen River (LM&LSMRRC 2013). It was also noted that the percentage of the TN load is greater in years when the Portage Diversion does not flow, and, unlike the average TP concentrations, average TN concentrations were not affected by the 2011 flood, with no significant increases observed (LM&LSMRRC 2013).

Other indicators of water quality being sampled by MSD include chlorophyll α, total suspended solids, conductivity, dissolved oxygen, metals and pesticides. The average chlorophyll α concentration in Lake Manitoba was slightly higher in 2011 than the long-term average, but within the range of historical concentrations. Dissolved oxygen concentrations in Lake Manitoba are typically sufficient for aquatic life, but have occasionally been below the guideline for supporting aquatic life, including measurements in May 2011 and in August 2011.

In 2011 to 2012, monitoring was conducted at five stations: Waterhen River, Lake Manitoba Narrows, Fairford River, Dauphin River, and Sturgeon Bay ─ to examine the regional water quality prior to and during the operation of the Lake St. Martin Emergency Outlet Channel. Monitoring showed that the Lake St. Martin water quality “met the majority of water quality objectives and guidelines” (LM&LSMRRC 2013).

TP, turbidity and chlorophyll α levels were found to be lower in Lake St. Martin than in the south end of Lake Manitoba, which had the highest levels of these parameters.

Additional water quality and bathymetric studies were conducted during 2015 and 2016. These studies focussed on the inlet and outlet areas for the LMBOC and LSMOC. A water quality program including such parameters as: dissolved oxygen; pH; temperature, conductivity, turbidity, and total suspended solids were collected. Bathymetric data for the inlet and outlet areas will be combined with existing LiDAR (Light Detection and Ranging) data.

5.1.4.6 Potential Effects of Project on Surface Water

Potential Project effects to surface water may include changes to water quality, groundwater input and flow regime. Changes in total suspended solids (TSS) levels, nutrients and metals may occur during construction and operation, potentially having direct impacts to fish, fish habitat and wetland systems. Indirect effects may include impacts to wildlife and terrestrial habitat, species at risk, traditional and non-traditional land uses, and Aboriginal and Treaty rights. Section 5.2 outlines potential linkages between the Project and surface water.

Construction and operation may also cause seepage of groundwater into surface water. Changes to current flow regimes may also alter flows within adjacent waterbodies, having potential direct and indirect implications for a variety of receptors like fish, wildlife, traditional and non-traditional land uses and Aboriginal and Treaty rights.

5.1.5 Aquatic Environment

5.1.5.1 Fish and Fish Habitat

Fish communities in each waterbody are diverse and are comprised of many species (e.g., at least 37 fish species occur in Lake Manitoba). Of relevance to the proposed Project, the Dauphin River is used as a migratory route by spawning and Lake Whitefish moving from feeding areas in Sturgeon Bay to spawning locations in upstream areas of the river and in Lake St. Martin. Commercial fisheries occurring in Lake Manitoba, Lake St. Martin and Sturgeon Bay target species such walleye, lake whitefish, common carp (*Cyprinus carpio*), suckers, and northern pike and are an important part of the local economies.

Monitoring of fish and fish habitat was conducted during emergency operations of the LSMEOC and again to document baseline conditions to describe the fish community for environmental assessment of the Project. To sample for fish within lakes, boat electrofishing and experimental gill netting were used. Hoop nets were used in smaller creeks. To sample for spawning, methods such as egg mats, kick net sampling and larval tow nets were used. Sampling was done during both spring and fall spawning periods. A summary of all documented fish species in Lake Manitoba, Lake St. Martin and Lake Winnipeg is listed in Appendix C.

5.1.5.1.1 Lake Manitoba

There is an estimated 2,367 km^2 of wetlands in the area surrounding Lake Manitoba,

Pineimuta Lake and Lake St. Martin. These wetlands provide important habitat for a variety of species, including fish, waterfowl, and aquatic mammals such as muskrats. The Lake Manitoba Stewardship Board (LMSB) have noted that invasive species are also present, which can negatively affect native species in Lake Manitoba and the surrounding wetlands (LMSB 2008). Of particular concern to the LMSB is the invasive common carp, which have altered many of the wetlands surrounding Lake Manitoba, affecting many native aquatic species (LMSB 2008).

Thirty-seven species of fish, including small-bodied forage species, are known to inhabit the Lake Manitoba watershed. Species of commercial and/or domestic importance include white sucker (*Catostomus commersonii*), walleye, common carp, northern pike, yellow perch (*Perca flavescens*), lake whitefish, sauger, goldeye, and freshwater drum (*Aplodinotus grunniens*) (NSC 2011).

While the majority of fish species are found throughout Lake Manitoba, species such as bigmouth buffalo (*Ictiobus cyprinellus*), brown bullhead (*Ameiurus nebulosus*), channel catfish (*Ictalurus punctatus*), mooneye (*Hiodon tergisus*), sand shiner (*Notropis stramineus*), and tadpole madtom (*Noturus gyrinus*) occur only in the south basin of Lake Manitoba, while blacknose shiner (*Notropis heterolepis*) have been found only in the north basin (Stewart and Watkinson 2008).

The Fairford Fishway provides passage for fish between Lake Manitoba and the Fairford River and areas further downstream (LMSB 2008). Historical tagging studies conducted by Derksen (1988) revealed that, after passing upstream through the Fairford Fishway, some walleye travel extensively throughout Lake Manitoba.

During fall gill net sampling for the Project in Watchorn Bay (Lake Manitoba) near the inlet of the LMBOC, the most abundant fish was lake whitefish, followed by northern pike and white sucker. During spring gill net sampling along in Watchorn Bay, the most abundant fish was white sucker, followed by northern pike and walleye. Spring electrofishing in Watchorn Bay showed predominantly yellow perch, followed by spottail shiner (*Notropis hudsonius*) and common carp (AAE 2017a).

5.1.5.1.2 Lake St. Martin

NSC (2012) described Lake St. Martin as having substrates primarily composed of soft mud, with an extensive area of gravel, sand, and compacted mud along the western shore near the mouth of the Fairford River, and areas of bare bedrock in the northeast basin and the narrows. It was noted that extensive gravel bars and boulders are abundant in Lake St. Martin, and these habitat types can provide suitable spawning habitat for several fish species in the area (NSC 2012). These substrate and cover features, along with areas of submerged and emergent vegetation, and a number of islands and reefs, were also observed during spring 2016 avian field surveys.

A total of 10 fish species were captured during gill-netting studies in Lake St. Martin

including cisco, common carp, freshwater drum (*Aplodinotus grunniens*), lake whitefish, longnose sucker (*Catostomus catostomus*), northern pike, shorthead redhorse (*Moxostoma macrolepidotum*), walleye, white sucker and yellow perch (NSC 2016). Lake St. Martin was noted as an important spawning area for lake whitefish, shorthead redhorse, white sucker and yellow perch (NSC 2016). NSC (2012) cited the fish species of commercial and domestic importance known to occur in Lake St. Martin as northern pike, walleye, and lake whitefish; with common carp, goldeye, burbot (*Lota lota*), longnose sucker, white sucker, yellow perch, sauger, and cisco composing a smaller portion of the lake's commercial fishery.

During fall gill net sampling for the Project in Birch Bay (Lake St. Martin) near the outlet of the LMBOC, the most abundant fish was lake whitefish, followed by white sucker and cisco. During spring gill net sampling along in Birch Bay, the most abundant fish was northern pike, followed by white sucker and shorthead redhorse. Spring electrofishing in Birch Bay showed predominantly common card, followed by yellow perch and northern pike (AAE 2017b).

5.1.5.1.3 Lake Winnipeg

NSC (2012) indicated a total of 19 fish species likely to be present in Sturgeon Bay based on fish species distribution information presented in Stewart and Watkinson (2008). In fall 2011, a total of nine fish species were captured including: burbot, cisco (*Coregonus artedi*), freshwater drum, lake whitefish, northern pike, shorthead redhorse, walleye, white sucker and yellow perch (NSC 2013b). Egg mats deployed in Sturgeon Bay in spring 2012 yielded < 30 eggs, which were identified as yellow perch and white bass, with one unidentified egg (NSC 2013a).

Fish species captured during spring 2012 neuston tows in Sturgeon Bay included: cisco, emerald shiner (*Notropis atherinoides*), lake whitefish, ninespine stickleback (*Pungitius pungitius*), rainbow smelt (*Osmerus mordax*), spottail shiner, white bass (*Morone chrysops*), yellow perch, as well as unidentified cyprinids (likely white suckers) and percids (walleye or yellow perch); the majority of the captured fish were juvenile and adult emerald shiners (NSC 2013a). Gill net sets in Sturgeon Bay in spring 2012 captured a total of 12 fish species, including cisco, freshwater drum, lake whitefish, longnose sucker, northern pike, sauger, shorthead redhorse, trout-perch, walleye, white bass, white sucker, and yellow perch (NSC 2013a).

Sturgeon Bay supports commercial, domestic and sport fishing in the area, which provides employment and income for the community of Dauphin River and other nearby communities (NSC 2012). Sport fishing is popular in the Dauphin River, Mantagao River, Sturgeon Bay, and in tributaries located to the north of the Dauphin River that flow into Sturgeon Bay (Pollard 1973 In NSC 2012), with angling for freshwater drum (also referred to as silver bass), northern pike, sauger, walleye, and yellow perch, and bow fishing for carp in the spring (Benson's Big Rock Camp and Campground 2017).

5.1.5.2 Potential Project Effects on Fish and Fish Habitat

Project-related construction, operation and maintenance activities may effect fish and fish habitat both directly and indirectly (Section 5.2). Sources of impacts may include activities influencing erosion and sedimentation, surface water quality, alteration of shoreline morphology, changes to drainage and surface water flows and the alteration of existing and creation of new aquatic habitat. The general regulation of water levels may also impact fish and fish habitat over time through alteration of riparian vegetation and wetland systems.

5.1.6 Terrestrial Environment

5.1.6.1 Vegetation

The Land Cover Classification (LCC) was used in defining vegetative cover classes, communities and habitats in the RAA and LAA. The LCC is a national database map layer used across major federal departments involved in land management and land change detection: Agriculture and Agri-Foods Canada, the Canadian Forest Service, and Canadian Centre for Remote Sensing. The LCC provides vegetated and non-vegetated land cover classes that identify the primary ecological and vegetation/habitat conditions of an area. A summary of the LCC information for the LMBOC and LSMOC are provided in Table 9**.**

Table 9. Land Cover Classification for the Lake Manitoba Outlet Channel

LCC Habitat Code	Habitat Class	Lake Manitoba Outlet Channel		Lake St. Martin Outlet Channel	
		LAA		LAA	
		Area km²	% Total	Area km²	% of Total
20	Water	5.67	11.08	5.55	2.25
33	Exposed Land	0.18	0.34	0.76	0.31
34	Developed	1.49	2.92	0.75	0.30
51	Shrub - Tall	-	-	0.25	0.10
81	Wetland Treed	-	-	4.88	1.98
82	Wetland Shrub	1.32	2.58	140.69	57.00
83	Wetland Herb	5.98	11.69	47.34	19.18
100	Herb	3.52	6.88	0.09	0.04
110	Grassland	23.03	45.04	0.25	0.10
121	Annual Crops	1.66	3.25	-	-
122	Perennial Crops and Pasture	4.99	9.77	-	-
211	Coniferous - Dense	-	-	22.12	8.96
212	Coniferous - Open	-	-	4.17	1.69
221	Broadleaf - Dense	3.02	5.90	4.26	1.73
222	Broadleaf - Open	0.27	0.53	5.92	2.40
231	Mixedwood - Dense	0.01	0.01	9.78	3.96
Total		**51.14**	**100.00**	**246.82**	**100.00**

The primary land cover type in the LMBOC LAA is grasslands, which covers almost half of the area. Other representative vegetation cover in the LMBOC LAA includes herb wetland, perennial crops and pasture, herb cover and dense broadleaf forests. Forest stand vegetation is dominated by trembling aspen (*Populus tremuloides*) in the ridge areas, but often associated with balsam poplar and white spruce, whose distribution is affected greatly by forest fires (Smith et al. 1998). Willow, sedge, and meadow grass occur in the poorly-drained depressions.

Within the LSMOC LAA, the dominant land cover type is shrub wetland, comprising just over 50% of the LAA. Other representative vegetation cover in the LSMOC LAA includes herb wetland, dense coniferous forest, and dense mixedwood forest. Black spruce *(Picea mariana*) dominates forest stands due to extensive bogs/fens (peatlands) and poorly-drained mineral soils (transitional areas) (Smith et al. 1998). Associated vegetation varies from mosses (e.g., *Sphagnum* spp.), ericaceous shrubs (e.g., Labrador tea [*Rhododendron groenlandicum*]), swamp birch (*Betula pumila*), sedge (e.g., *Carex* spp.), willow (*Salix* spp.), and tamarack (*Larix laricina*), depending on whether the area is characterized as a peatland or transitional area.

5.1.6.1.1 Lake Manitoba Outlet Channel Vegetation

The habitat at the inlet of the LMBOC alignment is comprised of a narrow strip of rocky and sandy shoreline and a small treed riparian buffer. A sparsely vegetated riparian buffer composed of Manitoba maple (*Acer negundo*), trembling aspen and American elm (*Ulmus americana*) borders the rocky shoreline, which is almost void of vegetation. Smooth brome (*Bromus inermis*) tame hayfields extend inland beyond the treed riparian buffer. Much of the area was heavily disturbed from human activity resulting in the spread of invasive species including Canada thistle (*Cirsium arvense*), absinth (*Artemisia absinthium*), yellow sweet clover (*Melilotus officinalis*) and field bindweed (*Convolvulus arvensis*) (Appendix C).

For the first several kilometres the LMBOC alignment passes through a large permanent marsh wetland (Class V) network, with some upland pockets of croplands and smooth brome and alfalfa (*Medicago sativa*) tame hayfields. As the channel continues north, the alignment follows an upland habitat along the western edge of this large wetland complex. The habitat consists of tame hayfields and cattle grazed pastures with scattered open bluffs of aspen and bur oak (*Quercus macrocarpa)*. The large wetland has a deep open water zone with a wide shallow to deep marsh zone dominated by cattails (*Typha latifolia*) and rushes (*Juncus balticus* and *Schoenoplectus acutus*).

The wet meadow zones surrounding the wetland varied in width and were composed of sedges, rushes and mint (*Mentha aevensis*) species. Some smaller permanent (Class V), semi-permanent (Class IV), seasonal (Class III) and temporary (Class II) wetlands were also scattered throughout the landscape. Many of the seasonal and temporary wetlands are heavily shrubbed with willows. As the channel alignment heads northward, upland habitats become more prevalent and a mix of cultivated cropland and tame smooth brome and alfalfa hayfields dominate the landscape. Although the terrain was generally not as wet as it

is further south along the alignment, some smaller permanent (Class V), semi-permanent (Class IV) and seasonal (Class III) wetlands were scattered across the landscape (Appendix C).

Just south of PR 239, the habitat shifts from tame pastures to an aspen dominant hardwood forest with a thick beaked hazel (*Corylus cornuta*) dominating shrub layer. The herbaceous ground cover was typical of moist forest and was composed of species such as star-flowered false Solomon's seal (*Maianthemum stellatum)* and wild sarsapirilla (*Aralia nudicaulis*). Several pockets of seasonal (Class III), semi-permanent (Class IV) and permanent (Class V) marsh and swamp wetlands are scattered throughout the aspen stand (Appendix C).

Between PR 239 and PTH 6, the aspen hardwood forest continues to dominate the landscape with some pockets of tame hayfields surrounding a large permanent wetland complex that is connected to the Goodison Lake wetland. Seneca root (*Polygala senega*) was widespread within the hayfields and found mainly adjacent to the sedge dominant wet meadow zone of the wetland. Within the aspen stand just south of PTH 6, several permanent, semi-permanent and seasonal wetlands were present, including a shrubby peat moss bog (*Sphagnum* spp.). The bog habitat was dominated by a shrub layer of bog birch (*Betula glandulosa*) and bog willow (*Salix pedicellaris*) with some Labrador tea and three-leaved false Solomon's seal (*Maianthemum trifolium)* as ground cover amongst the sphagnum moss (Appendix C).

North of PTH 6 and up to Lake St. Martin, the landscape consists of cultivated croplands as well as alfalfa and smooth brome in tame hayfields and pastures. The habitat at the channel outlet consists of a cattle grazed smooth brome pasture with a coastal marsh wetland. Cattails and bulrushes dominate the deep and shallow marsh zones of the wetland, whereas mints and sedges dominate the wet meadow zone (Appendix C).

No federally or provincially listed species, or any species listed by the Manitoba Conservation Data Centre (MBCDC) as having conservation concern, were observed during the vegetation surveys of the LMBOC route (Grey 2016).

5.1.6.1.2 Lake St. Martin Outlet Channel Vegetation

Much of the LSMOC lies within a wet depression zone that is dominated by vast interconnecting areas of tree-less graminoid rich fens with scattered black spruce/tamarack sphagnum bogs and tamarack dominant transitional bog peatlands. Scattered glacial moraine ridges in the area have created strips of upland habitat dominated by coniferous jack pine stands and mixedwood forests comprised of tamarack, trembling aspen, balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*; Appendix C; Smith et al. 1998).

The majority of the area is located in one large graminoid rich fen connected to Big Buffalo Lake and characterized by floating sedge and buckbean (*Menyanthes trifoliata*) mats with patches of common reed grass (*Phragmites australis*), bog birch and willows. Scattered throughout the large fen network are small pockets of treed and shrubby sphagnum bogs

dominated by Labrador tea, small bog cranberry (*Vaccinium oxycoccos*), bog rosemary (*Andromeda polifolia*), bog laurel (*Kalmia polifolia*) and three-leaved false Solomon's seal. Much of the area has experienced little to no human activity. Canadian thistle and yellow sweet clover were the only invasive species were present in the area, and were growing along disturbed shoreline reaches of Lake St. Martin.

The area along the Willow Point was composed largely of shrubby and open sphagnum bog habitat with few trees. As the alignment reaches Lake Winnipeg, the sphagnum bog habitats give way to hardwood riparian communities, marshlands and sedge meadows. One species of conservation concern, dragon's mouth orchid (S2), was observed at two locations along this alignment. At both locations, the habitat consisted of an open bog dominated by scattered tamaracks and willow and bog birch shrubs with the orchids found growing on high hummocks of sphagnum moss surrounded by buckbean, creeping juniper (*Juniperus communis*) and Labrador tea. The majority of the alignment was free of invasive species, except within the hardwood riparian area along the shoreline of Lake Winnipeg, where some common dandelions were found (Appendix C).

No federally or provincially listed species were observed during the vegetation surveys. One species listed by the MBCDC as a species of conservation concern was identified at several locations along the LSMOC. Dragon's mouth orchid (*Arethusa bulbosa*) is considered rare (S2) throughout its range or in the province (6 to 20 occurrences) and may be vulnerable to extirpation. Most often found singly, in suitable habitats it may be found in small colonies.

A single dragon's mouth orchid was observed within one of the densely treed black spruce sphagnum bog habitats close to Big Buffalo Lake. Although much of the surrounding habitat was flooded, the orchid was found on a hummock of sphagnum moss at the base of a tamarack tree, surrounded by Labrador tea and bog rosemary. Two more occurrences of single individuals were observed in close proximity to each other at the start of the Willow Point option, where it branches off from the existing Reach 3 channel. The habitat where these occurrences were made was more of an open bog with scattered immature tamaracks and some willow and bog birch shrubs. Further along the Willow Point alignment, another single individual and several small colonies of 3-5 individuals (13 in total) were observed within another survey plot. The habitat was similarly an open bog dominated by tamaracks and shrubs, where the orchids were found growing on high hummocks of sphagnum moss surrounded by buckbean and Labrador tea.

5.1.6.1.1 Potential Project Effects on Vegetation

Clearing and excavation activities during construction will result in the loss of terrestrial vegetation, but will be limited to the area comprising the channel footprint and other temporary work areas. Along the LMBOC, the loss of existing vegetation will largely be in previously effected (i.e. agricultural) habitats, whereas the LSMOC area is largely comprised of native vegetation communities; the conversion of terrestrial lands into aquatic habitat will result in the growth of aquatic vegetation in the LMBOC and LSMOC channels. In some instances, permanent or semi-permanent wetland habitats may be lost or altered

as a result of Project construction and operation. Along with the loss and alteration of terrestrial vegetative communities during construction, there is potential for loss of rare plants and sensitive sites as well as for the introduction of invasive species. The use of heavy machinery and other vehicles may compact soils and may allow for the establishment of invasive or non-native plant species and hinder revegetation of native species.

During times of channel operation, increased water flows may result in the loss of terrestrial vegetation and mobilization of woody debris within the LMBOC and LSMOC channels.

Potential effects of vegetation loss may be associated with soil erosion and bank destabilization, lost or alteration of fish and wildlife habitat. Further assessment of potential direct and indirect effects to vegetation, as well as the identification of mitigation measures, will be conducted through environmental assessment for the Project. Section 5.2 outlines potential linkages between the Project and vegetation.

5.1.6.2 Mammals

The RAA, which occurs within the Manitoba Lowlands of the Boreal Forest, consists of flat, poorly drained land with forested patches of various deciduous and coniferous tree species, intermixed with swamps, meadows, and arable areas cleared for agriculture (Rowe 1972). Based on this diversity of habitat types, mammal species typical in the area include American marten (*Martes americana*), beaver (*Castor canadensis*), black bear (*Ursus americanus*), coyote (*Canis latrans),* elk (*Cervus canadensis*), ermine (*Mustela erminea*), fisher (*Mustela pennanti*), grey wolf (C*anis lupus*), least chipmunk (*Eutamias minimus*), lynx (*Lynx canadensis*), mink (*Neovison vison*), moose (*Alces alces*), muskrat (*Ondatra zibethicus*), otter (*Lutra canadensis*), red squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), and white-tailed deer (*Odocoileus virginianus*).

Aerial and ground surveys as well as linear density analyses and habitat modelling were conducted for many mammal species in the Lake Manitoba and Lake St. Martin Outlet Channels RAA. The species and sign observed is listed in Appendix C.

5.1.6.2.1 Moose

Moose are distributed across much of forested Canada (Banfield 1974) and are common within many areas of Manitoba, including the RAA. Moose are found particularly in forest, shrub and wetland habitats occupying much of the northern extent of Manitoba and increasingly are more common in the southern prairie region of Manitoba where they were previously absent, including Spruce Woods and Turtle Mountain Provincial Parks. The home range is typically 40 km^2 where moose are associated with riparian habitat, predominantly featuring willow, a key forage species, and other habitats that feature areas of aquatic feeding, coniferous cover, and mineral licks (Gillingham and Parker 2008). Such successional (newly emergent or young growth) vegetation frequently exists after disturbance, both natural (i.e. wildfire) and anthropogenic (i.e. forest removal).

Moose are most commonly found in swampy areas with aquatic plants and willows, which

make up the majority of their diet (Renecker and Schwartz 1998). Cover is critical in winter to reduce snow depths and provide relief from heat stress in the summer. Moose are an integral component of the ecosystem in their predator/prey relationships. Moose population sustainability is a specific concern in several areas of western Manitoba.

