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May 08, 2023

Sean Carriere
Regional Director, Prairie and Northern Region
Impact Assessment Agency of Canada
Suite 1145, 9700 Jasper Avenue
Edmonton, AB T5J 4C3

Dear Sean Carriere:

Thank you for your January 31, 2023 letter to Manitoba Transportation and Infrastructure (MTI) from the Impact Assessment Agency of Canada (IAAC) requesting that MTI provide an update to the Project Description section of the Environmental Impact Statement (EIS; Volume 1 Section 3) for the proposed Lake Manitoba and Lake St. Martin Outlet Channels Project (the proposed Project) submitted on March 5, 2020.

MTI understands and it is MTI's view that the purpose of the request for an updated Project Description is to clarify and consolidate the refinements made to the proposed Project. Refinements are made as part of any standard planning and environmental review process and as projects progress through more detailed planning and design.

MTI's design refinements are typical of the planning process for any major project. These refinements are shaped not only through ongoing field studies and detailed design, but through feedback and discussions with regulators, and engagement with Indigenous groups and key stakeholders. The environmental assessment is an important planning tool that involves examining and re-examining potential effects as the design process proceeds, and developing mitigation measures, either through design modifications or through measures to monitor and manage effects. The EIS provides a formal venue for the process to be shared publicly, but it does not end with the filing of the EIS. The EIS conclusions are tested as the design process continues, to verify that there are no substantive changes to the environment that cannot be effectively mitigated. In many cases, the advancements in design are focused on methods to reduce adverse effects. As IAAC noted in its January 31, 2023 letter, key changes are already reflected in MTI's filed responses to the Round 1 Information Requests, and as applicable, will be included in MTI's responses to the Round 2 Information Requests.

Notwithstanding the above comments, MTI appreciates the value in developing a more formal update to the Project Description to consolidate those refinements shared publicly after the filing of the EIS.

MTI, therefore, provides the attached updated Project Description to IAAC, for posting on the Canadian Impact Assessment Registry, to support the continued effective review of the proposed Project EIS, IAAC's preparation of the draft Environmental Assessment Report, and to provide support for consultation and engagement activities. This updated Project Description is not being provided as an amendment to the proposed Project EIS.

Thank you again for your letter and I trust this has addressed your concerns.

Sincerely,

[redacted]

Amna Mackin
Director

c: Ian Martin, Team Leader, Impact Assessment Agency of Canada
Scott Johnstone, Environmental Assessment Ecologist, Transportation and Infrastructure
Jaime Smith, Environmental Manager, Major Projects, Transportation and Infrastructure

LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT
Environmental Impact Statement
May 2023 Project Description Update

CHAPTER 3

PROJECT DESCRIPTION UPDATE

May 2023

PREFACE

This document has been developed in response to a January 31, 2023, letter to Manitoba Transportation and Infrastructure from the Impact Assessment Agency of Canada (IAAC) to provide an update to the Project Description section of the Environmental Impact Statement (EIS; Volume 1 Section 3) for the Lake Manitoba and Lake St. Martin Outlet Channels Project (the proposed Project) that was submitted on March 5, 2020. Manitoba Transportation and Infrastructure understands, and it is Manitoba Transportation and Infrastructure's view that the purpose of the request for an updated Project Description is to simply clarify and consolidate the refinements made to the proposed Project. Refinements are made as part of any standard planning and environmental review process and as projects progress through more detailed planning and design.

Manitoba Transportation and Infrastructure's design refinements are typical of the planning process for any major project, and these refinements are shaped not only though ongoing field studies and detailed design, but through feedback and discussions with regulators and engagement with Indigenous groups and key stakeholders. The environmental assessment is an important planning tool that involves examining and re-examining potential effects as the design process proceeds, and developing mitigation measures, either through design modifications or through measures to incorporate to monitor and manage effects. The EIS provides a formal venue for the process to be shared publicly, but it does not end with the filing of the EIS. The EIS conclusions are tested as the design process continues, to verify that there are no substantive changes to the environment that cannot be effectively mitigated. In many cases, the advancement in design are focused on methods to reduce adverse effects. As IAAC noted in its January 31, 2023, letter, key changes are already reflected in responses to the Round 1 Information Requests (IRs) and will be included in responses to the Round 2 IRs, as applicable. Notwithstanding the above comments, Manitoba Transportation and Infrastructure appreciates the value in developing a more formal update to the Project Description to consolidate those refinements shared publicly after the filing of the EIS.

In their January 31, 2023, letter, IAAC specifically asked for the following:

- Updates to figures, as necessary.
- Proposed Project components or activities that are the same or unchanged as initially described are identified.
- Any changes made to proposed Project component details, activities, schedules, and mitigations are clearly identified.
- Proposed Project components and activities that may still be under consideration as part of the response to the Round 2 IRs are clearly identified.

- An update to the proposed Project's operating conditions is provided, including criteria used to determine the start, stop, and nature of operations.

In order to address these updates in a manner that allows efficient comparison with the March 2020 version, this May 2023 Project Description Update document is organized into the following sections, matching those in the March 2020 Project EIS Project Description:

- Scope of the proposed Project.
- Proposed Project phases.
- Proposed Project components.
- Proposed Project activities.
- Schedule.
- Environmental management plans.

In addition, Appendix 3A consists of a table summarizing the specific design refinements made between the March 2020 Project EIS version and this document. As with the March 2020 Project EIS, additional tables and figures are included in Appendices 3A and 3B, respectively. The other appendices provided in the March 2020 Project EIS have not been included as they have either not changed, or the documents were provided as part of the May 31, 2022, responses to the IAAC IRs or June 30, 2022, supplemental information package. In addition, where appropriate, references have been made to responses to various IAAC IRs to provide additional details. They are referenced in footnotes and the filed submissions can be found at the IAAC's Public Registry Project Page: https://iaac-aeic.gc.ca/050/evaluations/document/144334 (Document Reference Number: 147).

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Abbreviations and Acronyms

ac	acre
AEMP	Aquatic Effects Monitoring Plan
AgBMP	Agricultural Biosecurity Management Plan
AMP	Access Management Plan
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEAA	*Canadian Environmental Assessment Act*
CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
CSP	corrugated steel pipe
cfs	cubic feet per second
DCP	Dust Control Plan
DFO	Department of Fisheries and Oceans Canada
DO	dissolved oxygen
EHMP	Eastern Whip-Poor-Will Habitat Management Plan
EIS	Environmental Impact Statement
EMP	Environmental Management Program
EOC	Emergency Outlet Channel
EPP	Environmental Protection Plan
ERP	Emergency Response Procedures
f asl	feet above sea level
ft^3	cubic feet

Abbreviations and Acronyms
May 2023

FRWCS	Fairford River Water Control Structure
GCS	gradient control structure
GWMP	Groundwater Management Plan
ha	hectare
hp	Horsepower
HRPP	Heritage Resources Protection Plan
IAAC	Impact Assessment Agency of Canada
IDF	Inflow Design Flood
IMP	Ice Management Plan
in	inch
IR	Information Request
km	kilometre
kVA	kilovolt-amps
kW	kilowatt
LAA	Local Assessment Area
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m^3/s	cubic metres per second
m^3	million cubic metre
m asl	metres above sea level
mg/L	milligrams per litre
mm	millimetre
mi	mile
O&M Manual	Operation and Maintenance Manual

Abbreviations and Acronyms
May 2023

OEMP	Operation Environmental Management Program
PER	Project Environmental Requirements
PR	Provincial Road
PTH	Provincial Trunk Highway
QMP	Quarry Management Plan
RM	Rural Municipality
ROW	right-of-way
RHMP	Red-headed Woodpecker Habitat Management Plan
RVMP	Revegetation Management Plan
SDP	Site Decommissioning Plan
SMP	Sediment Management Plan
sq. mi	square miles
SWMP	Surface Water Management Plan
V	volt
WCP	Wetland Compensation Plan
WCS	water control structure
WetMP	Wetland Monitoring Plan
WMP	Wildlife Monitoring Plan

3.0 PROJECT DESCRIPTION

3.1 INTRODUCTION

As stated in the March 2020 Project Environmental Impact Statement (EIS), the purpose of the proposed Project is to develop a permanent flood control management system for Lake Manitoba and Lake St. Martin. This involves the construction of a new diversion channel from Lake Manitoba to Lake St. Martin – the Lake Manitoba Outlet Channel (LMOC), and a new diversion channel from Lake St. Martin to Lake Winnipeg – the Lake St. Martin Outlet Channel (LSMOC). The specific objective of the proposed Project is to better facilitate management and control of the water levels on these lakes by providing additional capacity to move water from Lake Manitoba through Lake St. Martin into Lake Winnipeg under flood conditions via new channels. These lakes are naturally connected through the existing Fairford and Dauphin rivers, and due to the low topography, this area is susceptible to flooding.

The catastrophic damage and disruption caused by flooding in 2011 and again in 2014 highlighted the need for improved flood protection on Lake Manitoba and Lake St. Martin and led to the proposed Project. The estimated impact of the 2011 flood for both the provincial and the federal governments exceeded $2.1 billion and disrupted and displaced local residents, damaged homes, properties, and people's way of life, and impacted local and provincial economies. The 2011 and 2014 floods were not isolated events; Manitoba continues to experience record flood events throughout the province and expects to be subject to more extreme weather events including both wetter and drier conditions in the future. In wetter periods, the proposed Project will help protect Manitobans in areas that currently remain vulnerable to flooding.

The proposed Project consists of the design, construction, and operation and maintenance of new permanent flood protection infrastructure: the LMOC and LSMOC, and associated works such as control structures. Maps that identify the Project components in relation to other major existing infrastructure, adjacent land uses, and important environmental features are provided in Appendix 3C (Figures 3C-1, 3C-2 and 3B-C). The proposed Project will be owned by the Government of Manitoba and operated by Manitoba Transportation and Infrastructure as the provincial department responsible for proposed Project operation and for monitoring and maintaining Project structure integrity.

Given the nature of the proposed Project and its objective of providing a flood control management system, the fundamental and most important engineering design consideration is the design discharge, which is how much water will flow through the channels during a flood. This design basis includes meeting flood management requirements for Lake Manitoba and Lake St. Martin for the worst flood to-date on record for these lakes (henceforth referred to as Flood of Record) - the 2011 flood, which represents an approximate 1 in 300-year flood event (i.e., a flood with a magnitude that is expected to occur, on average, once every 300 years). As a consequence, the proposed Project has been designed to safely move a similar volume of water, which will lower the lake levels of Lake Manitoba and Lake St. Martin, and thereby reduce the effects of flooding on communities and lands adjacent to those lakes.

The process of engineering design to meet this proposed Project objective progresses through a series of stages. Each share a focus on the same basic design parameters - lake levels, water volume and flow rate through the channels in combination with the natural rivers, and a rationale for those parameters. The three design phases are as follows:

- Conceptual Design: A level of design to address an initial lake level and volume flow representative of an optimization of flood management and cost criteria anticipated to provide a desired economic and safety benefit to communities. This was the design basis assessed in the Project EIS.
- Preliminary Design: A refinement of the conceptual design to meet requirements for the management of flood events and to meet federal dam safety guideline requirements (this is commonly known as the “engineering safety factor” because the proposed Project has similar features to dams).
- Detailed Design: Final refinement of preliminary engineering design for the purposes of meeting construction specification requirements. This design stage is in process and will be finalized after proposed Project approval is received.

Since the Project EIS was filed in March 2020, the proposed Project analysis and design has advanced and details have been refined on aspects such as system hydraulic design criteria, Lake St. Martin head loss, and potential physical impacts to rivers and lakes in the system. Some components advanced to the next phase in design earlier than others and so more details were available at different steps in the assessment process, so a conservative approach was taken in assessing effects. Reports documenting updated studies and refinements in designs were attached to the responses to the Impact Assessment Agency of Canada (IAAC) Information Requests (IRs) submitted in May 2022. They provide more details on aspects such as anticipated changes in flow and velocities at the Lake St. Martin Narrows and the Fairford and Dauphin rivers, and their associated sediment erosion and deposition potentials. They also provide more details on sediment movement between Lake Manitoba and Lake Winnipeg (Sturgeon Bay) to determine sediment loads in the rivers and channels that are anticipated to be transported to Lake Winnipeg. The output of this ongoing analysis has resulted in some design improvements, such as modifying the elevation of the LSMOC channel, and armouring both channels to improve erosion protection. As part of the planning and design process, potential environmental effects and proposed mitigation measures for relevant Valued Components have been checked to verify that there are no changes to the assessment conclusions reported in the March 2020 Project EIS.

It should be noted that the proposed Project is also expected to provide the benefit of flood mitigation far into the future in consideration of climate change, which is anticipated to gradually cause more precipitation in the region, more runoff into rivers, and a resulting increase in lake levels and related overland flooding. It is important to note that climate change impacts are not anticipated to result in direct impacts to increased lake levels with the proposed Project. The more likely direct impact is an increased frequency of operation. Once the lake level reaches the top of its target range and operation commences, the system is designed to manage flood waters until such time as operation is ceased in accordance with operational guidelines.

Although the proposed Project will work collaboratively 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 proposed Project is not considered to be an extension or expansion of other flood control measures constructed in Manitoba.

3.2 SCOPE OF THE PROPOSED PROJECT

The 2018 Project Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012* (CEAA Guidelines[1]) define the proposed Project scope to include the construction, operation, decommissioning, and abandonment of the following proposed Project components that will be described in this chapter:

- Main Works:
    - diversion (outlet) channels (outside drains, etc.)
    - channel inlets and outlets
    - drop structures (to manage water flow through steep sections of the LSMOC)
    - water control structures (WCSs)
    - bridges, including combined bridges and WCSs
    - road works, including re-alignment and/or construction of provincial highways and roads, and municipal roads that are incidental to the Project
    - repurposing of a portion of the existing Lake St. Martin Emergency Outlet Channel (EOC)
- Associated Works and Activities:
    - site clearing, earthmoving, stockpiling, leveling, and excavation – including in-lake excavation and dredging and potential blasting activities
    - rock quarries and borrow areas (production and transportation of aggregate materials)
    - explosives storage, manufacturing, and handling
    - installation and subsequent removal of temporary works structures used to divert water during construction so as to construct instream works in the dry (e.g., cofferdams, settling ponds and groundwater depressurization wells)

[1] Document Reference Number 10 of IAAC Registry Project Page: Final Environmental Impact Statement Guidelines (iaac-aeic.gc.ca)

- Construction activities and accommodations, including temporary construction camps, waste disposal, temporary work areas, laydowns, and other ancillary infrastructure (including installation and subsequent removal of temporary construction camps, maintenance buildings, offices, work areas, laydowns, and other ancillary infrastructure such as access roads)
- power supply (source, quantity)
- works for erosion and sediment control (including installation and monitoring of control measures to manage erosion, sediment, and nutrients in surface water during construction)
- waste collection and disposal for all waste streams
- woks for dust control

3.3 PROPOSED PROJECT PHASES

As requested by the CEAA Guidelines, the Project EIS discusses the following three phases:

1. Construction phase (site preparation, construction, and commissioning).
2. Operation phase (operation and maintenance).
3. Decommissioning and abandonment phase.

Various planning and design activities were undertaken to define the proposed Project components and activities. This initial work included identifying preferred route alignments for each outlet channel, preliminary and conceptual engineering studies and analysis, environmental baseline data collection and environmental assessment. This pre-construction phase also included the initiation of Indigenous and Public engagement processes, described in Volume 1, Section 5 of the March 2020 Project EIS. The planning and design process has continued since that time, with refinements made based on input from the review of the Project EIS that has contributed to advancing the detailed design for the proposed Project. As such, the specific designs, and exact locations of infrastructure such as bridges and WCSs, have been refined. The advancement of design has considered and incorporated input from a process that includes pertinent output from environmental studies, engagement (i.e., with regulators, Indigenous groups, and key stakeholders such as the Rural Municipality [RM] of Grahamdale), and Project EIS review, including refinement of mitigation measures and formal regulatory approvals conditions. The contract tendering process and construction-related Environmental Management Program (EMP), summarized in Section 3.7, will be completed prior to construction, and will incorporate the inputs from this process. This section of the document (Section 3.3) summarizes the types of activities carried out under each phase of the proposed Project. Details can be found on proposed Project activities in Section 3.5.

3.3.1 Site Preparation, Construction and Commissioning

Overview

The proposed Project construction phase is organized into site preparation, construction, and commissioning. Specific activities include construction of the outlet channels, inlet and outlet works, WCSs, road realignment, and bridges. Temporary and permanent works are also required to manage surface water and groundwater flows during construction and operations.

Site Preparation

Site preparation involves creating conditions suitable for construction activities to commence. Initial tasks include transporting equipment, machinery, vehicles, construction materials and supplies to the proposed Project site, as well as preparation of equipment marshalling areas, construction camps and staging areas, establishing traffic management and the relocation or removal of any infrastructure (i.e., fences, buildings) and waste piles. Site preparation for the proposed Project will also require vegetation clearing and grubbing of the final channel alignment rights-of-way (ROWs) prior to excavating the channel to designed depths along the proposed 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 topsoil and peat soils.

Construction

Once cleared, excavation of the outlet channels within the ROWs may proceed year-round. Topsoil will be temporarily stockpiled to later be spread over the earthen dikes as a seed bed. Clay and till material will be excavated and placed adjacent to the channel as spoil banks and/or containment dikes. Outlet channels will be isolated as necessary and excavated in the dry. Channels will be armoured to protect against erosion during flood management operations. The inlet and outlet for each of the LMOC and LSMOC will be excavated in the lakes behind isolation for control of sediment. Contractors may propose a combination of fish exclusion barriers, floating turbidity curtains, cofferdams, barges, or other temporary works to complete the work in-water or “in the dry.” Other in-water works include jetty installation for the LSMOC and shoreline excavation related to the inlet and outlet of each channel.

Selected methods and engineered designs proposed by the contractors will be reviewed and approved by Manitoba Transportation and Infrastructure to confirm compliance with regulatory and proposed Project requirements. Execution of in-water works will be undertaken in accordance with approvals obtained via a separate processes with The Department of Fisheries and Oceans Canada (DFO) based on the specifics of the engineering design to address *Fisheries Act* requirements, and Transport Canada to address *Canadian Navigable Waters Act* requirements.

WCSs will be concrete and span the full width of the outlet channels, with gates that can be operated to control the flow of water. WCSs will be constructed “in the dry” and will only be exposed to water when the control gates are in place and the structures can safely be exposed to flows. Since WCSs are to be

built in the dry and are located inland, scheduling of work relative to fish spawning windows will not be required and construction may take place year-round.

Bridges will consist of multiple spans across the full width of the outlet channels. They will include steel or concrete girders, a concrete deck and/or asphalt surface, driven steel pipe-pile pier bents with concrete caps, and concrete abutments founded on driven steel H-piles. Both channels will be armoured, and riprap will be installed at the bridge sites. Construction is expected to follow a standardized sequence, with abutments and piers completed first, followed by the superstructure. As with the channel and WCSs, bridges will be built in the dry with year-round construction being possible. Since these are to be built in the dry, scheduling of work will not be required for avoiding fish spawning windows.

As the outlet channels will intercept existing drains and natural surface water drainage paths, an outside drain will be excavated along the upgradient side of each of the LMOC and LSMOC to collect runoff and municipal flows and discharge into the lakes adjacent the inlets and outlets. New culverts will be designed and constructed to allow the drains to flow through road crossings, as required.

Realignment of Provincial Road 239 (PR 239) and municipal roads will be undertaken to accommodate the LMOC while still allowing for safe, economically feasible, and hydraulically efficient structures crossing the channel. Realignment of PR 239 will provide opportunities to reduce the number of bridge crossings over the channel and improve the intersection of PR 239 with Provincial Trunk Highway 6 (PTH 6). Similarly, sections of municipal roads will be reconstructed, realigned, or extended to maintain reasonable access within the municipality and across the channel (see Section 3.5.2.4).

Power will be provided to each WCS by a distribution line to be permitted, designed, constructed, and operated by Manitoba Hydro, the organization responsible for electrical utilities in the province of Manitoba. As Manitoba Hydro will permit, design, own and operate these lines, these proposed Project components are defined as the service connection points between the lines and the structures; the lines themselves are assessed based on general design information available from Manitoba Hydro as associated works (see Sections 3.4.2.8 and 3.4.3.7).

Associated works and activities such as construction staging areas and temporary construction camp locations will be selected, surveyed, and flagged as part of the onset of construction. Existing licensed and permitted quarry and borrow areas will be used if appropriate and will remain after proposed Project construction. Temporary facilities and work areas, including laydown areas and construction camps, that will not be needed for future operation and maintenance activities will be decommissioned and reclaimed at the end of the construction phase. The principles related to construction decommissioning, defined as the closure and/or de-construction of temporary infrastructure or work sites, are outlined in the Project Environmental Requirements (PERs), and Site Decommissioning Plan (SDP), as submitted as part of the June 2022 supplemental IR response to IAAC IRs.

Commissioning

Prior to being ready to operate (i.e., manage flooding), the final transitional phase of construction is the process of confirming that all systems and components of the proposed Project are installed and will operate according to the design specifications and operational requirements. This involves engineering procedures to check, inspect and test every operational component of the proposed Project, from individual functions such as specific instruments and equipment to complex effectiveness of structures in managing flows.

One issue given particular attention, based on further testing and modelling after submitting the March 2020 Project EIS, is the potential for channel erosion and potential issues with downstream sediment. As a result, a decision was made to armour each channel, as described in Sections 3.4.2.1 and 3.4.3.1. As described above and in Section 3.5.2.2, the channels will be constructed “in the dry,” and efforts will be made to remove or contain any residual materials (sediments), so they are not mobilized during commissioning or future operation. However, in order to manage the downstream effects of sediment, the commissioning phase will not commence until the revegetation of target erodible areas has become established and will include controlled releases of flow to manage downstream sediment levels to within acceptable limits. Details are described in Sections 3.5.2.11 and 3.5.2.12, and the Sediment Management Plan (SMP) filed as part of the June 2022 supplemental information response to IAAC IRs.

3.3.2 Operation and Maintenance

The operation and maintenance phase refers to the periods when the outlet channels are conveying flow to address flood conditions, once construction is completed, including maintenance and follow-up monitoring. Operational Guidelines for the WCSs (filed as part of the June 2022 supplemental information response to IAAC IRs) are defined relative to water levels in Lake Manitoba and Lake St. Martin for operation of the LMOC and LSMOC, respectively (as submitted as part of the June 2022 supplemental response to IAAC IRs). The Operating Guidelines will be further refined, as required, and be administered under Manitoba’s *The Water Resources Administration Act*. The Act includes provisions related to Operating Guidelines and enables the Minister to assemble advisory committees for water control works.

During the operations and maintenance phase of the proposed Project, the LMOC and LSMOC will be operated by adjusting the gates on the respective WCSs in response to monitoring and flood forecasting according to the Operating Guidelines. This results in essentially two modes for WCS gate operation:

1. Open gates, to reduce levels on Lake Manitoba and Lake St. Martin by increasing outflows through the LMOC and LSMOC, respectively, during flood conditions.

2. Closed gates, where only minimal riparian flows (i.e., baseflows) are conveyed through the LMOC and LSMOC to maintain oxygen levels in the channels (for fish); lake levels and river flows are maintained or only marginally decreased.

The gate opening and closing process will be used to facilitate fish leaving the channels, and to manage issues such as ice and sediment, as discussed in Section 3.5.3.4. Operations and maintenance activities will adhere to Canadian Dam Safety Guidelines (CDA 2013), including its Operating, Maintenance and

Surveillance Manual. A Project-specific Operation and Maintenance Manual (O&M Manual) will be developed for the proposed Project structures to detail maintenance needs for the proposed Project during the operation and maintenance phase. Maintenance requirements will generally differ according to open versus closed operations of the WCS gates. The O&M Manual will include roles and responsibilities (e.g., legislated responsibilities, and regulatory approvals/conditions) for Manitoba Transportation and Infrastructure and operator, records and logs (e.g., flow and water level monitoring), coordination with Indigenous groups and local governments (e.g., municipalities), emergency operations, operating guidelines, operating procedures (e.g., gate system, pre-operating inspection, notifications, monitoring), maintenance manuals, and maintenance procedures (e.g., vendor contracts, gate system, routine inspection/servicing).

3.3.3 Decommissioning and Abandonment

As indicated, the purpose of the proposed Project is to develop a permanent flood control management system for Lake Manitoba and Lake St. Martin. Decommissioning of the proposed Project is not anticipated; however, should portions of the proposed Project require decommissioning in the future, these activities will be undertaken in accordance with applicable guidelines and regulations at that time. Upgrading or rehabilitation to extend the life of the structures will take place as part of major maintenance projects and will depend on structural/historic attributes of the facility as well as economic and financial considerations at the time.

The proposed Project scope does not include decommissioning of the existing EOC Reach 1.

3.4 PROJECT COMPONENTS

3.4.1 Overview

The proposed Project includes the LMOC and LSMOC (see Appendix 3B-1), which have several associated components, listed and described below. The size and design flows related to operations are discussed in Sections 3.4.2 and 3.4.3. The proposed Project main works are as follows:

- LMOC:
    - a diversion channel, approximately 24.1 kilometres (km) (15.0 miles [mi]) long
    - a channel inlet positioned at Watchorn Bay on Lake Manitoba and outlet at Birch Bay on Lake St. Martin
    - a WCS (combined with a road bridge)
    - four road bridges, one of which is combined with the above-noted WCS
    - realignment and/or new construction of PR 239 and affected municipal roads

- LSMOC:
    - a diversion channel, approximately 23.8 km (14.8 mi) long
    - a channel inlet positioned at the east end of Lake St. Martin and outlet east of Willow Point in Sturgeon Bay of Lake Winnipeg
    - a combined bridge and WCS
    - eight drop structures
- Associated Works and Activities (both channels):
    - site clearing, earthmoving, stockpiling, leveling, excavation and revegetation
    - installation and subsequent removal of temporary works required to construct the main works, such as cofferdams, settling ponds
    - production and transportation of aggregate materials
    - electrical power supply
    - temporary construction camps and staging areas
    - temporary access routes (via existing roads)
    - diversion of existing drainage infrastructure and surface water flows
    - measures to manage groundwater during construction and operation
    - dust, erosion and sediment control
    - waste storage and disposal
    - fuel storage and handling
    - facilities for storage of explosives, if required
    - mitigation and site preparation activities such as the removal of manure stockpiles in the ROW and development of measures to manage runoff from adjacent cattle operations

The various phases of the proposed Project will include supporting activities that will be wholly undertaken by others (i.e., contractors) for the provision of construction materials, power, fuel, waste management and disposal and other proposed Project needs. Such items include the following:

- Rock and borrow materials will be provided from licensed and approved sources. The selection and use of specific sources are not defined and will be determined by the successful contractor(s) and

approved by Manitoba Transportation and Infrastructure to produce the required materials for the proposed Project.

- Electrical power lines to the WCSs will be provided by Manitoba Hydro. If applicable, temporary camps may also be powered by existing local Manitoba Hydro services as determined by the contractor.
- Solid wastes generated by proposed Project-related construction, and operation and maintenance phases will be transferred to appropriately permitted/licensed facilities for recycling and/or disposal.
- Wastewater generated by the proposed Project activities will be stored and transferred for disposal at existing licensed facilities by qualified carriers.

3.4.2 Lake Manitoba Outlet Channel

Since submission of the Project EIS in March 2020 there has been considerable progress on the LMOC design; primarily related to refinements to the dimensions and configuration of the channel, inlet, outlet, and outside drain. The channel alignment is unchanged and remains the same as presented in the March 2020 Project EIS; however, the channel cross-section has been optimized to incorporate findings from further geotechnical investigations and stability analyses that allow for a reduction in the quantity of excavation required to meet design objectives, as well as a reduction in water velocities within the portion of the channel between its WCS and Lake St. Martin. Additionally, analyses of shoreline geomorphology[2] and sediment transport processes[3] have indicated that such processes are not anticipated to detrimentally affect the operation of the LMOC; therefore, the installation of groins to manage sediment movement along shorelines is not required at either the inlet or outlet. It is presently assumed that construction of the inlet and outlet works will take place in the wet with the construction area enclosed by turbidity curtains to prevent or reduce the migration of disturbed sediments into the lake. The outside drain will no longer discharge directly into the channel; instead, it will convey watershed runoff originating from the upgradient area west of the channel into Lake Manitoba and Lake St. Martin.

3.4.2.1 Outlet Channel

Design Discharge

As described in the Project EIS, the design of the LMOC requires that the channel convey a flow of 212 cubic metres per second (m^3/s) (7,500 cubic feet per second [cfs]) when the water level on Lake Manitoba is at elevation 248.11 metres above sea level (m asl) (814 ft) and a Lake St. Martin level of 244.2 m (801 ft) asl (KGS Group 2016). The conceptual design of the LMOC presented in the Project EIS satisfied this requirement. However, the actual flow conveyed by the LMOC is dependent on the water level in Lake Manitoba and the channel must also be designed to accommodate a repeat of the 2011 Flood of Record, for this region, which has been designated as the Design Flood for the Project. As a

[2] Summarized in the May 2022 response to Information Request IAAC-32
[3] Summarized in the May 2022 responses to Information Requests IAAC-30 and IAAC-44

result, based on simulations reflecting this conceptual design configuration, the original estimated post-Project peak water level on Lake Manitoba during passage of a repeat of the 2011 Flood of Record through the Lake Manitoba/Lake St. Martin system was at an elevation 248.55 m (815.5 ft) asl, with a corresponding peak discharge in the LMOC of approximately 250 m^3/s (8,800 cfs).

As noted earlier in this document, since the Project EIS was filed, the design of the LMOC has been advanced and some design refinements have been made to optimize the channel cross-section. With these design refinements incorporated into the routing simulations, the estimated peak water level on Lake Manitoba and peak discharge in the LMOC during passage of a repeat of the 2011 Flood of Record through the Lake Manitoba/Lake St. Martin system is relatively unchanged at el. 248.61 m (815.6 ft) with a corresponding discharge in the LMOC of approximately 250 m^3/s (8,800 cfs).

Operating Guidelines were submitted as part of the June 2022 supplemental information response to IAAC IRs (original guidelines were included in Project EIS Volume 2, Appendix 6J and the influence of them on the original hydrologic analysis and modelling were included in Project EIS Volume 2, Appendix 6K). Figure 3C-4 shows the influence of the Operating Guidelines on levels in Lake Manitoba if the channels had been in place and operated for the 2011 flood. The LMOC would have commenced operation on June 16, 2010 - when the level of Lake Manitoba reached the upper target range elevation of 247.65 m (812.5 ft) asl. The channel would then have operated for 414 days, and operation would have ceased on August 2, 2012, when the level of Lake Manitoba reached an elevation of 247.35 m (811.5 ft) asl. In this scenario, the water level on Lake Manitoba exceeds the upper target range elevation for a total of 241 days, which is 448 days less than the pre-Project conditions. The peak lake level on Lake Manitoba is reduced from 249.0 m (816.9 ft) to 248.61 m (815.6 ft) asl, resulting in a direct flood protection benefit of 0.39 m (1.3 ft). The water level on Lake Manitoba exceeds the flood stage elevation of 248.11 m (814 ft) asl for a total of 119 days, which is 144 days less than the pre-Project conditions.

Modeling indicates that had the proposed Project been in place during the 2011 flood, it would have resulted in a reduction in flooded area of 451.6 square kilometres (km^2) (174.4 square miles [sq. mi]) for Lake Manitoba, representing a decrease in flooded area of 55% for Lake Manitoba[4]. The benefit as reduction of flooded area within Reserve lands is 9.2 km^2 (3.6 sq. mi) for Lake Manitoba (O-Chi-Chak-Ko-Sopi First Nation, Sandy Bay First Nation, Lake Manitoba First Nation).

In addition to the 2011 Design Flood, the design must accommodate a peak flow that would occur in the channel associated with passage of a 1-in-1,000 year flood event through the Lake Manitoba/Lake St. Martin system, with the permanent outlet channels in place without risk of failure of major proposed Project components (i.e., WCS, channel dikes). This event reflects the adopted Inflow Design Flood (IDF) for the LMOC (i.e., the most severe inflow flood for which a water retaining structure installation and its associated facilities are to be designed to accommodate), which was selected on the basis of the potential consequences of failure following the methodology outlined in the CDA Dam Safety Guidelines. Reduced freeboard (height at which the channel would overtop) and factors of safety are considered for

[4] Summarized in the May 2022 response to Information Request IAAC-112

this scenario. Based on the design of the LMOC, the peak flow in the channel for this condition is approximately 290 m^3/s (10,300 cfs).

Climate change trends and projections in the region generally indicate that there could be more water moving through the system in the future. This means that floods are likely to occur more often in the future. Runoff volumes estimated by these climate change projections indicate that the LMOC channel flow associated with a future 1 in 300-year flood event (i.e., with the impacts of climate change included), will be greater than at present, but still less than the magnitude of the estimated present day 1-in 1,000-year flood event (i.e., the IDF). Accordingly, the LMOC will be capable of passing such a future flood event without risk of failure of major proposed Project components, albeit with potentially some reduction in freeboard and factors of safety.

Channel Design

Based on the route selection process described in Volume 1, Section 2.4.2.1 of the March 2020 Project EIS (and incorporating efforts to reduce adverse environmental effects), the LMOC will run northwards from Watchorn Bay on Lake Manitoba to Birch Bay on Lake St. Martin as shown in Appendix 3C, Figure 3C-2. This alignment generally follows low-lying terrain between Lake Manitoba and Lake St. Martin, while avoiding existing lakes and wetlands located east of the proposed alignment. Figure 3C-7a shows a typical cross-section of the current design of the channel. Based on existing information, the channel will be excavated primarily in till deposits (KGS Group 2014), which reduces the potential effects on/from groundwater, and was a key consideration in the selection of the preferred alignment (as described in Volume 1, Section 2.4.2.1 of the March 2020 Project EIS).

The channel length is approximately 24.1 km (15.0 mi) long and will have a bottom elevation of 242.1 m asl (794.2 feet above sea level [f asl]) where the inlet transition connects to the channel and 239.29 m asl (785 f asl) where the channel connects to the outlet transition (Appendix 3C, Figure 3C-8). The depth of the channel will vary between 6 m (19.7 ft) and 12 m (39.4 ft) below grade, and since the invert of the channel will be lower than water level in the lakes, water will be present in the channel on both sides of the WCS at all times, both with the gates open and closed. The channel will be excavated below grade with the excavated material placed in permanent spoil piles along both sides of the channel.

The channel cross-section has been optimized since the March 2020 EIS to incorporate findings from the geotechnical investigations and stability analyses that allow for a reduction in the quantity of excavation and the length of the PTH 6 bridge while satisfying conveyance objectives, as well as a reduction in water velocities within the portion of the channel between the WCS and Lake St. Martin. The previous design (used in the March 2020 EIS) reflected a channel base width varying between 8 m (26.2 ft) and 13 m (42.7 ft) and side slopes between 5H:1V and 6H:1V, depending on bank slope stability requirements. The current design now reflects three main cross-section configurations along the length of the LMOC, with some localized constrictions/transitions at the locations of the bridges and WCS. The three main cross--section configurations along the length of the LMOC are as follows:

- Over the first approximately 10 km (6.2 mi) downstream of the inlet, the channel is set on a bed slope of approximately 0.0107% with a cross-section reflecting a 17 m (55.8 ft) base width and 5H:1V side slopes.

- Over the next approximately 11 km (6.8 mi) to the WCS, the channel invert is set on a bed slope of approximately 0.0144% with a cross-section reflecting a 12 m (39.4 ft) base width and 5H:1V side slopes.

- Downstream of the WCS to the outlet, the channel invert is set on a bed slope of approximately 0.0127% with a cross-section reflecting a 22 m (72.2 ft) base width and 5H:1V side slopes.

When the WCS is closed and Lake Manitoba is at elevation 247.65 m (812.5 ft) and LSM is at elevation 243.84 m (800 ft), water depths in the channel will range between approximately 5.5 m (18.0 ft) and 8 m (26.2 ft) upstream of the WCS and range between approximately 4 m (13.1 ft) and 4.5 m (14.8 ft) downstream of the WCS. The width of the water surface from shore to shore will vary between approximately 71 m (232.9 ft) and 91 m (298.6 ft) upstream of the WCS, and between approximately 63 m (206.7 ft) and 67 m (219.8 ft) downstream of the WCS.

At the 2011 peak flow, water depths in the channel will range between approximately 6 m (19.7 ft) and 6.5 m (21.3 ft) upstream of the WCS, and between approximately 5.6 m (18.4 ft) and 5.9 m (19.4 ft) downstream of the WCS. The width of the water surface from shore to shore will vary between approximately 73 m (239.5 ft) and 82 m (269.0 ft) upstream of the WCS, and between approximately 78 m (255.9 ft) and 79 m (259.2 ft) downstream of the WCS. Average velocities in the channel will range between approximately 0.8 metres per second (m/s) (2.6 feet per second [ft/s] and 1.0 m/s (3.3 ft/s) upstream of the WCS and be approximately 0.9 m/s (3.0 ft/s) downstream of the WCS. Locally higher velocities will occur in the vicinity of the bridges and the WCS. Riprap protection will be provided in these areas to accommodate the increased erosive forces.

At the conveyance flow of 212 m^3/s (7,500 cfs), when Lake Manitoba is at 248.11 m (814 ft), and Lake St. Martin is at 244.14 m (801 ft), water depths in the channel will range between approximately 5.5 m (18.0 ft) and 6 m (19.7 ft) upstream of the WCS, and between approximately 4.9 m (16.1 ft) and 5.2 m (17.1 ft) downstream of the WCS. The width of the water surface from shore to shore will vary between approximately 68 m (223.1 ft) and 77 m (252.6 ft) upstream of the WCS, and between approximately 71 m (232.9 ft) and 72 m (236.2 ft) downstream of the WCS. Average velocities will range between approximately 0.75 m/s (2.6 ft/s) and 1.0 m/s (3.3 ft/s) upstream of the WCS and range between approximately 0.9 (3.0 ft) to 0.95 m/s (3.1 ft/s) downstream of the WCS.

Revegetation and armouring of the channel surfaces will be incorporated along the entire length of the LMOC to mitigate the risk of erosion and sediment release. The armouring will extend 300 millimetres (mm) (12 inches [in]) above the top of the maximum non-operational water level in the channel. The maximum non-operational water level in the channel upstream and downstream of the water control structure is 247.65 m (812.5 ft) and 243.84 m (800 ft), respectively. Areas on the side slopes above the armouring will be revegetated to provide erosion control. Unlike the riprap targeted for high erosion-risk

areas, the armouring will be crushed limestone rock, which will be overlain on geotextile that will be placed on the underlying till substrates. The nominal median stone size will be approximately 50 mm (2 in) in diameter and the overall gradation will range in size from 20 to 100 mm (0.75 to 4 in). The thickness of the armouring in these areas will be 225 mm (9 in) on the base and lower side slopes. On the upper portions of the armoured side slopes that could interact with the ice cover in the channel, the same rock sizes will be used but the thickness will be increased to 400 mm (16 in). The armouring rock has been sized to withstand velocities in the channel for a full range of flows up to the peak flow from a repeat of the 2011 flood event.

With the excavation of the LMOC, the potential exists for local groundwater pressures to exceed the pressure of the weight of the overlying material. Staged construction sequencing combined with aquifer depressurization measures will be employed to prevent slope instability and blowout/basal heave of the channel during the construction phase. The type, location and duration of these aquifer depressurization measures (such as pumping and drains) will be identified during detailed design. Current details are described in Section 3.5.2.11.

3.4.2.2 Channel Inlet and Outlet

The hydraulic profile of the channel will require the lake bottom to be excavated at the channel inlet and outlet to match proposed channel invert elevations (Appendix 3C, Figure 3C-9 and 3C-10, respectively). Additional design details on the channel inlet and outlet have been developed since the March 2020 Project EIS.

Channel Inlet

There was no detail available on inlet geometry in the March 2020 Project EIS. It noted that the excavations will be tapered over a distance of 500 m or less from shoreline to meet existing lakebed elevations. More recent information is provided below.

The inlet geometry provides a flared transition, starting at a channel invert elevation of 242.1 m (794.2 ft) and rising at a slope of 0.85% in the upstream direction to daylight in Lake Manitoba (Watchorn Bay) at an approximate elevation of 245.8 m (806.4 ft). The bottom width starts at 17 m (55.8 ft) in the channel and widens in the upstream direction at a rate of 1 lateral to 4.5 longitudinal (approximately 12.5 degrees to the channel centerline) until reaching a width of approximately 121 m (397.0 ft) at a location 235 m (771.0 ft) upstream of the start of the channel. This rate of expansion is maintained on the east side; however, on the west side it changes to a rate of 1 lateral to 1.9 longitudinal (approximately 27.8 degrees to the channel centerline) so as to provide improved hydraulic entrance conditions. The width of the excavation where it daylights in Watchorn Bay is approximately 270 m (885.8 ft). The side slopes of the inlet excavation are 5H:1V. The overall length of the inlet is approximately 437 m (1,433.7 ft), with 305 m (100.7 ft) on land and 132 m (433.1 ft) in the lake, along the centerline. Riprap will be installed on a portion of the inlet side slopes, but not the base, extending from the channel proper to the shoreline. The portion of the excavation in Watchorn Bay beyond the shoreline will not have riprap.

Channel Outlet

There was no detail available on outlet geometry in the March 2020 Project EIS. It noted that the excavations will be tapered over a distance of 500 m or less from shoreline to meet existing lakebed elevations. More recent information is provided below.

The outlet geometry provides a flared transition, starting at a channel invert elevation of 239.29 m (785.1 ft) and rising at a slope of 0.85% in the downstream direction to daylight in Lake St. Martin (Birch Bay) at an approximate elevation of 241.6 m (792.7 ft). The bottom width starts at 22 m (72.2 ft) in the channel and widens in the downstream direction at a rate of 1 lateral to 5 longitudinal (approximately 11.3 degrees to the channel centerline) to approximately 128 m (419.9 ft) at the daylight location. The side slopes of the outlet excavation are 5H:1V. The overall length of the outlet is approximately 272 m (892.4 ft), with 128 m (419.9 ft) on land and 144 m (472.4 ft) in the lake, along the centerline. Riprap will be installed on a portion of the outlet side slopes, but not the base, extending from the channel proper to the shoreline. The portion of the excavation in Birch Bay beyond the shoreline will not have riprap.

The March 2020 Project EIS indicates that rock groins or other engineered structures may be considered as part of the design to reduce changes in shoreline morphology. Groins have been eliminated from the design at both the inlet and outlet as they are no longer deemed necessary based on the results of shoreline geomorphological studies and sediment transport analyses[5].

3.4.2.3 Water Control Structure

A WCS is required to control flows through the LMOC in accordance with the Operating Guidelines (as submitted as part of the June 2022 supplemental information response to IAAC IRs) to provide flood mitigation for Lake Manitoba. As described in Section 3.5.3.1, the operations are intended to be consistent with the Operating Guidelines. The WCS planned for the LMOC will be constructed where the LMOC intersects the existing Iverson Road and will include a bridge to cross the channel at this location (Appendix 3C, Figure 3C-2). One of the main factors in selecting this location is that it allows the WCS to be founded directly on bedrock.

Several refinements in WCS design have been made since the March 2020 Project EIS, as shown in Appendix 3C, Figure 3C-11a, 3C-11b, and 3C-11c. The WCS is still designed with three sluice bays, guides, and sill beams for upstream stoplogs, vertical lift gates and downstream stoplogs; however, the bays are now narrower (5.4 m [17.7 ft], down from 9 m [29.5 ft]) and a stoplog crane and support structure have been added downstream of the bridge deck. The WCS will have a base slab founded on bedrock to support the mass of the concrete substructure and a stilling basin with baffle blocks. The stilling basin and baffle blocks are designed to absorb or dissipate the energy from the flowing water and protects the downstream area from erosion.

When the WCS gates are closed, the water level in the channel on the upstream side will be the same as the water level in Lake Manitoba; on the downstream side of structure the water level will be the same as

[5] Summarized in the May 2022 response to Information Request IAAC-32

the water level in the south basin of Lake St. Martin. A gated valve will be incorporated into each of the WCS vertical lift gates to provide a minimum riparian flow (i.e., baseflow) of approximately 1.25 m^3/s (44.1 cfs) in the channel, so as to maintain dissolved oxygen (DO) levels in the winter. The outputs of DO modelling demonstrated that such a flow rate is anticipated to be sufficient to maintain DO concentrations in the channel above 5 milligrams per litre (mg/L), which achieves the Canadian Council of Ministers of the Environment (CCME 1999) guideline for the protection of aquatic life[6].

An ancillary building will be constructed near the WCS to house electrical equipment and a control console to operate the structure. The WCS will require permanent electrical power to raise and lower the gates, as well as to heat the structure and gates to maintain winter operation capability (KGS Group 2016). To provide this, Manitoba Hydro will upgrade an existing distribution line along Iverson Road and connect it to a pad-mount transformer that will be installed near the WCS ancillary building (described in Section 3.4.2.8). A diesel generator will also be installed as an emergency backup power source at the WCS site.

3.4.2.4 Permanent Bridge Structures

The LMOC 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 LMOC, of which, one will be combined with the WCS. The other three will be dedicated multi-span bridges, constructed to maintain connectivity along the Township Line Road, realigned PR 239 and PTH 6 (Appendix 3C, Figure 3C-2).

There are no substantive advancements to design to the bridges from the March 2020 Project EIS, other than adding two additional piers to the Township Line Road and PR 239 (formerly Carne Ridge Road) bridges and reducing the length of the PTH 6 bridge due to further geotechnical engineering and design optimization. All bridges will be paved with asphalt, including approaches on either side. The Township Line Road and PTH 6 bridges will be built on the same alignment as the existing roadways, while the PR 239 structure will follow the new highway alignment (former Carne Ridge Road) across the LMOC. All three bridges will have increased road profiles of 0.5 (1.6 ft) to 1 m (3.3 ft) with approach roadworks transitioning back to existing grades. The Township Line Road and PR 239 bridges have a clear road width of 9 m (29.5 ft), while the PTH 6 bridge roadway is 11.5 m (37.7 ft) wide with paved shoulders. Appendix 3C, Figure 3C-12a, 3C-12b, and 3C-12c show typical bridge plans and profiles.

Bridge structures are designed to accommodate and withstand water flows, ice flows, and safe passage of traffic volumes and vehicle types, including agricultural equipment. The LMOC will not be deemed navigable, and bridges are not designed to meet clearance requirements for passage of motorboats, sail boats and other powered vessels.

[6] Summarized in the May 2022 response to Information Request IAAC-31

3.4.2.5 PR 239 and Municipal Road Realignments

As indicated, the LMOC intersects the existing provincial and municipal road networks, resulting in the need to realign several sections of highways and roads to align with new bridges crossing the channel and maintain connectivity within the region. Realignment of PR 239 and municipal roads is required to accommodate the LMOC while still allowing for safe, economically feasible, and hydraulically efficient structures across the channel. The current preferred option for realignment of these roadways is shown in Appendix 3C, Figure 3C-2. A typical cross-section including the 50 m (164.0 ft) ROW for the PR 239 realignment is shown as Appendix 3C, Figure 3C-13.

PR 239 will be realigned with a new paved highway following the existing Jordan and Carne Ridge Roads in an s-shape to cross the LMOC due west of Grahamdale. The remaining portion of existing PR 239 will be discontinued on either side of the LMOC, and the resulting segments will be either repurposed as required for RM of Grahamdale and landowner access or decommissioned. This realignment will reduce the number of required bridge crossings over the channel and improve the geometry of the intersection between PR 239 and PTH 6.

Two new sections of unpaved municipal roads will be constructed to realign the existing Burnett Road around the LMOC and provide a new north-south road between the PTH 6 and WCS crossings along the east side of the channel ROW. Two other locations will require short extensions and intersection realignment west of the LMOC, while small sections of new municipal road will be constructed to restore private property access at four locations where the LMOC ROW intersected or otherwise impacted existing routes.

The realignments were developed with input from local residents, stakeholders, and the RM of Grahamdale which influenced the alignments, roadway widths, utility accommodations and access features. All road works are designed in accordance with Manitoba Transportation and Infrastructure standards for provincial highways and municipal roads.

3.4.2.6 Rock Quarries and Borrow Material Areas

Table 3.4-1 summarizes the total estimated quantities of the required aggregate and riprap for all LMOC components, including roads, bridges, channel armour stone, inlet/outlet protection, and concrete. High quality limestone rock will be required for armouring of the LMOC below typical water levels and additional riprap to control erosion at the inlet, outlet, bridges and WCS, as well as several points along the outside drain. Large diameter riprap required to provide erosion control downstream of the WCS will likely be sourced from granite quarries outside the Local Assessment Area[7] (LAA) at locations proposed by contractors and hauled to the proposed Project sites. Aggregate produced from limestone quarries will also be used as both structure and surfacing for permanent and temporary roadworks; granular filter and depressurization well materials; and backfill, levelling material, and concrete aggregate for bridges, culverts, and the WCS. Several potential rock and borrow sources exist in the general proposed Project

[7] As described in Volume 1, Section 4.4.3.1 of the Project EIS

region that will be available to proposed Project contractors. While existing permitted/licensed sources for the proposed Project are likely to be used, exploration and/or expansion of these permitted sources may be proposed by contractors but would need to adhere to Manitoba Transportation and Infrastructure's PERs, Quarry Management Plan (QMP) and other applicable commitments, requirements, and permits. In total, it is estimated that the proposed Project will require approximately 2.3 million cubic metres (m^3) (81.2 million cubic feet [ft^3]) of limestone from the local region and this accounts for just under 4% of the total estimated reserve calculated in the assessment, or conservatively just over 6% of the volume when excluding private quarries and those where quarry leases have been issued.[8]

Table 3.4-1 LMOC Aggregate Requirements

Material Type	Volume (m^3)	Weight (Tonnes)	Purpose
Limestone Granular Fill	169,000	380,000	roads, bridges, embankments, concrete
Limestone Crushed Rock	595,000	1,190,000	armouring, trench backfills
Limestone Riprap (600-800 mm)	85,000	168,500	erosion protection, energy dissipation, culverts
Granite Riprap (>800 mm) from outside region	20,000	40,000	erosion, energy dissipation

The PERs and QMP (as provided in the June 2022 supplemental information response to IAAC IRs) describe the environmental protection requirements for the development and operation of quarry and borrow areas used for the proposed Project, including requirements for submission of plans and details to Manitoba Transportation and Infrastructure prior to the commencement of activities. These requirements, as well as other applicable components of the Construction Environmental Management Program (CEMP) (see Section 3.7.2) and Operation Environmental Management Program (OEMP) (see Section 3.7.3) will be applied throughout the proposed Project lifecycle, as required.

3.4.2.7 Temporary Construction Camps and Staging Areas

Contractors will be responsible for securing and/or developing accommodations for their workforce for the duration of each construction contract. Given the close proximity of local and Indigenous rights-holders, cottages, and private lands to the LMOC, it is expected that some contractors will elect to house some or all of their crews within existing accommodations in the LAA. For the larger contracts, such as construction of the WCS, the successful contractor will likely construct a camp with trailers or modular units to meet the needs of their particular contract in supplementing existing accommodations. These camps will be located either within lands owned by Manitoba Transportation and Infrastructure adjacent to the channel ROW, or on private lands near their particular work areas, as negotiated with local landowners and approved by Manitoba Transportation and Infrastructure. Camp sites for the LMOC will

[8] Summarized in the May 2023 response to Information Request IAAC-R2-33

likely be located within the RM of Grahamdale, and the RM of Grahamdale will have the opportunity to provide feedback during ongoing monthly meetings with Manitoba Transportation and Infrastructure.

Contractor staging areas will be used to receive and store materials, maintain and assemble equipment, and administer work on the proposed Project. These staging areas may be located within or adjacent to the ROW where feasible; however, similar to construction camp sites, the exact location, number, size and details of the contractors' work areas will be proposed by contractors for review and approval by Manitoba Transportation and Infrastructure.

Information on anticipated construction equipment is provided in Section 3.5.2.9. In general, it is estimated that approximately 150 heavy equipment units could be on the various contract sites in peak summer months.

The estimated size of workforce ranges between approximately 30 to 70 persons per contract. The proposed Project schedule assumes multiple contracts will occur simultaneously, especially during summer months, resulting in a peak workforce of approximately 325 personnel to be housed at either existing local accommodations or construction camps. This includes approximately 75 workers for construction of the WCS, 175 workers for major earthworks, clearing and outside drain construction, and another 75 workers for road and bridge contracts. Additional information on workforce is provided in Section 3.5.2.16.

Although the exact location for temporary construction camps and staging areas are not known at this time, Manitoba Transportation and Infrastructure has developed a process for proposal and review of locations prior to their establishment. As stated in the PERs (submitted as part of the June 2022 supplemental information response to IAAC IRs), designated areas, including temporary work camps, equipment servicing areas, parking areas, and staging areas, will be identified by the contractor. The contractor will submit plans and details for designated areas, including proposed locations, access and traffic management, and utility impacts for review and approval by Manitoba Transportation and Infrastructure prior to mobilizing personnel or equipment to the site.

3.4.2.8 Power Supply

Permanent electrical service is required for power at the WCS to raise and lower the gates, as well as to heat them to maintain winter operation capability. To address this requirement, Manitoba Hydro will replace the existing 10 km (6.2 mi) distribution line from Grahamdale with a new 3-phase line on the same alignment. The line is located along PTH 6 from Grahamdale, then east along the north side of Iverson Road (west of the LMOC). Just west of the WCS, the line will cross Iverson Road and continue south within the LMOC ROW to cross the channel upstream of the WCS. It will connect to a pad-mounted transformer that will be installed at the WCS on Iverson Road.

Manitoba Hydro will be responsible for obtaining and adhering to any distribution line permit and/or regulatory approvals conditions. However, no permitting is anticipated for the replacement due to work

being on existing Manitoba Hydro easement. Maintenance of the distribution line and associated ROW will fall under Manitoba Hydro's standard operating procedures.

In addition to the power line, a 500-kilowatt (kW) (670 Electrical Horsepower [hp]) stand-by diesel-fueled generator (including a 4,500 L [989.9 gallon] fuel tank) will be installed as part of the proposed Project to provide emergency back-up power for the WCS should there be a power failure at the site.

During construction, temporary power will likely be required prior to construction of the distribution line or exceeding the capacity that can be provided via distribution. Power may be required for a concrete batch plant, rock crushing facilities, and general construction needs. Construction power requirements are being estimated as part of detailed design and ongoing coordination with Manitoba Hydro. The actual loads will vary based on the contractor's needs and proposed methods. Temporary power supply may involve tying into the existing power distribution system should capacity and work locations allow, with any additional power provided via generators. Channel dewatering and groundwater depressurization requirements during construction are expected to be handled with on-site diesel generation.

3.4.2.9 Temporary Access and Crossings

Temporary access routes may be required for access to the channel location, quarries and borrow areas, laydown areas and any other areas required for the LMOC. These may range from rough trails where vegetation may be removed or snow compacted, to service roads that are cleared, grubbed, graded, compacted and graveled to support heavy construction vehicle movement.

Construction-related traffic will be restricted to the proposed Project ROW, and several identified haul roads and associated temporary access routes required during construction. Haul roads will be improved as agreed upon with the RM of Grahamdale and maintained by Manitoba Transportation and Infrastructure throughout construction. Existing trails and other travel routes will not be altered adjacent to the proposed Project footprint, except as required for construction and agreed to with the RM of Grahamdale (see below). Where temporary access routes are accessible by the public, signage will be provided, and access will be blocked when not in use.

The following is a summary of refinements to temporary access (via existing roads) since submission of the March 2020 Project EIS:

- PTH 6 will be the primary access route to the LMOC construction sites for the movement of equipment, materials, and personnel.
- Secondary access to the southern and central outlet channel, bridge, and roadworks construction sites associated with the LMOC will include Township Line Road, existing Carne Ridge Road (new PR 239) and existing PR 239. Once the realignment of PR 239 is complete, the existing section of PR 239 crossing the LMOC will be closed and decommissioned, with remaining segments either repurposed as municipal roads for local access or levelled and lands offered to adjacent landowners.

- Manitoba Transportation and Infrastructure will be entering a Haul Road Agreement with the RM of Grahamdale to provide additional secondary access amongst the various Project sites. Under the Agreement, Manitoba Transportation and Infrastructure will be responsible for maintaining a series of municipal roads, including improvements prior to use, maintenance throughout, and restoration post-construction. Negotiations with the RM of Grahamdale are ongoing and haul roads have been selected with preliminary inspections, proposed improvements, and additional details drafted.
- Secondary access to the northern outlet channel sites will be provided via existing municipal roads (Iverson and Bankert), the shoofly detour at the location of the WCS, and the new Channel Road, once constructed, as part of the municipal road realignments in the RM of Grahamdale.

After proposed Project construction, access routes not required for ongoing maintenance of the LMOC will be decommissioned by contouring, de-compacting and trimming to encourage natural revegetation and will be seeded and/or planted, as required. Temporary detours will be used to maintain access through the area where the LMOC intersects existing provincial and municipal roads. Detours will be established prior or simultaneously with channel excavation and bridge construction, so as not to interrupt vehicle traffic. Details can be found in the Access Management Plan (AMP), as filed as part of the June 2022 supplemental information response to IAAC IRs.

3.4.2.10 Drainage Realignment

Permanent Drainage Infrastructure

As shown in Appendix 3C, Figure 3C-14, local land drainage in the area of the LMOC generally is from the west to the east towards the wetlands and small lakes, which include Goodison Lake, Reed Lake, Water Lake, and Clear Lake. These lakes and wetlands in turn discharge into Birch Creek, which flows north towards Lake St. Martin. Only a relatively small area near the channel inlet drains towards Lake Manitoba (Watchorn Creek). The alignment of the LMOC bisects several sub-drainage basins that feed these wetlands and small lakes resulting in the need to address surface water drainage on the west side of the outlet channel.

The primary measure to address local drainage issues is construction of an outside drain. As described in the temporary drainage infrastructure section below, it will be initially constructed to facilitate management of runoff during construction, but its permanent function will be as part of the permanent drainage works for the LMOC to collect surface water runoff arriving from the west and divert it into Lake Manitoba and Lake St. Martin, shown in Appendix 3C, Figure 3C-14. On the east side, surface water naturally flows away from the LMOC toward the existing wetlands and creeks. Accordingly, no outside drain will be required on that side of the channel.

Surface water management is discussed in Section 3.5.2.11 and in Volume 1, Section 3.5.3.4 of the March 2020 Project EIS. An updated description of surface water management during the construction phase[9] is presented in the Surface Water Management Plan (SWMP), filed as part of the June 2022 supplemental information response to IAAC IRs. Appendix 3C, Figure 3C-14 displays the current primary drainage infrastructure. Surface water management is required to manage existing surface water flows, as well as inputs from groundwater. Groundwater issues are addressed primarily through construction and discussed below under temporary drainage infrastructure. The primary groundwater issue is managing elevated pressure, which occurs in the vicinity of the proposed Project. During operation, passive depressurization along the channel will take place via depressurization wells and reverse drains. Depressurization wells will passively release groundwater into the LMOC, while reverse drains will involve excavating to the bedrock and infilling with coarse material. The coarse material will act as a cover and provide the higher hydraulic conductivity required to allow water to flow upward from the bedrock aquifer into the LMOC. More information on groundwater and groundwater management is available in the Groundwater Management Plan (GWMP) submitted as part of the June 2022 supplemental information response to IAAC IRs.

Additional details and refinements have been developed in the design of the permanent drainage infrastructure since submission of the March 2020 Project EIS. As indicated, the outside drain is designed to manage upgradient flows, and will be located along the west side of the LMOC to intercept the watershed runoff originating from the west. It will be sloped from a highpoint to be established where the realigned PR 239 will cross the drain. Runoff that enters the outside drain north of this location will drain to Lake St. Martin, while runoff that enters south of this location will drain to Lake Manitoba.

The hydraulic design of the outside drain is based on a trapezoidal channel shape with 4H:1V side slopes and sized for a 1 in 10-year runoff event. Typical cross-sections are shown in Appendix C, Figure 3C-7b. The drain base width varies between 4 m (13.1 ft) and 25 m (82.0 ft). Average velocities within the outside drain will generally be less than 1 m/s (3.3 ft/s) during the design runoff event, which will be accommodated by the vegetation that will have grown in the drain. Erosion protection measures (riprap, and not channel armouring) will be used in specific areas where hydraulic conditions exceed 1 m/s. This includes culverts at road crossings, the steeper portions of the north outside drain reach near Iverson Road and where the north outside drain connects to Lake St. Martin. A small riprap apron will also be installed on the lakebed where the drain outlets into the lake.

The outside drain invert and longitudinal slopes have been set to generally follow the existing ground elevation profile to reduce excavation depths, while also keeping the design water surface profile at or below the existing ground level, as well as the inverts of most existing lateral drains that will discharge into it, so as to not result in backwater effects during the 1 in 10-year runoff event with Lake Manitoba and the south basin of Lake St. Martin at the upper end of their normal operating ranges (i.e., 247.65 m asl [812.5 ft asl] and 243.84 m asl [800.0 ft asl], respectively).

[9] Summarized in the May 2022 response to Information Request IAAC-75

Passive wetland treatment designs are being investigated to mitigate potential effects of agricultural runoff from cattle operations that may enter the south outside drain between the new PR 239 and Lake Manitoba. They would be located downstream of agricultural (cattle) operations located near the channel ROW and would facilitate filtering and treatment of nutrient-laden runoff prior to it leaving those sites and entering the outside drain. In addition, natural vegetation will grow in the shallow water depths within a portion of the outside drain near where it discharges into Lake Manitoba, which will provide some additional secondary filtering of runoff. Water quality monitoring in the outside drain and near the discharge point to the lake will be undertaken to assess the effectiveness of the passive treatment and if additional measures are needed.

Permanent culvert crossings will be required under Township Line Road, PTH 6 and Iverson Road, which will be designed to Manitoba Transportation and Infrastructure Water Control and Structures design requirements. Three 1,800 mm (70.9 in.) diameter corrugated steel pipe culverts (CSPs) will be required at Township Line Road, while two 1,500 mm (59.1 in.) diameter CSPs will be required at Iverson Road. The crossing at PTH 6 will consist of a single 2,400 mm x 2,400 mm (94.5 x 94.5 in.) cast-in-place concrete box culvert. All culverts will be embedded into the bed of the outside drain by 300 mm (11.8 in.).

A riprap gradient control structure will be constructed in the north outside drain near the outlet to Lake St. Martin to help prevent upstream fish passage from the lake into the drain. Mitigation measures to address the reduction in contributing water drainage area to the wetlands and Birch Creek are under consideration.

Temporary Drainage

Information on temporary drainage was not available at the time of March 2020 Project EIS filing. Water management during construction and operation is discussed in Section 3.5.2.11[10]. Details can be found in the SWMP, as filed as part of the June 2022 supplemental information response to IAAC IRs.