Field investigations confirmed the presence of moose in the RAA. Moose aerial surveys, track and sign surveys, linear density analyses, and habitat modelling have been conducted in the RAA. A total of 14 moose were observed within the RAA during the winter 2016 aerial survey. During the spring 2016 ground-based track and sign surveys, there were no sign of moose or moose activity along the LMBOC and two moose tracks observed along the LSMOC.

Summer and winter moose habitat, including suitable food sources and vegetation cover, occurs within the RAA. Habitat models show that summer habitat is present throughout the RAA and LAA, and most winter habitat primarily occurs north and east of the proposed LMBOC.

5.1.6.2.2 Elk

Elk inhabit young coniferous tree stands and dense woodlands as well as meadows and valleys, including plains areas such as those found in the RAA. Elk are commonly found in early successional areas after disturbances such as fires where they find good foraging vegetation (Reid 2006).

A total of 16 elk were observed within the Project RAA during the 2016 winter aerial survey, with most elk located east of the proposed the LMBOC. Models indicate potential elk habitat exists throughout the RAA, primarily in the western and southern sections of the RAA.

5.1.6.2.3 White-tailed deer

White-tailed deer (deer) tend to inhabit both woodland and open areas, which are used for cover and forage (Reid 2006). A total of 628 deer and 3495 tracks were observed within the Project RAA during the 2016 winter aerial survey. Ground surveys in the spring of 2016 found several signs of deer activity along the LMBOC. Deer and deer sign was also observed in the areas of the municipal road, forestry road, and the Lake St. Martin shoreline.

5.1.6.2.4 Black Bears

Black bears are found across most wooded habitats in North America and are relatively common through the northern mixed and eastern deciduous forests (Kolenosky and Strathearn 1987; Reid 2006). Black bear densities are highest in diverse forests at relatively early stages of development and lowest where soils are thinner and plant growth generally poorer (Kolenosky and Strathearn 1987).

Black bears are found in the RAA in some areas, but due to habitat needs, they tend to stay away from the wetter lowland areas and the denser forest stands. During the aerial survey

conducted in October 2015, a large adult black bear was observed in the LSMOC LAA. A bear rub and black bear scat were also observed near the LMBOC during furbearer track and sign surveys conducted in June 2016 (Forester 2017).

5.1.6.2.5 Coyotes

Coyotes are a highly adaptable species found most commonly in mixed habitats versus dense unbroken forests (Reid 2006). Coyotes are found throughout the RAA and primarily feed on small mammals and rodents, as well as scavenging on deer and larger ungulates. Coyotes, when banding together, can also take down these large animals (Caras 1967). Several coyotes and tracks were observed during surveys in the area of the proposed inlet and outlets for LMBOC and within the LMBOC LAA. Coyote observations and tracks were also identified in both the southern and northern portions of the LSMOC LAA.

5.1.6.2.6 Other furbearers

The RAA offers suitable habitat to many furbearers. Beaver and muskrat provide valuable furs and, along with hare, good meat for eating. Ermine, fisher, marten, mink, otter, grey wolf, red fox (*Vulpes vulpes*), and red squirrel are furbearers that are known to be present in the RAA. Ermine habitat includes coniferous or mixedwood forests, fields, areas of dense vegetation and areas near wetlands, and can be found in most of these habitats in Manitoba, including the RAA (Reid 2006).

Both fisher and marten can be found in most of Manitoba with marten being limited to the northwest and eastern parts of the province. They generally inhabit mature coniferous or mixedwood forests and will feed on small mammals such as hares, some birds, fruit, nuts, and carrion (Reid 2006). They also feed on rodents, hares, shrews, and insects.

Mink inhabit areas along streams, lakes, and wooded cover. They can be found throughout Manitoba and will primarily feed on small to medium mammals, crayfish, frogs, snakes, and birds (Reid 2006). Otters can be found in most of central/northern Manitoba and within the RAA near or in lakes, streams, rivers, or swamps. They feed on fish, frogs, crayfish, and shellfish (Reid 2006).

There are several species of small mammals that can be considered to be within or at the edge of their natural range. These include the least weasel (*Mustela nivalis*), masked shrew (*Sorex cinereus*), meadow jumping mouse (*Zapus hudsonius*), northern bog lemming (*Synaptomys borealis*), plains pocket gopher (*Geomys bursarius*), pygmy shrew (*Sorex hoyi*), raccoon (*Procyon lotor*), short-tailed shrew (*Blarina brevicauda*), striped skunk (*Mephitis mephitis*), and woodchuck (*Marmota monax*).

The 2016 winter aerial multispecies survey identified the presence and/or sign of beaver, marten, otter (*Lontra canadensis*), hare (*Lepus americanus*) and lynx (*Lynx canadensis*) within the RAA. Three wolves were also observed in the RAA during the 2016 winter aerial multispecies survey, and another was observed in the same area in the spring of 2016.

Although beaver activity was noted in the RAA, none was documented near to the LMBOC. Marten tracks were identified in abundance throughout the RAA, but there was no marten activity identified within the LMBOC LAA. Otter activity was identified in Lake Manitoba near the Fairford River, and in the LSM the area of the proposed outlet for LMBOC. Hare activity within the LMBOC LAA was limited to an area east of the proposed outlet for LMBOC and no lynx activity was identified within the LMBOC LAA.

Within the LSMOC LAA, beaver activity was identified in abundance. Marten tracks were also identified in abundance throughout the LAA, except for the most southern portion of the area along the municipal road. Otter activity was identified most prominently in the northern portion of the LAA, and hare activity was identified in abundance throughout the LAA. Three lynx were observed during the 2016 winter aerial multispecies survey. Documented lynx activity appeared correlated to documented hare activity, which covered a majority of the LAA. Coyote observations and tracks were also identified in both the southern and northern portions of the LAA.

Furbearer track and sign surveys were conducted on foot in the RAA in June 2016. Wildlife observations within the LAA for the LMBOC include a coyote and sign (tracks and vocalization), a muskrat and muskrat lodge, a beaver lodge (on the Lake Manitoba shoreline north of the proposed LMBOC inlet), as well as wolf scat. .

Within the LSMOC LAA, the furbearer track and sign surveys conducted on foot in June 2016 found several signs of furbearer activity and presence, as well as several signs of predators. Furbearer observations included: beaver dams, houses, lodges, rubs, shore dens and tracks; coyote, deer, red fox, and raccoon tracks; a muskrat den and lodge; raccoon and otter scat, and an otter shore den. The majority of the furbearer activity was observed in the area of Reach 3, as well as in the area the LSM shoreline. Predator observations included a number of wolf and bear tracks, located on the Reach 3 channel and in the area of Reach 3, and one observation of bear activity at the LSM shoreline.

5.1.6.2.7 Bats

There are six species of bats that may occur within the RAA. These include the: big brown bat (*Eptesicus fuscus*), eastern-red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (or little brown myotis; *Myotis lucifugus*), northern bat (or northern myotis; *Myotis septentionalis*), and silver-haired bat (*Lasionycteris noctivagans*). The eastern-red, hoary and silver-haired bat species migrate south for the winter, while the big brown, little brown and northern bat species overwinter in hibernacula such as caves.

The little brown bat and northern bat are listed as Endangered on Schedule 1 of SARA and the Manitoba Endangered Species and Ecosystem Act (MBESEA) (SARA 2017; MSD No Date). SARA currently has a proposed Recovery Strategy for the little brown bat and northern bat, with three Critical Habitat areas for these species identified in the Interlake area of Manitoba (Norquay et al. 2013). Further information is provided in the Species of Conservation Concern section below.

The spring 2016 and summer 2016 ground surveys identified potential areas of previously and/or currently active bat hibernacula near the existing LSMOC access road. To further determine the presence/absence and species of bats within the LAA, an Acoustic Recording Unit (ARU) was deployed along the existing LSMOC access road in 2016 during the months of August, September, and October. Four bat species were identified from this study: big brown bat, hoary bat, little brown bat and silver-haired bat. The acoustic data collected from September 26, 2016 to October 17, 2016 included a small number of recordings that also indicated the potential presence of the northern bat.

To determine if there were any areas being used by bats for hibernation, further investigations were conducted in March and April of 2017. These investigations included a forward looking infra-red (FLIR) aerial study to locate potential heat signatures or 'hotspots' on the landscape that could indicate the presence of hibernacula, followed by pedestrian searches of the hotspot areas. The FLIR survey was flown using systematic aerial transects spaced 200 m apart and at heights of 300 to 800 feet above ground level to provide total ground coverage of the survey area. There were 16 hotspot locations identified during the FLIR aerial survey that were investigated by pedestrian surveys. Pedestrian ground-truthing surveys employed a search area buffer of 250 m around the documented hotspot and entailed walking transects at 10 m spacing for total area coverage. The pedestrian investigations determined that the hotspot locations identified during the winter aerial FLIR survey were false positives. Further ground-based investigation was also conducted of the potential hibernaculum that was identified during the 2016 baseline field studies; this investigation showed that the area was not being actively used by bats. As such, the bat Species at Risk field studies conducted during March and April of 2017 did not identify the presence of active bat hibernacula within the LAA (EcoLogic 2017).

5.1.6.2.8 Potential Project Effects on Mammals

Potential Project-related effects to wildlife populations include: habitat loss, alteration and fragmentation, sensory disturbance, increases in vehicular collisions, and increased predation pressure (Section 5.2). Indirect impacts of these effects may extend to a number of other biophysical and socio-economic receptors including vegetation, and hunting. Further assessment of these effects and identification of mitigation strategies will be conducted through environmental assessment for the Project.

5.1.6.3 Birds

The Mid Boreal and Interlake Plain Ecoregions provide considerable wetland habitat for various migratory waterbirds such as ducks, geese, American white pelican (*Pelecanus erythrorhynchos*) and double-crested cormorants (*Phalacrocorax auritus*) as well as diverse habitats which support raptors, shorebirds and songbirds (Smith et al 1998).

Key bird species of interest in the LAA and RAA were identified through review of information from the Manitoba Breeding Bird Atlas (MBBA 2015), Manitoba Conservation Data Centre (MBCDC 2016a, b), Manitoba Sustainable Development (MSD 2016),

Important Bird Areas of Canada (IBA 2015) and the federal *Species at Risk Ac*t (SARA 2015). This information was used to assist in bird survey design and key species habitat analysis.

Species of concern observed in the Project region include trumpeter swan (*Cygnus buccinator*) (S1B) and short-eared owl (*Asio flammeus*) (S2S3B). Some other species that may potentially occur in the Project region but which were not observed during field studies include the least bittern (*Ixobrychus exilis*) (endangered under MBESEA, threatened under SARA and COSEWIC, and S2B under MBCDC), the piping plover (*Charadrius melodus*) (endangered under SARA and COSEWIC, and S1B under MBCDC) and great egret (*Ardea alba*) (S2S3B under MBCDC).

Bird presence and activity in the RAA was examined during baseline studies through a combination of aerial nest and rookery surveys, shoreline aerial and pedestrian surveys, pedestrian nest search surveys, and point count surveys. Field surveys were conducted in the early morning, during the daylight hours, at dusk, and in the evening to capture the range of periods when different bird species may be active or vocalizing.

A total of 92 bird species were documented during baseline studies. Most common songbirds identified in the RAA include red-winged blackbird (*Agelaius phoeniceus*), common raven (*Corvus corax*), killdeer (*Charadrius vociferus*), brown-headed cowbird (*Molothrus ater*) and American robin (*Turdus migratorius*). Most common waterbirds in the RAA include Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), double-crested cormorant, common tern (*Sterna hirundo*) and American white pelican. The most common raptors included bald eagle (*Haliaeetus leucocephalus*) and Swainson's hawk (*Buteo swainsoni*; Forester 2017). A complete listing of bird species documented within the Project region during baseline studies, as well as by the Manitoba Breeding Bird Atlas, is provided in Appendix C.

5.1.6.3.1 Potential Project Effects on Birds

Potential direct and indirect effects to migratory and resident birds that may result from construction, operation and maintenance activities include: habitat loss, alteration or fragmentation; sensory disturbance; increased mortality due to vehicle collisions and increased predation (Section 5.2). Indirect impacts of these effects may extend to a number of other biophysical and socio-economic receptors including vegetation and hunting. Further assessment of these effects and identification of mitigation strategies will be conducted through environmental assessment for the proposed Project.

5.1.6.4 Amphibians and Reptiles

The RAA provides habitat for a number of herptile (i.e., reptile and amphibian) species. The red-sided garter snake (*Thamnophis sirtalis parietalis*) has the northernmost distribution of any species of snake in North America and, along with the smooth green snake (*Liochlorophis vernalis)* and the western plains garter snake (*Thamnophis radix haydenii*),

are the only snake species known to inhabit this area (Cook 1984; Conant and Collins 1991; Nature North 2014; Preston 1982). The red-sided garter snake prefers mesic woodlands where they can be often found at the margins of ponds (Preston 1982). They often hibernate within crevices in upland areas. The range of the red-sided garter snake extends throughout much of the RAA (Conant and Collins 1991). The limestone and dolomite found within the LAA is characterized by crevices and cavernous formations that can provide suitable habitat for snake hibernacula.

The species of frogs and toads that may occur within the area include: boreal chorus frog (*Pseudacris triseriata maculata*), Canadian toad (*Anaxyrus hemiophrys*), grey tree frog (*Hyla versicolor*), northern leopard frog (*Lithobates pipiens*), and wood frog (*Lithobates sylvatica*) (Conant and Collins 1991). With the exception of the northern leopard frog, these species generally require shallow ponds and puddles for breeding and moist environments in shrubby and wooded areas for the rest of the year. The northern leopard frog requires several habitat types to meet its needs throughout the year, using different sites for overwintering, breeding, and foraging. The overwintering sites for northern leopard frogs need to be well-oxygenated bodies of water that do not freeze to the bottom (SARA 2017). A typical breeding pond is 30 to 60 m in diameter and 1.5 to 2.0 m deep, located in an open area with abundant vegetation and no fish (SARA 2017). The eastern tiger salamander (*Ambystoma tigrinum*) and the blue-spotted salamander (*Ambystoma laterale)* are two other amphibian species also found within the RAA (MBCDC 2016a, b).

Reptile and amphibian presence and activity in the RAA was examined through incidental observations, point count surveys and hibernacula investigations, as well as during all pedestrian early morning, daytime, dusk, and evening field work activities. Within the LMBOC LAA, there were observations and vocalizations of three amphibian species: boreal chorus frog, northern leopard frog and wood frog; and observation of one reptile species, the red-sided garter snake. The northern leopard frog is currently listed as a species of Special Concern on Schedule 1 of SARA.

Within the LSMOC LAA, there were observations and vocalizations of three amphibian species: boreal chorus frog, grey tree frog and wood frog; and observation of one reptile species, the red-sided garter snake. During winter 2016 aerial surveys, there were areas of limestone depressions and sinkholes identified that were investigated on foot during the spring, summer and fall of 2016. Two of these areas were identified as potential snake hibernacula, and the red-sided garter snake noted above was observed near one of the potential snake hibernaculum.

5.1.6.4.1 Potential Project Effects on Amphibians and Reptiles

Potential effects to amphibians and reptiles associated with construction, operation and maintenance activities for the Project may include loss or alteration of habitat, sensory disturbance and increased mortality (Section 5.2). Further assessment of these effects and identification of mitigation strategies will be conducted through environmental assessment for the proposed Project.

5.1.6.5 Species of Conservation Concern

5.1.6.5.1 Flora

Based on the desktop review, there are seven vascular plant Species at Risk that occur in the Interlake Plain Ecoregion and none in the Mid-Boreal Lowland Ecoregion. However, no plant listed under MBESEA, SARA, or that having a special designation by COSEWIC are known or expected to occur in the RAA (MSD 2016; SARA 2017). The small white lady's-slipper (*Cypripedium candidum*) and the rough agalinis (*Agalinis aspera*), are both listed federally and provincially as Endangered, and have known distributions 100 km south of the RAA, close to St. Laurent, MB (MSD 2016; EC 2015). Based on the grassland, prairies and wet meadows habitat requirements of these species, there is an extremely low probability of these species' occurrence in the RAA (MSD 2016; EC 2015).

There were no federally or provincially listed species observed during the 2016 vegetation surveys. One species listed by the MBCDC as a species of conservation concern was identified at several locations along the LSMOC, the dragon's mouth orchid, which is considered rare throughout its range or in the province (6 to 20 occurrences) and may be vulnerable to extirpation. This species was found at several locations along the Willow Point within open sphagnum bogs. The habitats in which the dragon's mouth orchids were found are common habitat types throughout the LAA for the LSMOC.

One sphagnum bog habitat observed along the LMBOC could provide habitat for rare orchids (e.g. ram's-head lady-slipper), though none were observed. The rocky coastal habitat along the LMBOC alignment has a similar habitat to the shoreline at the town of Steeprock, where historic observations of long-fruited parsley (*Lomatium macrocarpum*) and hairy-fruited parsley (*Lomatium foeniculaceum*) were made. However, neither of these species were found during the 2016 spring and summer surveys.

5.1.6.5.2 Fauna

For the purpose of baseline studies, all species that are listed federally and provincially, or having a designation of S1 or S2 by the MBCDC were considered to be of conservation concern. A number of mammal, bird and herptile Species at Risk were identified during the wildlife studies.

During the fall 2015, an acoustic recording unit captured recordings of the little brown bat (*Myotis lucifugus*) and the northern bat (*Myotis septentrionalis*). Both of these bat species are listed under Schedule 1 of SARA and MBESEA as Endangered. In order to confirm their presence, additional investigations were conducted in areas of potential habitat. The FLIR survey flown in March 2017 and the follow-up pedestrian ground-truthing ruled out all potential sites as bat hibernacula.

A number of bird species assessed by COSEWIC, listed by SARA, and/or MBESEA or ranked by the MBCDC have ranges that overlap with the RAA (MBBA 2015; MSD 2015a; SARA 2015). Those documented as part of baseline studies and confirmed to be present

within the RAA included bank swallow, barn swallow, bobolink, common nighthawk, red-headed woodpecker and short-eared owl. Along the LSMEOC, the bird species at risk (SAR) confirmed to be present included bank swallow, common nighthawk, and trumpeter swan. American white pelican and Caspian tern were observed along the Lake St. Martin shoreline. Information on presence of SAR and Species of Conservation Concern (SOCC) within the Project is presented in Table 10.

Northern leopard frogs were observed within the proposed LMBOC. These were the only herptile SAR observed or heard during the field studies. A listing of herptile species potentially present in the RAA and their conservation rankings is presented in Table 11.

Table 10. Bird Species at Risk Observed in the Project Region

Common Name	Scientific Name	MBESEA Status	COSEWIC Status	SARA Schedule	SARA Status	Confirmed Presence
Trumpeter Swan	*Cygnus buccinator*	Endangered	N/A	N/A	N/A	Yes
Bank Swallow	*Riperia riparia*	N/A	Threatened	Schedule 1	Threatened	Yes
Barn Swallow	*Hirundo rustica*	N/A	Threatened	Schedule 1	Threatened	Yes
Bobolink	*Dolichonyx oryzivorus*	N/A	Threatened	Schedule 1	Threatened	Yes
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Schedule 2	Threatened	Yes
Red Headed Woodpecker	*Melanerpes erythroceph-alus*	Threatened	Threatened	Schedule 1	Threatened	Yes
Short Eared Owl	*Asio flammeus*	Threatened	Special Concern	Schedule 1	Special Concern	Yes

Table 11. Summary of Amphibian Species at Risk or of Conservation Concern with Confirmed Presence in the Regional Assessment Area

Common Name	MBESEA Status	COSEWIC Status	SARA Schedule	SARA Status	Confirmed Presence	Observed Location
Northern leopard frog	N/A	Special Concern	Schedule 1	Special Concern	Yes	RAA

5.1.6.5.3 Potential Project Effects on SAR

Project-related activities that have the potential to impact or influence species of conservation concern during Project construction, operation and maintenance include: quarrying, vegetation clearing, increased traffic, and accidental spills or malfunctions (Section 5.2). These activities have potential to result in sensory disturbance, temporary or permanent displacement, loss or alteration of habitat and increased mortality. Further assessment of potential direct and indirect effects and identification of mitigation strategies will be conducted through environmental assessment for the proposed Project.

5.2 Potential Changes in the Environment

A preliminary evaluation of potential interactions between the Project and various receptors of the biophysical and socio-economic environment, including those identified in section 5 of CEAA 2012, are provided in Tables 12 and 13. Interactions identified in these tables have a reasonable likelihood of occurrence and will undergo further assessment in the EIS. Interactions have been identified for the construction, operation, maintenance and non-operation (post-construction period when channels are not in use) phases of the Project. Detailed Project-related effects assessment and cumulative effects assessment (CEA), as well as the development and identification of mitigation strategies will be conducted through the environmental assessment process for the proposed Project.

5.3 Potential Changes on Federal and Adjacent Lands

The physical works of the proposed Project are not located on federal lands, and any potential adverse effects on federal lands will be indirect. First Nations located in proximity to Lake St. Martin and Dauphin River (Map 1) will experience change in water levels and reduction in flooding potential. This will benefit communities and community members by alleviating future flooding risks.

The Project is not expected to influence current inflows from Saskatchewan or the United States or outflows into Lake Winnipeg. Water and lands in other adjacent jurisdictions, such as Ontario and Nunavut, are not anticipated to be affected by the Project. There are currently no anticipated measurable effects on other federal lands or any transboundary effects. The EIS will further evaluate and assess the nature and extent of potential effects on federal and adjacent lands.

5.4 Potential Effects on Indigenous Peoples of Changes to the Environment

Potential effects of the Project to Indigenous peoples are primarily related to changes in: health and socio-economic conditions, physical and cultural heritage, current use of lands and resources for traditional purposes, and sites of importance (Table 13). For example, the Project will reduce flooding potential for First Nations on Lake St. Martin. Several Indigenous communities on Lake St. Martin have been displaced by past flooding events. Reduced flood frequency and intensity, and the resulting changes to the environment may prove beneficial to Indigenous communities by reducing the potential for damages to housing and infrastructure, as well as permitting continued traditional land uses.