As indicated in Section 5.2.1, the primary method of managing surface water during construction of the channel works will be via the permanent outside drain, which will be constructed in advance of the channel excavation. Temporary measures will be required during construction to manage surface water to improve constructability, control the potential for erosion and manage sediments. The specific measures will depend on construction staging and sequencing until the permanent works are completed. The outside drain described previously will facilitate construction of the LMOC, providing drainage for the realigned and upgraded portion of PR 239 (see below), and conveying water from local construction dewatering and groundwater depressurization works. Where possible, the existing municipal drainage network will also be utilized to convey waters from the channel ROW to the creeks and lakes during construction.

[10] Summarized in the May 2022 response to Information Request IAAC-75

As indicated, details regarding the management of water quality in and around the construction areas are addressed in the SWMP and summarized in Section 3.5.2.11. Erosion control measures are described in the SMP and summarized in Section 3.5.12. This will also include revegetation, as described in the Revegetation Management Plan (RVMP) and summarized in Section 3.5.2.13. These plans were submitted as part of the June 2022 supplemental information responses to IAAC IRs.

3.4.2.11 Facilities for the Storage of Explosives

Some limited blasting may be required at the WCS site; the extent will not be known until excavation and exposure of the bedrock surface during construction is completed. If conditions encountered on the site warrant blasting, explosives, and any initiation systems to be used for blasting activities during the construction phase will be stored in temporary, independent magazines. The contractor will be responsible for obtaining any required permits/licensing. Magazines used for the storage of explosives will meet the federal standards and licensing requirements as specified in the *Explosives Regulation* of the federal *Explosives Act*. Siting of magazines will meet the provincial standards and licensing requirements as specified in the Operation of Mines Regulation of *The Workplace Safety and Health Act* of Manitoba.

3.4.3 Lake St. Martin Outlet Channel

Advancements in design to the design of the LSMOC include design refinements to the discharge criteria, channel geometry and lining, inlet, outlet, drop structures, and WCS. While the channel invert is generally similar, there has been some additional excavation proposed upstream of the first drop structure. The extent of excavation at the inlet has also increased. These changes were made to account for the head loss through the Lake St. Martin Narrows[11]. Based on shoreline morphology assessments, it was concluded that rock fill jetties are not required and are therefore omitted from the current design of the inlet works. The WCS design has been optimized from a two-bay structure to a four-bay structure with narrower bays. The two interior bays are designed with inverts at a higher elevation to facilitate operation at reduced flows during winter conditions. The extent of the excavation was reduced at the outlet in Sturgeon Bay. There have also been some advancements to design to the drainage control works to best accommodate drainage of overland flows from east of the channel while maintaining natural conditions in the existing wetlands. In addition, options are being considered to mitigate impacts on wetlands west of the channel.

[11] Summarized in the May 2022 response to Information Request IAAC-68

3.4.3.1 Outlet Channel

Design Discharge

As described in the March 2020 Project EIS, the original design of the LSMOC required that the channel convey a flow of 326 m^3/s (11,500 cfs) when the water level in Lake St. Martin is at an elevation of 244.14 m asl (801 ft asl). The conceptual design of the LSMOC presented in the March 2020 Project EIS satisfied this requirement. However, the actual flow conveyed by the LSMOC is dependent on the water level in Lake St. Martin, and the channel must also be designed to accommodate a repeat of the 2011 Flood of Record, which has been designated as the Design Flood for the proposed Project. As a result, based on routing simulations reflecting this conceptual design configuration and equal water levels in the south and north basins of Lake St. Martin (i.e., no head loss through the Lake St. Martin Narrows), the post-Project estimated peak water level on Lake St. Martin during passage of a repeat of the 2011 Flood of Record through the Lake Manitoba/Lake St. Martin system was at an elevation of 244.72 m asl (802.9 ft asl), with a corresponding peak discharge in the LSMOC of approximately 424 m^3/s (15,000 cfs).

The conceptual design described above has been optimized following an analysis of the water level differential between the two basins of Lake St. Martin in response to the issue raised regarding what is referred to as the “Lake St. Martin Narrows head loss” (the south basin is slightly higher than the north basin, resulting in a drop of water and hence lake elevation as water flows from the south to the north basin). The results of the analysis confirmed that the Lake St. Martin Narrows (i.e., the area of the lake that spans between the north and south basins) will act as a constriction during flood events. Based on the results of this analysis, the design of the LSMOC was refined to account for the water level differential between the two basins and thus achieve a capacity of 326 m^3/s (11,500 cfs) when the water level in the south basin of Lake St. Martin is at elevation 244.14 m asl (801 ft asl). With the advancements to design incorporated into the routing simulations, the current estimated post-Project peak water level on the south basin of Lake St. Martin during passage of a repeat of the 2011 Flood of Record through the Lake Manitoba / Lake St. Martin system is at an elevation of 244.88 m asl (803.4 ft asl) with a corresponding peak discharge in the LSMOC of approximately 481 m^3/s (17,000 cfs) and a minimum freeboard on the channel dikes of 0.6 m (2.0 ft).

Operating Guidelines were submitted as part of the June 2022 supplemental information response to IAAC IRs (original guidelines were included in Project EIS Volume 2, Appendix 6J and the influence of them on the original hydrologic analysis and modelling were included in Project EIS Volume 2, Appendix 6K). Appendix 3C, Figures 3C-5 and 3C-6 show the influence of the Operating Guidelines on levels in Lake St. Martin if the channels had been in place and operated for the 2011 flood for the north and south basins, respectively. LSMOC commences operation on June 16, 2010, when the Lake St. Martin south basin lake level reaches the upper target range elevation of 243.84 m asl (800 ft asl). The channel operates for 458 days, and operation ceases on September 15, 2012, when the Lake St. Martin south basin lake level reaches an elevation of 243.23 m (798 ft). The water level on Lake St. Martin south basin exceeds the upper target range elevation for a total of 635 days, which is 281 days less than the pre-Project conditions.

The peak lake level on Lake St. Martin south basin is reduced from 245.5 m asl (805.4 ft asl) to 244.88 m asl (803.4 ft) asl, resulting in a direct flood protection benefit of 0.62 m (2.0 ft). The water level on Lake St. Martin south basin exceeds the flood stage elevation of 244.14 m asl (801 ft asl) for a total of 343 days, which is 308 days less than the pre-Project conditions. The peak lake level on Lake St. Martin north basin is reduced from 245.38 m asl (805.1 ft asl) to 244.36 m asl (801.7 ft asl), resulting in a direct flood protection benefit of 1.02 m (3.3 ft). The water level on Lake St. Martin north basin exceeds the flood stage elevation of 244.14 m (801 ft) for a total of 130 days, which is 388 days less than the pre-Project conditions.

Modeling indicates that had the proposed Project been in place during the 2011 flood, it would have resulted in a reduction in flooded area of 18.2 km^2 (3.6 sq. mi) for Lake St. Martin, representing a decrease in flooded area of 74%[12]. The benefit as a reduction of flooded area within Reserve lands is 7.1 km^2 (2.7 sq. mi) for Lake St. Martin (i.e., Lake St. Martin First Nation, Little Saskatchewan First Nation, and Pinaymootang First Nation).

In addition to the 2011 Design Flood, the design must accommodate a peak flow that would occur in the channel associated with passage of a 1 in 1,000-year flood event through the Lake Manitoba/Lake St. Martin system, with the permanent outlet channels in place without risk of failure of major Project components (i.e., WCS, channel dikes). This event reflects the adopted IDF for the LSMOC (i.e., the most severe inflow flood for which a water retaining structure installation and its associated facilities are to be designed to accommodate), which was selected on the basis of the potential consequences of failure following the methodology outlined in the Canadian Dam Association (CDA) Dam Safety Guidelines. Reduced freeboard and factors of safety are considered for this scenario. Based on the current design of the LSMOC, the peak flow in the channel for this condition is approximately 513 m^3/s (18,100 cfs) and the freeboard is 0.3 m (1.0 ft).

Climate change projections and an assessment of trends in the region have also been undertaken, which generally indicate that there will be more water moving through the system in the future. This means that floods are likely to occur more often in the future. Runoff volumes estimated by these climate change projections indicate that the LSMOC channel flow associated with a future 1 in 300-year flood event (i.e., with the impacts of climate change included), will be greater than at present, but still less than the magnitude of the estimated present day 1 in 1,000-year flood event (i.e., the IDF). Accordingly, the LSMOC will be capable of passing such a future flood event without risk of failure of major Project components, albeit with potentially some reduction of freeboard and factors of safety.

Channel Design

The alignment of the LSMOC has not changed and was based on the route selection process described in Volume 1, Section 2.4.2.2 (incorporating efforts to reduce adverse environmental effects). It will still run northeast from the east end of Lake St. Martin towards Sturgeon Bay on Lake Winnipeg. It will pass through a wetland area, eventually connecting to an existing partially completed, but non-functioning

[12] Summarized in the May 2022 response to Information Request IAAC-102

portion of the EOC (Reach 3) located east of the approximate midpoint of Buffalo Creek. A length of approximately 1 km (0.6 mi) of Reach 3 (at the upstream end near Buffalo Creek) will not be included as part of the LSMOC. The outlet channel will discharge to Sturgeon Bay in Lake Winnipeg, southeast of Willow Point (Appendix 3C, Figure 3C-3). The functioning EOC Reach 1 (connected to Lake St. Martin) will not be incorporated as part of the proposed Project, nor are there plans to decommission Reach 1 as part of the proposed Project.

The length of the channel will remain at approximately 23.8 km (14.8 mi), but there have been some refinements in current channel design for the LSMOC that have been made since the March 2020 Project EIS. Appendix 3C, Figure 3C-15a, 3C-15b, and 3C-15c show the current cross-section of the LSMOC channel, and design refinements are summarized below. Refinements from the March 2020 EIS include lowering the invert between the WCS and Drop Structure 1 (to increase conveyance to account for the head loss through the Lake St. Martin Narrows[13] and modifying the invert slope to optimize the channel geometry with armouring. The channel invert slope now ranges from 0.021% (upstream of the first drop structure) to 0.04% (downstream of the first drop structure). The channel will have a bottom elevation of approximately 240.5 m asl (789.04 ft asl) at the shoreline of Lake St. Martin and 214.9 m asl (705.05 ft asl) at the shoreline of Lake Winnipeg (see Appendix 3C, Figure 3C-16).

The March 2020 Project EIS describes a uniform trapezoidal cross-section with a base width of about 44 m (144.4 ft) and 4H:1V side slopes. The refined design includes a modified trapezoidal shape with a bench located part way up the side slope. The bench height will vary, and will approximately follow the clay elevation (i.e., the underside of the peat). The side slopes will now be 5H:1V. The base width will vary over the length of the LSMOC. From the WCS to the first drop structure, the base width will generally be 45 m (147.6 ft), with the exception of a short segment immediately downstream of the WCS where the base width will be 47 m [154.2 ft]. Downstream of the first drop structure, the base width will generally be 35 m (114. 8 ft), with the exception of the segment between the third and fourth drop structures where the base width will be 59 m (193.6 ft).

As shown in Appendix 3C, Figure 3C-15a and 3C-15b, permanent water-retaining dikes will be located on both sides of the excavated channel to contain design flows within the LSMOC and also to isolate the surface water and the upper saturated peat system from the excavated channel. These will have a maximum height approximately 3m [9.8ft] above ground surface, with a typical top width of approximately 6m. Spoil piles for the excavated material will be located outside of the channel dikes. Final spoil pile geometry will be determined by the contactor and depend on a number of factors such as material properties, compaction, and hauling distance. Access for long-term maintenance and inspection will be obtained via maintenance roads on top of the dikes on both sides of the LSMOC for the entire 23.8 km (14.8 mi) length.

[13] Summarized in the May 2022 response to Information Request IAAC-68

The March 2020 Project EIS describes the LSMOC as being excavated with a bare soil (till or clay) base, with revegetation on the upper side slopes to control erosion. The refined channel design includes armouring of the LSMOC base and lower side slopes to mitigate erosion risks[14]. The armouring will be crushed limestone rock, which will be overlain on geotextile that will isolate the channel from the underlying till substrates. The armouring will extend 300 mm (12 in.) above the top of the maximum non-operational water level in the channels. On the channel base and lower side slopes, the median stone size will be approximately 50 mm (2 in.) diameter and the overall gradation will range in size from 20 to 100 mm (0.8 to 4 in.). The thickness of the armouring in these areas will be 225 mm (9 in.) thick on the base and lower side slopes. On armoured portions of the side slopes that could interact with the ice cover in the channel, the same rock sizes will be used but the thickness will be increased to 400 mm (16 in.). The armour footprint will end at the shorelines and will not extend into Lake St. Martin or Sturgeon Bay. Riprap will be placed on the banks of the channel to prevent erosion from wave action at or in vicinity of the inlet/outlet areas but is not planned to be placed in the lake.

When the LSMOC is not in operation (WCS gates closed), pools will form upstream of the eight drop structures. A year-round riparian flow (i.e., baseflow) of approximately 1.4 m^3/s (50 cfs) will be conveyed via valves in the WCS gates, resulting in velocities less than 0.1 m/s (0.3 ft/s), with depths ranging from 1.5 to 3.7 m (4.9-12.1 ft) along the channel centreline. The deepest areas will be located immediately upstream of the drop structures.

The outputs of modelling demonstrate that this flow is sufficient to maintain DO concentrations in the channel above the 5 mg/L guideline for the protection of aquatic life[15]. The top width of the pools will vary along the length of the channel and will generally range between 55 to 85 m (180.4 to 278.9 ft). The top width is a function of the channel base width and water depth.

During operation at the Design Flow condition (i.e., peak flow during repeat 2011 flood event), average velocities will range from 1.0 to 1.4 m/s (3.3 to 4.6 ft/s) and the flow depth will range from 4.3 to 5.9 m (14.1 to 19.4 ft). The width of the water surface from shore to shore will range from 115 to 135 m (377.3 to 442.9 ft). Due to the steep gradients and shallow flow depths on the ramps of the drop structures, water velocities in these localized areas will exceed 4 m/s (13.1 ft/s).

During operation at the conveyance target flow of 326 m^3/s (11,500 cfs), average velocities will range from 0.9 to 1.1 m/s (3.0 to 3.6 ft/s) and the flow depth with range from 3.7 to 5.5 m (12.1 to 18.0 ft). The width of the water surface from shore to shore will range from 94 to 130 m (308.4 to 426.5 ft).

[14] Summarized in the May 2022 responses to Information Request IAAC-30 and IAAC-44
[15] Summarized in the May 2022 response to Information Request IAAC-31

In years where winter operation is required, the WCS will be operated in a manner to promote the formation of a solid ice cover in the LSMOC. Flow properties will depend on the discharge and ice conditions, which may vary from year to year. Under-ice water velocities are expected to typically be in the range of 0.5 to 0.9 m/s (1.6 to 3.0 ft/s) or less, while flow depths are expected to be in the range of 3.4 to 4.6 m (11.2 to 15.1 ft) or less.

In areas where the LSMOC invert intersects bedrock, the interconnection with the bedrock aquifer will result in groundwater inflows that will contribute marginally to the riparian flow (i.e., baseflow) when the channel is not in operation. In sections where the channel invert approaches bedrock, the potential exists for local groundwater pressures to exceed the pressure of the overlying material. This could result in areas of uncontrolled groundwater discharge into the channel from the underlying bedrock aquifer. Construction sequencing is proposed to help manage this risk by promoting interconnections in a centralized pilot channel, and subsequently proceeding with excavation to the design invert and cross-section width. This is described in the GWMP, as filed as part of the June 2022 supplemental information response to IAAC IRs.

Aquifer depressurization measures (such as groundwater pumping or drainage) will be implemented to prevent blowout and basal heave of the channel during construction and post-construction phases. Active temporary groundwater depressurization via pumping wells installed in the bedrock aquifer will be implemented during construction of the WCS. Subsurface passive drainage of groundwater pressures may be required long-term at the WCS to relieve uplift pressures. At the drop structures, active temporary groundwater depressurization will occur by pumping seepage from the open excavation for the sheet pile cutoff walls during installation. No long-term active aquifer depressurization measures are planned for the drop structures. In areas where the final channel invert is sufficiently close to the bedrock aquifer to result in inadequate long-term factors of safety against basal heave or slope stability, sand drains will be installed to relieve groundwater pressures.

3.4.3.2 Channel Inlet and Outlet

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 design has been refined since the March 2020 Project EIS, for both the inlet and outlet areas.

Channel Inlet

The March 2020 Project EIS describes the inlet excavation as extending 800 m (2,624.7 ft) into Lake St. Martin, with the base width varying from 100 m (328.1 ft) at the shoreline to approximately 400 m (1,312.3 ft) at the point of daylight in the lake (i.e., to existing lake elevation). As shown in Appendix 3C, Figure 3C-17, the current design inlet excavation extends approximately 1,100 m (3,608.9 ft) into Lake St. Martin, with the base width ranging from 110 m (360.9 ft) at the shoreline to approximately 550 m (1,804.5 ft) at the point of daylight (lake bed elevation). These modifications were made to provide the required flow conveyance accounting for the head loss through the Lake St. Martin Narrows, as described previously.

The March 2020 Project EIS notes that rock jetties will likely be required for a short distance from the shoreline, extending parallel to the inlet excavation. Shoreline morphology assessments concluded that the inlet is in a low wave energy location and the risk of sediment transport and deposition in the excavated inlet is low[16]. Therefore, the current design does not include jetties at the inlet.

Channel Outlet

The March 2020 Project EIS describes an excavation extending approximately 400 m (1,312.3 ft) into Sturgeon Bay, with a width of 80 m (262.5 ft) at the shoreline and 180 m (590.6 ft) at the point of daylight, 400 m (1,312.3 ft) from shore. As shown in Appendix 3C, Figure 3C-18, the current design includes an excavation that extends approximately 200 m (656.2 ft) into Sturgeon Bay, with a base width of 174 m (570.9 ft) at the shoreline and approximately 224 m (734.9 ft) at the point of daylight.

The March 2020 Project EIS indicates that rock jetties will run parallel to the excavation along its entire length (i.e., extending 400 m [1,312.3 ft] into Sturgeon Bay). The current design includes rock jetties that extend approximately 100 m (328.1 ft) into Sturgeon Bay. The alignment of the jetties may follow the cofferdam alignment if that mode of excavation is selected (see Section 3.5.2.2).

3.4.3.3 Water Control Structure

A WCS is required to control flows through the LSMOC while managing Lake St. Martin water levels during flood events. The operations are intended to be consistent with the Operating Guidelines, as filed as part of the June 2022 supplemental information response to IAAC IRs. The current design and changes since the March 2020 Project EIS are shown in Appendix 3C, Figure 3C-19a, 3C-19b, and 3C-19c and described below.

The location of the WCS has not changed from what was presented in the March 2020 Project EIS, but the configuration has been altered. The current design has the WCS located approximately 600 m (1968.5 ft) inland from the shore of Lake St. Martin (see Appendix B, Figure B-3). The WCS will be founded on bedrock. The March 2020 Project EIS indicates that the structure will have two bays, with each being 9 m (20.5 ft) wide. The current design includes a four-bay structure with 6 m (19.7 ft) wide bays. Two bays (outer bays) will have crest elevations of 236.8 m (776.9 ft), and the other two bays (inner bays) will have crest elevations of 240.5 m (789.0 ft). The additional bays will allow greater flexibility in controlling flow into the LSMOC, particularly during winter months. Only the inner bays with higher crests will be operated during the winter (if required). A gated valve will be incorporated into the outer gates to allow a minimum riparian flow (i.e., baseflow) to be provided in the channel, if required, to maintain DO levels in the winter. This is to reduce the likelihood of ice damage to the backside of the gates and allow winter operation at reduced flows. The WCS includes a stilling basin to dissipate flow energy and reduce potential for erosion. The stilling basin design includes rollway profiles, baffle blocks, and a vertical end sill.

[16] Summarized in the May 2022 response to Information Request IAAC-32

3.4.3.4 Drop Structures

The LSMOC will require drop structures to manage flow velocities in areas of steep sloping terrain. A typical plan and profile of a representative drop structure is shown in Appendix 3C, Figure 3C-20. The current design and refinements from the March 2020 Project EIS are summarized below.

The locations of the drop structures have not changed substantially from what is shown in the March 2020 Project EIS, as shown in Appendix 3C, Figure 3C-3. The current design still includes eight drop structures. The design of the drop structures remains consistent with what was presented in the March 2020 Project EIS. The structures will be constructed of rockfill with a cutoff wall at the crest. The approximate weir and drop heights of the structures have not changed substantially. The slopes of the rock ramps were flattened to reduce the risk of erosion at the Design Flow. Another modification that was made is that the low-flow trapezoidal chute that extends down the length of the rock ramp will be grouted. This will provide a more uniform flow depth in the chute and will reduce the potential for fish stranding in voids between the rocks.

When not in operation, and there is a riparian flow (i.e., baseflow) in the channel, the water depth just upstream of each drop structure in the LSMOC will be 2.5 m (8.2 ft), with the exception of the first drop structure where the water depth will be 3.7 m (12.1 ft). The pool depth upstream of the first drop structure is greater to meet minimum water depth requirements further upstream. The depth of water will reduce the risk of ice freezing completely to the bottom of the channel. The design intent is to provide an area within each pool where fish can overwinter in the channel under the ice, if they do not make their way downstream to Lake Winnipeg prior to winter. The top width of the pools will vary along the length of the channel from approximately 55 to 85 m (180.4 to 278.9 ft) - a function of the water depth.

The height of the drop structure weirs range between 2.5 m (8.2 ft) and 3.7 m (12.1 ft). The overflow crest widths range from 80 m (262.5 ft) to 125 m (410.1 ft). Cutoff walls are included at the crests to prevent flow through the structures when the LSMOC is not in operation. Sheet pile will be used as the cutoff walls for all structures with the exception of the fourth drop structure. At this structure, a concrete cutoff wall will be used due to the shallow depth to bedrock and inability to drive sheet pile.

A low-flow notch is included in the crests of the drop structures. The notches are trapezoidal in shape with a height of 0.5 m (1.6 ft), base width of 2 m (6.6 ft), and 3H:1V side slopes. The notches are designed to pass the riparian flow (i.e., baseflow) when the channel is not in operation (i.e., WCS gates closed). The notches connect to low-flow chutes that run down the centre of the rock ramps. As indicated, the chutes will be grouted to help reduce maintenance and to facilitate downstream fish passage.

The channel elevation drop at each structure ranges between 1.2 m (3.9 ft) to 3.3 m (10.8 ft). The slope of the rock ramps range from 45H:1V to 60H:1V. The rock ramp lengths typically vary between 200 m (656.2 ft) and 250 m (820.2 ft), with the exception of the fourth drop structure which has a ramp length of approximately 350 m (1,148.3 ft) (note that the lower portions of the rock ramps will be submerged by the downstream pool). The rock ramps will be lined with limestone riprap with a median diameter of 350 mm (13.8 in.).

The design of the furthest downstream drop structure is similar to the other drop structures and comprises a sheet pile crest with a 45H:1V rockfill chute on the downstream side. When flows in the channel equal or exceed the Design Flow, water passing over the crest of the drop structure moves down the rock ramp at a high velocity, exceeding 4 m/s (13.1 ft/s). The structure has a crest elevation of 219.55 m asl (720.3 ft asl) and the notch through the sheet pile has an invert elevation of approximately 219.05 m asl (718.7 ft asl). Although average Lake Winnipeg water levels are approximately 217.6 m asl (713.9 ft asl), different combinations of high Lake Winnipeg water levels and large wind events could result in Lake Winnipeg water levels exceeding 219.05 m asl (718.7 ft) asl under extreme flood events. These conditions may also coincide with periods of channel operation, with flows serving to keep fish from moving upstream past the last structure.

The high velocities and elevation differences through the drop structures will inhibit the movement of fish in the upstream direction from Sturgeon Bay in Lake Winnipeg to Lake St. Martin. However, since fish may be able to move downstream into the LSMOC from Lake St. Martin when the WCS gates are open during flood conditions, the drop structure design criteria considers that fish must be able to escape from the LSMOC post-flooding to the extent possible when the control structure gates are closed.

Considerations regarding fish passage included in the design of the LSMOC to achieve the proposed design criteria are listed below:

- During periods of non-operation, with the WCS gates closed in the LSMOC control structure:
    - fish will not be able to move upstream past the LSMOC WCS (i.e., the closed gates impede the movement of fish)
    - the design will accommodate the movement of fish downstream past the drop structures during the open water season. This will reduce the potential for fish stranding after flood operations end in any particular year when the LSMOC is used
- During periods of operation to manage flooding, with the WCS gates closed in the LSMOC control structure:
    - under most gate opening conditions, it is not anticipated that fish will be able to pass upstream through the control structure due to high water velocities
    - fish may be able to move downstream past the drop structures, but it is not anticipated that they will be able to move upstream at these structures due to the high water velocities and large differential in water levels

Several considerations were incorporated in the drop structure design to reduce potential impacts to fish. For example, a level of riparian flow (i.e., baseflow) and inclusion of a notch at the top of each drop structure will provide downstream passage for fish during low flow/non-flood conditions to reduce the risk of fish stranding within the channels. Provision of adequate riparian flow (i.e., baseflow) and sufficiently

deep pools upstream of the drop structures also reduces the potential risk of mortality for fish that may overwinter in the channel.

3.4.3.5 Rock Quarries and Material Borrow Areas

Table 3.4-2 summarizes the total estimated quantities of required aggregate and riprap for all LSMOC components, including roads, channel armour stone, riprap, and concrete. Quarried rock will be required for channel armouring, drop structures, and riprap for the purpose of erosion protection at various points along the channel. Large diameter riprap required to dissipate energy downstream of the WCS will likely be sourced from granite quarries outside the LAA (at locations proposed by contractors) and hauled to the proposed Project sites. Aggregate produced from the quarries will also be used in permanent and temporary roadworks, groundwater management, environmental mitigations, and various components of WCS construction. Potential sources exist in the region and contractors will be required to use existing permitted sources or obtain proper permits prior to development of new sources of rock for the proposed Project. While it is not anticipated that additional quarries will need to be developed to source material for the LSMOC, expansion of existing permitted sources may be required, as permitted by Manitoba Transportation and Infrastructure and Manitoba Mines and Minerals. It is estimated that the proposed Project will require approximately 2.3 million m^3 (81.2 million ft^3) of limestone from the local region and this accounts for just under 4% of the total estimated reserve calculated in the assessment, or conservatively just over 6% of the volume when excluding private quarries and those where quarry leases have been issued[17].

Table 3.4-2 LSMOC Aggregate Requirements

Material Type	Volume (m^3)	Weight (Tonnes)	Purpose
Limestone Granular Fill	400,000	898,000	roads, bridges, embankments, concrete
Limestone Crushed Rock	385,000	770,000	armouring, trench backfills
Limestone Riprap (600-800 mm)	806,500	1,613,000	erosion protection, energy dissipation, culverts
Granite Riprap (>800 mm) from outside region	43,000	86,000	erosion, energy dissipation

Permitting, operation and decommissioning of rock sources will be conducted by contractors if and as required. Estimated quantities, volumes, or sources of aggregate (rock) or borrow will continue to be developed as proposed Project design progresses. The PERs, filed as part of the June 2022 supplemental information response to IAAC IRs, describe the various environmental requirements for the development and operation of quarry and borrow areas used for the Project, including requirements for submission of plans and details to Manitoba Transportation and Infrastructure prior to commencement of

[17] Summarized in the May 2023 response to Information Request IAAC-R2-33

activities. These requirements, as well as other applicable components of the CEMP (see Section 3.7.2) and OEMP (see Section 3.7.3) will be applied throughout the Project lifecycle, as required.

3.4.3.6 Temporary Construction Camps and Staging Areas

Temporary construction camps and staging areas will be located in existing disturbed areas and existing facilities wherever possible. Some additional details have been developed since the March 2020 Project EIS and are added to the previous descriptions below.

It is currently anticipated that at least three construction camps and one cleared area to facilitate construction of the WCS will be required for the LSMOC, which will operate at varying capacities throughout the construction schedule. A supplementary analysis has confirmed that LSMOC camps will be located at existing (previously cleared) borrow sites that are located along the access road near the proposed Project site. The locations and cleared dimensions of the designated camp sites will be identified in the construction tenders and no additional clearing is anticipated.

The largest construction camp is expected to be located close to the WCS, as it will require the largest number of workers and require facilities, typical of other large civil works projects that accommodate a more diverse labor force. 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. Camp-specific communications services will also be provided by the contractor. For the clearing and channel contract(s), one or multiple smaller camps will be developed, similar to other camps recently installed in the region during construction of the access road and the EOC.

The estimated size of workforce ranges between approximately 30 to 100 persons per contract. Considering that the proposed Project schedule assumes that multiple contracts will occur simultaneously, peak camp capacity is anticipated to be approximately 250 workers, including approximately 100 workers for construction of the WCS and 150 workers for major earthworks and drop structures along the channel length. Details are provided in Section 3.5.2.16. The workforce estimate also forecasts that approximately 100 heavy equipment units may be required on the various contract sites at peak times on the proposed Project. Details are provided in Section 5.5.2.9.

Contractor staging areas will be used to store materials, maintain and assemble equipment, and administer work on the LSMOC, WCS, and associated components. These staging areas will be located within the ROW or designated construction camp locations; however, similar to the camps, the exact location, number, size, and details of the contractors' work areas will be proposed by contactors for review and approval by Manitoba Transportation and Infrastructure.

Manitoba Transportation and Infrastructure has developed a process for proposal and review of locations prior to their establishment. As stated in the PERs, filed as part of the June 2022 supplemental information response to IAAC IRs, designated areas, including temporary work camps, equipment servicing areas, parking areas, and staging areas, will be identified by the contractor. The contractor will

submit plans and details for designated areas, including proposed locations, access and traffic management, and utility impacts for review by Manitoba Transportation and Infrastructure prior to mobilizing personnel or equipment to the site.

3.4.3.7 Power Supply

Permanent electrical service is required at the WCS to electrically raise and lower the gates, as well as to heat an appropriate number of gates to maintain winter operation capability. There have been several design refinements since the March 2020 Project EIS, as summarized below. The most recent estimate for permanent power loads required at the WCS have confirmed that they remain between 300 to 400 kW, as stated in the March 2020 Project EIS.

Manitoba Hydro will design, permit, and install a 24 kV overhead distribution line to a pad-mount transformer that will be installed at the WCS location. The distribution line is expected to extend approximately 15 km (9.3 mi) from an existing line along PR 513 northwest of the LSMOC (Appendix 3C, Figure 3C-3) to a pad-mount transformer at the WCS location. The distribution line alignment will require a 30 m-wide ROW, as well as an additional 30 x 30 m (98.4 x 98.4 ft) cleared area for helicopter landing pads each kilometer along the length of the distribution line. A total of twelve (12) of these pads will be cleared and constructed adjacent to the 30 m (98.4 ft) ROW to provide maintenance or emergency access if needed in non-frozen conditions.

The line accommodating conductors strung on wooden poles was to be a minimum of 12 m (39.4 ft) above the ground; however, detailed design has determined that a minimum 13.7 m (44.9 ft) height will be required to support potential future additional lines and may need to be as high as 16.7 m (54.8 ft) in select locations in order to cross the maintenance road (Appendix 3C, Figure 3C-21). As indicated, Manitoba Hydro will be responsible for obtaining and adhering to any distribution line permit and/or regulatory approvals conditions. Maintenance of the distribution line and associated ROW will fall under Manitoba Hydro's standard operating procedures.