Table 12. Potential Key Direct Interactions between the Project and the Environment

Project Component	Project Phase	Receptor									
		Climate, Noise and Air Quality	Geology and Soils	Groundwater	Surface Water	Fish and Fish Habitat	Vegetation	Mammals	Birds	Amphibians and Reptiles	Species at Risk
LMBOC Channel, Inlet and Outlet	Construction	✦	✦	✦	✦	✦	✦	✦	✦	✦	✦
	Operation		✦	✦	✦	✦	✦	✦	✦	✦	✦
	Maintenance	✦			✦	✦	✦	✦	✦	✦	✦
	Non-Operation			✦	✦	✦	✦	✦	✦	✦	✦
LMBOC Water Control Structure	Construction	✦					✦	✦	✦	✦	✦
	Operation	✦									
	Maintenance	✦									
LSMOC Channel, Inlet, Outlet and Drop Structures	Construction	✦	✦	✦	✦	✦	✦	✦	✦	✦	✦
	Operation		✦		✦	✦	✦	✦	✦	✦	✦
	Maintenance	✦			✦	✦	✦	✦	✦	✦	✦
	Non-Operation				✦	✦	✦	✦	✦	✦	✦
LSMOC Water Control Structure	Construction	✦	✦				✦	✦	✦	✦	✦
	Operation	✦									
	Maintenance	✦									
Bridges and culverts	Construction	✦			✦	✦	✦	✦	✦	✦	✦
	Operation				✦	✦		✦	✦	✦	✦
	Maintenance	✦			✦	✦		✦	✦	✦	✦
PR 239 and Municipal Road Re-Alignments	Construction	✦	✦	✦	✦	✦	✦	✦	✦	✦	✦
	Operation	✦		✦	✦	✦	✦	✦	✦	✦	✦
	Maintenance	✦	✦		✦	✦	✦	✦	✦	✦	✦

Project Component	Project Phase	Receptor									
		Climate, Noise and Air Quality	Geology and Soils	Groundwater	Surface Water	Fish and Fish Habitat	Vegetation	Mammals	Birds	Amphibians and Reptiles	Species at Risk
Temporary Construction Camps, and Staging Areas	Construction*	✦	✦		✦		✦	✦	✦	✦	
	Operation**										
	Maintenance**										
Quarries	Construction	✦	✦	✦	✦		✦	✦	✦	✦	
	Operation	✦	✦	✦	✦		✦	✦	✦	✦	
	Maintenance	✦	✦	✦	✦		✦	✦	✦	✦	
Distribution Line	Construction	✦	✦	✦	✦	✦	✦	✦	✦	✦	✦
	Operation						✦	✦	✦	✦	✦
	Maintenance	✦					✦	✦	✦	✦	✦

✦Potential interaction; Blank cell: No anticipated interaction

*Includes mobilization, demobilization and rehabilitation of temporary sites that are only required during the Project's construction phase

**Temporary Construction Camps and Staging Areas will be decommissioned after construction and are therefore not required in the Maintenance and Operation phases

The following terms are used in the table as defined in, and in accordance with section 5(1)(a) of CEAA 2012, as:

- *Fish and Fish Habitat* as per the definition in section 2(1) of the Fisheries Act
- *Species at Risk* as per the definition in section 2(1) of the Species at Risk Act
- *Birds* includes *Migratory Birds* as defined in section 2(1) of the Migratory Birds Convention Act, 1994

Table 13. Potential Key Direct interactions between the Project and Indigenous peoples.

Project Component	Project Phase	Health and Socio-Economic Conditions	Physical and Cultural Heritage	Current use of Lands and Resources for Traditional Purposes	Sites of Importance
LMBOC Channel, Inlet and Outlet	Construction	✦	✦	✦	✦
	Operation	✦	✦	✦	✦
	Maintenance	✦		✦	
	Non-Operation				
LMBOC Water Control Structure	Construction	✦	✦		
	Operation	✦	✦	✦	✦
	Maintenance	✦			
LSMOC Channel, Inlet, Outlet and Drop Structures	Construction	✦	✦	✦	✦
	Operation	✦	✦	✦	✦
	Maintenance	✦		✦	
	Non-Operation				
LSMOC Water Control Structure	Construction	✦	✦		
	Operation	✦	✦	✦	✦
	Maintenance	✦			
Bridges and culverts	Construction	✦	✦	✦	
	Operation				
	Maintenance	✦			
PR 239 and Municipal Road Re-Alignments	Construction	✦	✦	✦	
	Operation				
	Maintenance	✦			
Temporary Construction Camps, and Staging Areas	Construction*	✦	✦	✦	✦
	Operation**				
	Maintenance**				
Quarries	Construction	✦	✦	✦	✦
	Operation			✦	
	Maintenance	✦			
Distribution Line	Construction	✦	✦	✦	
	Operation			✦	
	Maintenance	✦		✦	

✦Potential interaction; Blank cell: No anticipated interaction

*Includes mobilization, demobilization and rehabilitation of temporary sites that are only required during the Project's construction phase

**Temporary Construction Camps and Staging Areas will be decommissioned after construction and are therefore not required in the Maintenance and Operation phases

Table 13 identifies currently understood potential interactions between the Project and Indigenous peoples relative to section 5(1)(c) of CEAA 2012. All potential interactions will be fully considered in the environmental assessment. Furthermore, MI will engage and work with Indigenous communities to further identify potential effects of the Project and to identify potential avoidance or mitigation measures.

6 INDIGENOUS ENGAGEMENT AND CONSULTATION

Initial engagement with Indigenous communities on the LMB & LSM OC Project began following the 2011 flood. Discussions at that time were focussed around a number of studies commissioned by the province, including the Lake Manitoba and Lake St. Martin Regulation Review Committee, the 2011 Flood Review Task Force. The outcome of these discussions included the identification that new flood protection infrastructure was required.

Consultation and engagement responsibilities for the proposed LMB & LSM OC Project have been segregated within the Project Team. The Project Team is composed of dedicated engineering, environmental, administrative and consultation units. The engineering and environmental units will engage Indigenous communities with regard to considering the identification, incorporation and resolution of concerns, as well as mitigation opportunities for Project planning, design, construction, maintenance and operation.

Consultation and engagement plans for the proposed Project are in the process of being prepared. As noted above, the Indigenous and Public Engagement Program (IPEP) will be led by MI's Project Team consultation unit, while the Crown consultation process will be led by the Province of Manitoba's Indigenous and Northern Relations (INR) department. Working with the Interlake Reserves Tribal Council (IRTC) MI and INR are in the process of finalizing consultation agreements for 6 First Nations communities within the Interlake Region. Other Indigenous communities who have an interest in the proposed Project are currently at various states of engagement and consultation processes.

Preliminary scoping completed by MI has tentatively identified 12 communities that may be affected by the LMB & LSM OC Project. The extent of potential effects on Aboriginal and Treaty rights will assist in determining the scope and scale of engagement and consultation.

Introductory informational letters were sent to the identified communities in July and August of 2015 (Appendix D). The introductory letter resulted in a number of initial meetings with First Nations and Indigenous Groups. A summary of the engagement and consultation activities to date can be found in Appendix D.

6.1 Interested and Potentially Affected Indigenous Groups

Currently, there are potentially twelve Indigenous groups and communities that have been identified as potentially being affected by the LMB & LSM OC Project.

6.1.1 First Nations

First Nations with an interest in, and who may be directly affected by, the proposed Project are:

- Pinaymootang First Nation
- Dauphin River First Nation
- Little Saskatchewan First Nation
- Lake St. Martin First Nation
- Peguis First Nation

Pinaymootang, Dauphin River, Little Saskatchewan, Lake St. Martin are all signatories to Treaty 2 and have the rights to hunt and trap and exercise their Aboriginal and Treaty rights throughout the RAA. Peguis FN is a signatory to Treaty 1 but its Community Interest Zone is located in in Treaty 2 territory.

First Nations with an interest in, and who may be indirectly affected by, the proposed Project are:

- Fisher River Cree Nation
- O-Chi-Chak-Ko-Sipi First Nation
- Ebb and Flow First Nation
- Kinonjeoshtegon First Nation
- Lake Manitoba First Nation

6.1.2 Indigenous Groups

6.1.2.1 Manitoba Metis Federation

In 2012, the Manitoba Metis Federation (MMF) partnered with the Province of Manitoba to recognize Métis rights to harvest natural resources for food and domestic use in Manitoba. An agreement was reached on Métis harvesting rights in mutually agreed-to regions of the province. The proposed LMBOC is located within the recognized harvest zone, but the LSMOC is not.

The MMF, however, asserts that their community exercises their rights in areas outside of the recognized area. Discussions continue between the MMF and the provincial government in this regard.

6.1.2.2 Dauphin River Indigenous Relations Community

The community of Dauphin River is located adjacent to the Dauphin River and Dauphin River First Nation and has participated in discussions and engagement activities regarding the previous operations of the Lake St. Martin emergency channel in 2011 and 2014 and the current discussions on the interim operating authorization for the emergency channel.

6.2 Engagement and Consultation Activities with Indigenous Groups

The purpose of the IPEP and consultation activities is to provide meaningful opportunities for potentially affected people to receive information about the proposed Project, provide the opportunity to share information about the Project and to hear and understand concerns and comments from these communities about the proposed channel and how and where it could affect Aboriginal and Treaty rights.

The overall IPEP includes meetings with affected First Nation communities, and the MMF. Meetings held to date have been in the directly affected communities when possible. In some situations, the communities that are still displaced from the 2011 flood, meetings were held in the temporary offices in Winnipeg.

In the summer of 2011, the Government of Manitoba began engagement with the most affected Indigenous groups regarding the LSMEOC. Discussions continued in 2014 and are ongoing in 2017. In 2014, the provincial government informed communities that permanent outlet channels for Lake Manitoba and Lake St. Martin were being considered as an infrastructure project to allow for better management of lake levels on Lake Manitoba and Lake St. Martin. The decision to proceed with the permanent outlet channel project followed the completion of the Lake Manitoba and Lake St. Martin Regulation Review, the Manitoba 2011 Flood Review Task Force and the Assiniboine and Lake Manitoba Basin Flood Mitigation Study.

MI completed an initial assessment of potential effects and identified the desire to engage with 12 of approximately 30 different communities. Since that time, letters were forwarded to communities introducing the decision to construct flood channels and offering the opportunity to meet and discuss impacts resulting from this crown decision. Additional attempts to contact the communities were made largely through phone calls and emails.

Recent meetings with the Interlake Reserves Tribal Council (IRTC) have identified the desire for the IRTC to lead their membership in the engagement and consultation processes. A consultation framework and budget are in development. IRTC membership includes Dauphin River First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First nation, Kinonjeoshtegon First Nation and Lake Manitoba First Nation. A resource mapping exercise will be used to collect TK to assisting the environmental assessment process.

Although the engagement and consultation processes are in the early stages, engagement

has occurred with a number of communities as identified in the summary table of engagement activities (Appendix D). Communities have identified concerns related to effects of channel development with respect to their traditional areas; their rights based activities as well as commercial activities through these processes and the previous engagements in 2011 and 2014. The list below provides an overview of some of the concerns provided by Indigenous groups through these consultation efforts:

Economic

- Commercial fishing compensation packages were inadequate and new compensation must be better
- Outstanding compensation from the operation of the emergency channel has not been resolved
- Compensation for loss of income, equipment, and hardship as a result of operating the channel needs to continue if there are losses to our commercial fisheries
- Commercial fishing on Lake St. Martin is poor and production is down since the channel was built
- Loss of commercial fishing licences
- Commercial fishing on Lake St. Martin is slow and there is a need for economic benefits for the community from the permanent channel project
- Exiting Reach 3 into Johnson Beach will adversely affect the commercial fishers
- Concerns about the buying back of commercial quotas by the government
- The operation of the Fairford Water Control Structure has resulted in the loss of former agricultural cattle operations with the loss of hay lands due to flooding
- Economic benefits should come to the First Nations as they were the most affected by the previous floods (specific to road construction at this time)
- Operation of the emergency channel increased debris in Lake Winnipeg and causes damage to commercial fishing equipment

Environmental

- Bear Creek on the south east side of Lake St. Martin is an important spawning grounds and it could be affected
- River flows in Dauphin River and Buffalo Creek will affect whitefish movement and spawning in Lake St. Martin
- Operation of the emergency channel had an effect on the spawning areas at the

mouth of the Dauphin River

- Operation of the channel has an effect on the spawning grounds on Lake St. Martin.
- Channels and structures have changed the species composition of Lake St. Martin with a reduction in the preferred species of pickerel to carp
- Whitefish stocks on Lake St. Martin will be affected as were the whitefish spawning areas.
- Spawning areas at Johnson Beach would be affected if water is discharged into that area from Reach 3 option
- Operation of Reach 1 resulted in fish stranding and a fish kill
- Fish that travel down Buffalo Creek will become stranded in the channel and Big Buffalo Lake and marsh
- Construction of the permanent outlet channel will result in fish stranding when in use
- Concerns regarding the movement of fish between Lake Manitoba and Dauphin River
- Buffalo Creek as the outlet for the emergency channel will increase debris in Dauphin River and Lake Winnipeg
- Discharge through Big Buffalo Marsh and down Buffalo Creek will affect water quality in Dauphin River
- Channel will cut off creeks and affect the natural process within Buffalo Lake Bog
- Dauphin River is at receiving end of all the water which affects fishers, water quality, increases shoreline erosion
- Lake Winnipeg water level change affects our shoreline and erosion increases
- Construction of new channels will increase sediments and silt into LSM and Lake Winnipeg
- Permanent channels will increase levels of Lake Winnipeg and bring water from Lake Manitoba into Lake Winnipeg
- There are concerns that water quality of Lake Winnipeg has changed over time with more sediments, increased turbidity, blue green algae, and invasive species. Additional channel projects will make this worse. These effects affect water supply for Norway House Cree Nation.
- Introduction of invasive species with the operation of the channel

- Norway House Cree Nation will be receiving the water from the permanent channel project and everything that is contained in that water
- Concerns with respect to effects of frazil ice formation at Dauphin River
- Emergency channel will result in silting up the mouth of the Dauphin River which will affect ice jamming
- The cumulative effect of the provincial flood infrastructure with specific reference to the effects of the operation of the Fairford River Control Structure and Portage Diversion has on Lake St. Martin
- The narrows on Lake St. Martin will be a restriction for flows and will result in flooding on Lake St. Martin with these channels
- There are concerns this Project may be related to the Lake Winnipeg water level regulation process and that Manitoba Hydro may be involved
- Water level fluctuations on Lake St. Martin have affected the fisheries

Cultural

- How will access be controlled on the new road, Lake St. Martin First Nation members hunt in that area?
- Proposed permanent channels are in Peguis First Nation traditional hunting area. These areas were flooded in 2011 by the first channel construction
- Operation of the emergency channel affected Lake St. Martin First Nation members from hunting and trapping in Big Buffalo Lake Bog
- Loss of wildlife due to flooding and channels
- Traditional fishing on Lake St. Martin and Dauphin River will be affected
- Sustenance fishing has been affected by the effects to Lake St. Martin
- Flooding of Lake St. Martin has resulted in adverse effects to the harvesting of medicinal plants and herbs
- New permanent channel will cause more damage to our traditional territories and affect our ability to use the area

Community

- Lack of First Nation participation in the work being conducted by consultants
- Involve First Nations in the work that consultants do to provide training to First Nation members

- Engage local First Nation trappers, hunters, fishers, gatherers in your process as they know the land and can provide valuable information
- Effects on fish that are consumed because of all the material being added into the lake and creek
- The negative effect on the community's way of life has affected members' health
- Permanent channel location Option C is in same area as Pinaymootang First Nation is considering purchasing more lands to be added to the reserve
- Unresolved mitigation on the effects of the Fairford River Water Control Structure on Pinaymootang First Nation
- Chief and council have funding shortfall to attend meetings with government
- Does consultation process and budget have funds to hire expertise to consider the reports provided

MI has not formally responded to the above listed concerns but is currently in process of initiating such discourse with communities. Comments and concerns raised by Indigenous communities and responses provided by MI as part of consultation and engagement activities will be documented and addressed through the environmental assessment.

6.3 Next steps in engagement and information gathering

MI will continue to engage with Indigenous peoples regarding development of consultation plans and TK studies. MI will thereby obtain a thorough understanding of the interest of people and communities potentially affected by the proposed Project. These processes will provide ways to minimize potential adverse effects and enhance positive effects where possible. Accommodation for potential adverse Project effects may include: operating guidelines for the channel, detailed design, regulatory methods through the environmental licensing process, and or compensation processes.

Once MI has made the determination the communities have provided all the information they want or they if have chosen not to consult, an internal report on what was heard and what accommodation measures could be applied will be completed. MI will undertake external communications with each First Nation, Metis or other Indigenous communities who participated in the engagement and consultation processes. MI will address the government decisions and any measures to be undertaken to mitigate potential adverse effects on the exercise of Aboriginal and Treaty rights. The communication will convey all the concerns heard from the community, how the community input was incorporated into the decision and how community concerns were or will be addressed or accommodated.

Notices have been sent out to Indigenous communities advising them of the recently launched project website and inviting them to provide comment through the project email.

7 INDIGENOUS AND PUBLIC ENGAGEMENT PROGRAM

Similar to engagement with Indigenous communities and groups, engagement and consultation initiatives with the public and other parties was first initiated following the 2011 flood. Discussions at that time were focussed around a number of studies commissioned by the province, including the Lake Manitoba and Lake St. Martin Regulation Review Committee, and the 2011 Flood Review Task Force. The outcome of these discussions included the identification that new flood protection infrastructure was required.

MI has begun providing opportunities for input on the LMB & LSM OC Project for the public and other parties. To date, these have targeted potentially affected landowners, RMs, and other jurisdictions. Table 14 provides a summary of public engagement that has occurred to date.

Table 14. Summary of Engagement with the Public and Other Parties

Stakeholder	Activity
Landowners, including: agricultural producers and cottage owners	• Individual meetings with potentially affected landowners • Information sessions
Rural Municipalities, including the RM of Grahamdale	• Information session
Others, including: industry stakeholders, recreational land users, First Nations, landowners and the general public	• Information session – Moosehorn, MB. May and June 2017 • Information session – Winnipeg, MB. July 2017

In addition to the meetings and sessions listed above, MI has developed a Project-specific website (https://www.gov.mb.ca/mit/wms/lmblsmoutlets/index.html) where information on the Project is being made available and regularly updated. Boards produced for open houses and information sessions are to be posted to the website for public consumption (Appendix E). Furthermore, the Project website also provides opportunities for continued public input on the proposed Project via email.

7.1 Overview of comments and concerns from the public and other parties

Comments/questions received during the May 29, 2017 landowner meeting are summarized below:

- Why is the emergency channel (LSMEOC) not being opened?
- Environmental concerns are a large concern with this project. Why is it not a concern that the channel will be changing the watershed that impacts the mud lakes or the drains that run into the project, like the Woodale Drain near Hilbre? This is fish spawning habitat.
- What are the effects on the RM? What is the reduction in tax base? How do you account for the loss of spending and gratuities and how does the RM get compensated for this?
- Capital gains on the sale of land is a big concern. How do individuals deal with this? Land values have been dropping due to continual flooding. How will landowners be fairly compensated?
- What are the effects to Watchorn Bay? Will the channel need to be cleaned out due to silting, and if so, how much will it cost? There are many sandbars here, and they move around a lot. How will this affect the inlet?
- Landowners are upset that environmental considerations seem to have a higher rank than agricultural considerations

Questionnaires were developed for the June 29, 2017 information session and the July 13, 2017 public open house in order to document public commentary and concerns regarding the LMB & LMS OC Project. The information session and public open house were attended by a total of 217 people, with 49 filling out questionnaires. The questionnaires allowed respondents to select multiple answers to questions, so summary results below may not add up to 100%.

Of those who responded to the questionnaire, over 81% expressed support of the overall project concept, while only 49% expressed support for the proposed operating guidelines, and only 39% expressed support for the proposed relocation of PR 239. Of the 49 questionnaire respondents, the majority (67%) identified one of their primary land uses as farming and/or residential, followed by recreational land use (31%). When looking at these primary land use groups alone, support of the overall project remains strong at 78%, while support for the proposed operating guidelines and realignment of PR 239 is reduced, but higher than the overall response at 47% and 42% respectively.

Of the respondents who identified one of their primary land uses as farming and/or residential, 48% expressed that they were in favour of the proposed LMBOC location, while 42% opposed and 9% were undecided. Similarly, of the farming and residential land use respondents, 60% expressed that they are in favour of the proposed LSMOC location, while 9% are opposed and 30% are undecided. Farming and residential land users listed one of their primary project concerns to be that they are affected landowners (84%), followed by community impacts (42%) and environmental impacts (36%). Aboriginal and Treaty rights as was the primary project-related concerns of 12% of respondents.

The following is a summary of comments/questions made by farming and residential land users:

- There is no concern for the communities or the people that are affected. Let the water flow down the Assiniboine
- Possible loss or reduction of well water
- The Portage Diversion has already impacted our fish population. Protect our fish
- Concern over well water quality and drainage
- Wildlife is important. Birds and small animals in the area will be disturbed
- The loss of agricultural land at the expense of small environmental benefit is not balanced. Agriculture is not being adequately considered
- The project will develop an entirely new environment where the channels are proposed. The channels will also change the environment in the chain of small lakes east of the LMBOC
- Concern about losing existing beaches, medicines, fish, moose and other plants and animals
- The effects of the project are too devastating to write into a few short lines. My opinion doesn't seem to matter anyway
- Operation of the Portage Diversion is killing Lake Manitoba
- Will water sent to Lake Manitoba via the Portage Diversion be monitored?
- Will water seep out of the channel and onto adjacent lands?
- How will access along the channels be controlled?
- Will the channel become a breeding ground for carp and zebra mussels?

Of the respondents who identified their primary land use as commercial and/or not applicable (16%), 88% expressed support for the overall project concept. Similarly, 63% expressed support for the location of the LMBOC, and 75% supported the location of the LSMOC. Among this user group, support for the realignment of PR239 was only 37.5%, with 50% undecided and 12.5% not in favour. There was 50% support of the proposed operating guidelines for this land user group.

The following is a summary of comments made by individuals who identified themselves as commercial and/or non applicable land users:

- Devastating impacts on commercial fisheries, a 100 year old industry. Loss of fish habitat, loss of dependency on the region and loss of wildlife
- Migration, wildlife, use of traditional medicine, spawning of fish are important environmental considerations
- Environmental concerns when building new channel, but no concerns with environmental impact in emergency situations, even when damage is going to happen again
- Will a new channel reduce frazzle ice at the mouth of the Dauphin River? What is the variance in flows between this new channel and the Dauphin River?
- Operating guidelines are to be changed on a regular basis
- I support the channel, but you have selected the worst possible route. Effects to our community are sickening, especially the re-routing of PR 239. Just build a bridge along PR 239 and keep it in its current location

MI will formally respond to the above listed comments and concerns. Public input has been documented and will continue to be considered as part of project planning, design, construction and operation. MI currently holds a monthly public meeting with the affected RMs to provide project updates and get input from local stakeholders.

MI is currently developing a continued public engagement strategy. While not finalized, MI endeavours to hold a series of additional public information sessions and or public open houses which will be correlated to planning and design milestones. At these sessions, MI plans to present the means by which public input has factored into the Project planning and the environmental assessment process in order to provide transparent, formal and detailed responses to input provided by concerned parties.

7.2 Proposed Stakeholder Engagement and Consultation Activities

Additional stakeholder consultation is currently under development to provide stakeholder groups with opportunity to provide ongoing input into the environmental assessment process. Notices have been sent out to interested stakeholders including municipal governments, and members of the general public advising them of the recently launched project website and inviting them to provide comment through the project email.

Regular, and transparent communication with interested stakeholders will continue as the project progresses. Communication strategies are still in development and may be adapted over time to facilitate public engagement and input.

Public feedback will be collected thought the ongoing monthly project update meetings with affected Rural Municipalities. More open houses both in Winnipeg and in the local project area (e.g. Moosehorn) are planned to gather further feedback from the public.