A 500-kW (670.2 hp) stand-by diesel-fueled generator will be installed as part of the proposed Project to provide emergency back-up power for the WCS should there be a power failure at the site. The current design calls for a 300 kilovolt-amps (kVA; 600 volts [V], 3P, 402.3 hp) capacity generator to be installed complete with necessary cabling in a separate building at the WCS site.

During construction, additional electrical power will likely be required beyond the capacity of the new distribution line. Power may be required for construction camps, a concrete batch plant, and general construction needs. A preliminary estimate of the total construction power requirements is approximately 2,000 to 3,000 kVA (2,682.0 to 4,023.1 hp). Manitoba Hydro has advised that an estimated 2,000 kVA (2,682.0 hp) should be available to the WCS location by the 24 kV (32.3 hp) distribution line once constructed. The remaining power demand will be serviced by temporary diesel generation (multiple generators) including at the WCS and along the channel length to support such construction demands as channel dewatering. Should the distribution line not be in-place in advance of major construction activities, all construction power will be serviced by diesel generation. It is envisioned that this will include

two 1,000 kW (1340.5 hp) generators for the WCS construction activities and camp (includes some redundancy) during construction, and the remaining power requirement will be supplied by multiple smaller generators related to the earthworks contractor camps and construction activities. Manitoba Transportation and Infrastructure will continue to define and optimize the power requirements through detailed design.

3.4.3.8 Temporary Access and Channel Crossings

PTH 6 will be the main access road for the transportation of equipment, materials, and personnel from Winnipeg and other commercial centres into the LAA. Construction-related access to the LSMOC will still be via the Lake St. Martin Access Road, as described in the March 2020 EIS. Where access routes are accessible by the public, signage will be erected restricting access to authorized personnel. Details can be found in the AMP, as filed as part of the June 2022 supplemental information response to IAAC IRs.

A construction access road will also be built within the east limits of the LSMOC ROW, which will provide access for construction equipment and personnel to areas north of the Lake St. Martin Access Road, which crosses the LSMOC ROW at the WCS site. The construction access road may also be used by Manitoba Transportation and Infrastructure for future maintenance activities along the outside drain. The top of the dikes will also be used to access the full length of the channel for inspection and maintenance of the channel dikes, drop structures and outlet.

The existing 14 km (8.7 mi) winter road located several kilometers east of the LSMOC will be used during construction to access the northern portion of the LSMOC for clearing and peat excavation contracts, but only during winter months. It is not anticipated that this winter road will be maintained for long-term operation or maintenance uses once the roads within the ROW are established.

The only channel crossing currently planned for the Lake St. Martin Access Road is at the WCS. There are no major changes to this configuration since the March 2020 Project EIS submission and only slight adjustments in design have been required; the bridge superstructure design includes partial depth precast concrete panels with a cast-in-place concrete slab above. The 8.9 m (29.2 ft) clear roadway width will have asphalt pavement over the bridge deck and for short sections of approaches on either side to improve durability of the remote structure. The existing section of Lake St. Martin Access Road within the ROW will be realigned to cross the WCS perpendicular to the channel and continue north to the remaining road segments. No realignment of the Lake St. Martin Access Road outside of the LSMOC ROW is anticipated as part of the proposed Project.

3.4.3.9 Drainage Realignment

Permanent Drainage

Appendix 3C, Figure 3C-22 shows the permanent drainage plan for the LSMOC. For upgradient flows, a drainage ditch, or outside drain, will be constructed on the east side of the channel to collect existing drainage flowing from the east. On the west (downgradient) side of the LSMOC, surface water naturally flows away from the channel toward the peatlands and Buffalo Creek. Therefore, no outside drain is

required on the west side of the channel. Additional details have been developed since the March 2020 EIS on both upgradient and downgradient flows, and these are summarized below. Further details can be found in Section 3.5.11 and the SWMP, as filed as part of the June 2022 supplemental information response to IAAC IRs.

The outside drain to manage upgradient flows will be designed to maintain shear stress in the drain below the adopted erosion threshold value of 6 Pascals for clay and clay till during the 1 in 10-year runoff event. It will also convey flows up to the 1 in 10-year runoff event without causing substantial inundation of adjacent land. Select portions of the outside drain that are incised in mineral soil through high topographic areas will be maintained in a similar manner as other provincial drains across Manitoba. Other portions of the drain where the invert intersects peat will require minimal maintenance. The hydraulic roughness of the drain will change over time from growth of vegetation in the unmaintained areas. At those locations, this will result in higher water levels in the drain. Under this long-term condition, the design allows for some inundation of adjacent land during the 1 in 10-year runoff event.

The outside drain is comprised of a trapezoidal excavated channel, as shown in Appendix 3C, Figure 3C-23. The drain invert was selected to reduce excavation volumes while also reducing inundated areas at the 1 in 10-year design runoff event. The drain invert intersects both peat and mineral soil along its length. In areas where the drain runs through peat, the cross-section will have side slopes of 3H:1V. In areas where the drain runs through mineral soil, the side slopes will be 4H:1V. The base width of the drain varies from 4 m (13.1 ft) at the upstream end to 12 m (39.4 ft) at the downstream end, to account for the accumulation of flow in the downstream direction. The typical invert slope of the drain is 0.06% with the exception of two reaches that have slopes of 0.02% and 0.04% to better fit the natural topography.

Fourteen rockfill gradient control structures (GCSs) will be constructed along the drain to limit water velocities and shear stresses to permissible levels and reduce the risk of erosion in the drain. As shown in Appendix 3C, Figure 3C-24, the GCSs will be rockfill structures with raised crests and steep chutes. The chutes will be protected with riprap to prevent erosion from the high velocities in the region where the water surface elevation is lowered over a short distance. The GCSs are designed to withstand flows up to the 1 in 25-year event with limited damage and flows up to the 1 in 200-year event without complete failure (i.e., washout of structures). The construction road that will be constructed adjacent to the outside drain during the site preparation contracts will be used to access the outside drain for future maintenance. Routine maintenance activities will likely be required and will mostly consist of regrading and/or replacing of riprap that has moved or settled from its original position. Placement of additional riprap on the edges of the structures or at locations where erosion has occurred may also be required to mitigate the development of alternate flow paths.

The design flow depth in the drain at the 1 in 10-year design flow is approximately 1 m (3.3 ft). The velocities at the design flow are predicted to be less than 0.7 m/s (2.3 ft/s). The seasonal flow in the drain will vary depending on inflow from the perched groundwater system and surface water runoff.

The permanent outside drain will discharge into the LSMOC via a culvert outlet structure at the downstream end. Flows exceeding the capacity of the outlet structure may be discharged directly to Lake

Winnipeg. Rockfill overflow sections will be included with the design, if required, on the banks of the LSMOC to control overflow from the drain into LSMOC during extreme events that exceed the capacity of the drain. A small riprap apron will be installed on the lake bed at the drain outlet to allow temporary discharge of the drain to Lake Winnipeg during construction.

Since the March 2020 Project EIS, Manitoba Transportation and Infrastructure has examined potential effects associated with a loss of downgradient flows and has evaluated options to offset for the water intercepted by the LSMOC during operation and reduce potential effects to wetland function. Details on potential conceptual options for rewatering (an effects-based design change), including a description and preliminary evaluation of the options are presented in the May 2022 responses[18] and additional information to be provided in the May 2023, responses[19]. Assessment of the existing peatlands and evaluation of rewatering options is ongoing; further information will be provided in responses to the Round 2 IRs.

Temporary Drainage

Information on temporary drainage was not available at the time of the March 2020 Project EIS filing. Water management is discussed in Project EIS Volume 1, Section 3.5.2.11, but additional details are now available. An updated description of surface water management during the construction phase[20] is presented in the SWMP, as filed as part of the June 2022 supplemental information response to IAAC IRs. Appendix 3C, Figure 3C-25 shows the temporary drainage plan.

The primary method of managing surface water for channel works will be via the permanent outside drain, which will be constructed as part of the initial contracts. The purpose of the outside drain is to intercept surface water runoff from the east side of the proposed Project upstream of the construction areas to reduce inflow of surface water into the construction zone. During construction, intercepted surface water will be conveyed along the drain and discharged directly into Lake Winnipeg with a temporary outlet protected with riprap. As indicated, the outside drain will be constructed along the east side of the LSMOC within the ROW as part of the site preparation contract. It is designed to accommodate flows up to a 1 in 10-year rainfall event. Once construction of the outside drain is complete, intercepted surface water will be conveyed along the drain to Lake Winnipeg.

Within the excavated channel, a pilot ditch will be constructed as part of the initial contracts to promote downstream drainage of the excavated area. Earth plugs will be maintained between contracts to prevent discharge of water from one contract to the next. As contracts are completed, the earth plugs will be removed to allow for gravity drainage away from the construction site. Temporary outlets for the pilot ditch and the outside drain are shown in Appendix 3C, Figure 3C-25.

[18] Summarized in the May 2022 response to Information Request IAAC-53
[19] Summarized in the May 2023 response to Information Request IAAC-R2-14
[20] Summarized in the May 2022 response to Information Request IAAC-75

Surface water management within the excavated area of each individual contract will be the responsibility of the contractor. This is anticipated to involve a combination of temporary pumping in low lying areas and gravity drainage away from the construction site. Water from within the work area will be treated, as required, to comply with the water quality criteria outlined in the SWMP, prior to discharge into the outside drain, or towards Lake Winnipeg, or Buffalo Creek, and as approved by Manitoba Transportation and Infrastructure during construction. Water discharged offsite will be released to settling ponds, filtering systems or through dense terrestrial vegetation of sufficient distance from waterbodies or streams to reduce the potential of sediment release into fish-bearing waters downstream of the construction areas. As described in the SWMP (filed in June 2022 as part of the supplemental information responses to IAAC IRs) and summarized in Section 3.5.2.11, the primary method to prevent or reduce the potential for erosion within the LSMOC beyond channel armouring will be through the establishment of permanent vegetation, as described in the RVMP (filed in June 2022 as part of the supplemental information responses to IRs) and summarized in Section 3.5.2.13. Until vegetation is established, temporary erosion and sediment control measures will be employed during construction, as described in the SMP (filed in June 2022 as part of the supplemental information responses to IRs) and summarized in Section 3.5.2.12.

3.4.3.10 Facilities for the Storage of Explosives

Explosives and initiation systems to be used for blasting activities during the construction phase will be stored in temporary, independent magazines. The contractor will be responsible for obtaining any required licensing. Magazines used for the storage of explosives will meet the federal standards and licensing requirements as specified in the *Explosives Regulation* of the federal *Explosives Act*. Siting of magazines will meet the provincial standards and licensing requirements as specified in the Operation of Mines Regulation of *The Workplace Safety and Health Act* of Manitoba.

3.5 PROPOSED PROJECT ACTIVITIES

3.5.1 Introduction

This section focuses on proposed Project construction and operation and maintenance activities. As earlier indicated, the proposed Project design is still ongoing, and as such, channel and structure optimization, financial considerations, environmental considerations, and continued discussions with local landowners, Indigenous groups, stakeholders and the RM of Grahamdale may result in further refinements to proposed Project components and associated activities.

3.5.2 Site Preparation and Construction

The construction stage for all proposed Project components includes general preparation such as equipment marshalling, construction camps and staging areas. Requirements for specific construction activities and/or proposed Project components are described in more detail below. Proposed Project components such as construction staging areas and construction camps and the 400 m (1,312.3 ft) wide

ROWs will be surveyed and flagged to mark the extent of clearing as an initial activity once construction begins.

3.5.2.1 Clearing

Construction of the proposed Project will require vegetation clearing and grubbing of the final alignment ROWs and excavating the channel to designed depths along the proposed channel alignments. ROW clearing will generally be 400 m (1,312.3 ft) wide and will be conducted in accordance with Manitoba Transportation and Infrastructure's environmental mitigations and regulatory requirements. Clearing will consist of the removal and disposal of trees, shrubs, fallen timber and surface litter from the ROW and temporary access roads, prior to grading.

Clearing and grubbing for the proposed Project is planned to occur between September 1 and March 31, which is outside the breeding bird nesting period. Any minor clearing efforts required within this period will be completed in accordance with the regulatory requirements and PERs, as filed as part of the June 2022 supplemental information response to IAAC IRs. Typical equipment used for clearing and grubbing is described in Section 3.5.2.9. Once cleared, excavation of the LMOC and LSMOC within the ROW may proceed year-round and will primarily be excavated in the dry (with exception of the inlet and outlet structures).

For the LMOC, approximately 188 hectares (ha) (464.6 acres [ac]) of tree clearing will be required. For the LSMOC, based on an approximate 23.8 km (14.8 mi) channel length (excluding in-water works at the inlet and outlet) and 400 m (1,312.3 ft) wide ROW, approximately 880 ha (2,174.5 ac) of vegetation clearing will be required, less the approximately 72 ha (177.9 ac) that were previously cleared during initial construction of EOC Reach 3. The current plan to handle cleared material is as follows:

- Timber from which forest products can be manufactured (merchantable timber) will be limbed and neatly piled within the work limits, where easily accessible.
- Disposal of cleared non-merchantable trees and brush will be conducted in a manner approved by Manitoba Transportation and Infrastructure. Disposal may involve burning, piling, burying, windrowing, and compacting, limbing and chipping. Disposal methods may be restricted or prohibited in certain locations if they are deemed to result in future issues such as fire hazards.

3.5.2.2 Excavation

After clearing has occurred, construction of both the LMOC and LSMOC will involve excavation activities along the channels, outside drains, WCS, bridges, inlets, and outlets. Channel construction will be carried out in a series of segments and include developing spoil piles and dikes. The management of erosion, surface and groundwater are discussed in other sections. Excavation will involve isolating the channel excavation into sections to mitigate groundwater effects and provide better control of dewatering efforts. After work is completed in each section, breaches will be created to allow flooding of the areas with lake water and reducing the amount of pumping/groundwater depressurization.

Other than local surface water management, most excavation activities will be carried out on land, with the exception being the inlet and outlet areas, where particular attention is required to address issues such as effects to fish. The inlet and outlet excavations may proceed in the wet, dependent on the selected construction methods. The means and methods of the inlet construction will be at the discretion of the contractor with approval from Manitoba Transportation and Infrastructure, and in adherence with the environmental requirements described in the EMPs. It will likely involve the use of silt curtains to manage sediment within the excavation area.

Total estimated volumes of excavated materials for the LMOC and LSMOC channels (including topsoil, peat, till, clay, and bedrock) are approximately 11.6 million m^3 (409.7 million ft^3) and 12.5 million m^3 (441.4 million ft^3), respectively. Topsoil and peat will be temporarily stockpiled to later be placed over excavated surfaces as a seed bed in areas that require revegetation. Till and clay material will be excavated and placed adjacent to the channel as spoil banks and/or containment dikes.

Cofferdams may be constructed to allow dewatering and excavation of the inlets and outlets under dry conditions. The cofferdams would likely be constructed using a combination of imported rockfill and clay or clay till material sourced locally from the channel excavation. They would include rockfill riprap (as required) to mitigate potential erosion related to wind and wave action. The alignment of the cofferdams is expected to surround the limits of excavation and tie-in to high ground elevations where possible.

If required, construction and removal of cofferdams will take place outside of DFO Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat[21] and will be completed in accordance with the conditions outlined in the *Fisheries Act* Authorization. Portions of the cofferdams may be left in place where they do not affect the hydraulic conveyance of the channels. Removal of any silt/turbidity curtains will occur once monitored water quality parameters on both sides of the curtain are similar and meet the criteria and protocols described in the SWMP and SMP, as filed as part of the June 2022 supplemental information response to IAAC IRs.

For the LSMOC, excavation of the inlet may occur at any time once construction of the cofferdam is complete as it will be isolated from the lake environment. Other methods of construction may include excavation in the wet from a barge or groins. The excavation area would be isolated from Lake St. Martin with turbidity curtain, or other containment method, during construction. Outlet construction may involve installation of a cofferdam to complete excavation within an area isolated from the lake. An alternate method may be excavation in the wet from a barge or groins in an area isolated from Lake Winnipeg with a turbidity curtain, or other containment method. For the LSMOC, final material at the inlets and outlets (or the cofferdams if selected as the preferred construction methodology) will only be removed once all other excavation works are complete and sequenced in controlled fashion to prevent excess sedimentation or scour. This release will also be scheduled with consideration of fish spawning windows for in-water works.

[21] As described for the Province of Manitoba at: https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html

Prior to construction start, a site investigation and heritage resources impact assessment of the LMOC inlet shoreline and inland areas will be completed before excavation of these areas may commence.

3.5.2.3 Blasting

Blasting may not be required for the LMOC or LSMOC; there may be some limited blasting for the LMOC and LSMOC at the WCS, as excavation is required in bedrock. For the LSMOC, bedrock excavation will occur as required (near the downstream end of the channel alignment in the vicinity of the existing EOC Reach 3, where the bedrock surface is at or above the design channel invert). Previous bedrock excavation during the EOC construction was completed using D8 dozers equipped with ripping teeth. A similar approach may be utilized as part of the Project; however, as indicated, limited blasting may be required because bedrock is anticipated to become more competent with depth. The planning process uses a conservative approach and blasting is assumed to be used in all instances where bedrock is encountered.

Should blasting be required, contractors will be required to store, handle and transport explosives in compliance with relevant provincial and federal legislation, best practices and guidelines for safety and environmental protection as outlined in the PERs, as filed as part of the June 2022 supplemental information response to IAAC IRs, which will accompany the tender(s) for construction. The PERs describe the environmental requirements for blasting, including steps to take if blasting occurs near a waterbody, or in proximity to sensitive wildlife habitat during critical lifecycle periods. To the extent possible, the timing of blasting activities will consider area-specific environmental sensitivities, such as reducing disturbance to stakeholders, avoiding disturbance to rare species and sensitive time periods, and reducing potential effects on wildlife populations used by Indigenous rights-holders for hunting. As described in Section 3.7.2, site-specific measures will be stipulated in applicable Environmental Protection Plans (EPPs), as were filed as part of the June 2022 supplemental information response to IAAC IRs.

In addition to requirements stipulated in the PERs, the QMP described in Section 3.3, will also include requirements for the contractor to submit a blast plan prior to preparatory work for each blast. This plan will, among other things, provide advanced details and notice regarding the contractor’s intention to produce aggregate material and will include accompanying details such as:

- The location, depth and area of each blast.
- Diameter, depth, pattern and inclination of blast holes.
- The type, strength, amount, column load and distribution of explosives to be used per hole, per delay and per blast.
- The sequence and pattern of delays and the description and purposes of any special methods to be adopted.

3.5.2.4 Access Roads and Detours

Traffic management plans with local detours will be implemented early in the construction phase to reduce potential effects to access and traffic flows on the existing road network that may arise from construction of the outlet channels. Initial access to construction areas will be through a proposed Project checkpoint located along PTH 6 to facilitate the mobilization of equipment and temporary infrastructure in accordance with the PERs, and details can be found in the AMP, both of which were filed as part of the June 2022 supplemental information response to IAAC IRs.

The LSMOC is located away from much of the existing road network and will primarily use PTH 6 and the Lake St. Martin Access Road for access to and from the site. A current Haul Road Agreement between Manitoba Transportation and Infrastructure and the RM of Grahamdale governs the short sections of municipal roads (DeWalt Road and Birch Lake Drive) that connect the access road to PTH 6, requiring that Manitoba Transportation and Infrastructure continue to maintain these roads throughout construction of the LSMOC and restore them to the pre-construction condition once work on the outlet channel is complete. Temporary and permanent maintenance access roads will be constructed within the ROW to allow travel along the outlet channel and outside drain.

Access to the LMOC construction sites will primarily be via PTH 6, with sections of PR 239 and various municipal roads providing access to the specific work locations or ROW access points. These anticipated sections of road were identified by Manitoba Transportation and Infrastructure and confirmed with the RM of Grahamdale to establish a proposed Haul Road Agreement for the LMOC. All roads covered under this agreement will be upgraded to suit construction traffic, maintained by Manitoba Transportation and Infrastructure during the work, and restored to the agreed upon condition post-construction. Signage will be in place on all Haul Roads to notify the public of construction traffic. Traffic management plans and temporary adjacent detour roads (shooflys) will be constructed at each bridge and WCS site to maintain local traffic through the sites while bridges are constructed, and channels are excavated. Temporary lane drops or closures with local municipal detours may be required for specialized operations or equipment maneuvers, as approved by Manitoba Transportation and Infrastructure on a limited basis. These measures in combination with the PR 239 and municipal road realignments will reduce impacts to traffic on provincial roads and highways, as well as access to emergency medical services within the proposed Project area.

3.5.2.5 Bridges

Four bridges will span the full width of the LMOC, one of which is incorporated into the WCS on Iverson Road. The only crossing of the LSMOC will be part of the WCS connecting to the Lake St. Martin Access Road. The three stand-alone bridges over the LMOC will be built in accordance with Manitoba Transportation and Infrastructure's design and construction standards for structures on municipal and provincial roads, all of which will have asphalt pavement on the bridge deck and approaches. The bridges on Township Line Road and realigned PR 239 will be composed of precast concrete girders, driven steel pipe pile pier bents with concrete caps, and concrete abutments founded on driven steel H-piles. The

bridge on PTH 6 will have similar components, except for steel girders, a cast-in-place concrete deck, and longer spans (fewer piers). All bridges and WCS will have riprap erosion protection on the channel base and slopes where required to resist erosive forces due to higher local velocities at these structures.

Construction is likely to follow typical sequencing for bridge construction in the dry, with deep foundation installation followed by pier and abutment construction. Girders, deck, and roadworks will follow and final excavation beneath the bridge will be completed with the future channel excavation contract. It is expected that construction will take place year-round where required, as scheduling of work relative to fish spawning windows will not be required.

3.5.2.6 Water Control Structures

WCSs will be mass concrete structures spanning the full width of the outlet channels with gates that can be operated to control the flow of water. Both the LMOC and LSMOC WCSs will be excavated into and founded on the underlying bedrock to provide a secure footing. WCSs will be constructed in the dry and will only be exposed to water once the control gates are in place and a satisfactory level of construction has been achieved to safely allow exposure to flow. Since WCSs are to be built in the dry, scheduling of construction work relative to fish spawning windows will not be required.

Construction activities for the WCS are currently anticipated to start early in the construction phase of the proposed Project and will continue through the completion of channel excavation works. Construction includes commissioning of the WCS and channel, and therefore will not conclude until all components are ready for operation. Commissioning is discussed in Section 3.5.2.12.

After clearing and installing any necessary temporary drainage, measures will be taken to manage groundwater depressurization and dewatering, prior to site excavation. These temporary measures will be required during construction to manage flowing artesian groundwater and maintain dry working conditions for excavation, foundation works, and concrete placement. Active depressurization (pumping from wells below the bedrock surface) of the groundwater aquifer will temporarily draw down the groundwater levels at the WCS sites to eliminate the flow of groundwater into the excavation area. Dewatering of the excavation (pumping at the excavated surface) will also be required to remove any surface water that collects and accumulates within the excavation area. Groundwater and surface water collected during depressurization and dewatering activities within the ROW will be managed and monitored in accordance with the SWMP and PERs (see Section 3.7). In addition, contractors will be required to submit excavation plans for Manitoba Transportation and Infrastructure approval in which all activities and management measures related to groundwater and surface water are outlined and comply with proposed Project requirements.

After site preparation, construction activities will then include base slab and stilling basin construction (placing reinforcing, formwork and other related works, concrete placement, and curing period), and concrete substructure construction (placing reinforcing, formwork and other related works, concrete placement, and curing period). This will be followed by bridge superstructure construction (girder or concrete slab installation, deck formwork and placing reinforcement, concrete placement and curing

period). Then there will be backfilling around the superstructure, construction of auxiliary and diesel generator buildings, and fill placement in the WCS compound area. This will be followed by installing various components such as the gates, walkways, and mechanical and electrical systems.

While the actual timelines for WCS construction start will be dependent on approvals and tendering periods, once this is provided, excavation and WCS concrete works, and installation of hoist housing and gate components (e.g., stair towers, hoist bridge and housing, hoists and mechanical systems) may be completed at any time during the calendar year. However, heating and hoarding will be required to complete some of these activities in winter months. In addition, activities such as placement and compaction of backfill materials will need to be completed during non-frozen conditions. Finally, most of the work associated with commissioning will be completed during summer months, with consideration given to fish spawning windows for timing of wet gate and channels commissioning (see Section 3.5.2.12).

3.5.2.7 Road Realignment

The roadworks associated with the realignment of the access road within the LSMOC ROW to meet approaches of the WCS bridge crossing and new maintenance roads will be constructed using typical methods for unpaved service roads, with embankments of suitable native till materials and granular surfaces. Realignment of PR 239 for LMOC construction will follow Manitoba Transportation and Infrastructure standard performance-based construction specifications for provincial roads (Manitoba Transportation and Infrastructure 2020). All new sections of municipal roads, intersections, and private accesses within the RM of Grahamdale will meet current Manitoba Transportation and Infrastructure standards.

Repurposing and realignment of road segments may re-use the existing road embankments as either subgrade or common fill if suitable. Site preparation for these roads may include addition of sub-grade material, contouring, levelling, and compaction. Materials, including rock fill aggregate and composite material, will be loaded, hauled, dumped, spread, graded and compacted, and trimmed and shaped before the granular surface or asphalt layers are applied. Other activities will include placement of geotextile fabric, riprap, roadway signs, erosion and sedimentation control and seeding of ditches. The existing alignments of Jordan Road and Carne Ridge Road require some vegetation clearing to accommodate the wider ROW required for PR 239 and utility infrastructure.

New municipal roads, intersections, and accesses will involve grading of native, borrow, and fill materials along new ROWs and will conform to appropriate Manitoba Transportation and Infrastructure construction specifications. In addition to the steps listed above for PR 239, these roads will include vegetation clearing and stripping of surface organic materials to be stockpiled for later use on road shoulders or for site reclamation. The new roads and accesses will have unpaved granular surfaces providing consistency with other municipal roads in the region for RM of Grahamdale and landowner maintenance considerations.

3.5.2.8 Drop Structures

Drop structures are not required as part of the LMOC due to the low slope of the existing topography. For the LSMOC, drop structure construction includes installation of a sheet pile cutoff wall and building a sloped rock bed by backfilling the area immediately upstream and downstream of the sheet pile crest with rock. The design includes gradually widening the channel base width upstream of the sheet pile cutoff wall, and gradually narrowing back to the outlet channel base width downstream. Drop structures will be constructed within the dry channel reach once the channel has been excavated. Water management measures for LSMOC channel construction are described in Section 3.4.3.9.

Construction of the drop structures is likely to occur concurrent with channel excavation works and will be completed within the scheduled timeline. Some components of the earthworks may need to be completed under summer conditions, such as placement of backfill that requires moisture conditioning and compaction. The timing and duration of specific activities associated with the drop structures will vary, depending on the type of drop structure that is selected at each location along the channel.

3.5.2.9 Equipment Requirements

It is anticipated that contractors will use typical grading, hauling, drilling, and paving heavy equipment to construct the outlet channels, drains, roads, and structures for both the LMOC and LSMOC. Multiple types of grading equipment will be working at the various Project sites concurrently, including but not limited to excavators, backhoes, dozers, and loaders; scrapers, graders, packers, and water trucks; semi-trucks and articulating rock trucks for hauling. It is expected that the clearing, outside drain, and outlet channel excavation contracts will make up the majority of heavy equipment on the Project.

Road realignment and bridge contracts will use similar grading equipment in smaller quantities and likely add boom trucks, cranes, and concrete mixers or pump trucks. Water control structures will also make use of these machines and may require additional boom trucks, cranes, or access vehicles due to the scale and complexity of the structures. Other miscellaneous equipment that could be used on one or more contracts include: crushers and conveyors at quarry sites; drilling rigs for deep foundations, bedrock work and groundwater management; utility service vehicles; and pumps, generators, heaters, lighting, and other machinery for maintaining work site and camp conditions.

The total number of vehicles used at the various sites on any given time varies between 150 to 250 units with an approximate peak of 250 units across all sites in Year 1.5. A preliminary estimate of the equipment required for construction of both LMOC and LSMOC contracts is summarized in Table 3.5-1. Anticipated equipment types by Project component are listed in further detail in Appendix 3B, Table 3B-1.

Table 3.5-1 LMOC Preliminary Estimate of Number of Construction Equipment

Construction Year	Year 0	Year 0.5	Year 1	Year 1.5	Year 2	Year 2.5	Year 3	Year 3.5 to 5
Peak LMOC Equipment	100	125	100	150	100	100	50	15
Peak LSMOC Equipment	75	75	75	100	100	100	100	10
Total Peak Equipment Use[1]	175	200	175	250	200	200	150	25

NOTE:
[1] Peak Equipment Use refers to the upper limit estimate for equipment requirements for each respective construction year.

3.5.2.10 Temporary Construction Camps and Staging Areas

Construction activities may need to be accommodated by temporary staging areas and construction camps that will be required throughout the construction period. The construction schedule is discussed further in Section 3.6. The anticipated number and configuration of these areas is discussed in Section 3.4.2.7 (LMOC) and Section 3.4.3.6 (LSMOC). An estimate of the required workforce is provided in Section 3.5.2.16.

Construction staging areas will likely include mobile construction trailer facilities for use as administration buildings and equipment maintenance. Construction camps are likely to be composed of mobile construction trailer or modular facilities organized in a manner to provide sleeping quarters, living quarters, dining areas and work spaces for construction crews. Depending on the final size and occupancy of the camps and staging areas, trailers will most likely be equipped with self-contained holding tanks for potable water and septic waste. Drinking water could potentially be sourced from wells (existing permitted/licensed sources or otherwise to be permitted or licensed by contractors with approvals obtained in accordance with provincial acts and regulations) or delivered by truck from the nearest water treatment facility. Sewage holding tanks will be used to temporarily hold generated wastewater; these will be pumped out at regular intervals and disposed of at permitted or licensed facilities or lagoons, subject to any fees applied by the authority having jurisdiction. The camps will be equipped with diesel fueled generators to power the facilities. However, if located near an existing distribution line, electricity may be supplied from the existing distribution system as capacity allows.

3.5.2.11 Water Management

The management of surface water and groundwater is a critical element of the design, construction, and operation of the Project. As described below, plans have been developed to address how surface water and groundwater will be managed during construction and over the life of the proposed Project, and to manage the risk of erosion. These include the SWMP, SMP, RVMP and GWMP. These plans are summarized in the EMP described in Section 3.7. Key items include the following:

- Control of surface water sources within or in close proximity to the proposed Project that may be impacted during construction, including surface water in adjacent watercourses and water bodies, surface water from construction dewatering activities due to seepage, groundwater depressurizing systems, surface water from rainfall and/or snow melt runoff.
- Management and accommodation of surface water during construction staging and sequencing with consideration for ditching requirements, alignments and risks associated with runoff and flooding; this includes, but is not necessarily limited to, dewatering and collection, and monitoring and treatment of waters that originate within the construction areas.
- Management and accommodation of surface water runoff during long-term operation with consideration given to ditching requirements, preliminary sizing of the drains and required structures.
- Management of sediment and erosion.

The drainage design incorporates outside drains and drainage outlet structures, as appropriate. Permanent and temporary drainage measures are discussed in Section 3.4.2.10 (for the LMOC) and 3.4.3.9 (for the LSMOC). Temporary drainage measures will be required during construction and will form an interim step towards the final drainage plans for the region. Sediment control measures (e.g., engineered temporary sediment basins, dikes, silt fences, straw wattles) are described in the SMP, with details developed by contractors at the start of construction that must conform to the EMP.