7.3 Consultation with other jurisdictions

Engagement and information sharing process with other jurisdictions has taken place with open discussion planned as part of the ongoing project planning, design and approvals processes (Table 15).

Table 15. Summary of Engagement with Other Jurisdictions

Activity	Group
Preliminary Project Information Session and Site Visit	• Fisheries Branch, MSD • Biodiversity and Endangered Species Section, MSD • Wildlife Branch, MSD • Groundwater Section, MSD • Water Science & Management Branch, MSD • Parks and Regional Services, MSD • Medical Officer of Health, Interlake-Eastern Regional Health Authority • Prairie and Northern Region, Canadian Environmental Assessment Agency • Manitoba Region, Aboriginal Affairs and Northern Development Canada • Fisheries Protection Program, Fisheries and Oceans Canada • Canada-Manitoba Infrastructure Secretariat
Project Information Update and Discussion	• Fisheries Branch, MSD • Biodiversity and Endangered Species Section, MSD • Wildlife Branch, MSD • Groundwater Section, MSD • Water Science & Management Branch, MSD • Parks and Regional Services, MSD • Medical Officer of Health, Interlake-Eastern Regional Health Authority • Manitoba Region, Aboriginal Affairs and Northern Development Canada • Fisheries Protection Program, Fisheries and Oceans Canada • Manitoba Agriculture • Manitoba Hydro • Bell MTS • West Interlake Community Futures • RM of Coldwell • RM of Grahamdale • Canadian Environmental Assessment Agency • Highway Planning and Design Branch, MI • Navigable Water Protection Program, Transport Canada

7.4 Next Steps in Engagement and Consultation

As part of the ongoing IPEP and consultation activities, MI and INR plan and hold community and landowner meetings at key stages of the environmental assessment process for the proposed Project. This is expected to include several rounds of engagement session that ensure adequate opportunity for:

- Providing information on the environmental assessment and obtain input from communities and the public regarding the identification and verification of VCs.
- Presenting and obtaining feedback on preliminary environmental assessment findings including potential environmental effects, and recommended mitigation and follow-up concepts to communities and the public.
- Presenting the environmental assessment results along with a summary of the process to-date and description of the process moving forward to communities and the public

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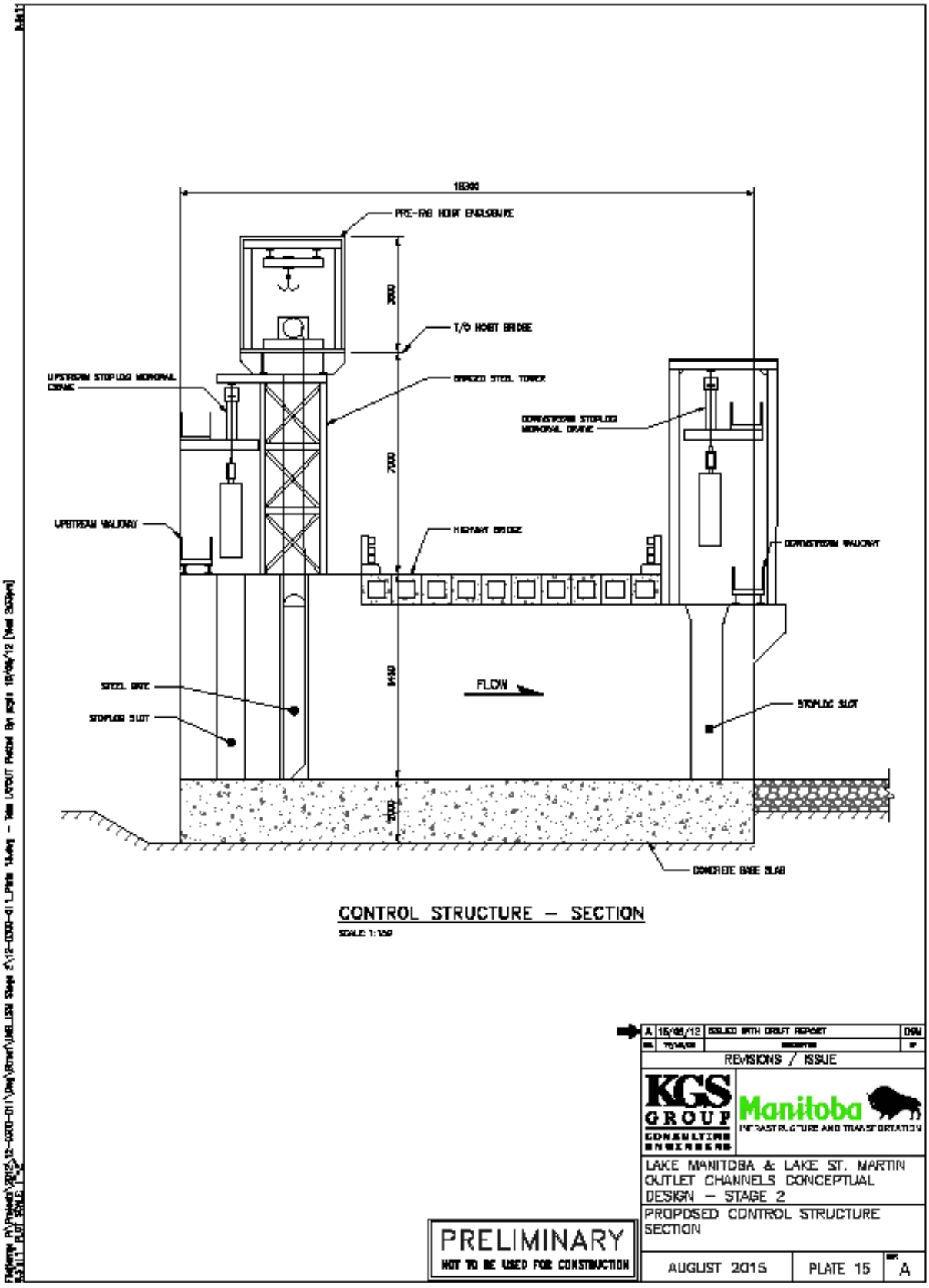
Appendix A - Conceptual Drawing Water Control Structure


PRE-FAB HOIST ENCLOSURE
T/O HOIST BRIDGE
BRACED STEEL TOWER
UPSTREAM STOPLOG MEMORIAL CRANE
DOWNSTREAM STOPLOG MEMORIAL CRANE
UPSTREAM WALKWAY
HIGHWAY BRIDGE
DOWNSTREAM WALKWAY
STEEL GATE
STOPLOG SLOT
FLOW
STOPLOG SLOT
CONCRETE BASE SLAB
CONTROL STRUCTURE – SECTION
REVISIONS / ISSUE
KGS GROUP CONSULTING ENGINEERS
Manitoba INFRASTRUCTURE AND TRANSPORTATION
LAKE MANITOBA & LAKE ST. MARTIN OUTLET CHANNELS CONCEPTUAL DESIGN – STAGE 2
PROPOSED CONTROL STRUCTURE SECTION
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION
AUGUST 2015
PLATE 15
A

Appendix B – Project Photos

Photo 1. Approximate location of the Inlet of the Lake Manitoba Outlet Channel, looking southwest from approximately 14 U 5302187 E 5681941 N

Photo 2. Approximate location of the Inlet of the Lake Manitoba Outlet Channel, looking west from approximately 14 U 530072 E 5681843 N

Photo 3. Approximate location of the Lake Manitoba Outlet Channel, looking south from approximately 14 U 530797 E 5687962 N

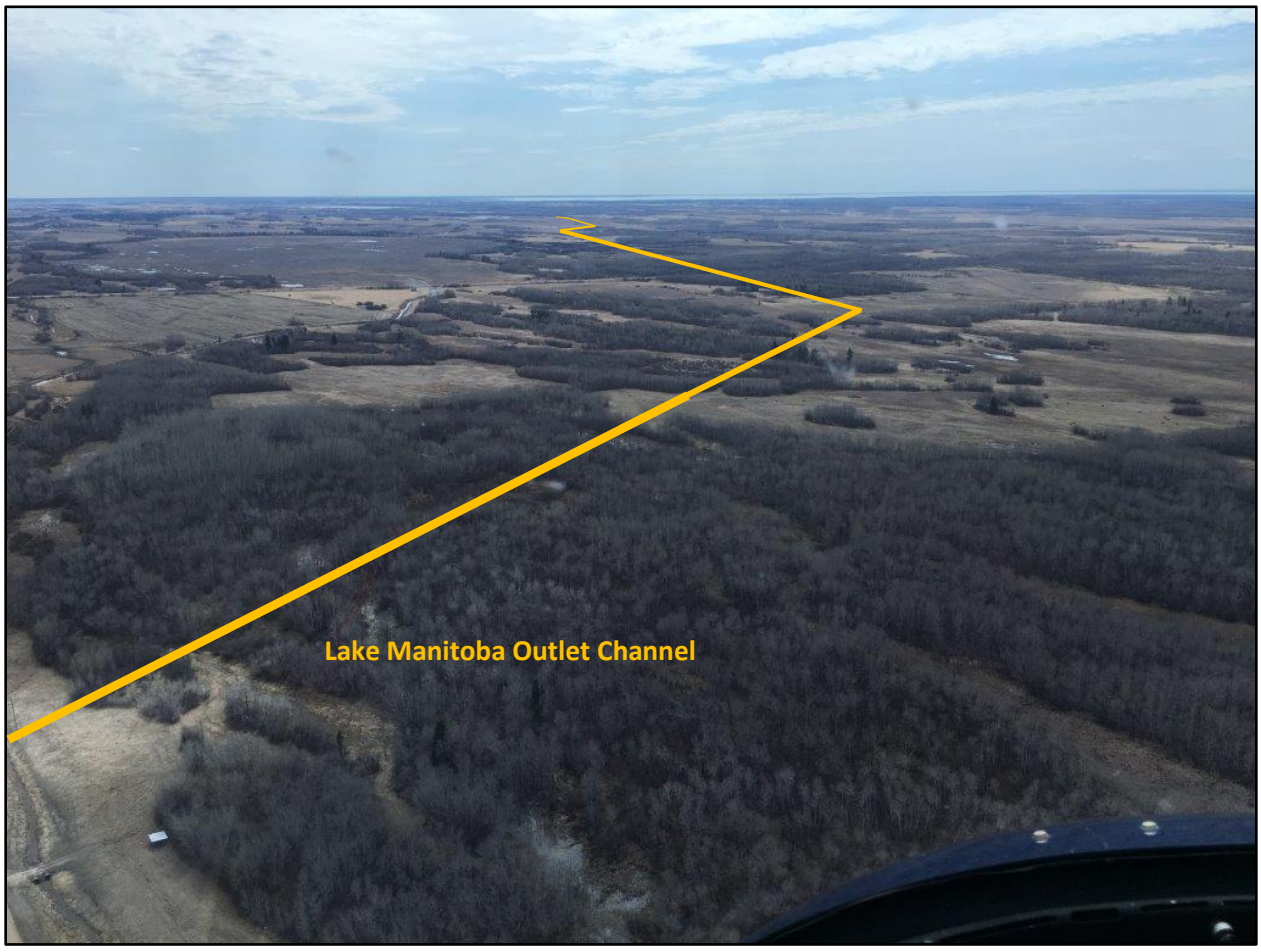


Photo 4. Approximate location of the Lake Manitoba Outlet Channel, looking south from Provincial Trunk Highway 6 at approximately 14 U 531751 E 5699140 N

Photo 5. Approximate location of the Outlet for the Lake Manitoba Outlet Channel, looking southwest from approximately 14 U 533672 E 5703641 N

Photo 6. Approximate location of the Outlet for the Lake Manitoba Outlet Channel, looking south southwest from approximately 14 U

Photo 7. Approximate location of the Lake St. Martin Outlet Channel, looking south from approximately 14 U 558599 E 5739741 N

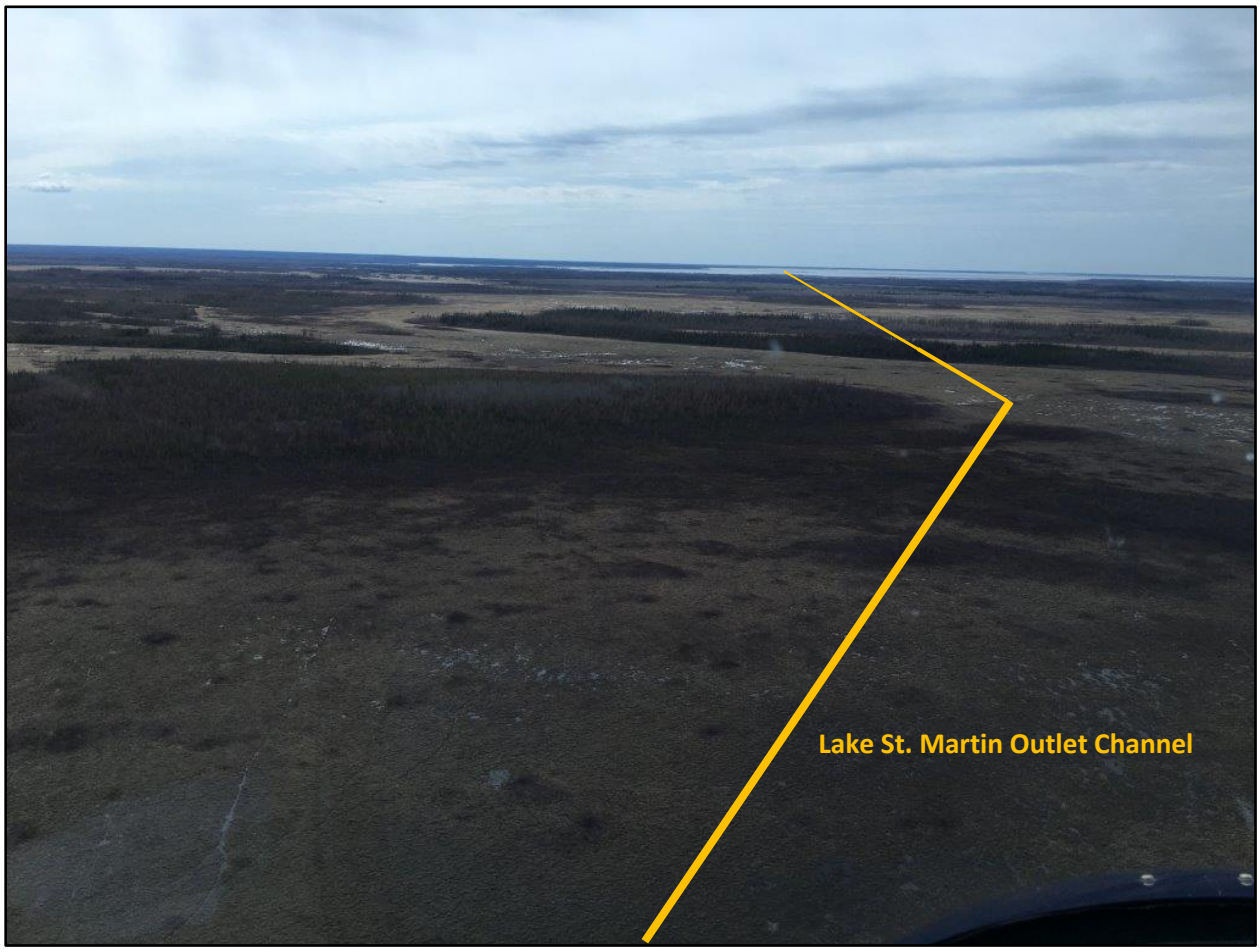


Photo 8. Approximate location of the Lake St. Martin Outlet Channel, looking south from approximately 14 U 561910 E 5742837 N

Photo 9. Approximate location of the Outlet for the Lake St. Martin Outlet Channel south of Willow Point, looking east northeast from approximately 14 U 569942 E 5753735 N

Photo 10. Approximate location of the Outlet for the Lake St. Martin Outlet Channel south of Willow Point, looking northwest from approximately 14 U 572786 E 5751591 N.

Appendix C – Fish, Wildlife and Plant Species Lists

Table C-1. Fish Species Documented in Major Waterbodies in the Project Region during Baseline Studies

Scientific Name	Common Name	Provincial Conservation Status[1]	SARA Status[1]	Lake St. Martin	Lake Manitoba	Lake Winnipeg
Ictiobus cyprinellus	Bigmouth Buffalo	S5	Special Concern			X
Ameiurus melas	Black Bullhead	S5		X		
Notropis heterolepis	Blacknose Shiner	S5		X		
Lota lota	Burbot	S5				X
Culea inconstans	Brook Stickleback	S5		X		
Umbra limi	Central Mudminnow	S5				X
Coregonus artedi	Cisco	S5		X		X
Cyprinus carpio	Common Carp	SNA		X	X	
Notropis atherinoides	Emerald Shiner	S5		X	X	X
Pimephales promelas	Fathead Minnow	S5		X	X	
Aplodinotus grunniens	Freshwater Drum	S5		X	X	X
Notemigonus crysoleucas	Golden Shiner	S5		X		
Etheostoma exile	Iowa Darter	S5		X		
Etheostoma nigrum	Johnny Darter	S5		X	X	
Coregonus clupeaformis	Lake Whitefish	S5		X	X	X
Percina caprodes	Logperch	S5			X	
Catostomus catostomus	Longnose Sucker	S5		X		X
Cottus bairdii	Mottled Sculpin	S5		X		
Esox lucius	Northern Pike	S5		X	X	X
Pungitius pungitius	Ninespine Stickleback	S5		X		X
Carpiodes cyprinus	Quillback	S5			X	
Osmerus mordax	Rainbow Smelt	SNA				X
Notropis blennius	River Shiner	S5		X		
Sander canadensis	Sauger	S5				X
Moxostoma macrolepidotum	Shorthead Redhorse	S5		X	X	X
Moxostoma anisurum	Silver Redhorse	S5				X
Notripis hudsonius	Spottail Shiner	S5		X	X	X
Percopsis omiscomaycus	Troutperch	S5		X	X	X
Sander vitreus	Walleye	S5		X	X	X
Morone chrysops	White Bass	SNA				X

Scientific Name	Common Name	Provincial Conservation Status[1]	SARA Status[1]	Lake St. Martin	Lake Manitoba	Lake Winnipeg
Catostomus commersonii	White Sucker	S5		X	X	X
Perca flavescens	Yellow Perch	S5		X	X	X

[1]See Table C-5 for definitions

Table C-2. Plant Species Observed during Baseline Studies in the Project Region

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Non Vascular Species				
Sphagnum spp	sphagnum moss	-		
Brachythecium spp.	feather moss	-		
Vascular Plant Species				
Graminoids				
Alopecurus aequalis	short awned foxtail	S5		
Bromus inermis	smooth brome	SNA		
Carex atherodes	awned sedge	S5		
Carex gynocrates	northern bog sedge	S5		
Carex lacustris	water sedge	S5		
Carex lenticularis	lakeshore sedge	S5		
Carex rostrata	beaked sedge	S4		
Carex spp.	sedges	-		
Carex viridula	green sedge	S4?		
Eleocharis palustris	common spike rush	S5		
Equisetum arvense	common horsetail	S5		
Equisetum fluviatile	swamp horsetail	S5		
Equisetum hyemale	scouring rush	S5		
Eriophorum gracile	slender cotton grass	S4S5		
Eriophorum angustifolium	tall cotton-grass	S5		
Glyceria striata	fowl manna grass	S5		
Hierochloe odorata	common sweet-grass	-		
Juncus balticus	wirerush	S5		
Koeleria macrantha	June grass	S5		
Phleum pratense	timothy	SN		
Phragmites australis	common reed grass	S5		
Poa palustris	fowl blue grass	S5		
Poa pratenses	kentucky blue grass	S5		
Schoenoplectus acutus	hardstem bulrush	S4		
Schoenoplectus tabernaemontani	softstem bulrush	S5		
Scirpus cyperinus	woolgrass	S4S5		
Triglochin maritima	seaside arrow grass	S5		
Woody Species - Trees				
Abies balsamea	balsam fir	S5		
Acer negundo	Manitoba maple	S5		
Betula papyrifera	white birch	S5		

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Larix laricina	tamarack	S5		
Picea glauca	white spruce	S5		
Picea mariana	black spruce	S5		
Pinus banksiana	jackpine	S5		
Populus balsamifera	balsam poplar	S5		
Populus tremuloides	trembling aspen	S5		
Quercus macrocarpa	bur oak	S5		
Ulmus americana	American elm	S4S5		
Woody Species - Shrubs				
Acer spicatum	mountain maple	S5		
Alnus rugosa	speckled alder	S5		
Alnus viridis	green alder	S5		
Amelanchier alnifolia	Saskatoon serviceberry	S5		
Arctostaphylos uva-ursi	bearberry	S5		
Betula glandulosa	bog birch	S5		
Betula occidentalis	water birch	S5		
Comarum palustre	marsh cinquefoil	S5		
Cornus sericea	red osier dogwood	S5		
Corylus cornuta	beaked hazel	S5		
Dasiphora fruticosa	shruby cinquefoil	S5		
Elaeagnus commutata	wolf willow	S4S5		
Juniperus horizontalis	creeping juniper	S5		
Kalmia polifolia	bog lauriel	S5		
Lonicera dioica	twinning honeysuckle	S5		
Myrica gale	sweet bayberry	S5		
Prunus pensylvanica	pin cherry	S5		
Prunus virginiana	chokecherry	S5		
Rhamnus alnifolia	alder leaved buckthorn	S5		
Rhododendron groenlandicum	labrador tea	S5		
Ribes americanum	wild black currant	S5		
Ribes idaeus	raspberry	S5		
Ribes lacustre	black gooseberry	S4		
Ribes triste	wild red current	S5		
Rosa acicularis	prickly rose	S5		
Salix bebbiana	beaked willow	S5		
Salix exigua	sandbar willow	S5		
Salix lutea	yellow willow	S5		
Salix myrtillifolia	myrtle leaved willow	S5		

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Salix pedicellaris	bog willow	S5		
Salix spp.	willow	-		
Symphoricarpos albus	common snowberry	S4S5		
Vaccinium oxycoccos	small bog cranberry	S5		
Vaccinium vitis-idaea	lingonberry	S5		
Viburnum edule	low-bush cranberry	S5		
Viburnum rafinesqueanum	downy arrowwood	S4S5		
Herbaceous Species				
Achillea millefolium	common yarrow	S5		
Actaea rubra	red baneberry	S5		
Andromeda polifolia	bog rosemary	S5		
Agastache scrophulariifolia	giant hyssop	S5		
Anemone canadensis	Canadian anemone	S5		
Antennaria neglecta	field pussytoe	S5		
Apocynum androsaemifolium	wild sarsparilla	S5		
Arctium lappa	great burdock	SNA		
Arethusa bulbosa	dragon's mouth orchid	S2		
Argentina anserina	silverweed	S5		
Arnica chamissonis	leafy arnica	S4		
Artemisia absinthium	absinth	SNA		
Asclepias syriaca	common milkweed	S3S4		
Caltha palustris	marsh marigold	S5		
Campanula rotundifolia	harebell	S5		
Carduus nutans	nodding thistle	S5		
Cerastium arvense	field chickweed	S5		
Chamerion angustifolium	common fireweed	S5		
Cicuta maculata	water hemlock	S4S5		
Cirsium arvense	Canada thistle	SNA		
Comandra umbellata	bastard toadflax	S5		
Convolvulus arvensis	field bindweed	SNA		
Corallorhiza maculata	spotted coralroot	S4		
Cornus canadensis	bunchberry	S5		
Cypripedium parviflorum	yellow lady slipper	S5?		
Dodecatheon pulchellum	saline shooting star	S5		
Disporum trachycarpum	rough-fruited fairybell	S5		
Drosera rotundifolia	sundew	S4S5		
Erigeron glabellus	smooth fleabane	S5		