Groundwater conditions within the vicinity of the LSMOC and LMOC are complex, and critical to the functioning of the regional groundwater aquifer system in the Interlake region of Manitoba. The GWMP addresses groundwater management measures required during construction of the proposed Project. Key items to be addressed in the GWMP related to the construction phase of the proposed Project will include the following:

- Confined aquifer artesian pressures (to flowing artesian conditions) in the region of the LSMOC and LMOC.
- Groundwater seepage into and/or out of the channel.
- Impact of channel construction on groundwater wells.
- Impact of groundwater on the channel design, construction, and operation.

- Potential effect of channel construction on wetlands.

3.5.2.12 Erosion and Sediment Control

Erosion and sediment control will be factored into all aspects of construction, operation and maintenance. Mitigation and monitoring measures for erosion and sedimentation during proposed Project construction are provided in:

- PERs Section 2.3 (Erosion and Sediment Control).
- CEMP Section 5.5 (Erosion and Sediment Control).
- SWMP Sections 6.2.2 and 10.2.2 (General Discharge Monitoring Protocol – for each channel) and Sections 6.2.2, 6.2.4, 10.2.2, and 10.2.4 (Sediment Monitoring and Response Protocol – for each channel).
- SMP Sections 7.2 and 12.2 (Follow Up Response – for both channels).

As indicated, the key document describing erosion and sediment control measures is the SMP. The PERs document (see Section 3.7) as filed as part of the June 2022 supplemental information response to IAAC IRs, also provides instructions on measures to be used. The SWMP includes monitoring and decision thresholds to assist in applying erosion and sediment control measures. Erosion control management measures, such as silt fence and erosion control blankets, will be in place for the duration of site-specific construction works; the SMP provides examples of appropriate measures. While in place, erosion and sediment control products will be inspected repaired and replaced as required. Erosion and sediment control will be used in vulnerable areas during construction and, in some cases for a period afterwards, to provide protection to erosion-prone sites and prevent/limit the mobility of materials during and after construction.

Specifications for the supply and installation of erosion and sediment control products will be followed, including those identified in the DFO Measures to Protect Fish and Fish Habitat[22]. In addition, any in-water activity will be scheduled to take place outside fish spawning windows (i.e., DFO Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat[23]) and will be completed in accordance with the conditions outlined in the DFO Authorization.

[22] As summarized at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html
[23] As summarized for the Province of Manitoba at: https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html

The SMP describes temporary and permanent measures to be incorporated during construction until vegetation has been established on disturbed areas, as described in the RVMP. The measures will consider the short- and long-term drainage plans to facilitate their intended purpose, which is to reduce and mitigate the transport and deposition of sediment beyond construction areas and into off-site receiving water bodies. The SMP considers revegetation and construction management practices and cross-references the SWMP for water quality monitoring and follow-up, adaptive management strategies and contingency. In combination, these plans address erosion and sediment control and response measures, described generally as follows:

- Construction management practices: various methods and techniques for the installation, monitoring, and management of erosion and sediment control measures may be employed, such as drainage ditches, check dams, silt fences, sediment ponds and temporary slope stabilization.
- Water quality monitoring and follow-up requirements: a water quality monitoring program will be implemented to assess any changes that may result from channel construction activities and the effectiveness of proposed mitigation, and of the SMP.
- Adaptive management strategies: designed to create opportunity to use the initial designs while managing risks, to learn from field performance, and to incorporate new knowledge into subsequent management steps.
- Contingency and emergency response planning and controls: measures are deployed if the predefined erosion and sediment control measures do not achieve the water quality objectives or if the prescribed measures are overwhelmed during a severe runoff event greater than the design.

A key activity requiring sediment management is the commissioning phase, which marks the end of construction and the transition to the operational phase. The SMP includes a real-time sediment management protocol to address in-stream sediment concentrations from construction activities in or near water, river management, shoreline erosion, and commissioning of the outlet channels. Management triggers and adaptive management actions will be developed for the post-commissioning monitoring program based on the results of the SWMP monitoring during construction.

3.5.2.13 Revegetation

Revegetation is required to mitigate the potential for erosion and the potential colonization of the channel by weeds and is described in the RVMP. Revegetation will be among the final phases of site-specific construction activities for all proposed 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 benefit germination and plant establishment.

Permanent revegetation activities will be completed using a staged approach as channel excavation progresses and will commence as soon as possible after finished grades are established. Revegetation will be conducted in general accordance with the Native Revegetation Program Guidance Document, as filed as part of the June 2022 supplemental information response to IAAC IRs, and the RVMP. Additional mitigation measures may also be required to address the risk of poor vegetation growth on portions of the channel side slopes that will experience alternating periods of submergence and exposure as a result of long-term operation during flood and non-flood conditions. The RVMP benefits from revegetation test plots using varying soil thickness and soil amendments that were installed in the proposed Project region and monitored over the summer of 2019, the results of which will be used to optimize vegetation growth on the channel slopes.

3.5.2.14 Fuel and Hazardous Waste Storage

Solid, liquid, and hazardous wastes from the proposed Project will be collected, stored, transported, disposed of and/or treated in accordance with relevant legislation (see Appendix 1A) such as Manitoba's *The Environment Act* (Waste Disposal Grounds Regulation) and *The Dangerous Goods Handling and Transportation Act* (Dangerous Goods Handling and Transportation Regulation, Environmental Accident Reporting Regulation and Storage and Handling of Petroleum Products and Allied Products Regulation). If contaminated soil is discovered during proposed Project activities, the affected site will be assessed and managed in accordance with provincial regulations.

During construction, there will likely be multiple fuel storage areas either near construction camps or within staging areas with the total volume of fuel storage determined by the contractor. Fuel handling and storage areas will be required to be located at least 100 m from a waterbody or watercourse and incorporate secondary containment to reduce or avoid the potential for contamination in the event of an unexpected spill or container leak. Materials and equipment for the containment and recovery of accidental hazardous material spills will be available at all construction sites.

During operation, fuel handling and storage will be in accordance with appropriate provincial and federal regulations and guidelines. Fuels and hazardous materials expected to be present on site are summarized in Appendix 3B, Table 3B-2. Requirements pertaining to fuel and waste storage requirements are described in the CEMP and PERs.

3.5.2.15 Power Supply

Overhead distribution lines will be constructed to provide service to each of the WCSs. The lines will be designed, constructed, and operated by Manitoba Hydro (the Crown Corporation responsible for electrical utilities in the province of Manitoba). All activities will be completed in accordance with Manitoba Hydro's environmental management practices, as well as proposed Project requirements as communicated to Manitoba Hydro through ongoing coordination meetings and design reviews. Maintenance of the distribution lines and associated ROWs will follow Manitoba Hydro's standard operating procedures.

3.5.2.16 Workforce

Detailed construction phase workforce requirements (including number of employees, characterization and management of workforce, transportation of employees, associated traffic on municipal and/or provincial roads, work schedules, and lodging) will be estimated following completion of detailed design. It is difficult to accurately predict total workforce at this time, as there are many factors that could influence the size of workforce that will be present on various proposed Project sites or accommodations, including the proposed methods and work schedule, overall Project timeline, and environmental considerations. As a result, the estimated peak workforces (by half-year) for each channel presented in Table 3.5-2 are based on an anticipated range of 30 to 100 persons per contract. In total, there may be upwards of 575 personnel working on the proposed Project at one time. This is likely to occur during Year 1.5 or whichever period constitutes the second summer of construction.

The LSMOC construction camps are expected to require a 250-worker capacity, which aligns with the peak estimate for personnel at the site. This estimate consists of approximately 100 workers for construction of the WCS and 150 workers for major earthworks and drop structures along the channel length. Section 3.5.2.9 provides further details on construction camp activities for the proposed Project.

It is expected that some of the workforce on LMOC construction contracts may be housed in existing accommodations in the region, however the peak estimate of 325 personnel on the various sites will likely exceed the readily available local capacity. At least one construction camp can likely be expected to accommodate approximately 75 workers for the WCS, 175 workers for major earthworks, and another 75 workers for roads, bridges, and other LMOC contracts.

Table 3.5-2 Outlet Channels Estimate of Peak Construction Workforce

Construction Year	Year 0	Year 0.5	Year 1	Year 1.5	Year 2	Year 2.5	Year 3	Year 3.5 to 5
Peak LMOC Personnel	250	300	275	325	250	250	200	45
Peak LSMOC Personnel	150	225	225	250	250	250	250	40
Total Peak Construction Personnel	400	525	500	575	500	500	450	85

3.5.2.17 Waste Management

The contractor(s) will also be responsible for managing wastes associated with construction and/or maintenance contracts and will be required to provide a Waste Management Plan at the beginning of the contract. Small quantities of domestic solid waste will be collected in appropriate on-site containment for transport to the closest appropriate permitted/licensed landfill. Wastewater (sewage and grey water) from work camps and construction sites will be collected in approved holding tanks and will be hauled to an appropriately licensed or permitted facility for disposal and treatment. The contractors' use of these municipal facilities will be subject to any fees applied by the authority having jurisdiction. A detailed estimate of wastewater generation has not been completed. A conservative conceptual estimate based

on a typical 240 L (52.8 ga) of wastewater per capita per day is 120,000 L (26,396 ga) per day for a workforce of 500 (total average workforce for both LMOC and LSMOC construction). Waste petroleum products (e.g., lubricants, oils, greases) from construction vehicles and equipment will be collected and stored in designated areas and containers until they can be removed from site for recycling or disposal through a licensed waste disposal/treatment company.

3.5.3 Operation and Maintenance

This section focuses on the operation and maintenance activities associated with the Project. As described in Volume 1, Section 2.3.1.2 of the March 2020 Project EIS, Manitoba has a flood control system that includes major structures such as the Red River Floodway, Fairford River Water Control Structure (FRWCS), Portage Diversion, and the Shellmouth Dam. These flood control structures are governed by provincial operating rules or guidelines administered under *The Water Resources Administration Act*. As noted by the Manitoba Provincial Flood Control Infrastructure Operation Review Panel (MPFCIORP 2015), they provide guidance to the operator and a frame of reference for the people who may potentially be impacted by the operation.

The Hydrologic Forecast Center of Manitoba Transportation and Infrastructure produces flood outlooks in February and March of each year based on antecedent basin conditions, riparian flows (i.e., baseflows), soil moisture, winter precipitation, and a range of potential spring weather conditions. Once spring begins, operational flood forecasts are developed using hydrologic models based on observed conditions and probable future weather conditions. Lake levels are monitored regularly, and forecasts are updated if observed conditions (i.e., water levels) are trending above or below those forecasted. Preparations for operation of the flood control structures will occur if the lakes are projected to exceed their operating ranges specified in the Operating Guidelines. Preparations include notifying Indigenous rights-holders, and other stakeholders of the planned operation through media release, coordinating with gate structure operators on the timing of the initial operation, and coordinating with the Water Survey Canada so that the relevant hydrometric gauges are ready and operational. Once in operation, the structures are operated according to the Operating Guidelines with regular monitoring of flows and water levels. In recognition of the need to integrate flexibility to make adjustments during emergency conditions to facilitate maximum overall benefit to all affected interests, operating guidelines of existing major structures may be revised based on experience gained during previous flood or drought events. The flood control structures are operated as an overall system in an effort to reduce the overall damage caused by a flood event that might affect specific or general areas of the province.

The outlet channels will supplement Manitoba's existing flood management infrastructure and are not expected, on average, to operate on an annual basis. The LMOC and LSMOC will only commence operation when the target range of Lake Manitoba and Lake St. Martin, respectively, exceed their target ranges and will cease operation when the flood event is over.

The proposed Project's sole purpose is to provide flood protection and there are no current or future plans for it to be used for hydroelectric energy production, as confirmed by Manitoba Hydro. Based on March 30, 2023, correspondence, Manitoba Hydro has confirmed that the proposed Project is not a Manitoba Hydro project, and that the movement of waters within the proposed outlet channels is not being directed for hydro-electric generation purposes. In addition, Manitoba Hydro has indicated that its analysis of the changes to the flows that may result from Manitoba's proposed operation of the proposed Project will not impose a material change on its operations in the province, and that Manitoba Hydro will not build any hydro-electric generating stations on the Fairford River or Dauphin River between Lake Manitoba and Lake Winnipeg.

3.5.3.1 Operation Criteria

Operation of the LMOC and LSMOC will be tied to water levels and projected near-term water flows in the local area and region. Regional floodwater is currently managed using the existing Fairford River FRWCS. Constructed in 1961 and located on Fairford River at PTH 6, the FRWCS is currently the only water control structure used to regulate outflows from Lake Manitoba. The LMOC will provide a secondary mechanism by which outflows from Lake Manitoba into Lake St. Martin can be regulated. The Dauphin River is currently the only natural outflow from Lake St. Martin. While the EOC (Reach 1) has provided additional outflow capacity for Lake St. Martin in the past, under emergency conditions, the LSMOC will provide a permanent mechanism with greater discharge capacity for regulating outflows from Lake St. Martin. Manitoba Transportation and Infrastructure will operate the LMOC and LSMOC by adjusting the gates on the WCSs. Through an extensive review process, Manitoba Transportation and Infrastructure has developed Operating Guidelines for the LMOC and LSMOC based on defined high-water events and forecasted conditions, as filed as part of the June 2022 supplemental information response to IAAC IRs. Appendix 3C, Figure 3C-4 displays the influence of the Operating Guidelines on lake levels in Lake Manitoba, and Figures 3C-5 and 3C-6 display the influence of the Operating Guidelines on lake levels in Lake St. Martin, for the south and north basins, respectively.

LMOC

In addition to riparian flow (i.e., baseflow) provided through the WCS to maintain appropriate water quality conditions (DO levels), expected flow sources into the LMOC include discharge from Lake Manitoba (when the WCS gates are open), groundwater discharge, and local runoff originating from within the LMOC ROW. Water will be present throughout the LMOC, even when the WCS gates are closed. Under this condition, the water level in the channel upstream of the WCS will be equal to the water level in Lake Manitoba, and on the downstream side of the WCS it will be equal to the water level in the south basin of Lake St. Martin.

When the WCS gates are initially opened, the water level in the LMOC will drop approximately 2.8 m (9.2 ft) immediately upstream of the WCS and will increase in the upstream direction such that it is equal to the level of Lake Manitoba at the inlet. Immediately downstream of the WCS, the water level in the LMOC will rise by approximately 0.5 m (1.6 ft) and will decrease in the downstream direction such that it

is equal to the level of the south basin of Lake St. Martin at the outlet. Water levels along the channel will then rise and fall in response to the levels of Lake Manitoba and Lake St. Martin.

The mode of operation of the LMOC is such that some revegetated portions of the channel side slopes (above the channel armouring) will experience alternating periods of submergence (wet) and exposure (dry). This could lead to zones where vegetation may not survive or grow well, thus making these portions of the slopes potentially susceptible to erosion. Adaptive management measures to mitigate this risk are included in the RVMP and the SMP, as filed as part of the June 2022 supplemental information response to IAAC IRs and involve implementing a long-term monitoring and management approach as well as installing permanent erosion control measures if deemed necessary.

LSMOC

When the LSMOC WCS gates are closed, sheet pile cut-off walls at the crests of the drop structures will maintain a minimum water depth of 1 m (3.3 ft) above the channel invert in the pools between the drop structures. A riparian flow (i.e., baseflow) will be provided through the WCS to maintain appropriate water quality conditions (DO levels). Other sources of water into the LSMOC will include groundwater discharge and local runoff within the channel banks and along the slopes of the channel dikes.

When the LSMOC is in operation, water levels in the channel will typically increase by two to three meters for extended periods. As a result, portions of the channel side slopes will experience alternating periods of submergence (wet) and exposure (dry). Under these conditions, there will be a zone (above the channel armouring) where vegetation may not survive or grow well, thus making these portions of the slopes potentially susceptible to erosion. Adaptive management measures to mitigate this risk are included in the RVMP and in the SMP, as filed as part of the June 2022 supplemental information response to IAAC IRs and involve implementing a long-term monitoring and management approach as well as installing permanent erosion control measures if deemed necessary.

3.5.3.2 Equipment Requirements

Equipment requirements will be minimal during the operation and maintenance phase and limited to vehicles transporting staff to maintain and inspect the channels and WCSs, and to activities associated with the management of vegetation growth on channel side slopes and within permanent drainage ditches. The equipment types required for operation and maintenance will be similar to those listed in Appendix 3B, Table 3B-1. Additional equipment requirements will be identified once the O&M Manual described in Section 3.3.2 has been developed. Preparation of manuals and drawings for the inlet, outlet, and channel and specifically, an O&M Manual for the WCSs is scheduled to be completed after construction.

3.5.3.3 Vegetation Management

For the proposed Project, realistic performance measures for the establishment and monitoring of permanent vegetative cover are described in the RVMP, as filed as part of the June 2022 supplemental

information response to IAAC IRs. During the initial maintenance phase of the proposed Project (immediately post-construction), services will be provided to track revegetation progress, monitor for environmental compliance and to identify deficiencies and requirements for remedial planting work. Additionally, long-term vegetation monitoring and management requirements will be developed as part of the O&M Manual. Maintaining vegetative cover on the channel slopes, embankments and adjacent perimeter drainage ditches will mitigate against erosion damages from flooding and heavy precipitation and will prevent growth of invasive weedy species. The RVMP describes the implementation schedule of inspections and the potential channel and embankments vegetation management measures including re-seeding, mowing and weed control, as required.

3.5.3.4 Water Management

As indicated, several plans, such as the SWMP and GWMP, have been developed to address how surface water and groundwater will be managed during construction and operations. Key items addressed in the SWMP during the operation and maintenance phase of the proposed Project include the following:

- Surface water runoff during long-term operation will be managed and accommodated, with consideration given to ditching requirements, preliminary sizing of the drains, and required structures.
- There is a potential for sedimentation to occur in the channel at the outlets due to shoreline geomorphology processes and opening the WCS gates could mobilize these sediments to the lakes. Commitments for long-term sediment/erosion monitoring are documented in the SMP and Aquatic Effects Monitoring Plan (AEMP).
- For the LSMOC, debris floating along the shoreline of Lake Winnipeg could accumulate in the outlet and wash away when the WCS gates are opened.
- The management of flows during winter will include monitoring for ice and adjustment of flows and other mitigation measures, as documented in the Ice Management Plan (IMP).

Key items to be addressed in the GWMP related to post-construction of the proposed Project include the following:

- Confined aquifer artesian pressures (to flowing artesian conditions) in the LAA.
- Groundwater seepage into the channels.
- Impact of channel on domestic groundwater wells.
- Potential impact of channels on wetlands.

3.5.3.5 Ice Management

Although the outlet channels will be used primarily during the spring and summer to reduce damages of open water flooding, the channels are designed to permit operation in the winter months as well. The channels have been designed in recognition of ice processes, including geometry, and having components such as WCSs and bridges on both channels will be designed to a design standard for withstanding ice conditions.

Winter operation of the outlet channels will be considered to reduce water levels in the lakes following a large flood the previous spring/summer, or to pre-emptively lower lake levels to prepare for a large flood in the subsequent spring. In years when winter operation is required, the LMOC and LSMOC will be operated in a manner to reduce the severity of ice formation within the outlet channels. Conditions in the outlet channels will be monitored during winter operation to identify the development of adverse ice conditions (e.g., ice jams) and inform operational adjustments (e.g., flow reduction) to maintain safe freeboard on the channel dikes. Operation of the outlet channels during the winter will alter the local flow patterns in the vicinity of the inlets and outlets, which could result in locally thinner ice cover compared to when the channels are not operated.

. The LMOC and LSMOC will be operated in accordance with the Operating Guidelines developed for the proposed Project, which includes considerations for ice management. Management of ice processes, both in the channels and in the connected flow system, will be considered during winter operation of the outlet channels in accordance with the IMP. The IMP describes measures to be employed to mitigate or avoid changes in regional and/or local ice processes and impacts to the environment or public and worker safety associated with changes in ice processes. The IMP (filed as part of the June 2022 supplemental information response to IAAC IRs) describes the location of signs indicating potential areas of thin ice at the LMOC and LSMOC inlet and outlet to provide public and worker safety.

3.5.3.6 Fuel and Waste Management

The WCSs for both the LMOC and LSMOC will require standby diesel generators to supply emergency back-up power in the case of power outages. A 4,500 L (989.9 ga) fuel tank will be provided at the LMOC, which will be able to supply over 24 hours of runtime at full load. Fuel storage tanks will incorporate secondary containment to minimize the potential for contamination in the event of an unexpected spill or leak. Materials and equipment for the containment and recovery of accidental hazardous material spills will be available on site. Suitable protection, such as bollards, will be placed around fuel tanks to minimize potential for vehicle collision with tanks. Waste generation is expected to be negligible during post-construction, during the operations phase of the proposed Project.

3.5.3.7 Workforce

The number and transportation of employees required during maintenance (including inspection) is expected to be 1 to 2 employees and 1 truck/vehicle for routine inspections during non-flood conditions. Additional employees/labor may be required seasonally to assist in management of vegetation growth on

channel side slopes, detailed inspection of proposed Project components, or for additional monitoring/maintenance when the WCS gates are open, with staffing and equipment provided commensurate with the work to be undertaken.

3.5.3.8 Maintenance Requirements

The WCSs include operable gates and hoists for which maintenance will be required. An O&M Manual will be developed for WCSs, as noted in Section 3.3.2, to detail post-construction maintenance needs for the proposed Project under both open and closed gate conditions. The O&M Manual will include roles and responsibilities (e.g., legislated responsibilities, regulatory approvals conditions, Manitoba Transportation and Infrastructure and operator), records and logs (e.g., flow and water level monitoring), coordination with agencies (e.g., municipalities), emergency operations, operating guidelines, operating procedures (e.g., gate system, pre-operating inspection, notifications, monitoring), maintenance manuals, detailed inspection requirements, and maintenance procedures (e.g. vendor contracts, gate system, routine inspection/servicing). Preparation of manuals and drawings for the inlets, outlets, and channel works and specifically, an O&M Manual for each WCS is scheduled to be completed as part of the operation and maintenance activities.

3.5.4 Decommissioning and Abandonment

3.5.4.1 Permanent Facilities

Manitoba Transportation and Infrastructure does not plan to decommission the proposed Project. Upgrading or repairing activities to extend the life of the structures will take place as part of major rehabilitation projects and will depend on structural/historic attributes of the facility as well as economic and financial considerations at the time. If decommissioning of the proposed Project were required at some future date, a decommissioning plan consistent with the environmental conditions and regulatory requirements at that time will be developed for federal and provincial review prior to implementation.

3.5.4.2 Temporary Components

Facilities and work areas including temporary access routes, laydown areas and construction camps that will not be needed for future maintenance activities will be decommissioned following construction. Closure of temporary construction work areas will typically consist of the following:

- Organic materials stripped from the areas will be redistributed to encourage natural vegetation regeneration of the area.
- Seeding, following the RVMP, as filed as part of the June 2022 supplemental information response to IAAC IRs, will be done as required on disturbed lands such as in areas vulnerable to erosion.

Decommissioning measures associated with temporary components are outlined further in the PERs and are described in the SDP (see Section 3.7.2), both of which were filed as part of the June 2022 supplemental information response to IAAC IRs.

3.5.4.3 Ownership and Responsibility

The proposed Project is solely owned and operated by the Province of Manitoba. The Province is responsible for monitoring and maintaining the integrity of the proposed Project structures, the hydrological function of the surrounding environment, and operation of the facilities. There is no intention to change the ownership structure or transfer the control and/or operation of any component of the proposed Project to any other entity.

3.6 SCHEDULE

A detailed construction staging and sequencing plan is being developed as part of the ongoing preliminary and detailed design and considers the proposed Project schedule and adopted contracting strategy. Construction activities (including tendering) are currently planned to commence following receipt of environmental and regulatory approvals and will require an approximate 6-year period to construct and commission the proposed Project. Construction is tentatively expected to occur over a period of approximately 3 to 4 years followed by a 2-year period for vegetation to establish and commissioning of the channels. The overall schedule is contingent largely on receipt of the final regulatory approvals by the end of 2023. It is currently assumed that there will be no findings during the construction phase that will substantially affect the proposed in-service date of spring/summer 2029. At that time, the proposed Project will be ready for flood operations on an as-required basis. Maintenance will be an ongoing activity.

Assuming outcome and timing of regulatory approvals allow, the currently proposed Project schedule includes the following major phases:

1. Construction (3 to 4 years: year-round construction activities anticipated)
2. Commissioning (2 to 3 months: summer - outside the fish spawning period)
3. Operation and maintenance (will start once the channels are commissioned and ready for operation and continue indefinitely).

3.7 ENVIRONMENTAL MANAGEMENT PROGRAM

3.7.1 Overview

The EMP describes the environmental management processes that will be followed during construction and operation. One of the primary functions of the EMP is to demonstrate compliance with the various federal and provincial environmental regulatory requirements, including verification that all environmental commitments are executed, monitored, evaluated for effectiveness, and that information is reported back

in a timely manner to the proposed Project management team for adjustment, if required. The EMP describes the roles and responsibilities of the parties involved in implementing the Project. It is a living document that will be reviewed and refined by Manitoba Transportation and Infrastructure on a regular basis, with continuous improvement being made so that the proposed Project is constructed, operated and maintained in an environmentally responsible manner.

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

To effectively address the specific issues involved, the EMP is organized into a CEMP and an OEMP, which will be finalized prior to proposed Project construction and operation, respectively. Their finalization will benefit from the regulatory review process, as well as the ongoing Indigenous and public engagement process. These plans are summarized in the following sections.

3.7.2 Construction Environmental Management Program

Overview

The purpose of the CEMP is to guide how environmental issues will be addressed during construction and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted plans that will guide Manitoba Transportation and Infrastructure's development of the proposed Project's contract documents and subsequently, the contractor(s)' activities, in constructing the proposed Project in an environmentally responsible manner.

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

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

the contractor(s). Individual plans from the EMP will form the basic requirements for the plans that the contractor(s) will develop for their specific construction means and methodology. The contractor plans will be required to conform to the basic requirements of the EMP, as well as any other relevant provincial or federal legislation.

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

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

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

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

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

The environmental protection measures also incorporate best practices for compliance monitoring. The CEMP provides the framework for follow-up and monitoring. The purpose of follow-up and monitoring is to:

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

Manitoba Transportation and Infrastructure will facilitate effective environmental oversight of proposed Project development through a compliance monitoring process. In addition, Manitoba Transportation and Infrastructure will provide ongoing oversight of the proposed Project during the construction phase and coordinate with the contractor.

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

- Management Plans:
    - Environmental Protection Plan (EPP)
    - Project Environmental Requirements (PERs)
    - Access Management Plan (AMP)
    - Sediment Management Plan (SMP)
    - Surface Water Management Plan (SWMP)
    - Groundwater Management Plan (GWMP)

- Revegetation Management Plan (RVMP)
- Agricultural Biosecurity Management Plan (AgBMP)
- Dust Control Plan (DCP)
- Waste Management Plan (Section 5.1.1 of CEMP)
- Quarry Management Plan (QMP)
- Hazardous Materials Management Plan (Section 5.1.1 of CEMP)
- Emergency Response Procedures (ERP) (Section 5.1.2 of CEMP)
- Heritage Resources Protection Plan (HRPP)
- Site Decommissioning Plan (SDP)
- Complaint Resolution Process (CRP)
- Wetland Compensation Plan (WCP)
- Red-headed Woodpecker Habitat Management Plan (RHMP)
- Eastern Whip-Poor-Will Habitat Management Plan (EHMP)

- Monitoring Plans:
  - inspection and compliance monitoring (part of the PERs, SWMP, SMP, RVMP and GWMP)
  - Aquatic Effects Monitoring Plan (AEMP)
  - Wildlife Monitoring Plan (WMP)
  - Wetland Monitoring Plan (WetMP)

Environmental Protection Plan

The EPP forms part of the proposed Project's EMP framework and describe the suite of environmental protection measures for key environmental areas. The purpose of the EPPs is to support proposed Project planning and reduce the potential for environmental effects during construction. The EPPs are focused on describing the proposed Project activities and the associated potential effects, mitigation measures, and plans. Construction EPP mapbooks have been developed to supplement the EPP by providing site-specific mitigation measures and considerations at environmentally sensitive locations. Together, these documents are intended to facilitate the operationalization of mitigation measures outlined in the Project EIS and be used for tendering purposes. These plans will guide the contractor(s)

and are supplemented with standard specifications included in each construction contract's PERs and other plans.

Project Environmental Requirements

PERs are environmentally focused requirements and commitments for construction contracts and ongoing activities that are fundamental to Manitoba Transportation and Infrastructure's regulatory compliance. PERs contain site-specific or point-source requirements for dealing with issues (e.g., access, sediment management, quarries). They are specific and applicable to all construction and maintenance operations under the authority of licences, permits, authorizations or approvals obtained for the proposed Project. Requirements listed within the PERs are not mutually exclusive of one another and must be adhered to for all activities pertaining to construction, post-construction, maintenance, and decommissioning activities for the proposed Project. A copy of the current version of the PERs was filed as part of the June 2022 supplemental information response to IAAC IRs.

Access Management Plan

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

- Provide safe, coordinated access to the proposed Project site.
- Protect the area's natural resources for sustainable use by rights-holders.
- Preserve and respect the socio-economic, cultural and heritage values of the lands around the proposed Project.
- Allow proposed Project staff and contractors to construct, operate and maintain the proposed Project year-round.
- Provide security for proposed Project personnel and property.
- Prescribe measures to reduce potential negative direct and indirect effects on proposed Project access.
- Protect land users from hazards resulting from construction and operation of the proposed Project.
- Reduce land user conflicts.

Sediment Management Plan

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

- Define guidelines and procedures for construction to reduce the potential for erosion and sedimentation.
- Develop site-specific control measures to manage potential drainage issues (e.g., run-off).
- Develop site-specific erosion and sediment control measures to reduce adverse, sediment related, effects to the receiving waterbody.
- Develop emergency response practices to mitigate extreme design conditions, respond to unforeseen events and accidents, and reduce potential environmental impacts.
- Verify that contractors maintain the expectations of the SMP.

Surface Water Management Plan

The SWMP describes measures to be employed to mitigate or avoid impacts to surface water during and post-construction. These include methods to be used for:

- Temporary diversions of surface water (including but not limited to ditches and drains, dewatering, or deposition of sediment-laden water).
- Management of water resulting from precipitation events (e.g., winter snow accumulation in excavated channel or heavy rainfall event).
- Management of natural watershed flows during construction.

Measures identified in this plan will reduce impacts to the environment (e.g., fisheries) and people (e.g., consideration given to avoid localized flooding due to surface water management activities).

Groundwater Management Plan

The GWMP describes measures to avoid or reduce adverse effects to groundwater or from groundwater during the construction and operation of the proposed Project. These effects may include changes in groundwater quality and quantity in the vicinity of the proposed Project, effects on construction from groundwater or changes in the relationship of the groundwater aquifer discharge to the surface water

system. The GWMP outlines measures to manage groundwater that is brought to the surface because of depressurization activities, as well as measures to prevent/mitigate groundwater impacts to local well users. It also identifies adaptive measures to take if the outlined monitoring reveals the need for additional steps.

Revegetation Management Plan

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

- Areas affected by construction of the proposed Project.
- Areas designated for revegetation treatments, such as sites along the side slopes of the channels and temporary works decommissioned after construction.
- The approach for determining rehabilitation treatments for specific disturbed areas.
- Rehabilitation treatment options for regenerating vegetation in disturbed areas, including methods for site preparation that will contribute to revegetation success.
- How the rehabilitation will be implemented.
- How the rehabilitated areas will be monitored, the process for how improvements, if required, will be made, and how and to whom the results will be reported.

Agricultural Biosecurity Management Plan

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

- Background information including a summary of agricultural land use in the proposed Project area, regulatory context and industry guidelines and related proposed Project management plans.

- A summary of biosecurity risk issues, mechanisms and levels, and issues related to construction and operation activities.
- Required actions by Manitoba Transportation and Infrastructure and contractor(s) to protect agricultural biosecurity.
- Identification of specific biosecurity risk areas and controlled access point.
- Guidance for Manitoba Transportation and Infrastructure to implement the AgBMP for Project construction and operation, including roles and responsibilities, planning and preparation, facilities and equipment, worker requirements, record keeping and reporting, worker training, communication, monitoring, and implementation schedule.

Dust Control Plan

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

Waste Management Plan

A WMP describes how solid and non-hazardous liquid waste will be stored, managed, and disposed of during construction. The plan commits to keeping the construction area clean and orderly, during and at completion of construction with waste materials and refuse removed and disposed of promptly in a manner that will not contaminate the surrounding area. Waste materials shall be recycled to a degree that is economically and practically feasible or disposed of at a Waste Disposal Ground operating under the authority of a permit issued pursuant to Manitoba Waste Disposal Grounds Regulation 150/91 of *The Environment Act*. All sewage and seepage from on-site sanitary facilities will be disposed of at a local licenced facility and in accordance with the Manitoba Onsite Wastewater Management Systems Regulation 83/2003 of *The Environment Act*.

Quarry Management Plan

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

Hazardous Materials Management Plan

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

Emergency Spill Response and Reporting Procedures

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

Heritage Resources Protection Plan

The HRPP describes measures to mitigate effects to cultural and heritage resources that can occur from ground-disturbing proposed Project activities, such as vegetation clearing and excavation and development of temporary construction camps, staging areas, and access roads. The HRPP is developed based on the findings of a Heritage Resource Impact Assessment conducted prior to the start of construction. The HRPP includes the following key components:

- General information about the proposed Project.
- Heritage resources procedures and protection measures to be implemented during Project construction.
- Specific measures required for any heritage sites located within the Project development area and any adjacent site that may be affected by proposed Project construction or operation.
- Additional heritage resource protection measures, as applicable.
- The steps for reporting and follow-up related to heritage resources unintentionally disturbed during construction.

Site Decommissioning Plan

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

Complaint Resolution Process

The CRP describes the methods to receive and document complaints, records management, and process tracking, as well as the process for complaint notification, investigation, and resolution. It will be in place during the construction and operation phases of the proposed Project and will be used to assist contractors and Manitoba Transportation and Infrastructureto resolve proposed Project-related issues related to Manitoba Transportation and Infrastructure's environmental management and monitoring plans. However, measures for emergency response, including spills, wildfire, and other accidents or malfunctions are to be addressed by onsite personnel pertaining to contractor submittals and other requirements outlined in the PERs, but imminent or perceived emergencies identified by others can be reported as part of this process as well. Although the CRP is designed to address potential proposed Project effects that were not successfully mitigated, or where mitigation failed and resulted in an undesired effect to the environment or people, the CRP is not intended to act as a substitute or replacement for Section 35 Crown Consultation, and related concerns, nor is it intended to replace other communications regarding Project progress and updates.

Aquatic Effects Monitoring Plan

The AEMP describes the monitoring that will be conducted during and after the proposed Project is commissioned. Results of monitoring will be used to determine whether unanticipated effects are occurring and whether modifications to planned mitigation measures are required. This plan also addresses anticipated requirements for monitoring that will be set out in provincial and federal licenses and permits for the proposed Project; the final draft of this plan will be amended after final regulatory approvals are received to incorporate any additional monitoring requirements. The specific objectives of the AEMP are to:

- Verify the anticipated effects to water quality and fish and fish habitat based on the environmental assessment completed for the proposed Project.
- Determine the effectiveness of mitigation measures.
- Assess the need for additional mitigation measures if initial measures are not adequate.
- Determine the effectiveness of any additional/adapted measure(s).
- Confirm the compliance with regulatory requirements relevant to surface water quality and fish and fish habitat set out in proposed Project approvals (e.g., Manitoba Environment Act Licence; *Fisheries Act* Authorization).

Wildlife Monitoring Plan

The WMP describes the monitoring activities that will be undertaken to address follow-up requirements that will be implemented to verify key environmental assessment predictions, to reduce potential adverse effects on wildlife and their habitat(s), and to confirm compliance with regulatory requirements. Monitoring will be carried out during the construction and operation phases of the proposed Project and includes consideration of species that have been listed as culturally important by Indigenous rights-holders. The

WMP provides details on how predicted changes to habitat, mortality risk, and movement will be verified and how the effectiveness of mitigation strategies will be evaluated.

Wetland Monitoring Plan

The WetMP describes the monitoring program that assesses potential indirect effects on wetlands, including changes to class/size of wetlands, surface and groundwater quality and quantity, vegetation cover (plant species compositions/abundance) and wildlife habitat, from changes to groundwater and surface water regimes for those wetlands outside the proposed Project footprint that do not receive compensation under the provincial system. A process is currently underway to determine compensation. The purpose of the WetMP is to provide a comprehensive, integrated monitoring plan that tests the predictions of the Project EIS with respect to indirect wetland effects, determines the effectiveness of mitigation measures, and the requirement for, and nature of, associated follow-up where required.

Wetland Compensation Plan

This plan describes the process by which wetlands that will be affected by proposed Project construction and operation will qualify for mitigation, monitoring and/or compensation. The overall objectives of the WCP are to:

- Outline Manitoba Transportation and Infrastructure's approach for wetland compensation as it pertains to this proposed Project.
- Summarize the key findings of the wetland mapping and field investigations (WSP, 2020a) as they pertain to the determination of wetlands that qualify for compensation.
- Describe legislated approach to wetland compensation in Manitoba.
- Outline follow-up and monitoring measures to be adopted for other wetlands that do not meet the criteria as requiring wetland compensation.

Red-headed Woodpecker Habitat Management Plan

The purpose of the RHMP is to describe the red- headed woodpecker habitat mitigation and monitoring activities that will be implemented along the LMOC outlet channel ROW. The goal of the RHMP is to enhance breeding habitat opportunities for red- headed woodpecker along the LMOC ROW. This will be achieved by employing the mitigation measures and adaptive management techniques outlined in the RHMP during the construction and operation phases of the proposed Project. Specific objectives are to:

- Describe revegetation prescriptions (i.e., shrub plantings) and vegetation management practices that provide habitat opportunities for red-headed woodpecker, while adhering to requirements for the safe operation and maintenance of the proposed Project.
- Describe LMOC ROW habitat mitigation, including erecting salvaged snags and/or decadent trees and artificial nest structures.

- Describe how revegetation prescriptions and nest structure occupancy by red-headed woodpecker will be monitored to verify the effectiveness of mitigation measures.

Eastern Whip-Poor-Will Habitat Management Plan

The purpose of EHMP is to describe the habitat management and monitoring activities that will be implemented along the outlet channel ROW. The objective of the EHMP is to understand how eastern whip-poor-will are distributed along, and adjacent to, the outlet channel ROWs following proposed Project construction, including the application of revegetation descriptions and vegetation management practices, that provide habitat opportunities for eastern whip-poor-will.

3.7.3 Operation Environmental Management Program

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

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

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

The OEMP is supported by the same targeted plans developed to manage issues during construction; however, prior to construction completion they will be revised and adapted to suit the specific needs during the operation phase and incorporate lessons learned through implementing the CEMP. The objectives of the supporting OEMP plans are similar to those described with respect to construction

activities, with a focus on operational conditions. For example, the SMP will focus on reducing the impacts of in-stream sediment from operation of the LMOC and LSMOC, particularly after a flood. These plans are embedded within the OEMP or provided as separate supporting documents. Additional proposed Project operation-specific plans including an IMP, as described below, are developed for implementation during the operations phase.

As with the CEMP, the OEMP outlines the recommended best practices for compliance monitoring (inspections). Ongoing monitoring regarding the functionality of the outlet channels and associated infrastructure will occur regularly during non-flood periods. The frequency and type of compliance monitoring is expected to increase immediately before, during and after the flood operation of control structures in the LMOC and LSMOC. As such, Manitoba Transportation and Infrastructure has a role in ongoing environmental inspections of the proposed Project infrastructure and components. Manitoba Transportation and Infrastructure will generate documentation related to the findings of these investigations, including proposed Project functionality.

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

The OEMP is supported by several specific or targeted management plans that have been submitted as separate documents, with the exception of Waste Management, Hazardous Materials Management and Emergency Response, which are described in greater detail within this document. As listed in Section 3.7.2, these targeted management plans include:

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

  - Dust Control Plan (DCP)
  - Waste Management Plan
  - Hazardous Materials Management Plan
  - Emergency Response Procedures (ERP)
  - Ice Management Plan (IMP)
  - Heritage Resources Protection Plan (HRPP)
  - Complaint Resolution Process (CRP), and
  - Site Decommissioning Plan
  - Wetland Compensation Plan
  - Red-headed Woodpecker Habitat Management Plan (RHMP)
  - Eastern Whip-Poor-Will Habitat Management Plan (EHMP)

- Monitoring Plans:
  - inspection and compliance monitoring (part of the SWMP, SMP and GWMP)
  - Aquatic Effects Monitoring Plan (AEMP)
  - Wildlife Monitoring Plan (WMP)
  - Wetland Monitoring Plan (WetMP)

In addition to the specific management plans, O&M Manuals for the LMOC and LSMOC will be developed that will detail the technical aspects of the required activities, as well as proposed Project-specific restrictions respecting how such work is to be completed. The Operating Guidelines for the proposed Project, the OEMP, and associated management plans will help guide the manner to which the outlet channels are operated and maintained.

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

As indicated, like the CEMP, the OEMP provides the framework for the follow-up and monitoring program during the operation phase, as described in Chapter 12 of the Project EIS. This includes continued monitoring to verify key predictions of the Project EIS, with a focus on the effectiveness of key mitigation measures that will be proposed to be implemented. Reports generated through this process will be made available to regulators for review as required.

3.8 REFERENCES

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Appendix 3A SUMMARY OF DESIGN REFINEMENTS IN PROJECT DESCRIPTION SINCE MARCH 2020 - COMPONENTS ONLY

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
LMOC Components			
Outlet Channel (Section 3.4.2.1, pp. 3.12 to 3.14)	• Length: 24.1 kilometres (km) (15.0 miles [mi]) • Excavation depth: 6 to 12 metres (m) (19.7 to 39.4 feet [ft]) • Base widths: 8 to 13 m (26.2 to 42.7 ft) • Slopes: 5:1 to 6:1 • No armouring • No details on wetted widths • No details on water level depths • No details on velocities	• No change in length • Excavation depth: 6 to 12 m (19.7 to 39.4 ft) • Base widths: 12 to 22 m (39.4 to 72.2 ft) • Slopes: 5:1 • Armoured base and slopes • Wetted widths: 63 to 91 m (206.7 to 298.6 ft) • Water depths: 4 to 8 m (13.1 to 26.2 ft) • Velocities: 0.75 to 1 metres per second (m/s) (2.5 to 3.3 feet per second [ft/s])	• More details on bank stability from geotechnical investigations • Design advancements and hydraulic optimization • Channel armouring due to concern over mobilization of sediments from till materials (till degradation)
Channel Inlet (Section 3.4.2.2, p. 3.15)	• No details on geometry • Potential rock groins • Base and side slopes native till materials	• Base width of 17 m (55.8 ft) at channel proper flaring out to 270 m (885.8 ft) at a location 132 m (433.1 ft) from shore • Slope 5:1 • No rock groins • Riprap a portion of the side slopes	• Design advancements based on hydraulic analyses • Shoreline morphology investigations

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
Channel Outlet (Section 3.4.2.2, p. 3.15)	• No details on geometry • Potential rock groins • Base and side slopes native till materials	• Base width of 22 m (72.2 ft) at channel proper flaring out to 128 m (419.9 ft) at a location 144 m (472.4 ft) from shore • Slope 5:1 • No rock groins • Riprap a portion of the side slopes	• Design advancements based on hydraulic analyses • Shoreline morphology investigations
Water Control Structure (Section 3.4.2.3, p. 3.16)	• Located 21 km (13.0 mi) downstream of inlet • Three bays at 9 m-wide (29.5 ft) each • No riparian flow (i.e., baseflow) provision	• No change in location • Three bays at 5.4 m-wide (17.7 ft) each • Riparian flow valves provided in each lift gate	• Design advancements based on hydraulic analyses • Provision of baseflow (dissolved oxygen) for fish
Permanent Bridge Structures (Section 3.4.2.4, p. 3.17)	• Four new bridges at water control structure (WCS), Township Line Road, Provincial road (PR) 239, and Provincial Trunk Highway (PTH) 6	• No changes in bridge number and location • Addition of 2 more piers at Township Line Road and PR 239 bridges • Reduced bridge length at PTH 6	• Design advancements based on hydraulic, geotechnical and structural design
Road Alignments (Section 3.4.2.5, p. 3.17)	• Realignment of PR 239 and municipal roads to reduce bridge crossings	• No anticipated changes	-
Rock Quarries and Borrow Material Areas (Section 3.4.2.6, p. 3.18)	• Use of local quarries for limestone aggregate • Large diameter rip rap from outside local area	• No change in limestone and large riprap sources • Additional aggregate requirements for armouring	• Additional aggregate requirements for armouring
Construction Camps and Staging Areas (Section 3.4.2.7, p. 3.19)	• Peak of approximately 250 workers • Use of local accommodations, and camp for some areas such as WCS work	• Peak of approximately 325 workers • No substantive changes to accommodations plans	• Advances in construction planning
Power Supply (Section 3.4.2.8, p. 3.20)	• Manitoba Hydro will install an overhead distribution line to a pad-	• Manitoba Hydro will replace existing 10 km-long (6.2 mi) single phase	• Additional design details from Manitoba Hydro

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
	mount transformer that will be installed at the WCS • Backup power 750-kilowatt (kW) (1,005.8 horsepower [hp]) stand-by diesel-fueled generator and a 1,000 litre (L) (264.2 gallons [ga]) fuel tank	distribution line with 3-phase line to the WCS • Backup power 500-kW (670.5 hp) stand-by diesel-fueled generator and a 4,500 L (1,188.8 ga) fuel tank	• Advancement of WCS design
Temporary Access and Crossings (Section 3.4.2.9, p. 3.21)	• No details or specifics available	• Haul Road Agreement negotiated with Rural Municipality (RM) of Grahamdale to define details	• Advancement of engagement with RM of Grahamdale
Drainage Realignment (Section 3.4.2.10, p. 3.22)	• Design details not described, other than alignment of outside drain	• Outside drain side slopes of 4:1, base width 4 to 25 m (13.1 to 82.0 ft), velocities <1 m/s (3.3 ft/s) • Passive wetland concepts developed to treat drainage from cattle operations,	• Design advancements and engagement with RM of Grahamdale and landowners
Storage of Explosives (Section 3.4.2.11, p. 3.24)	• May be required for excavations in bedrock (WCS)	• No anticipated changes	-
LSMOC Components			
Outlet Channel (Section 3.4.3.1, pp. 3.25 to 3.29)	• Length: 23.8 km (14.8 mi) • Base width: 44 m (144.4 ft) • 4:1 side slopes • No armouring • No details on wetted widths • No details on water level depths • No details on velocities	• Length: 23.8 km (14.8 mi) • Base width: 35 to 59 m (114.8 to 193.6 ft) • 5:1 side slopes • Lowered channel elevation at downstream end to address head loss in Lake St. Martin basins • Armoured base and slopes • Permanent water-retaining dikes • Inclusion of a bench above clay layer	• More details on bank stability from geotechnical investigations • Design advancements • Channel armouring due to concern over mobilization of sediments from till materials (till degradation) • Invert lowered to increase conveyance to account for the head loss through the Lake St. Martin (LSM) Narrows

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
		• Lower invert elevation of channel upstream of drop structure 1 • Width of water: 94 to 130 m (308.4 ft to 426.5 ft) • Water depths: 1.5 to 5.9 m (4.9 to 19.41 ft) • Velocities in channel: 0.1 to 1.4 m/s (0.3 to 4.6 ft/s)	
Channel Inlet (Section 3.4.3.2, p. 3.29)	• Extending 800 m (2,624.7 ft) into LSM • Base width varying from 100 m (328.1 ft) at the shoreline to approx. 400 m (1312.3 ft) from shore • Rock jetties	• Extending 1,100 m (3,608.9 ft) into LSM • Base width ranging from 110 m (360.9 ft) at the shoreline flaring to approximately 550 m (1,804.5 ft) from shore • No rock jetties	• Design advancements • Modifications made to address head loss issues through LSM Narrows • Ongoing shoreline morphology investigations
Channel Outlet (Section 3.4.3.2, p. 3.30)	• Extending approx. 400 m (1312.3 ft) into Sturgeon Bay • Width of 80 m (262.5 ft) at the shoreline and 180 m (590.6 ft) at 400 m (1312.3 ft) from shore • 400 m-long (1312.3 ft) jetties	• Extending approx. 200 m (656.2 ft) into Sturgeon Bay • Base width of 174 m (570.9 ft) at the shoreline flaring to approximately 224 m (734.9 ft) at 200 m (656.2 ft) from shore • 100 m-long (328.1 ft) jetties	• Design advancements, • Modifications made to address head loss issues through LSM Narrows • Ongoing shoreline morphology investigations
Water Control Structure (Section 3.4.3.3, p. 3.30)	• Located 600 m (1,968.5 ft) from inlet • 2 bays, each 9 m-wide (29.5 ft) • Provision of riparian flow (i.e., baseflow)	• No change in location • 4 bays, each 6 m-wide (19.7 ft) with inner bays having higher crest elevation • Provision of riparian flow (i.e., baseflow) with valves in lift gates of outer bays	• Additional bays allow greater flexibility in controlling flows • Bays with higher crests will be operated during the winter to reduce risk of ice damage to gates • Provision of riparian flow (i.e., baseflow) (dissolved oxygen) for fish
Drop Structures (Section 3.4.3.4, pp. 3.31 to 3.32)	• 8 structures along length of channel • Pool depths: (not mentioned)	• Number, location, and design are the same	• More uniform flow depth in the chute and will minimize the potential for fish stranding in voids between the rocks

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
	• Pool widths: (not mentioned) • Crest height: 2.7 m (8.9 ft) • Crest width: 98m (321.5 ft) • Ramp lengths: 100 m (328.1 ft) • Riprap D50: 400 mm (15.7 inches [in]) • V-notch for downstream fish passage	• Pool depths: 2.5 to 3.7 m (8.2 to 12.1 ft) (when riparian flow [i.e., baseflow] is provided) • Pool widths: 55 to 85 m (180.4 to 278.9 ft) • Crest heights: 2.5 to 3.7 m (8.2 to 12.1 ft) • Crest widths: 80 to 125 m (262.5 to 410.1 ft) • Ramp lengths: typically, 200 to 250 m (656.2 to 820.2 ft) (exception of drop structure #4 with ramp length of 350 m [1,148.3 ft]) • Riprap D50: 350 mm (13.8 in) • Trapezoid notch that is 0.5 m (1.6 ft) deep and 2 m (6.6 ft) wide (at base)	• Design advancements • Channel armouring due to concern over mobilization of sediments from till materials (till degradation)
Rock Quarries and Borrow Material Areas (Section 3.4.3.5, p. 3.33)	• Use of local quarries for limestone aggregate • Large diameter rip rap from outside local area	• No change in limestone and large riprap source • Additional aggregate requirements for armouring	• Additional aggregate requirements for armouring
Construction Camps and Staging Areas (Section3.4.3.6, p. 3.34)	• Peak camp capacity approximately 250 people • One primary camp at WCS and several smaller camps	• No substantial change in peak worker numbers and camps (3 now anticipated)	-
Power Supply (Section 3.4.3.7, p. 3.35)	• 15 km (9.3 mi) distribution line on 12 m (39.4 ft) high poles from an existing line along PR 513 to WCS location • 500 to 750 kW (670.5 to 1,005.9 hp) stand-by generator	• 15 km (9.3 mi) distribution line on 13.7 m (44.9 ft) high poles, and 30 x 30 m (98.4 x 98.4 ft) helicopter pads each km (12 total) • 500 kW (670.5 hp) stand-by generator	• Advancement of design details and construction requirements

Proposed Project Component/ Activity	March 2020	May 2023	Rationale for Change
Access and Crossings (Section 3.4.3.8, p. 3.36)	• Construction-related traffic will be restricted to the Project right-of-way with access via the LSM access road • Only channel crossing currently planned for the LSM access road is the WCS	• No change for construction-related traffic and crossing, but PTH 6 confirmed as main access road for the transportation of equipment and materials	• Advancement of design details and construction requirements
Drainage Realignment (Section 3.4.3.9, pp. 3.36 to 3.39)	• Drainage ditch along east side of channel • Base width: 4 m (13.1 ft) wide • 4:1 side slopes • Depths: 1 to 1.5 m (3.3 to 4.9 ft) • Velocity: <1 m/s (3.3 ft/s) • Drainage control structures for local drainage to drain to channel	• Outside drain along east side of channel • Base width: 4 m (13.1 ft) (upstream) to 12 m (39.4 ft) (downstream) • Side slopes in peat 3:1, side slopes in mineral soil 4:1 • Depth: 1 m (3.3 ft) • Velocity: 0.7 m/s (2.3 ft/s) • 14 gradient control structures to manage flow velocities • Discharge to channel at downstream end (permanent configuration) • Rewatering concepts being considered	• Advancement of design details
Storage of Explosives (Section 3.4.3.10, p. 3.39)	• Stored in temporary, independent magazines	• No anticipated changes	-

Appendix 3B TABLES

LIST OF TABLES

Table 3B-1 Expected Construction Equipment and Vehicles Used for Proposed Project Components

Project Components	Equipment / Vehicle		
Diversion Channels	Flatbed trucks	Loaders	Packers
	Skidsteer	Graders	Fuel truck/trailers
	Cranes	Dozers	Pick-up trucks
	Drill rigs	Backhoe	Hand tools
	Blast trucks	Rock/Dump trucks	Tree feller bunchers
	Excavators	Hydro-axe	Scrapers
	Semi-trucks		
Channel Inlets and Outlets at Lakes	Flatbed trucks	Loaders	Fuel truck/trailers
	Cranes	Graders	Pick-up trucks
	Drill rigs	Dozers	Hand tools
	Blast trucks	Backhoe	Boats
	Excavators	Rock/Dump trucks	
	Pile Drivers	Skidsteer	
	Semi-trucks		
Drop Structures, Combined Bridge and Water Control Structures	Flatbed trucks	Loaders	Fuel truck/trailers
	Cranes	Graders	Concrete batch plants
	Drill rigs	Dozers	Concrete trucks
	Blast trucks	Backhoe	Pick-up trucks
	Excavators	Rock/Dump trucks	Hand tools
	Pile Drivers	Skidsteer	Scrapers
	Semi-trucks		
Re-alignment and/or Construction of PR 239 and Municipal Roads	Tree feller bunchers	Excavators	Hand tools
	Logging trucks	Packers	Snow-clearing equipment
	Dozers	Pick-up trucks	Graders
	Flatbed trucks	Fuel trucks/trailers	Sprayers
	Rock/Dump Trucks	Loaders	
Drainage realignment, Culvert Stream Crossings, Equalization Culverts	Excavators	Rock/Dump trucks	Graders
	Pick-up trucks	Flatbed trucks	Loaders
	Dozer		
Temporary Crossings over Watercourses	Flatbed trucks	Dozers	Pick-up trucks
	Excavators	Graders	Hand tools
	Loaders	Rock/Dump trucks	Cranes
Temporary Construction Camps, Staging Areas, Access Roads	Semi-trailers	All-terrain vehicles	Tree feller bunchers
	Excavators	Dozers	Pick-up trucks
	Flatbed trucks	Graders	Hand tools
	Fuel trucks	Rock/Dump trucks	Generators
	Loaders		

Table 3B-2 Typical Fuels and Hazardous Materials

Material	Purpose
Diesel	Construction equipment/vehicle fuel
Gasoline	Construction equipment/vehicle fuel
Propane	Construction equipment/vehicle fuel Heating trailers/structures Heating under hoarding
Oil	Construction equipment/vehicle motor lube
Hydraulic fluid	Construction equipment
Acetylene	Cutting steel
ANFO (Explosives)	Blasting rock to facilitate abutment installation (likely LSMOC only)
Uncured concrete	Constructing project structures
De-icing fluids	De-icing structures and equipment
Concrete Sealer	Penetrating sealer applied to exposed concrete surfaces on bridge structure
Asphalt Damp Proofing	Provide damp proofing in contact with backfill materials
Concrete Primer	Applied to concrete surface prior to Asphalt Damp Proofing
Concrete Curing Compound	Clear pigmented curing compound applied following 7-day wet cure to aid in attaining desired strength within reasonable timeframe
Hot Poured Rubberised Asphalt Waterproofing	Provide waterproofing to bridge deck surfaces, limit the wearing effects of water on concrete surface
Tack Coat (RS-1 emulsion or RC-0 liquid asphalt)	Adhesive coating applied to concrete surface prior to asphalt placement
Fine aggregates	Fines from backfill materials and or drill cuttings if pile foundations for structures are cored into bedrock
Sewage	Camp washroom facilities (holding tanks).

Appendix 3C FIGURES

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Figure 3C-1 Project and Associated Works

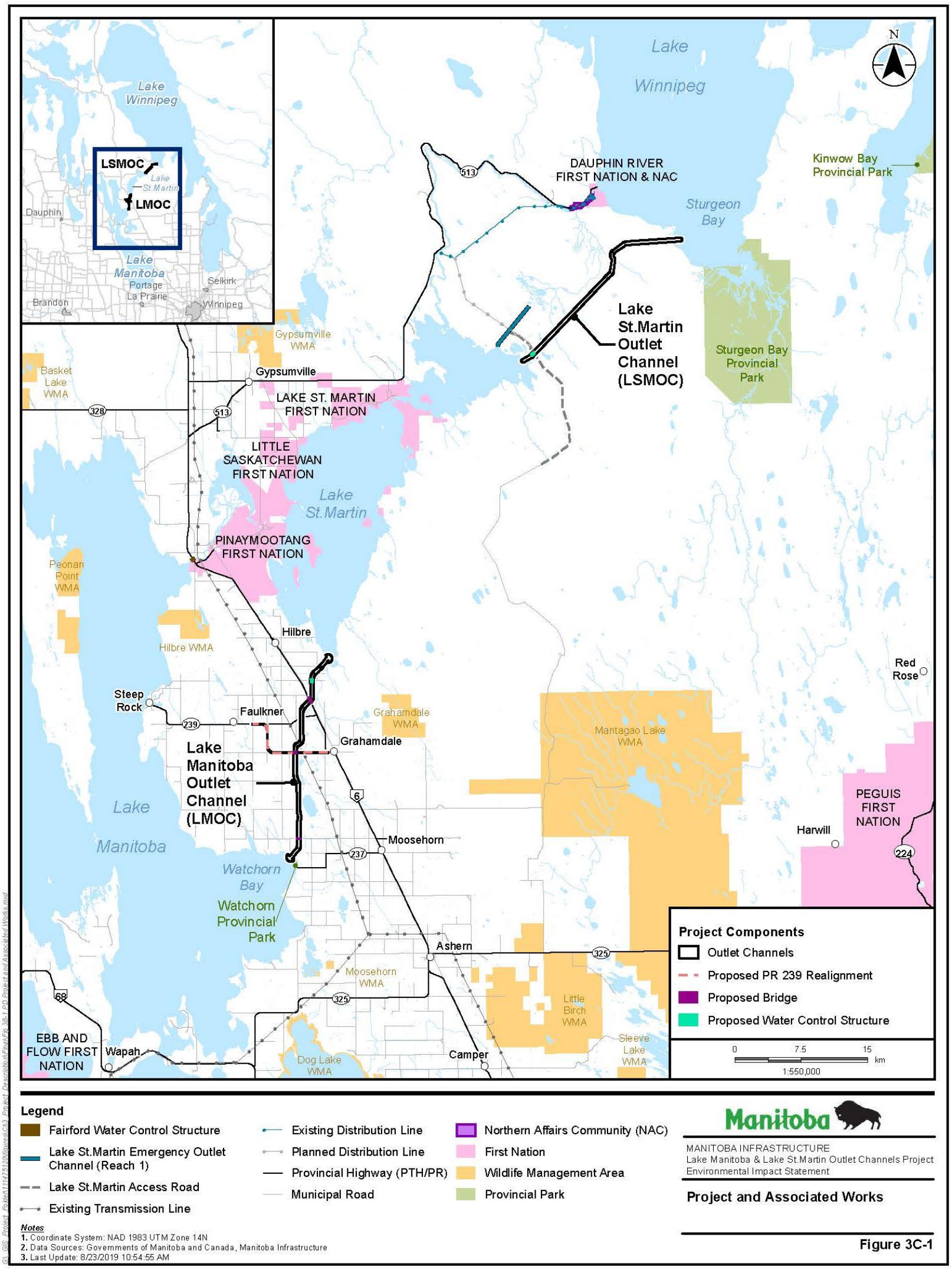

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Figure 3C-2 Components of LMOC

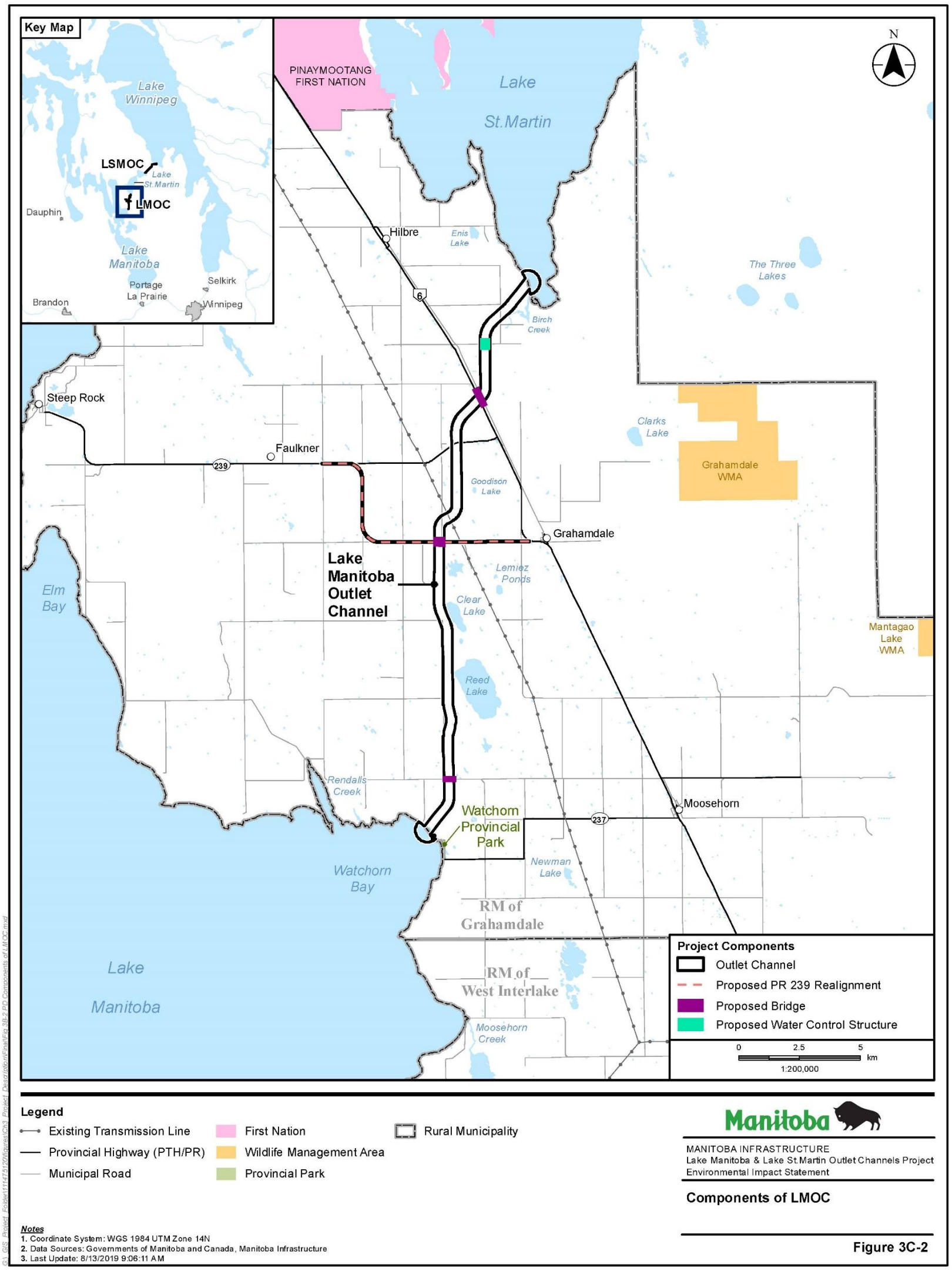

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Figure 3C-3 Components of LSMOC