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Eutrochium maculatum	spotted joe-pye weed	S5		
Fragaria vesca	woodland strawberry	S4S5		
Fragaria virginiana	common strawberry	S5		
Galeopsis tetrahit	hemp nettle	SNA		
Galium boreale	northern bedstaw	S5		
Galium triflorum	sweet scented bedstraw	S5		
Gentiana crinita	fringed gentian	S5		
Geocaulon lividum	false toadflax	S5		
Geum rivale	purple avens	S3S4		
Glycyrrhiza lepidota	wild licorice	S4S5		
Halenia deflexa	spurred gentian	S5		
Helianthus annuus	annual sunflower	S3		
Iris versicolor	blue flag iris	S3S4		
Lactuca tatarica	common blue lettuce	S5		
Lathyrus ochroleucus	creamy peavine	S5		
Leucanthemum vulgare	oxeye daisy	SNA		
Lobelia kalmii	kalm's lobelia	S5		
Linnaea borealis	twinflower	S5		
Lycopus uniflorus	northern water-horehound	S4S5		
Lysimachia thyrsiflora	tuft loosetrife	S5		
Maianthemum canadense	wild lily-of-the-valley	S5		
Maianthemum stellatum	star flowered false Solomon's seal	S5		
Maianthemum trifolium	three-leaved false Solomon's seal	S5		
Medicago sativa	alfalfa	SNA		
Melilotus albus	white sweet clover	SNA		
Melilotus officinalis	yellow sweet clover	SNA		
Mentha arvensis	wild mint	S5		
Menyanthes trifoliata	buckbean	S5		
Moehringia lateriflora	blunt-leaved sandwort	S5		
Oenothera biennis	yellow evening primrose	S5		
Oxytropis monticola	late yellow locoweed	S4		
Parnassia palustris	grass of parnassus	S5		
Pastinaca sativa	wild parsnip	SNA		
Petasite sagittatus	arrow-leaved coltsfoot	S5		
Physostegia virginiana	false dragonhead	S5		
Platanthera virdis	northern green bog-orchid	S5		

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Polygala paucifolia	fringed milkwort	S4		
Polygala senega	seneca root	S4		
Polygonum amphibium	water smartweed	S5		
Primula incana	mealy primrose	S4		
Ranunculus abortivus	small flowered buttercup	S5		
Ranunculus acris	meadow buttercup	SNA		
Ranunculus gmelinii	yellow water crowfoot	S5		
Ranunculus macounii	Macoun's buttercup	S5		
Ranunculus sceleratus	celery-leaved buttercup	S5		
Rubus acaulis	dwarf raspberry	S5		
Rubus chamaemorus	cloudberry	S5		
Rubus pubescens	dew berry	S5		
Rudbeckia hirta	black-eyed Susan	S5		
Salicornia rubra	red samphire	S4		
Sanicula marilandica	black sanicle	S5		
Sarracenia purpurea	pitcher plant	S4S5		
Scutellaria galericulata	marsh skullcap	S5		
Senecio congestus	marsh ragwort	S4S5		
Sisyrinchium montanum	common blue-eyed grass	S5		
Sium suave	water parsnip	S5		
Solidago canadensis	Canada goldenrod	S5		
Solidago graminifolia	flat top goldenrod	S5		
Solidago rigida	stiff goldenrod	S5		
Sonchus arvensis	perennial sow thistle	SNA		
Stellaria calycantha	northern stitchwort	S5		
Symphyotrichum ericoides	many-flowered aster	S4		
Symphyotrichum laeve	smooth blue aster	S5		
Taraxacum officinale	common dandelion	SNA		
Thalictrum dasycarpum	tall meadow rue	S5		
Thalictrum venulosum	veiny meadow rue	S5		
Trientalis borealis	northern star flower	S5		
Trifolium hybridum	alsike clover	SNA		
Tripleurospermum perforata	scentless chamomile	S5		
Typha latifolia	common cattail	S5		
Urtica dioica	stinging nettle	S5		
Valeriana dioica	northern valerian	S4		
Vicia americana	American vetch	S5		

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Viola adunca	early blue violet	S5		
Viola candensis	Canadian white violet	S5		
Viola palustris	marsh violet	S4		

[1]See Table C-5 for definitions

Table C-3. Mammals and Herptile Species Documented in the Project Region during Baseline Studies

Scientific Name	Common Name	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Mammals				
Castor canadensis	Beaver	S5		
Eptesicus fucus	Big Brown Bat	S4S5B		
Ursus americanus	Black Bear	S5		
Canis latrans	Coyote	S5		
Cervus elaphus	Elk	S4		
Lasiurus cinerus	Hoary Bat	S3B		
Lynx canadensis	Lynx	S5		
Myotis lucifugus	Little Brown Bat	S2N, S5B	Endangered	Endangered
Martes americana	Marten	S5		
Alces alces	Moose	S5		
Ondatra zibethicus	Muskrat	S5		
Myotis septentrionalis	Northern Myotis	S3S4N, S4B	Endangered	Endangered
Lutra canadensis	Otter	S5		
Procyon lotor	Raccoon	S5		
Vulpes vulpes	Red Fox	S5		
Lasionyctris noctivagans	Silver-haired Bat	S3S4B		
Lepus americanus	Snowshoe Hare	S5		
Odocoileus virginianus	White-tailed deer	S5		
Canis lupus	Wolf	S5		
Herptiles				
Amphibians				
Pseudacris maculata	Boreal Chorus Frog	S5		
Lithobates pipiens	Northern Leopard Frog	S4		Special Concern
Lithobates sylvaticus	Wood Frog	S5		
Reptiles				
Thamnophis sirtalis	Red Sided Garter Snake	S4		

[1]See Table C-5 for definitions

Table C-4. Bird Species Documented during Baseline Studies and Manitoba Breeding Bird Atlas Surveys in the Project Region

Scientific Name	Species	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Empidonax alnorum	Alder Flycatcher	S5B		
Botaurus lentiginosus	American Bittern	S5B		
Corvus brachyrhynchos	American Crow	S5B, SUN		
Turdus migratorius	American Robin	S5B		
Pelecanus erythrorhynchos	American White Pelican	S4B		
Scolopax minor	American Woodcock	S4B		
Haliaeetus leucocephalus	Bald Eagle	S5B, SUN		
Icterus galbula	Baltimore Oriole	S4B		
Riparia riparia	Bank Swallow	S5B		Threatened
Hirundo rustica	Barn Swallow	S4B		Threatened
Pica hudsonia	Black billed Magpie	S4		
Poecile atricapillus	Black-capped Chickadee	S5		
Cyanocitta cristata	Blue Jay	S5		
Anas discors	Blue-Winged Teal	S4B		
Dolichonyx oryzivorus	Bobolink	S4B		Threatened
Certhia americana	Brown Creeper	S5B		
Molothrus ater	Brown Headed Cowbird	S5B		
Branta canadensis	Canada Goose	S5B		
Hydroprogne caspia	Caspian Tern	S3B		
Bombycilla cedrorum	Cedar Waxwing	S5B, SUN		
Setophaga pensylvanica	Chestnut-sided Warbler	S5B		
Spizella passerina	Chipping Sparrow	S5B		
Spizella pallida	Clay-coloured Sparrow	S5B		
Quiscalus quiscula	Common Grackle	S5B		
Mergus merganser	Common Merganser	S5B		
Chordeiles minor	Common Nighthawk	S3B	Threatened	Threatened
Corvus corax	Common Raven	S5		
Sterna hirundo	Common Tern	S5B		
Geothlypis trichas	Common Yellowthroat	S5B		
Calidris ferruginea	Curlew Sandpiper	SNA		
Junco hyemalis	Dark-eyed Junco	S5B, SUN		
Phalacrocoracidae auritus	Double-Crested Cormorant	S5B		
Picoides pubescens	Downy Woodpecker	S5		
Tyrannus tyrannus	Eastern Kingbird	S4B		
Sturnella magna	Eastern Meadowlark	SNA		
Sayornis phoebe	Eastern Phoebe	S5B		

Scientific Name	Species	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Contopus virens	Eastern Wood-Pewee	S4B		Special Concern
Leucophaeus pipixcan	Franklin's Gull	S4B		
Anas strepera	Gadwall	S5B		
Bucephala clangula	Goldeneye	S5B, SUN		
Vermivora chrysoptera	Golden Winged Warbler	S3B	Threatened	Threatened
Perisoreus canadensis	Gray Jay	S5		
Ardea herodias	Great Blue Heron	S5B		
Anas carolinensis	Green Winged Teal	S4B		
Leuconotopicus villosus	Hairy Woodpecker	S5		
Larus argentatus	Herring Gull	S4B		
Passer domesticus	House Sparrow	SNA		
Podiceps auritus	Horned Grebe	S4B		Special Concern
Charadrius vociferus	Killdeer	S5B		
Ammodramus leconteii	Le Conte's Sparrow	S5B		
Empidonax minimus	Least flycatcher	S5B		
Aythya affinis	Lesser Scaup	S5B		
Melospiza lincolnii	Lincoln's Sparrow	S5B		
Anas platyrhynchos	Mallard	S5B		
Cistothorus palustris	Marsh Wren	S5B		
Falco columbarius	Merlin	S5B, SUN		
Zenaida macroura	Mourning Dove	S4B		
Colaptes auratus	Northern Flicker	S5B		
Circus cyaneus	Northern Harrier	S5B		
Anas acuta	Northern Pintail	S5B		
Aegolius acadicus	Northern Saw-whet Owl	S4B		
Anas clypeata	Northern Shoveler	S5B		
Parkesia noveboracensis	Northern Waterthrush	S5B		
Seiurus aurocapilla	Ovenbird	S5B		
Contopus cooperi	Olive-sided Flycatcher	S3B	Threatened	Threatened
Hylatomus pileatus	Pileated Woodpecker	S5		
Haemorhous purpureus	Purple Finch	S5B		
Vireo olivaceus	Red-eyed Vireo	S5B		
Melanerpes erythrocephalus	Red-headed Woodpecker	S3B	Threatened	Threatened
Agelaius phoeniceus	Red-winged Blackbird	S5B		
Grus canadensis	Sandhill Crane	S5B		
Passerculus sandwichensis	Savannah Sparrow	S5B		
Asio flammeus	Short-eared Owl	S2S3B	Threatened	
Porzana corolina	Sora	S5B		

Scientific Name	Species	Provincial Conservation Status[1]	MBESEA Status[1]	SARA Status[1]
Buteo swainsoni	Swainson's Hawk	S4B		
Melospiza georgiana	Swamp Sparrow	S5B		
Leiothlypis peregrina	Tennessee Warbler	S5B		
Tachycineta bicolor	Tree Swallow	S4B		
Cygnus buccinator	Trumpeter Swan	S1B	Endangered	
Cathartes aura	Turkey Vulture	S4B		
Catharus fuscescens	Veery	S5B		
Pooecetes gramineus	Vesper Sparrow	S5B		
Vireo gilvus	Warbling Vireo	S5B		
Zonotrichia albicollis	White Throated Sparrow	S5B		
Gallinago delicata	Wilson's Snipe	S5B		
Hylocichla mustelina	Wood Thrush	SNA		
Xanthocephalus xanthocephalus	Yellow Headed Blackbird	S4B		
Setophaga petechia	Yellow Warbler	S5B		

[1]See Table C-5 for definitions

Table C-5. Manitoba Conservation Data Centre (2016), Manitoba Endangered Species and Ecosystems Act, and Species At Risk Act Definitions[1]

Provincial Conservation Status - Manitoba Conservation Data Centre	
Rank	**Definition**
1	Very rare throughout its range or in the province. Species may be vulnerable to extirpation
2	Rare in Manitoba or throughout its range. Species may be vulnerable to extirpation
3	Uncommon in Manitoba or throughout its range
4	Abundant, widespread and seemingly secure in Manitoba or throughout its range, but is of long-term conservation concern
5	Demonstrably abundant, widespread, and secure in Manitoba or throughout its range, and not vulnerable to eradication under present conditions
U	Status unknown but possibly in peril
H	Historically known with possibility of being rediscovered
X	Assumed extinct with historic records only
SNR	Species is not ranked
SNA	Conservation status rank is not applicable
Other Codes	**Definition**
S#S#	Numeric ranking range. Denotes a range of uncertainty as to the exact rarity of the species
B	Breeding status of a migratory species
N	Non-breeding status of a migratory species
?*	Rank is inexact or uncertain
Manitoba Endangered Species and Ecosystems Act	
Ranking	**Definition**
Special Concern	Species is at risk of becoming threatened or endangered
Threatened	Species is likely to become endangered, or due to low or declining numbers is at risk if threats are not reversed
Endangered	Species is at risk of imminent extinction or extirpation throughout all or most of its range in Manitoba
Extirpated	Species was formerly indigenous to Manitoba but no longer exists in the wild in Manitoba
Species At Risk Act	
Ranking	**Definition**
Special Concern	Species might become threatened or endangered due to natural conditions and/or other threats
Threatened	Species is likely to become endangered without action to reverse threats
Endangered	Species is facing imminent extinction or extirpation
Extirpated	Species is no longer present in the wild in Canada, but does exist elsewhere

[1]Adapted from MBCDC (No Date), Manitoba (2017) and SARA (2016)

Appendix D – Consultation Summary

Summary of Engagement Program Activities with Indigenous Groups 2014 - 2017	
Activity/Date	**Description**
Lake Manitoba and Lake St. Martin Outlet Channel	
May 30, August 29, 2014 MI sends letters to First Nations and Manitoba Metis Federation	Invitation to communities to attend open houses for preliminary channel options for Lake Manitoba and Lake St. Martin Outlet Channel
September 18, 2014	Response received from the Manitoba Metis Federation (MMF).
July 29, 2015 letter from MI to the MMF	MI commitment to consultation with MMF
August 23, 2015 MI sends letters to. Lake St. Martin (LSMFN), Little Saskatchewan (LSFN), Pinaymootang (PFN), Dauphin River (DRFN)	Invitation to information sharing meeting on September 9, 2015
September 1, 2015 letter received from Interlake Reserves Tribal Council (IRTC)	Resolution from communities on Lake St. Martin affected by 2011 and 2014 flood must have previous outstanding issues resolved prior to the commencement of consultation
September 2, 2015 letter from IRTC	Informational letter from IRTC
October 7, 2015 letter from MMF	MMF agrees to information sharing meeting
September 9, 2015 Information Sharing meeting presented by MI	In attendance: LSMFN, LSFN, DRFN.
November 26, 2015 Interlake Reserves Tribal Council meeting	In attendance: LSFN, PFN, DRFN, Lake Manitoba FN (LMFN), Kinonjeoshtegon (KFN), Peguis FN and councillors band advisors and IRTC staff with MI and IMR staff.
December 8, 2015 meeting with MI and MMF	Initial information sharing meeting with the MMF
December 8-10, 2015 email and phone exchanges between MMF staff and MI staff	Exchanges to answer questions that were raised during the December 8th meeting.
July 5, 2016 Meeting	In attendance: DRFN, LMFN, O-Chi-Chak-Ko-Sipi FN
July 22,and 26, 2016 letters	Letters sent to FNs to initiate development of consultation plan and budget
July 28, 2016 Meeting with PFN	In attendance: PFN and MI staff
August 2, 2016 Meeting with LSFN	In attendance: LSFN and MI staff

Summary of Engagement Program Activities with Indigenous Groups 2014 - 2017	
Activity/Date	**Description**
Lake Manitoba and Lake St. Martin Outlet Channel	
August 2, 2016 Meeting with DRFN.	In attendance: DRFN and MI staff
August 8, 2016 Update Letters	Letters sent to FNs to initiate development of consultation plans
August 9, 2016 Letter received from Little Black River	Request for additional information and meeting.
August 29, 2016 Letter received from Norway House Cree Nation	Request for additional information and meeting.
August 30, 2016 Meeting LSM	In attendance: LSM FN and MI Staff.
September 23, 2016 Update letter	Update letter sent to First Nations communities
October 12, 2016 Meeting PFN	In attendance: PFN and MI Project Staff
October 20, 2016 Meeting MMF	In attendance: MMF and MI Project Staff
October 27, 2016 Meeting with LSMFN	In attendance: LSMFN and MI Project Staff.
November 3, 2016 Meeting with Little Black River	In attendance: Little Black River and MI Project Staff
November 4, 2016 Meeting with LSFN	In attendance: LSFN and MI Project Staff
November 16, 2016 meeting with LSMFN, LSFN, PFN.	In attendance: LSMFN, LSFN, PFN.
November 29, 2016 meeting with MMF	In attendance: MMF and MI Project Staff
December 16, 2016 Meeting with DRFN	In attendance: DRFN and MI Project Staff
December 21, 2016 Meeting with Norway House Cree Nation	In attendance: Norway House Cree Nation and MI Project Staff
January 13, 2017 Letter received from Fisher River Cree Nation	In attendance: FRCN and MI Project Staff.

Summary of Engagement Program Activities with Indigenous Groups 2014 - 2017	
Activity/Date	**Description**
Lake Manitoba and Lake St. Martin Outlet Channel	
February 8, 2017 Meeting	In attendance: Project staff and FN
March 22, 2017 Meeting with DR IMR	In attendance: DR IMR and MI Project Staff.
April 3, 2017 Meeting with FRCN	In attendance: FRCN and MI Project Staff.
April 12, 2017 Meeting with DRFN and IRTC	In attendance: DRFN, IRTC and MI Project Staff.
April 28, 2017 Meeting	In attendance: LSMFN, DRFN, LMFM, LSFN, EFFN, Southern Chiefs Organization and MI Project Staff.
May 2, 2017 Meeting NRCN	In attendance: NRCN and MI Project Staff.
May 4, 2017 Meeting LMFN	In attendance: LMFN and MI Project Staff

Appendix E - Public Information Presentation

Lake Manitoba
Lake St. Martin

Lake St. Martin Emergency Outlet Channel (Fall 2011) (photo courtesy of KGS)

Outlet Channels

Public Information Session

June 29, 2017

Manitoba

Background & History

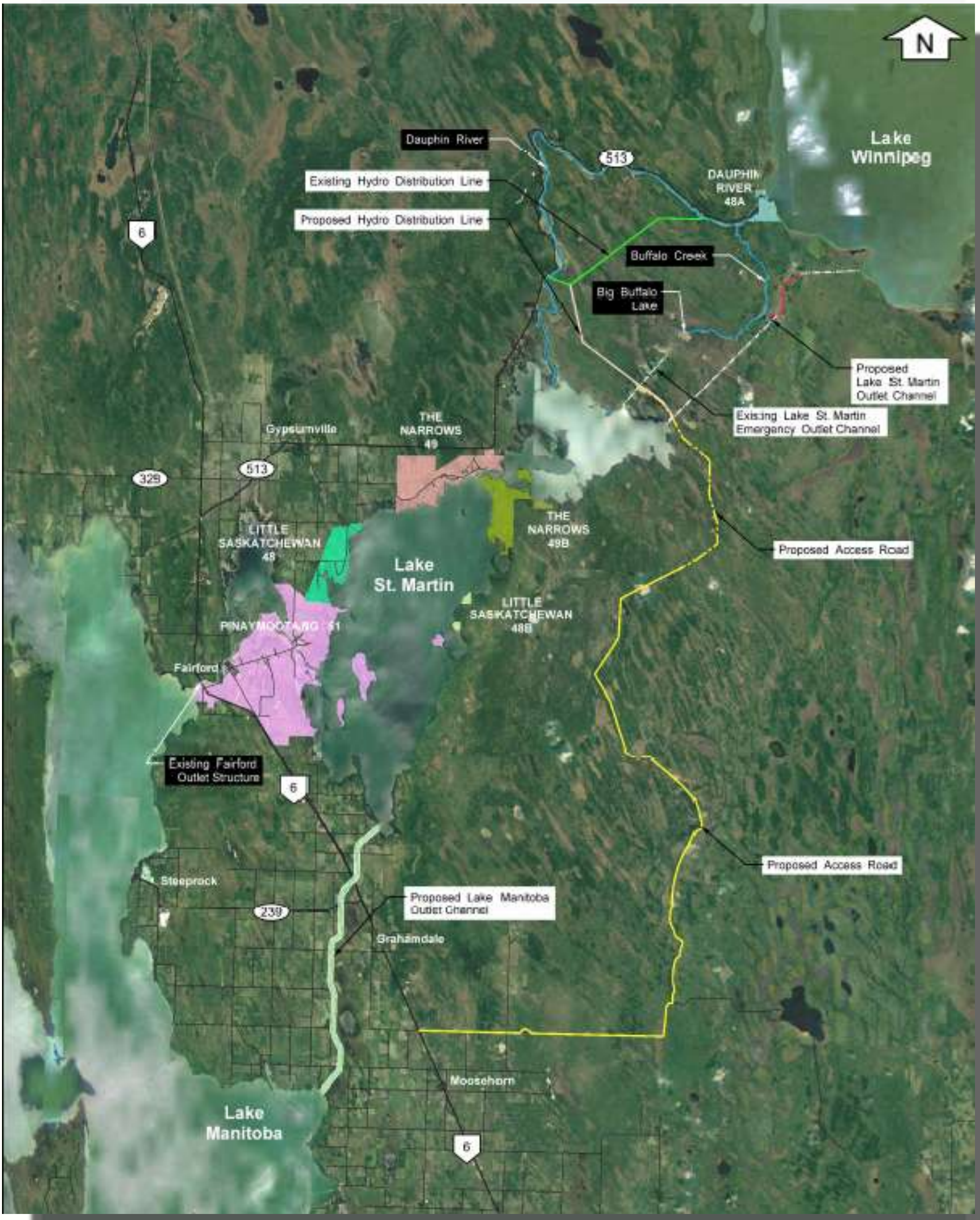
- 2011 Spring Flood Event
  - High flows recorded on most streams and rivers in the Assiniboine and Lake Manitoba Watershed
- 2011 Flood Review Task Force Report (Farlinger)
- Lake Manitoba and Lake St. Martin Regulation Review Committee Report (Westdal)
- Assiniboine River and Lake Manitoba Basins Flood Mitigation Study (KGS Group)
  - Consideration to
    - Water Retention along Assiniboine River
    - Water Control on Waterhen River
    - Pumping Lake Winnipegosis to Cedar Lake
    - Increased Outlet Capacity from Lake Manitoba and Lake St. Martin
- Lake Manitoba and Lake St. Martin Outlet Channel; Conceptual Design Stage 1 (KGS Group)
  - Development of Six Options for Lake Manitoba Outlet
  - Development of Two Options for Lake St. Martin Outlet
- 2014 Summer Rain Event
- Public Open House, Ashern MB, September 2014
- Lake Manitoba and Lake St. Martin Outlet Channel; Conceptual Design Stage 2 (KGS Group)
  - Further development of Options C and D on Lake Manitoba Channel
  - Addition of two options for Lake St Martin Outlet Channel

Background & History

- July 2015 Federal and Provincial Governments announce cost sharing of Outlet Channel Project
  - 50/50 cost share of $495 Million Budget Estimate
  - Desirable completion in 2020/21 creates accelerated schedule
- Environmental Data Collection and Field Investigation (M. Forster Enterprises)
  - Study area included options within Stage 2 Conceptual Design
  - Lake Manitoba Outlet Channel Options
  - Lake St. Martin Outlet Channel Options
  - Lake St. Martin OC Access Road Alignment
  - Lake St. Martin OC Hydro Distribution Line
- Investigation and Preliminary Engineering for the Lake Manitoba Outlet Channel; Options C and D (KGS Group)
  - Further investigation, preliminary engineering and evaluation of Options C and D
  - Recommendation of Route D as the preferred alternative
- Preliminary Design for Reach 2 of the Lake St. Martin Outlet Channel (KGS Group)
  - Evaluation of 4 alternatives
  - Recommendation of Option 4 with preliminary engineering design
- Spring 2017 RM of Grahamdale and Impacted Landowner Meetings; June 29th Public Information Session, Moosehorn
- July 13th Public Information Session, Winnipeg

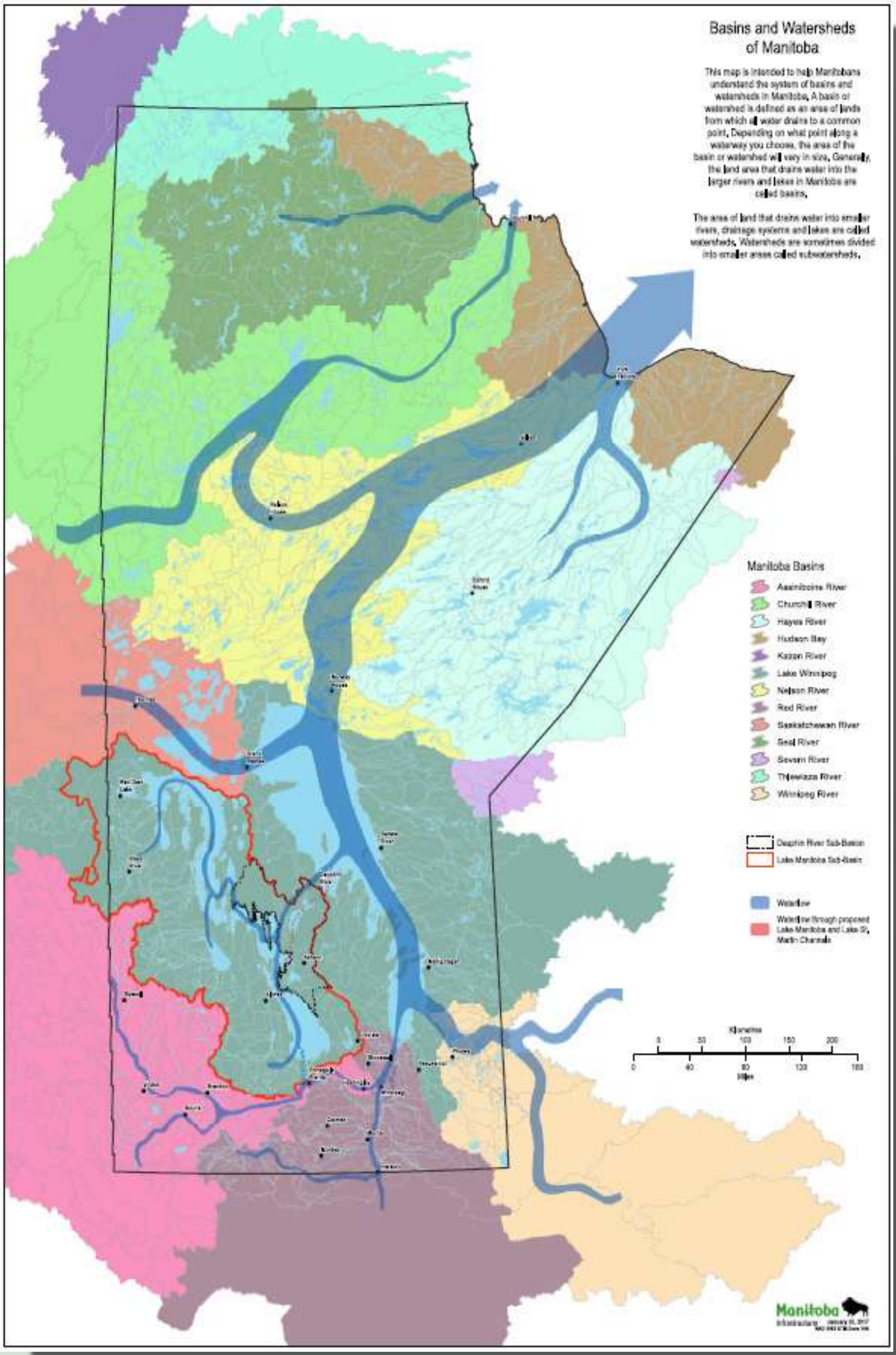
Manitoba

Project Location Overview



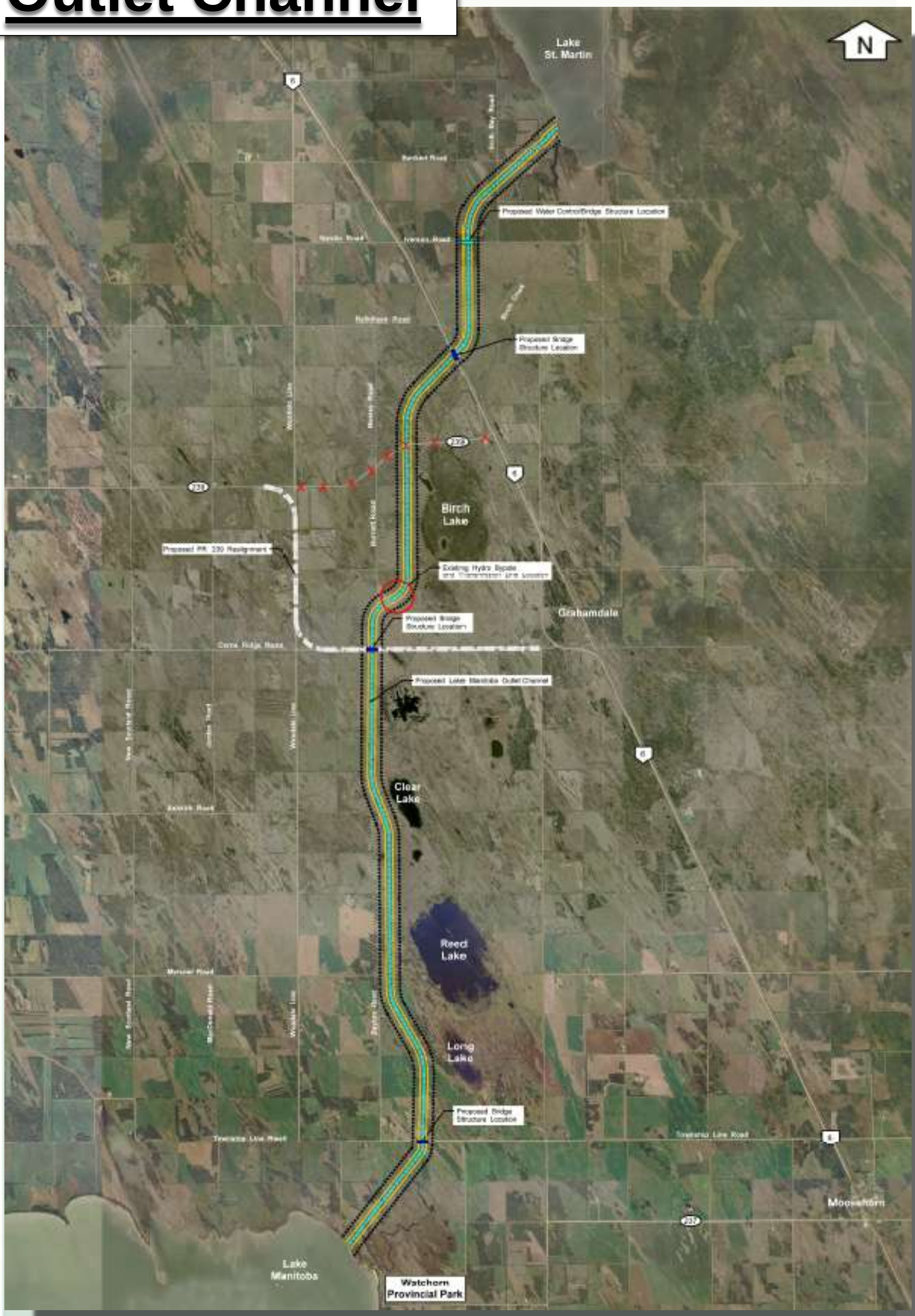
Manitoba

Basins and Watersheds of Manitoba



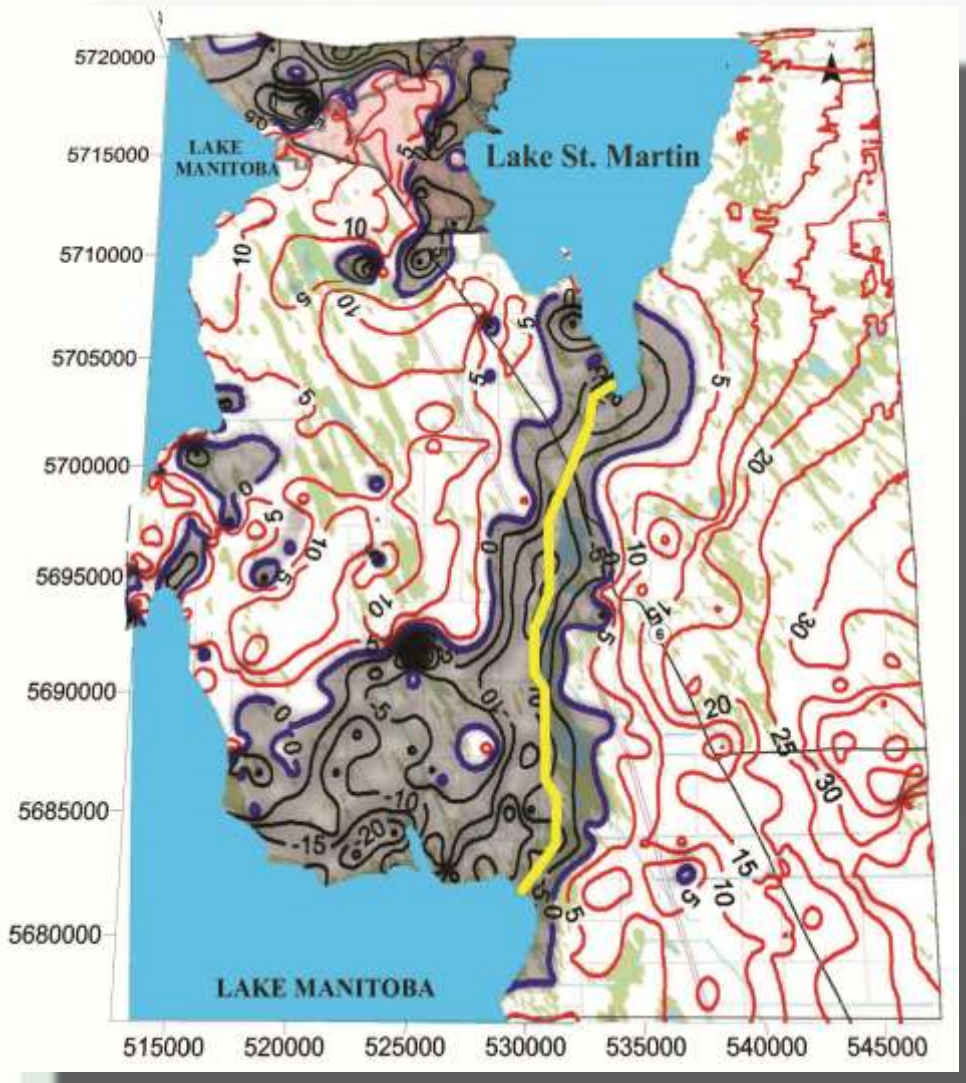
Proposed Lake Manitoba Outlet Channel

Manitoba



Lake Manitoba Outlet Channel

Bedrock Details

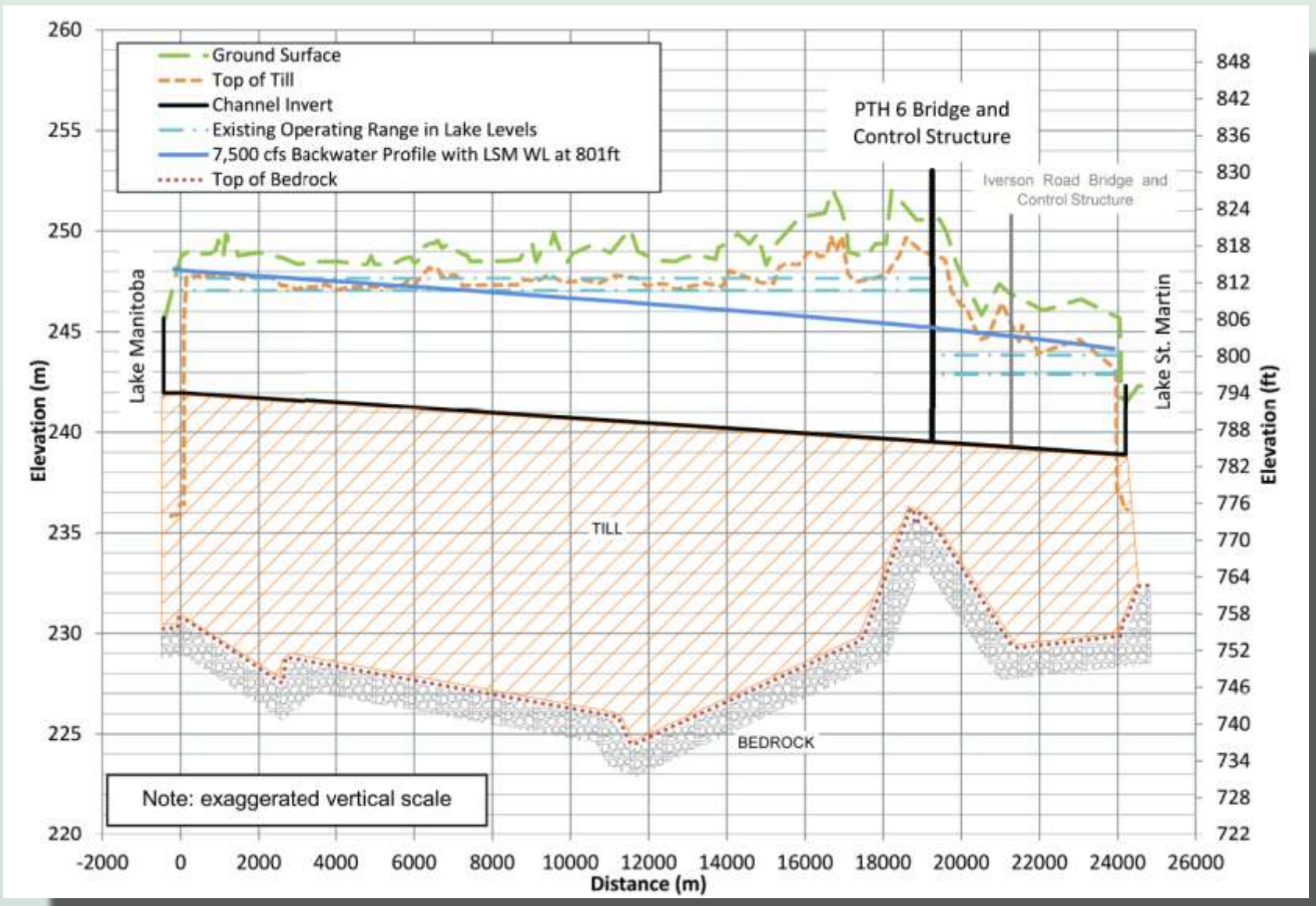


- Channel Excavation in Bedrock
- Channel Excavation in Till

•Excavation in bedrock creates high risk of aquifer contamination

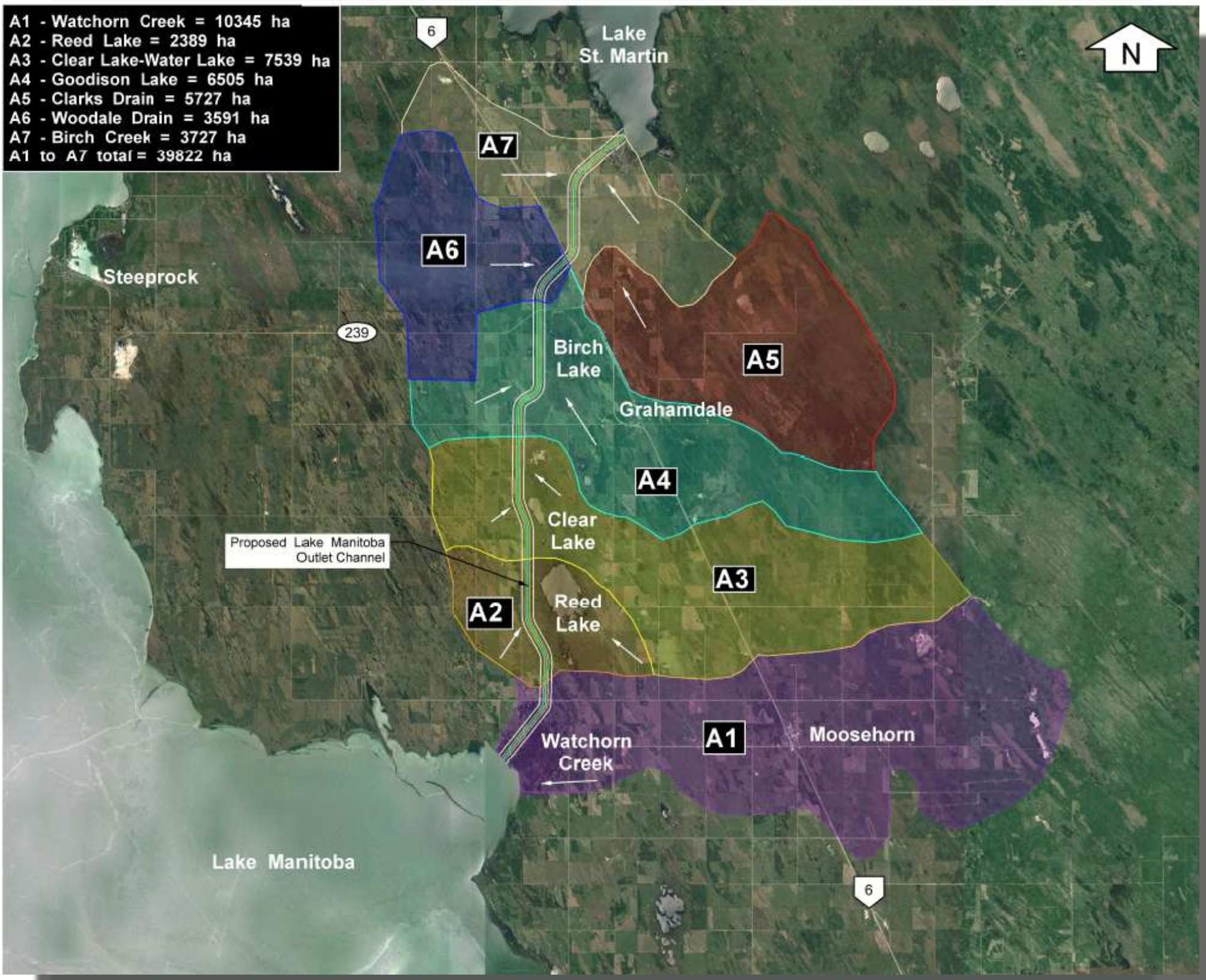
•Proposed channel will be excavated in Till

Proposed Channel Profile with Bedrock



Information provided by KGS Group

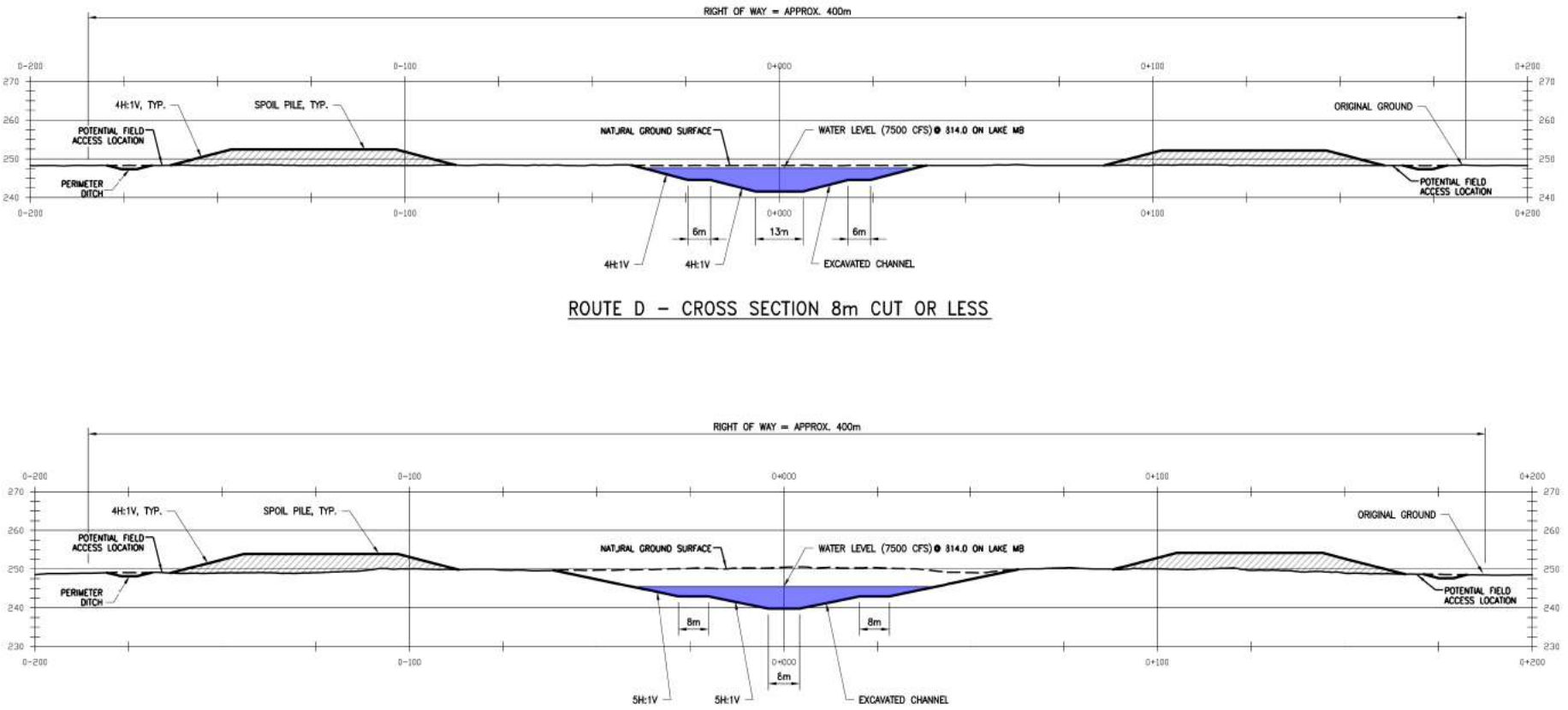
Local Watersheds
Vicinity of Lake Manitoba
Outlet Channel