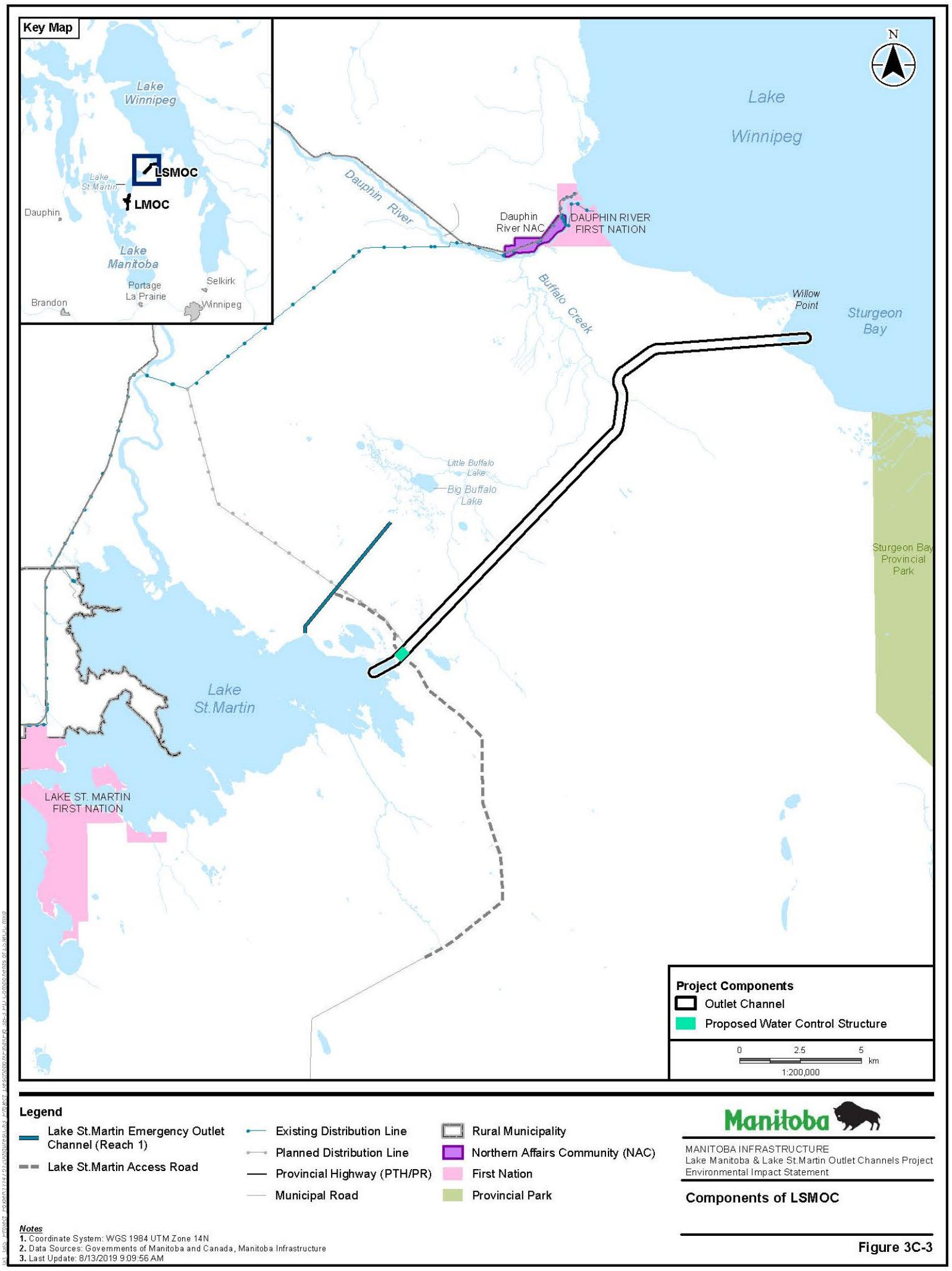

Figure 3C-4 Influence of Operating Guidelines Levels in Lake Manitoba

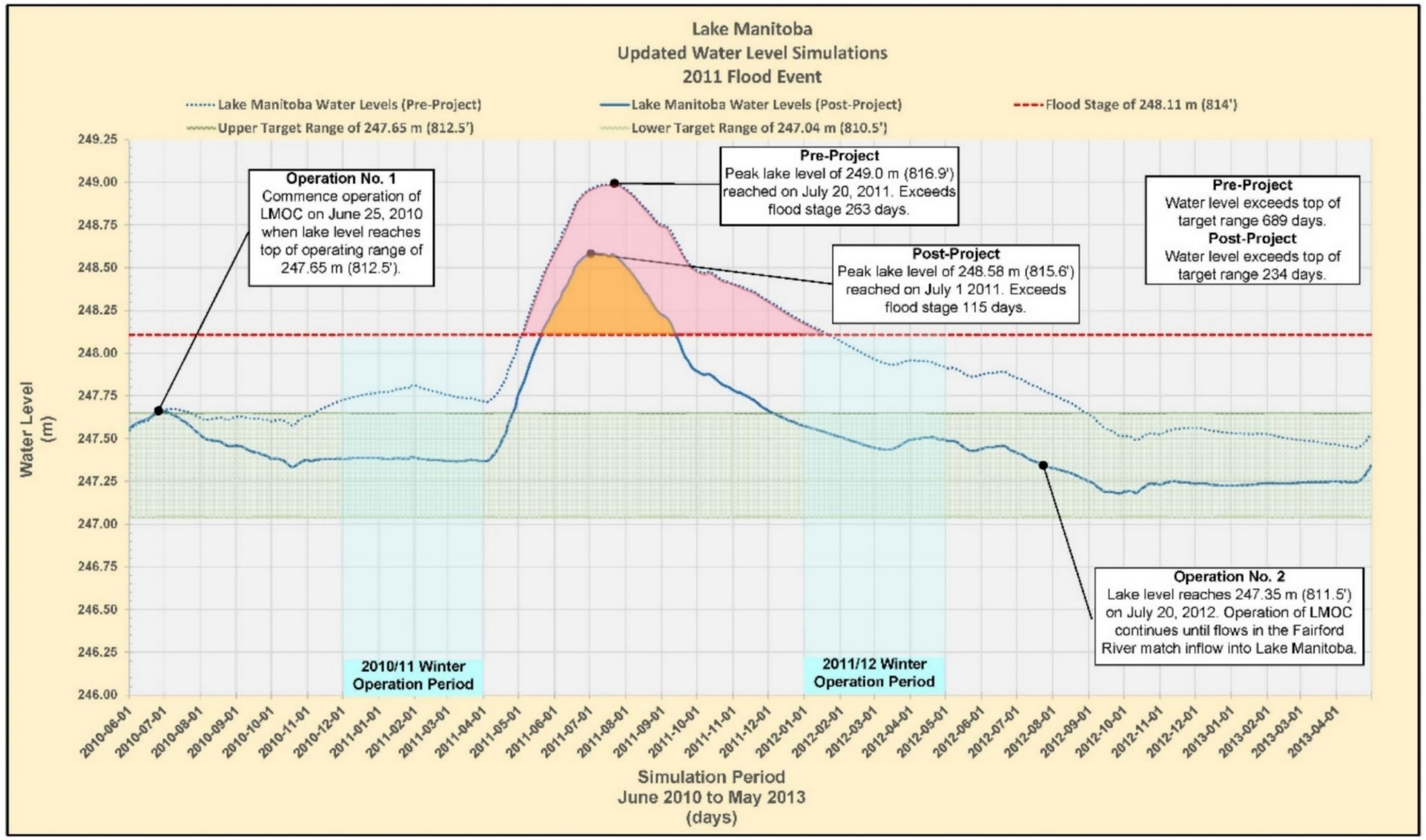

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Figure 3C-5 Influence of Operating Guidelines on Lake Levels in Lake St. Martin – North Basin

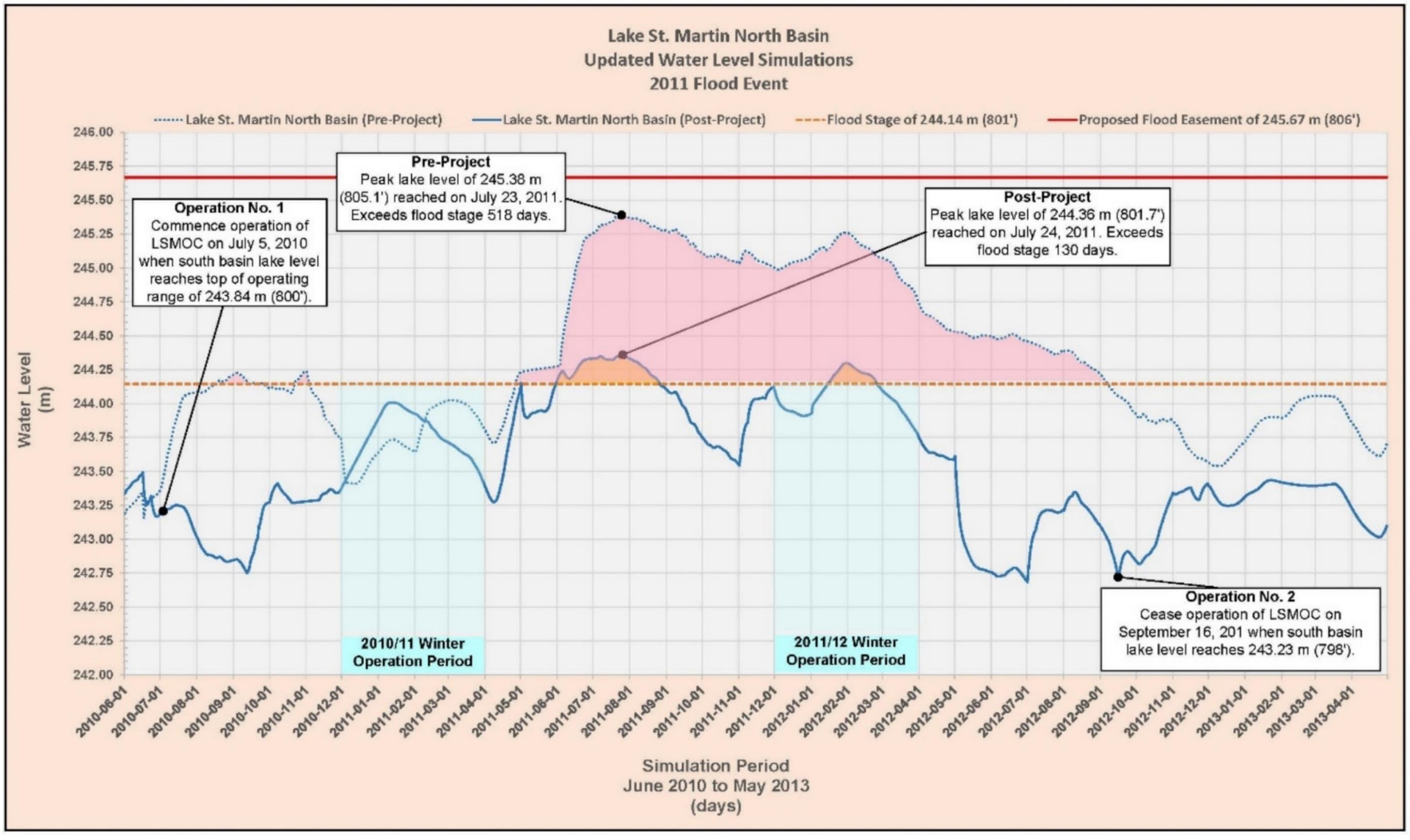

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Figure 3C-6 Influence of Operating Guidelines on Lake Levels in Lake St. Martin – South Basin

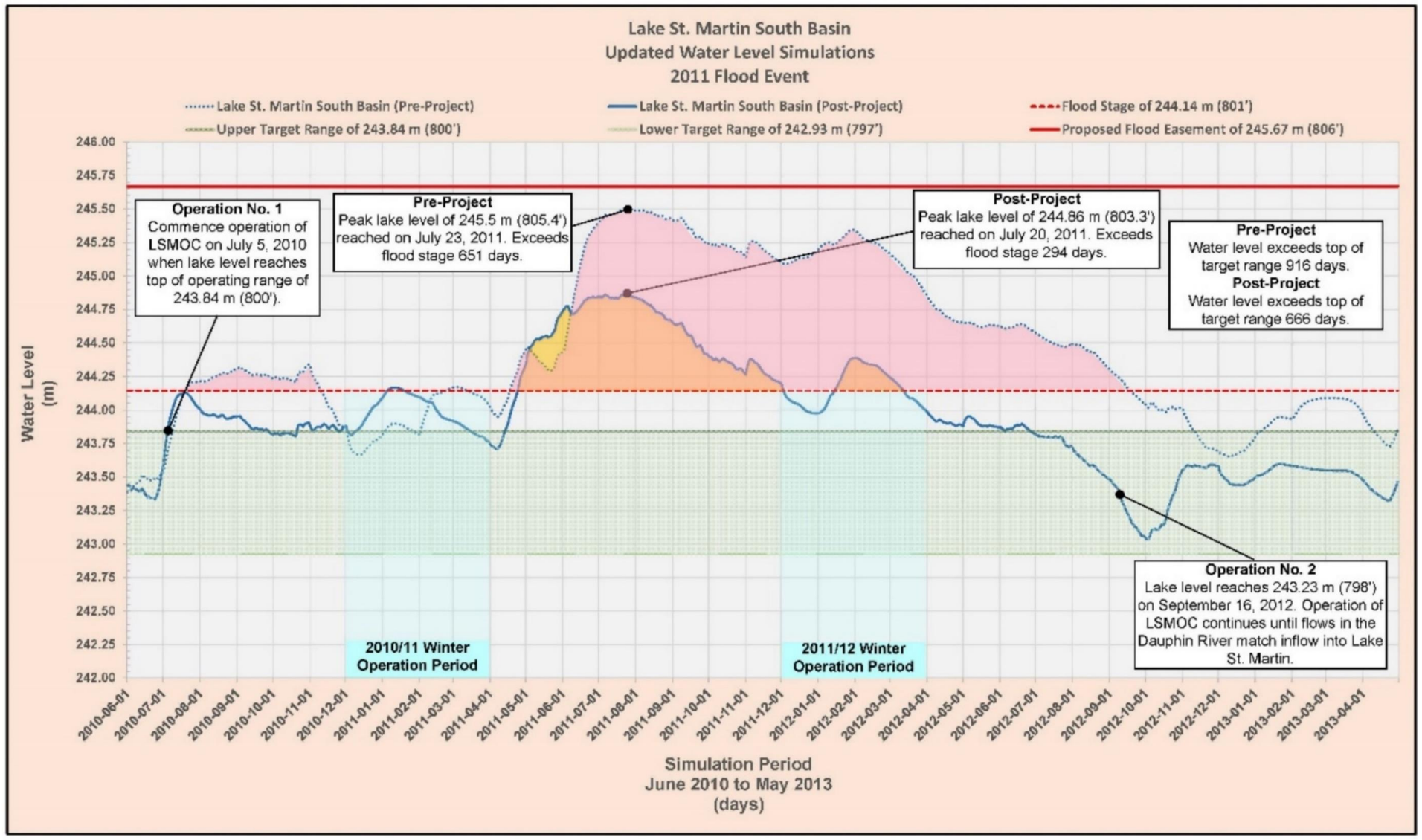

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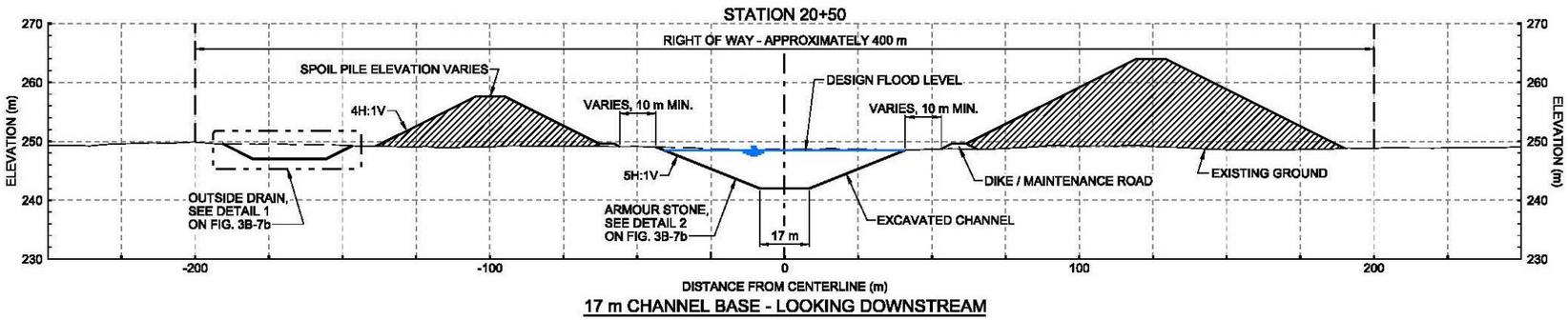
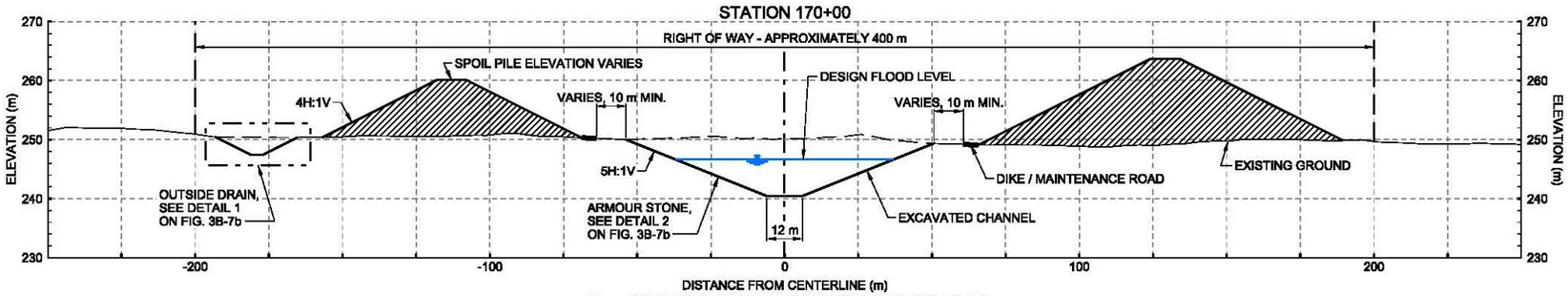
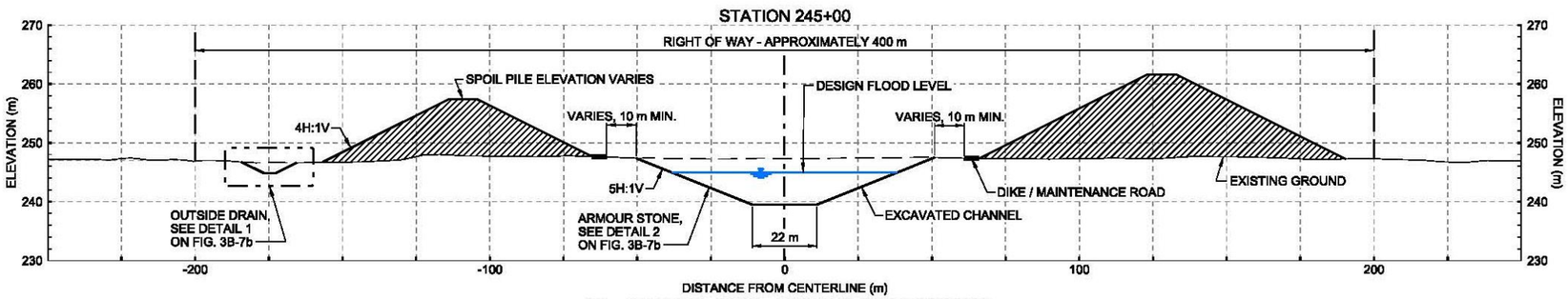
Figure 3C-7a Typical Cross-Sections of LMOC



17 m CHANNEL BASE - LOOKING DOWNSTREAM



12 m CHANNEL BASE - LOOKING DOWNSTREAM



22 m CHANNEL BASE - LOOKING DOWNSTREAM

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Figure 3C-7b LMOC Cross-Section Details

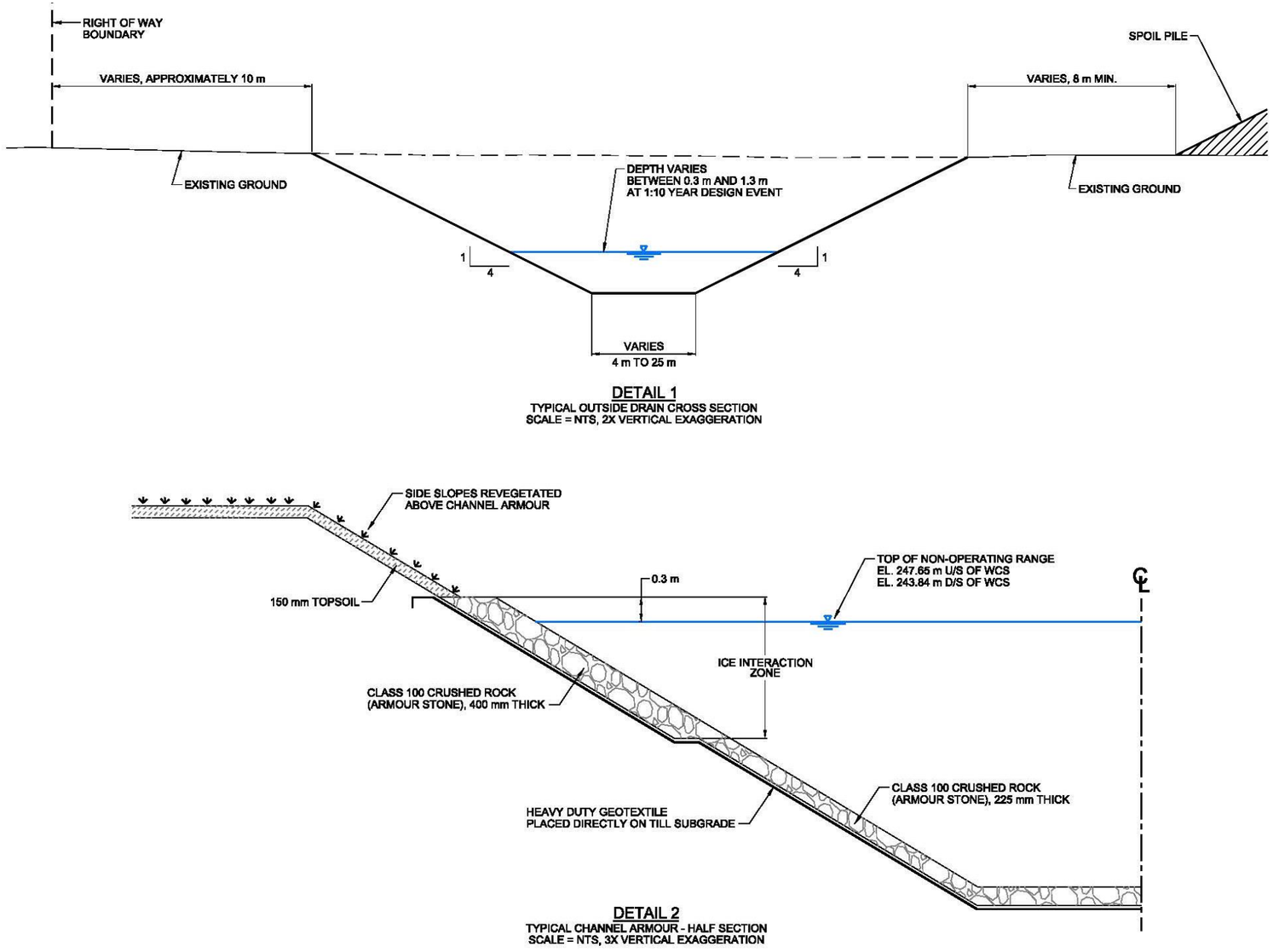

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Figure 3C-8 LMOC Profile

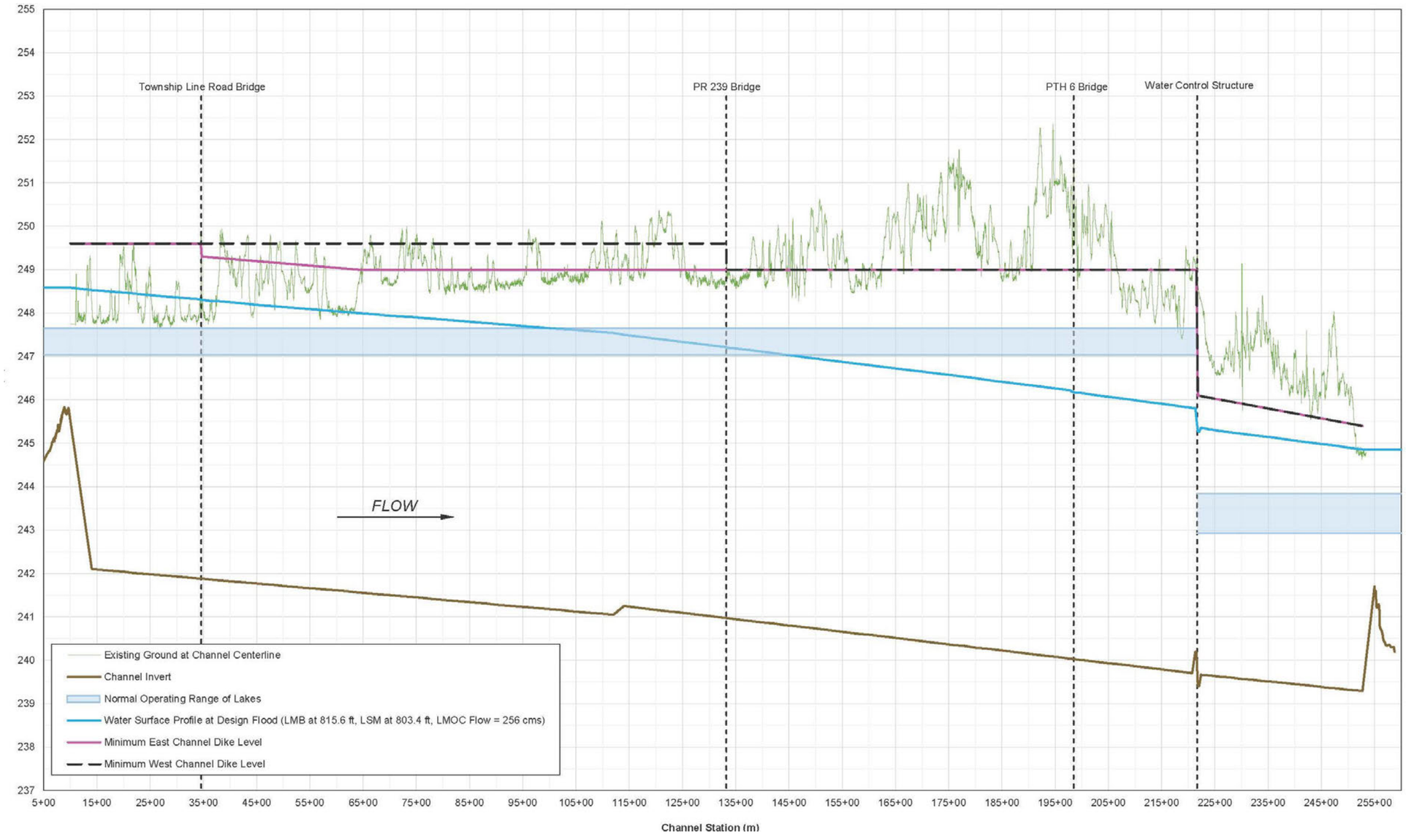

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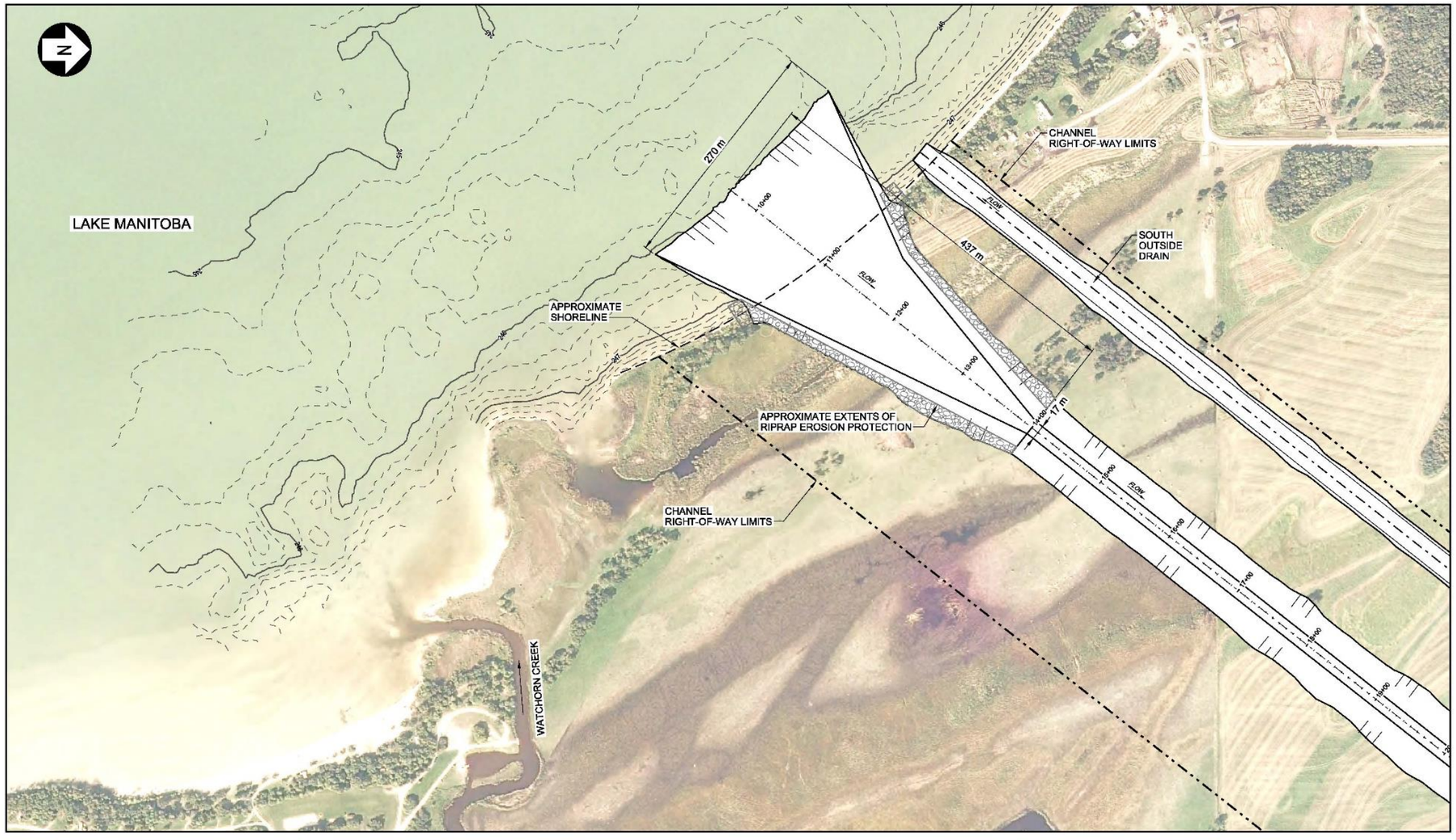
Figure 3C-9 LMOC Inlet Plan



NOTE: SPOIL PILES NOT SHOWN.