- Perimeter ditching to accommodate local area drainage

Lake Manitoba Outlet Channel

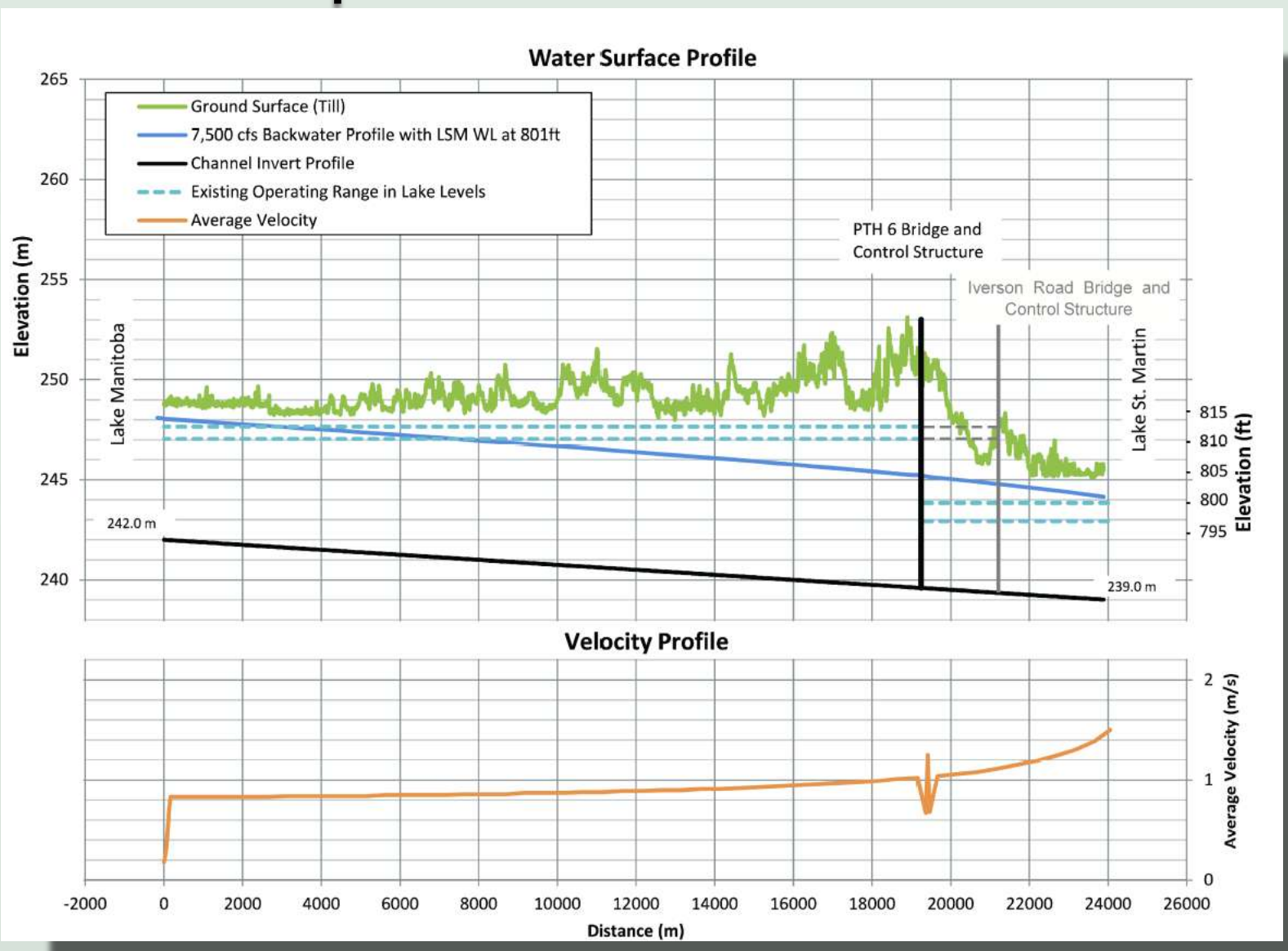
Typical Channel Cross Sections



ROUTE D – CROSS SECTION 8m CUT OR LESS

ROUTE D – CROSS SECTION >8m CUT

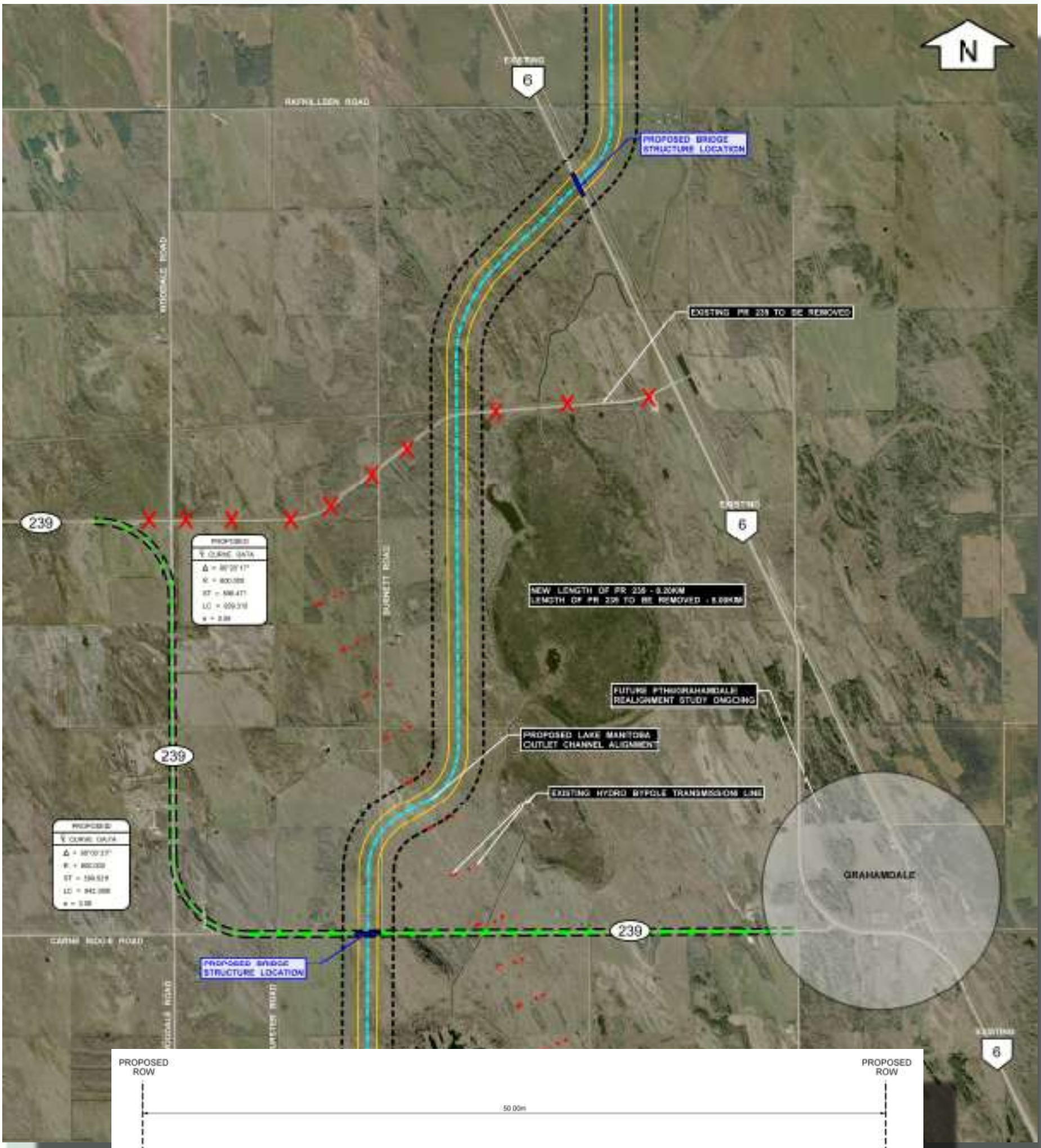
Proposed Channel Profile

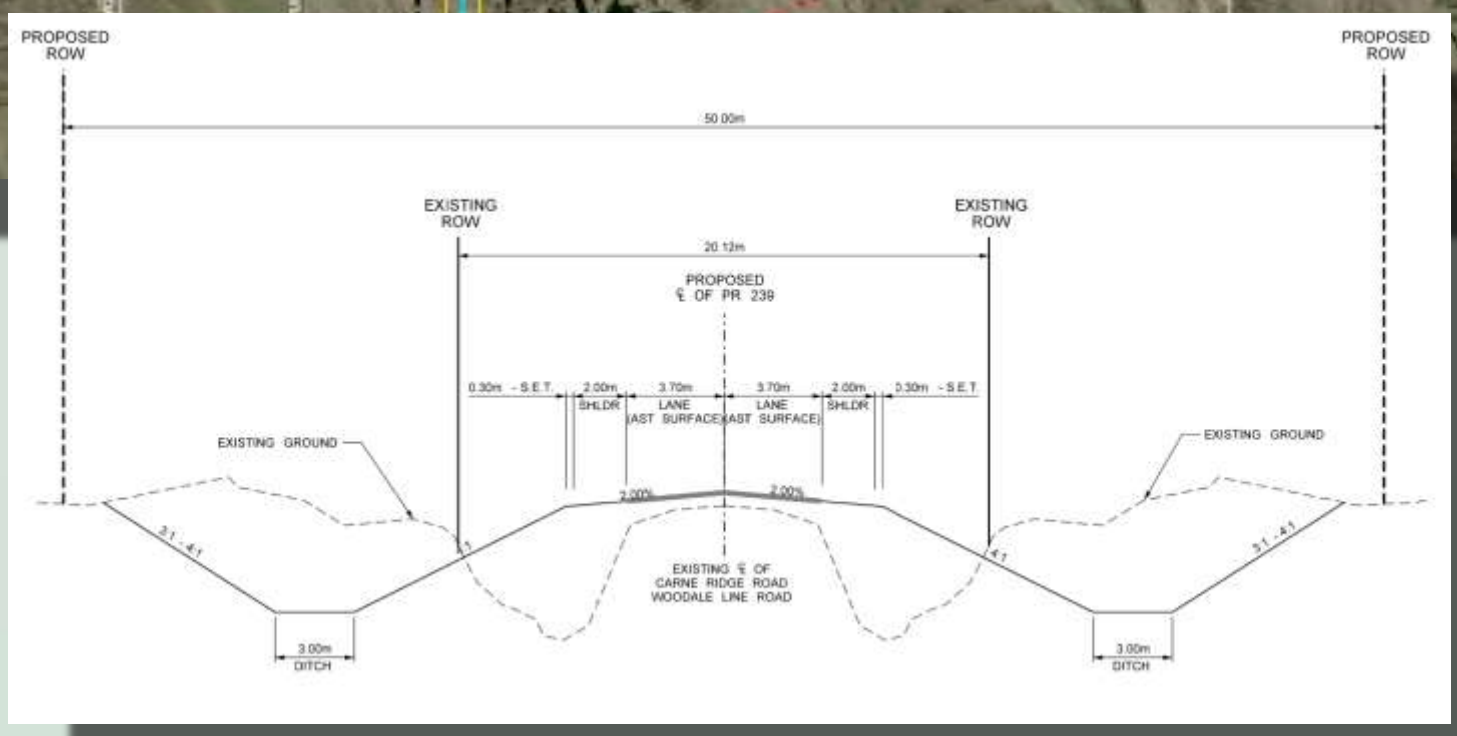


Information provided by KGS Group

Manitoba

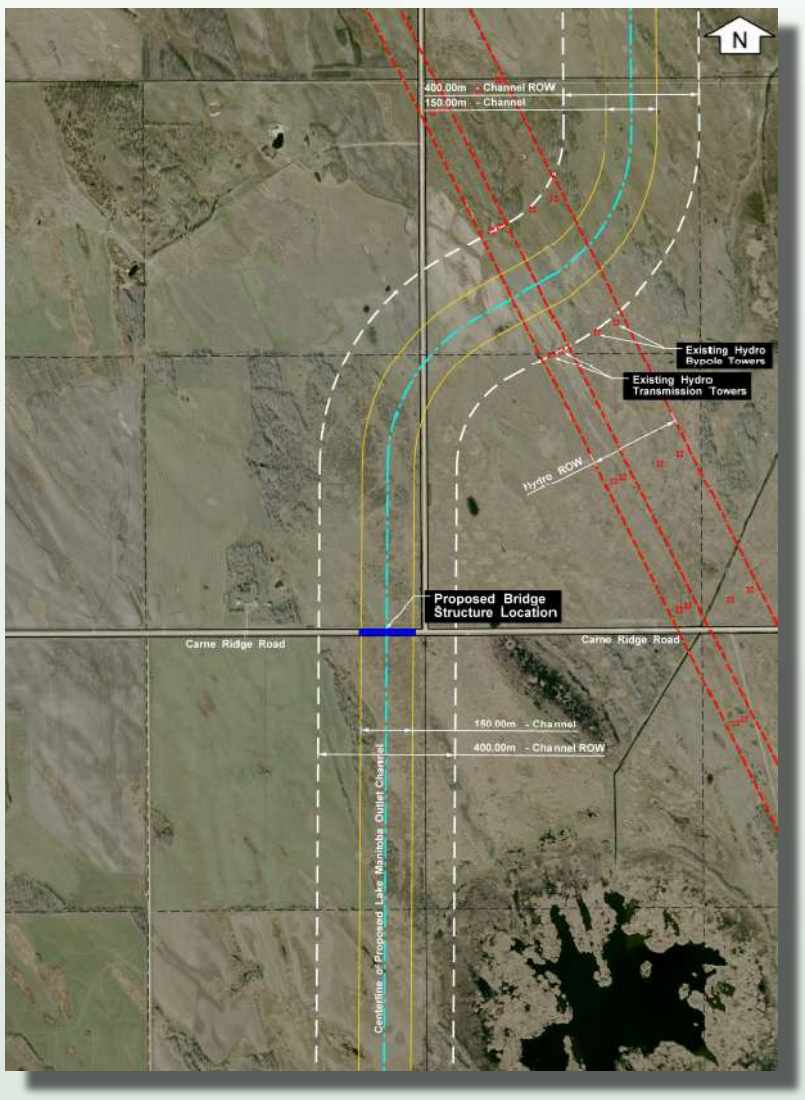
Lake Manitoba Outlet Channel
PR 239 Realignment





Lake Manitoba Outlet Channel Structure Locations

Township Road Bridge Structure



Carne Ridge Road Bridge Structure

PTH 6 Bridge Structure

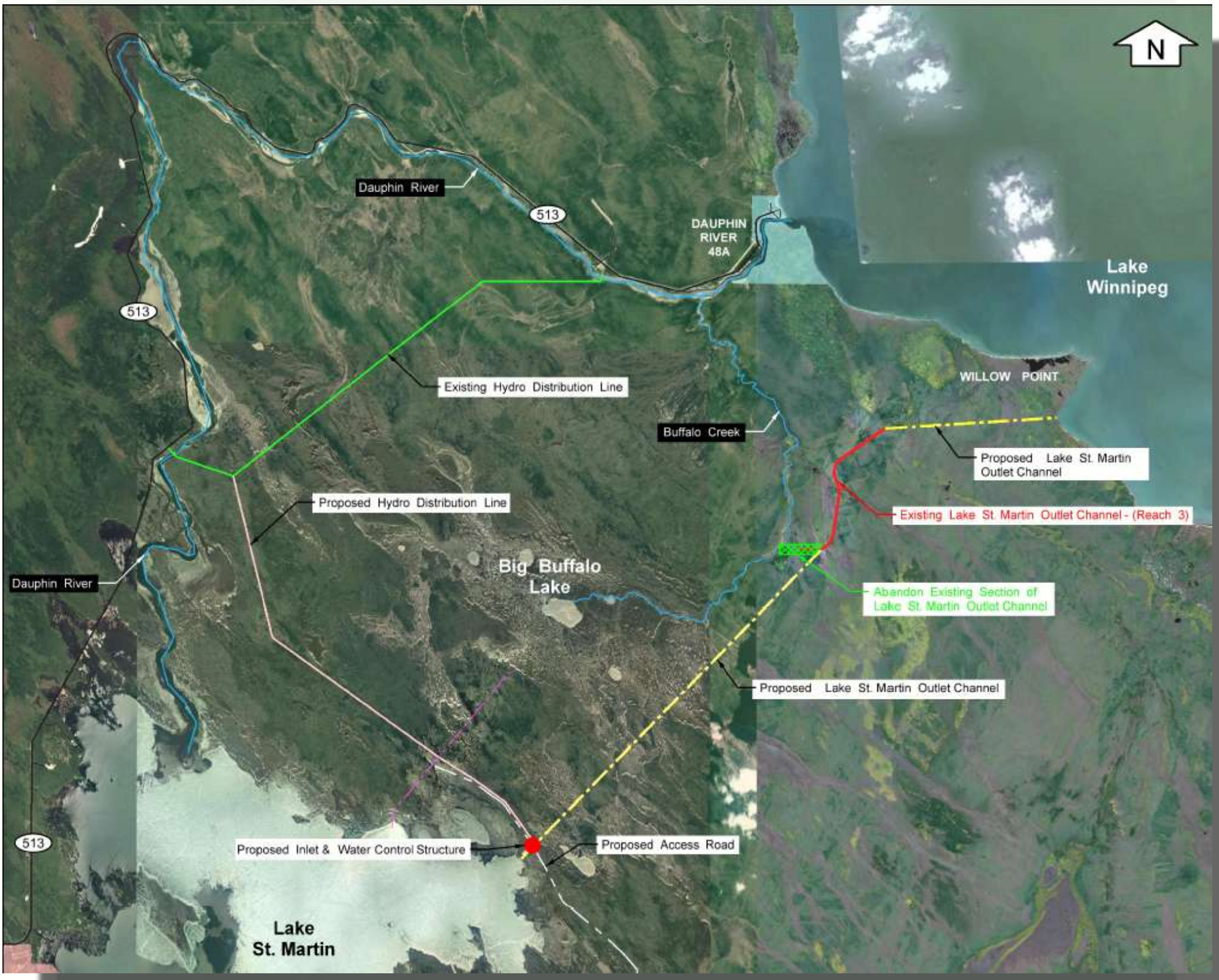
Iverson Road Water Control & Bridge Structure

Existing Lake St. Martin Emergency Outlet Channel

- Lake St. Martin Emergency Outlet Channel available for use during construction
- Lake St. Martin Emergency Outlet Channel used to maintain water levels in Big Buffalo Lake complex
- No long term impacts to Big Buffalo Lake / Buffalo Creek aquatic system
- Construction costs are similar between options
- Future opportunities for environmental compensation

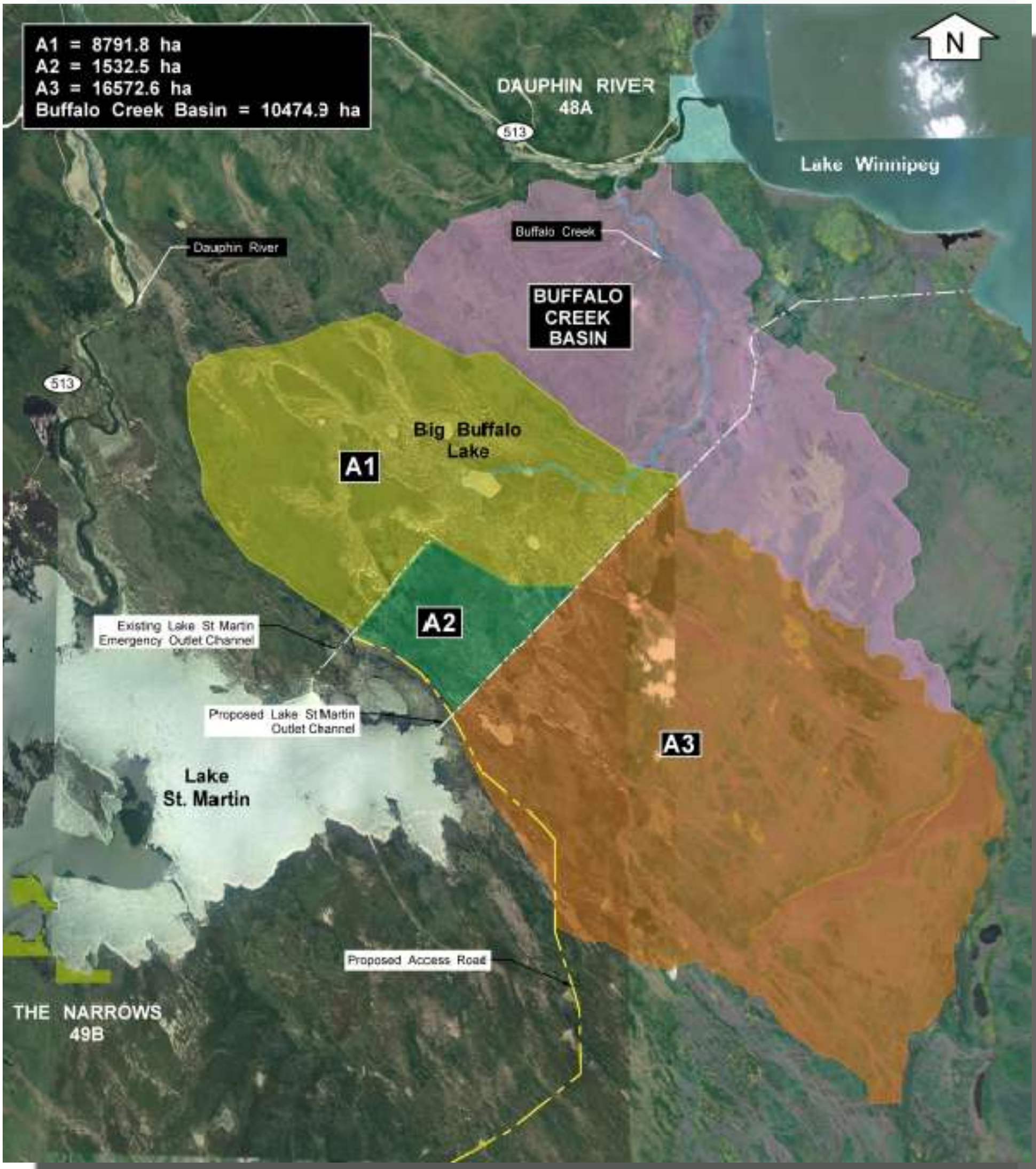
Manitoba

Proposed Lake St. Martin Outlet Channel



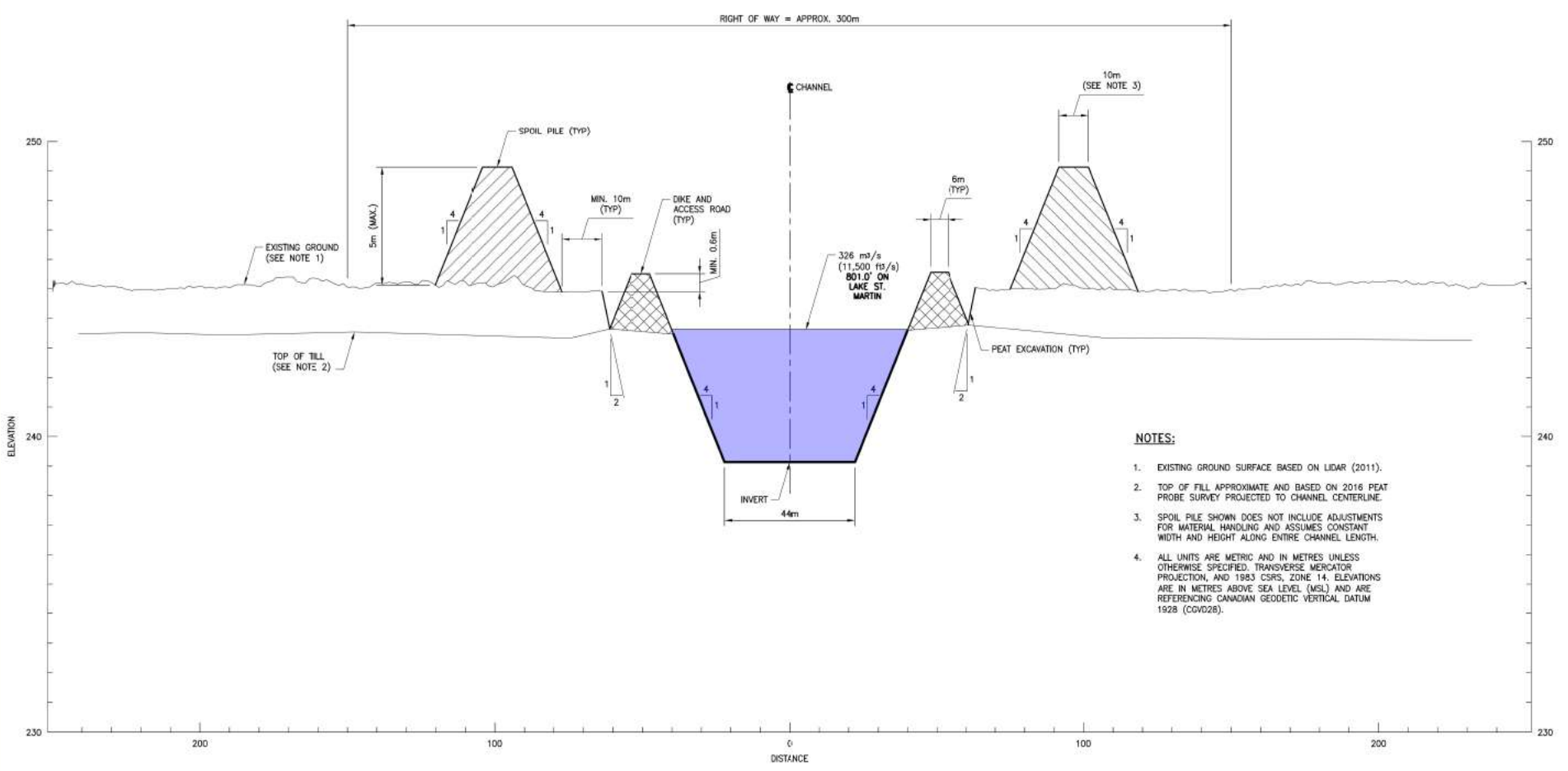
Manitoba

Lake St. Martin Outlet Channel Drainage Area

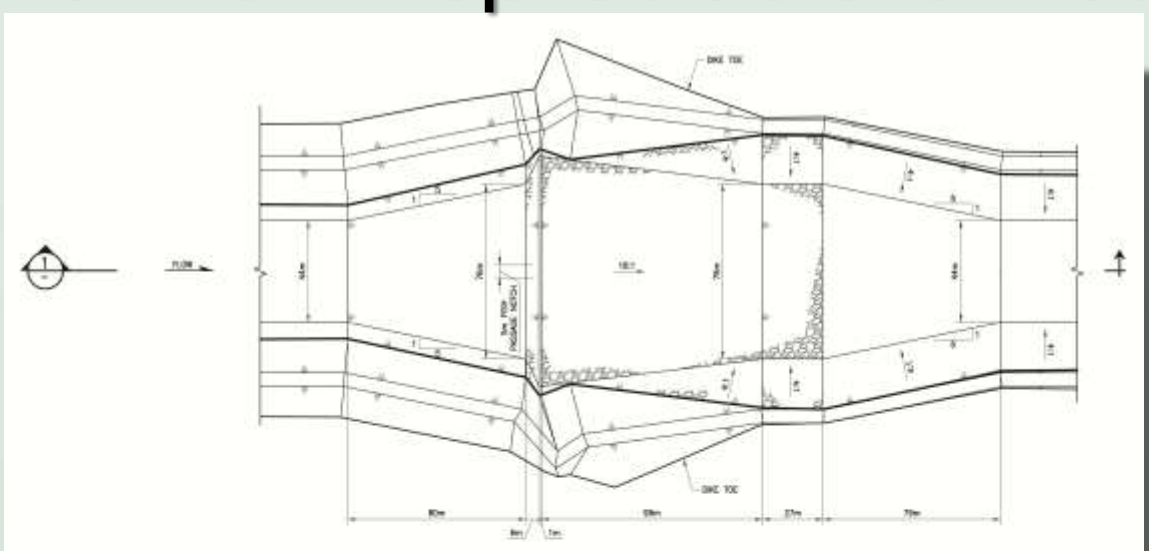


Lake St. Martin Outlet Channel

Typical Channel Cross Sections



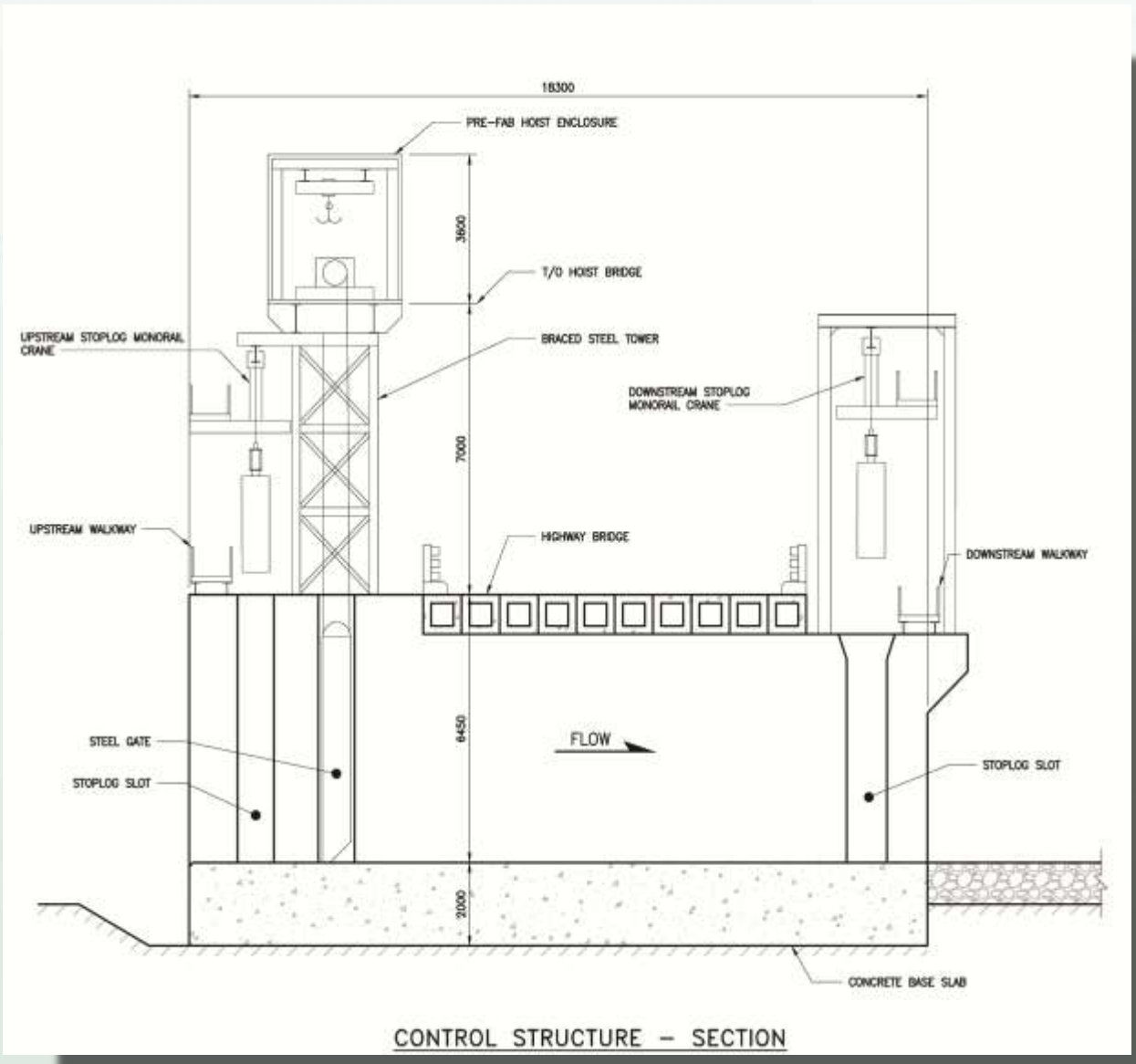
Channel Drop Structure Detail



Information provided by KGS Group

Lake Manitoba - Lake St. Martin Outlet Channels

Water Control Structure Details - Conceptual



CONTROL STRUCTURE – SECTION

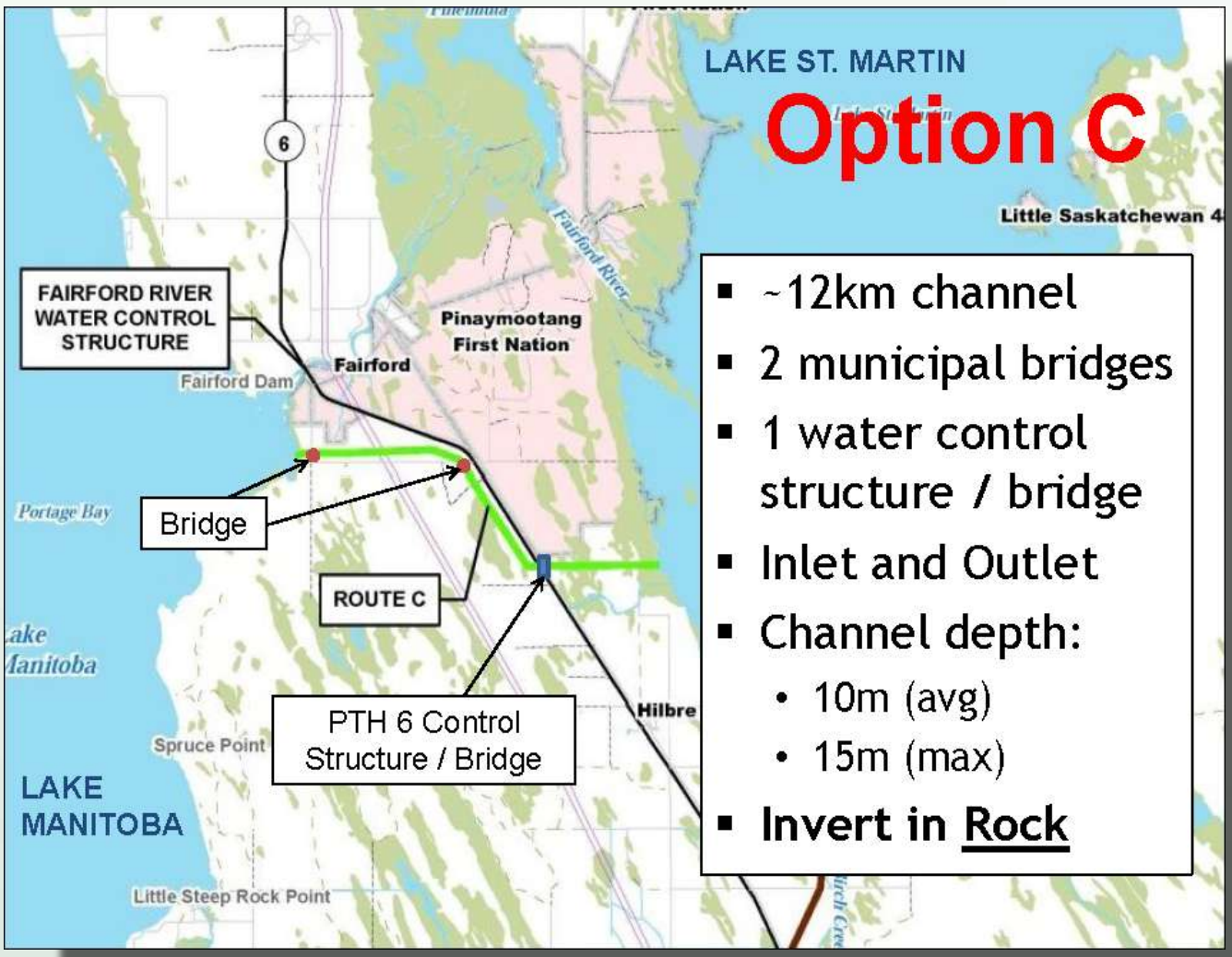
3 BAY CONTROL STRUCTURE – UPSTREAM ELEVATION

Information provided by KGS Group

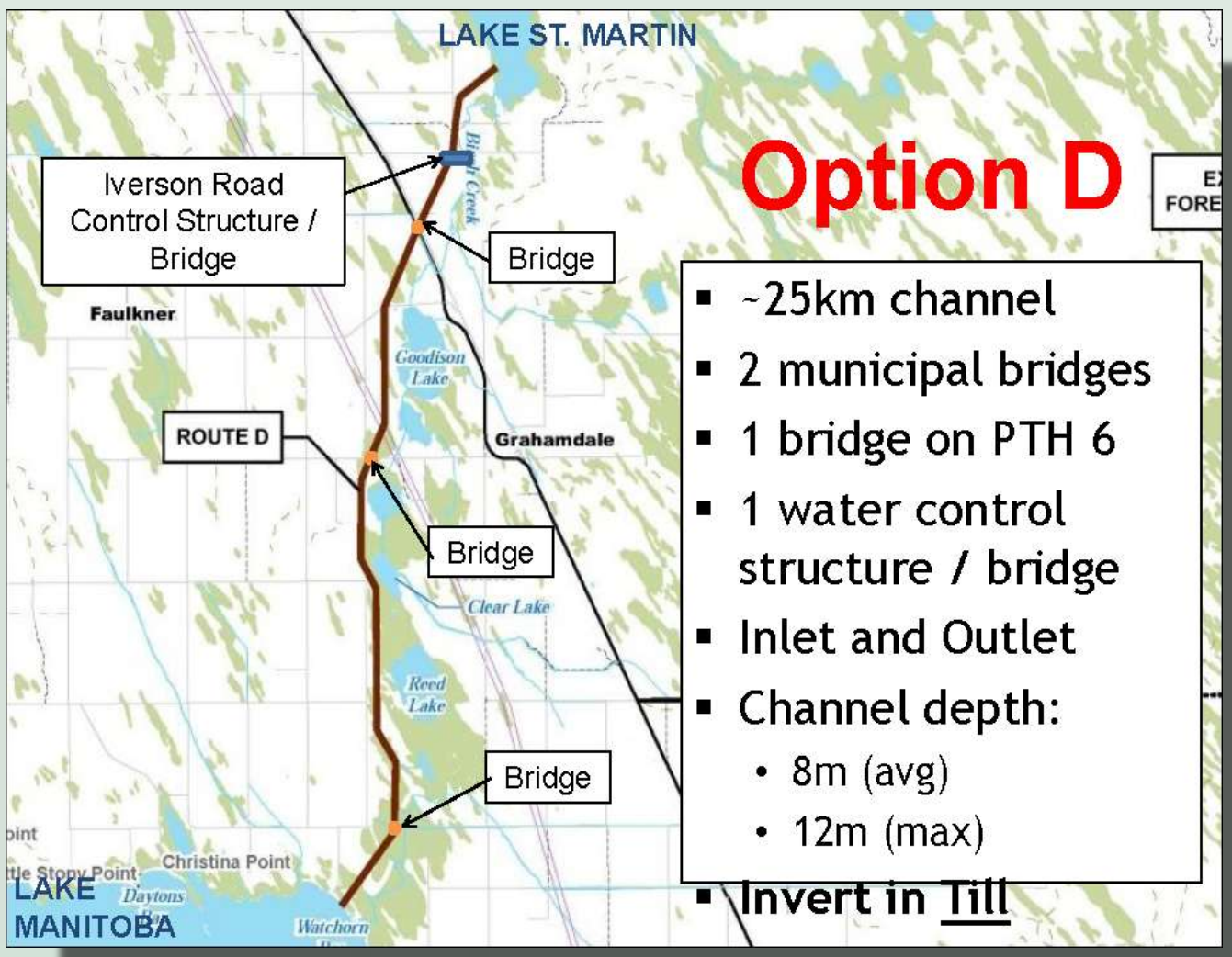
Lake Manitoba Outlet Channel

Channel Alignment Options

Option C



Option D



Information provided by KGS Group

Lake Manitoba Outlet Channel

Channel Alignment Options

Summary of Results

	Route C	Route D
Constructability	★★½	★★½
Operation and Maintenance	★½	★½
Cost	★★★	★★½
Risk	★	★★★½
Physical / Biological Environment Impacts	★★★★★	★★★½
Social Economic Considerations	★½	★½
Surface Water Impacts	★½	★
Groundwater Impacts	★	★★★★★
Average Rating	★★	★★½

- Option D identified as preferred alternative
- Mostly attributed to groundwater impacts and associated risks

Information provided by KGS Group

Proposed Operating Guidelines

Lake Manitoba Outlet Channel

Lake Manitoba

Fairford River Water Control Structure

- The Fairford River Water Control Structure will be operated according to the "Minimal Log Change Regime" with target Lake Manitoba range between 810.5 – 812.5 ft (recognizing that the lake will occasionally reach 810.0 ft or lower on the low side, and 813.0 ft or higher on the high side) and Lake St. Martin range between 797.0 – 800.0 ft
- Under normal operating conditions, outflow will be set to 50% capacity and there are no further stop-log adjustments
- During recovery from flood conditions on Lake Manitoba (level above 812.5 ft), the FRWCS will be kept wide open until Lake Manitoba recedes to the middle of the range (811.5 ft) after which point the FRCWS will be operated to achieve normal outflow (50% capacity)
- For recovery from drought on Lake Manitoba (level below 810.5 ft), the FRWCS is kept at 800 cfs until Lake Manitoba levels increase to the middle of the range (811.5 ft) after which point the FRCWS will be operated to achieve normal outflow (50% capacity)

Lake Manitoba Outlet Channel

- The outlet channel will be opened to maximum capacity when Lake Manitoba is above top of operating range (812.5 ft),
- Once the water level on Lake Manitoba recedes below the middle of the regulation range (811.5 ft), the outflow from the Lake Manitoba Outlet Channel will be reduced so that the outflow from the Fairford River Water Control Structure and the Lake Manitoba Outlet Channel, insofar as possible matches the inflow into Lake Manitoba
- The Lake Manitoba Outlet Channel will be closed once Lake Manitoba is below 811.5 ft and the outflow from the Fairford River Water Control Structure is greater than the total inflow into Lake Manitoba
- Initial operation of the outlet control structure shall not be initiated during the period in which there is solid ice cover in the channel (typically from Dec 1 – April 30th)

Proposed Operating Guidelines

Lake St. Martin Outlet Channel

Lake St. Martin

Lake St. Martin

Lake St. Martin Outlet Channel

- The target regulation range for Lake St. Martin is 797-800 ft
- The Lake St. Martin Outlet Channel will be opened to full capacity when the Lake St. Martin water level rises above 800 ft or when the Lake Manitoba Outlet is opened for initial operation and Lake St. Martin is above 797 ft.
- During recovery from high water when the lake level decreases below 800 ft, the outflow from the Lake St. Martin Outlet Channel will be reduced to the greater of either 50% of channel capacity or the outflow required to ensure total outflow from Lake St. Martin matches inflow from the Fairford River and Lake Manitoba Outlet Channel
- If the Lake Manitoba Outlet is in operation in November, the Lake St. Martin Outlet Channel should be operated so that the total outflow from Lake St. Martin, insofar as possible, matches inflow from the Fairford River and Lake Manitoba Outlet Channel during winter
- The Lake St. Martin Outlet Channel will be closed fully when Lake St. Martin drops below 798 ft during the period from when ice cover has cleared out of the channel in the spring to October 31st
- During the spring freshet the Lake St. Martin Outlet Channel will be operated if the Lake Manitoba Outlet Channel has been in operation over the winter under the following conditions:
  - If the Dauphin River outflow plus Lake St. Martin Outlet Channel capacity is less than the total inflow into Lake St. Martin, then the Lake St. Martin Outlet Channel will be open to full capacity
  - Otherwise, the Lake St. Martin Outlet Channel should be operated so that the total outflow from Lake St. Martin, insofar as possible, matches inflow from the Fairford River and Lake Manitoba Outlet Channel
- Initial operation of the outlet control structure shall not be initiated during the period in which there is solid ice cover in the channel (typically from Dec 1 – April 30th)

Project Schedule / Next Steps

Item	Schedule
Preliminary Design Packages Complete	Jan 31 – June 30, 2018
Crown Consultation wrap up	First ¼ of 2018
Environmental Impact Statement Submission (by Manitoba Infrastructure)	Second ¼ of 2018
Detailed Design Packages Complete	Jan 31 – June 30, 2019
Environmental Authorization	Second ¼ of 2019
Initiate Tendering	Second ¼ of 2019
* Construction commences	Second ¼ of 2019
Completion of Channel	Fourth ¼ of 2021

* Lake St. Martin Outlet Channel access road construction commences summer of 2017

Questions / Comments

Feedback forms available here today or please feel free to share your feedback at Survey Monkey using the following link:
https://www.surveymonkey.com/r/BT7FYXJ

Reach out to one of the Manitoba Infrastructure or KGS Group Representatives here today! They would be happy to answer any questions or discuss the project with you!

OR

Contact:

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