0 30 60 90 120 150
SCALE IN METRES

Figure 3B-9 LMOC Inlet Plan

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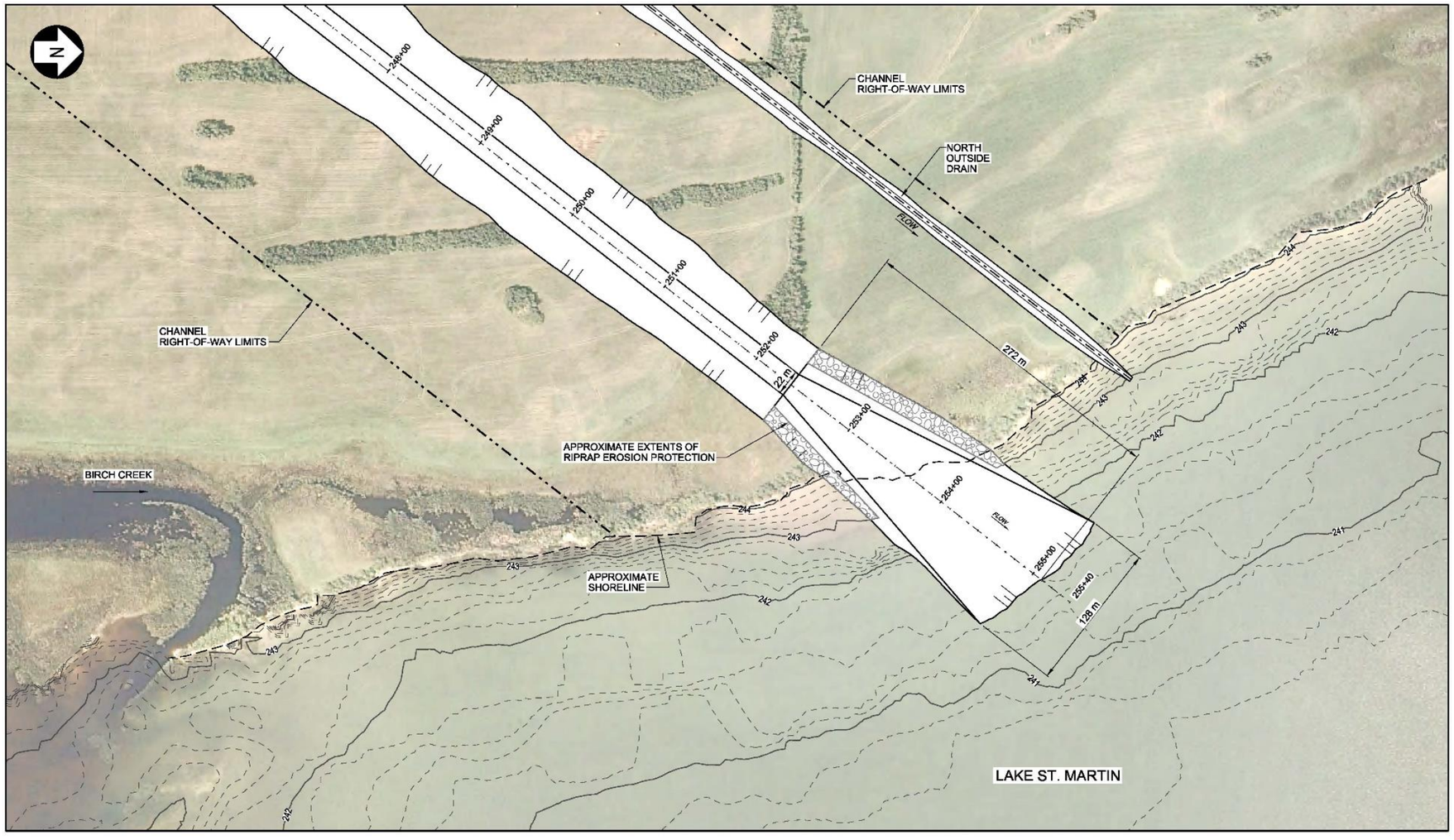
Figure 3C-10 LMOC Outlet Plan



NOTE: SPOIL PILES NOT SHOWN.

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SCALE IN METRES

Figure 3B-10 LMOC Outlet Plan

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Figure 3C-11a LMOC Water Control Structure - General Arrangement Plan

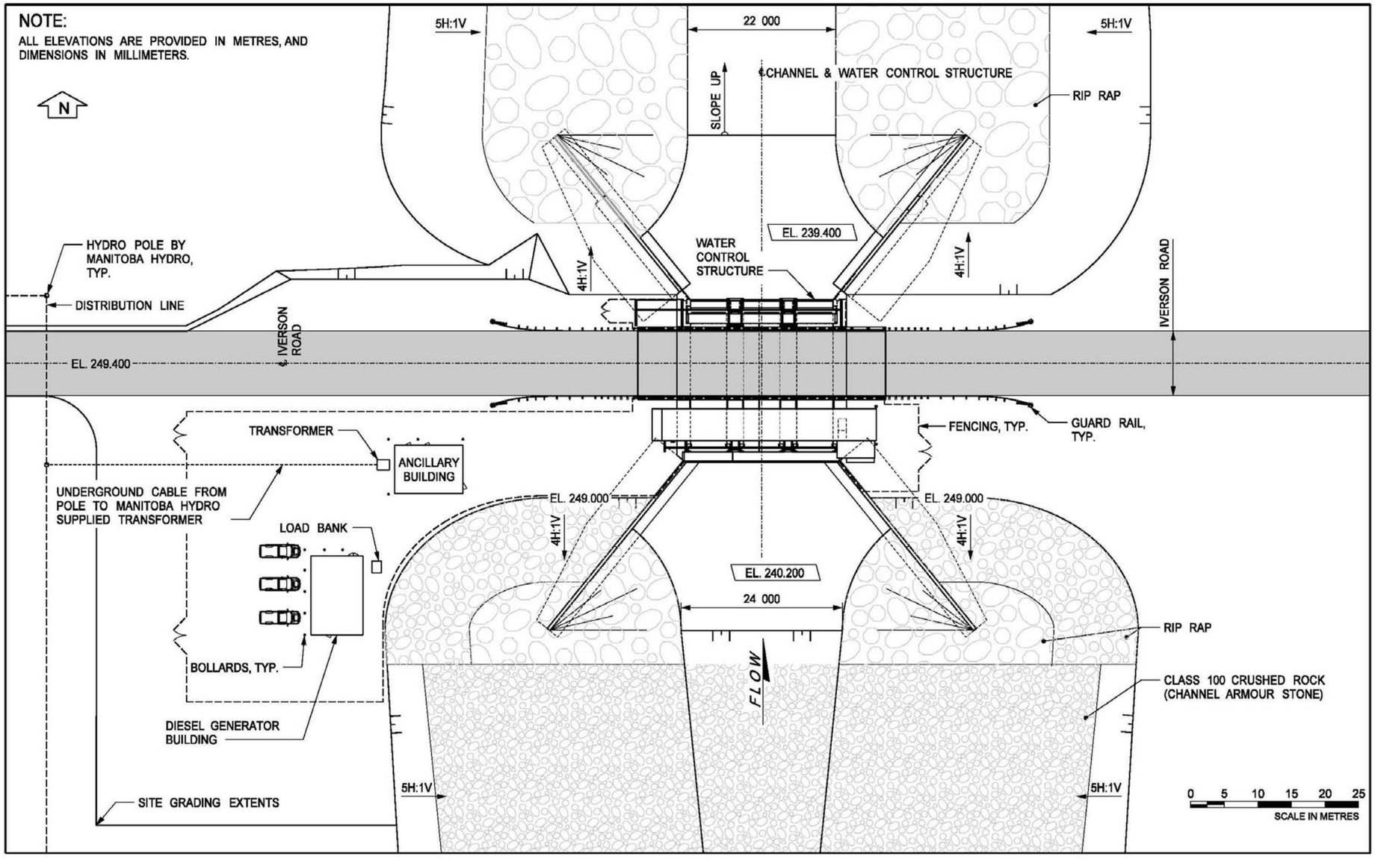

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Figure 3C-11b LMOC Water Control Structure - Upstream Elevation

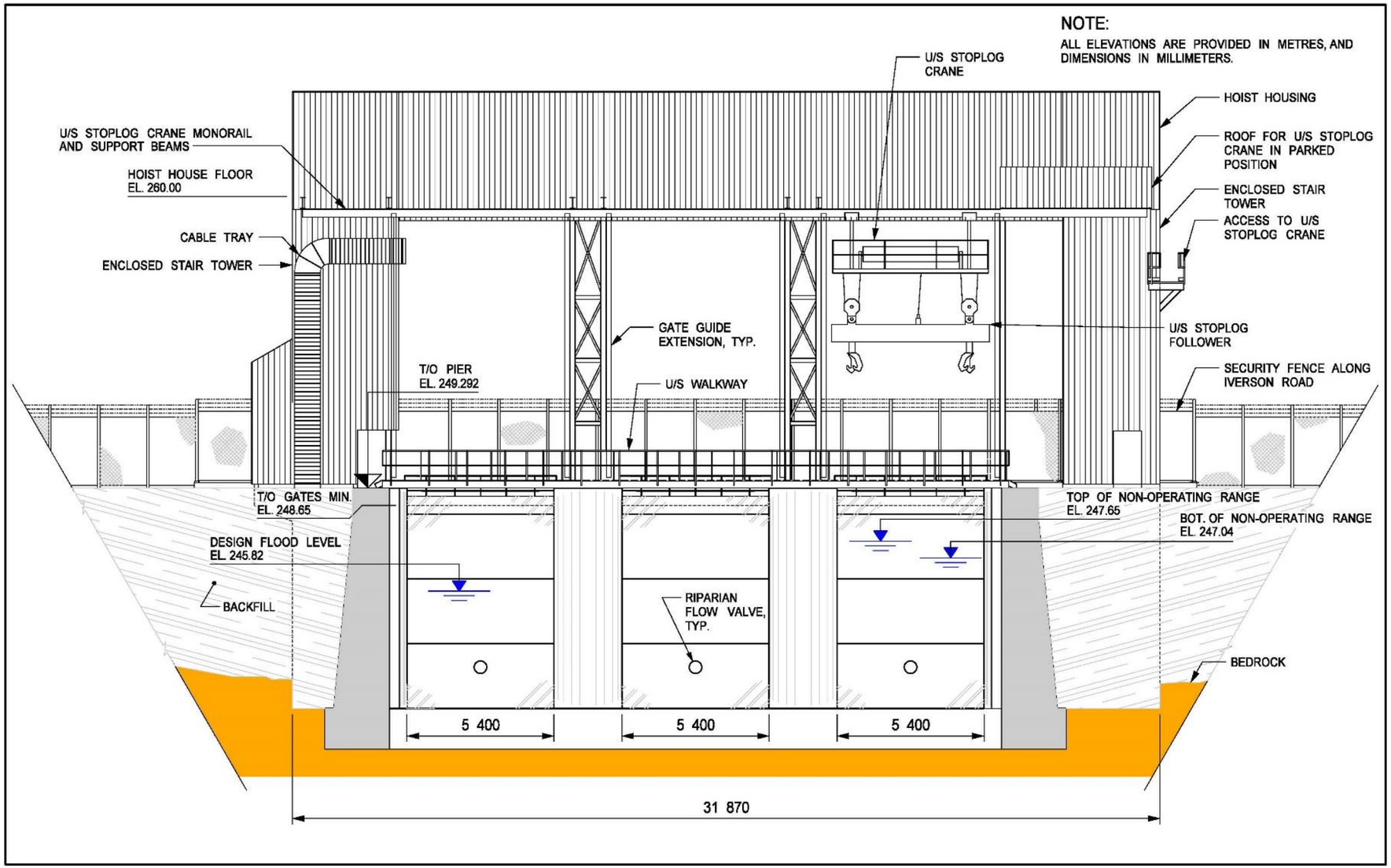

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Figure 3C-11c LMOC Water Control Structure - Section Through Centerline

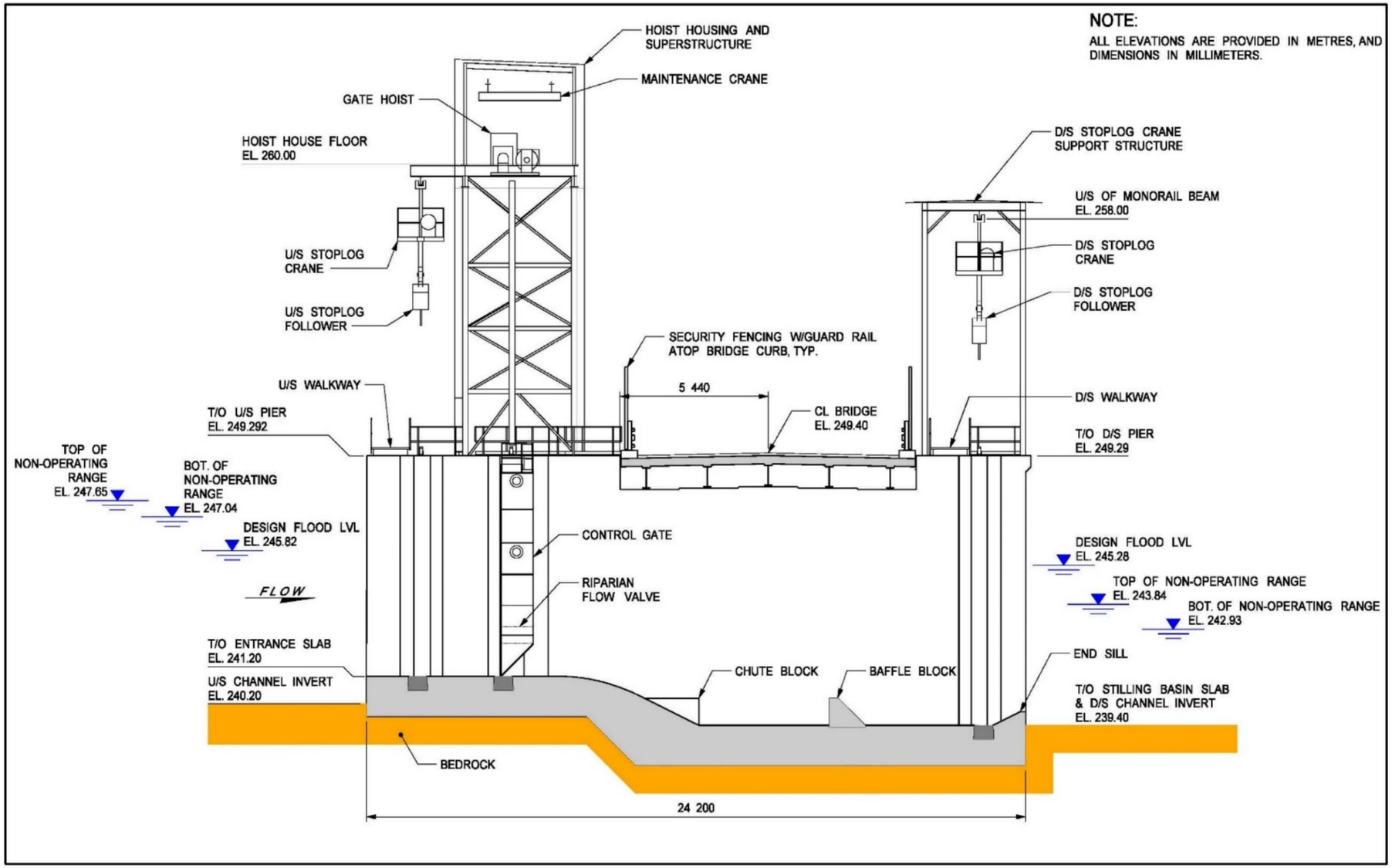

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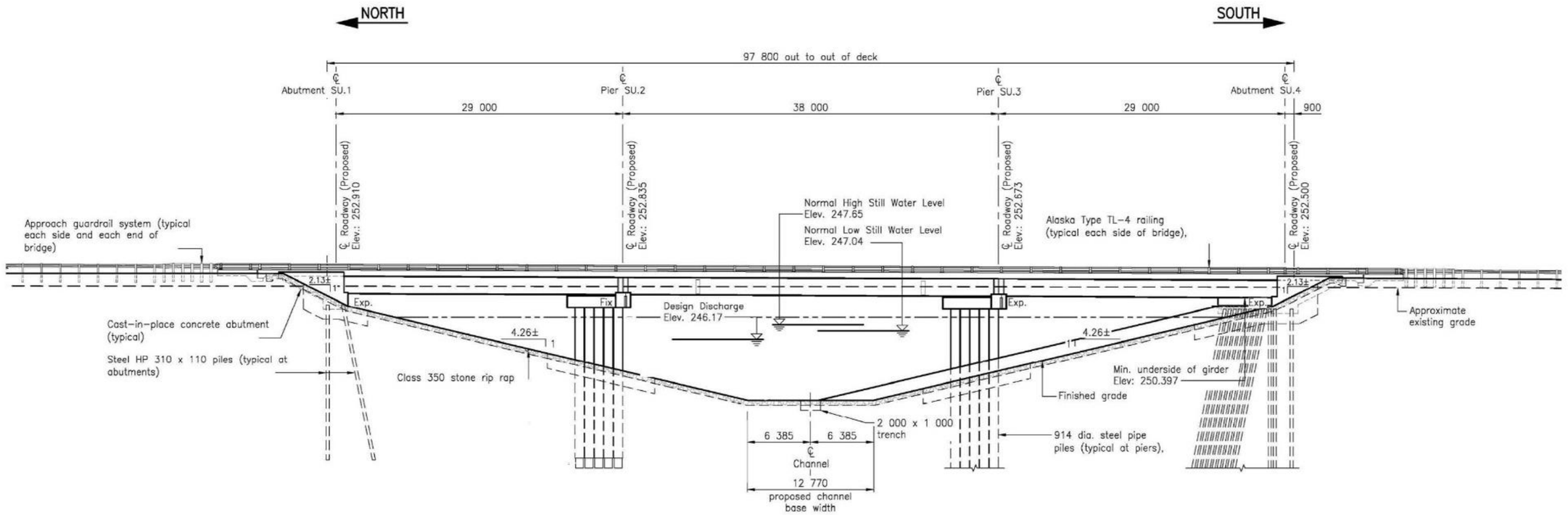
Figure 3C-12a LMOC Typical Bridge Elevations and Cross-Sections – PTH 6 Bridge



BRIDGE GENERAL ARRANGEMENT
PROPOSED PROVINCIAL TRUNK HIGHWAY 6 BRIDGE
ELEVATION LOOKING EAST

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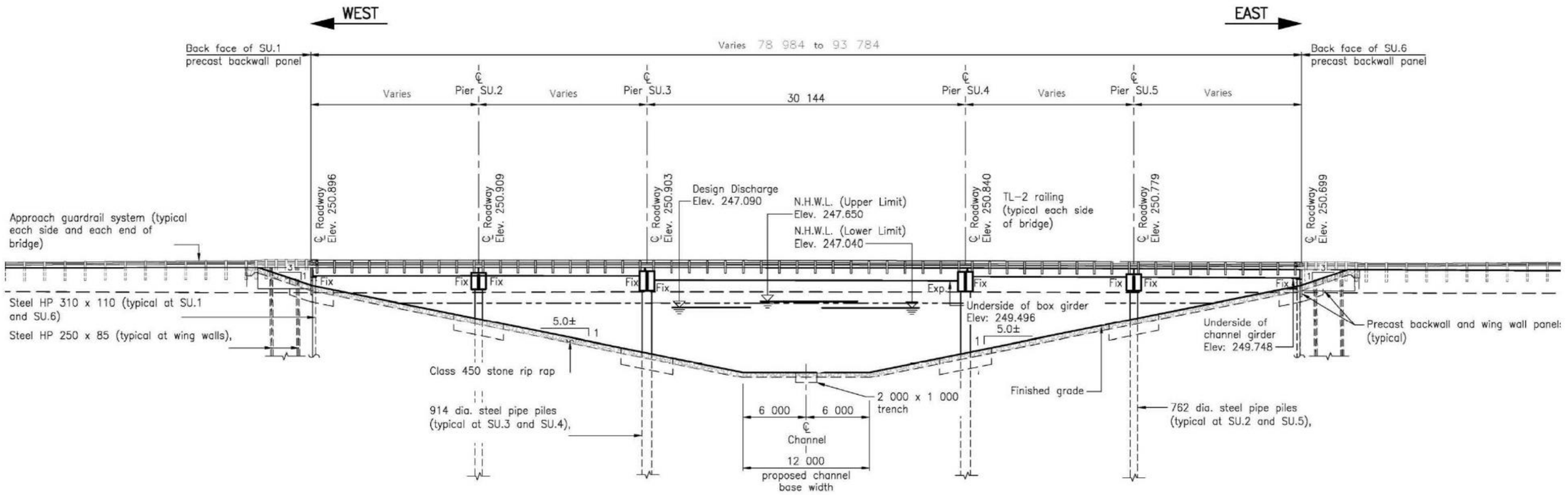
Figure 3C-12b LMOC Typical Bridge Elevations and Cross-Sections – Provincial & Municipal Road Bridge



BRIDGE GENERAL ARRANGEMENT
PROPOSED PROVINCIAL & MUNICIPAL ROAD BRIDGE
ELEVATION LOOKING NORTH

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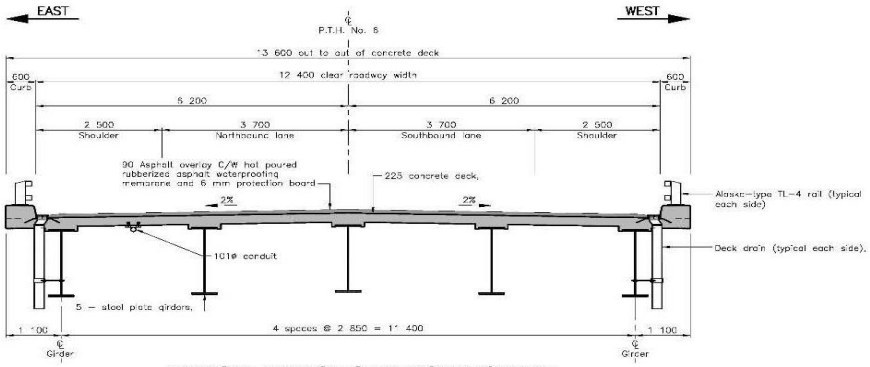
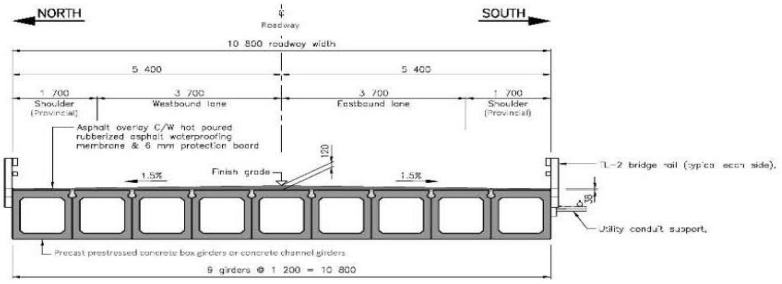
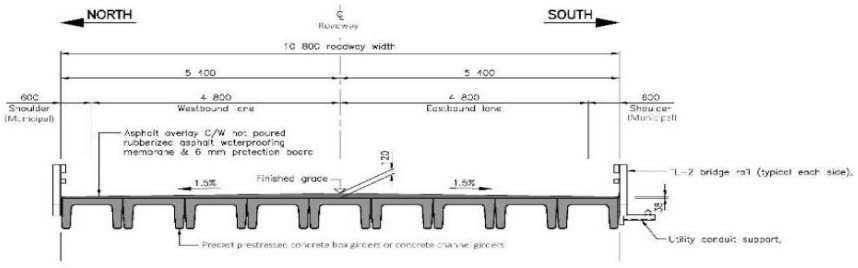
Figure 3C-12c LMOC Typical Bridge Elevations and Cross-Sections – Superstructures



TYPICAL BRIDGE SUPERSTRUCTURE
PROPOSED PROVINCIAL TRUNK HIGHWAY 6 BRIDGE
CROSS SECTION LOOKING SOUTH



TYPICAL BRIDGE SUPERSTRUCTURE
PROPOSED PROVINCIAL & MUNICIPAL ROAD BRIDGE
CROSS SECTION LOOKING EAST



TYPICAL BRIDGE SUPERSTRUCTURE
PROPOSED PROVINCIAL & MUNICIPAL ROAD BRIDGE
CROSS SECTION LOOKING EAST

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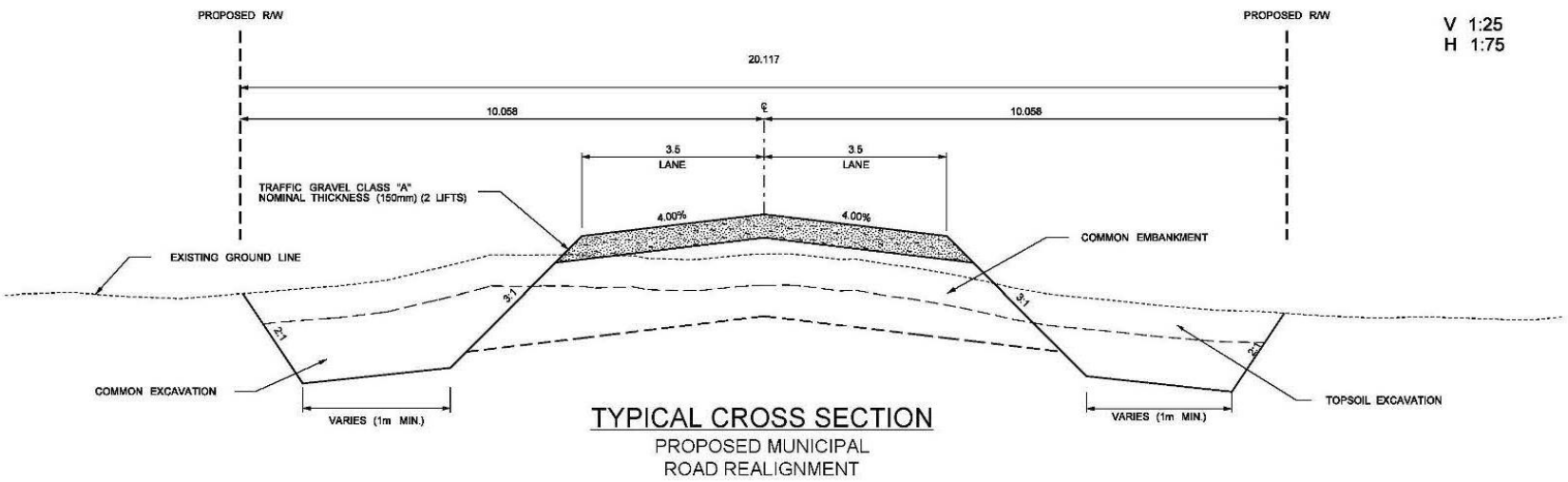
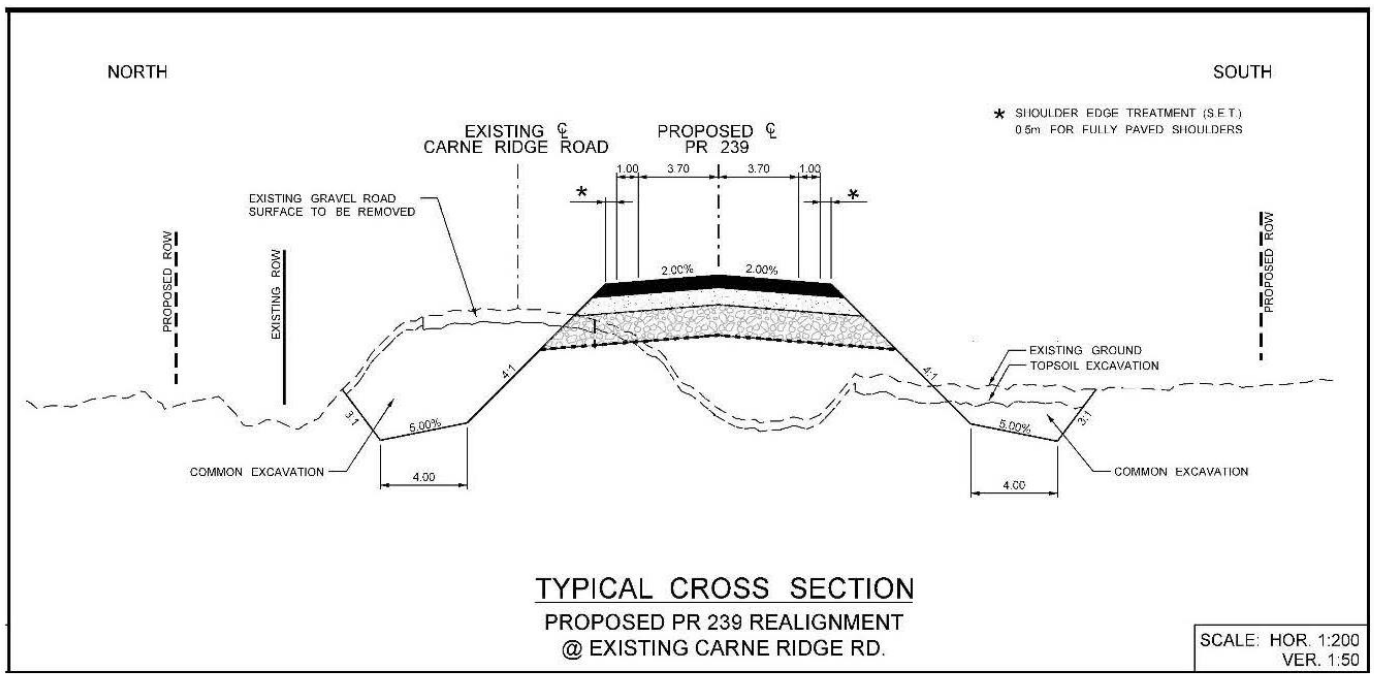
Figure 3C-13 Typical Municipal Road and PR 239 Realignment Cross-Sections





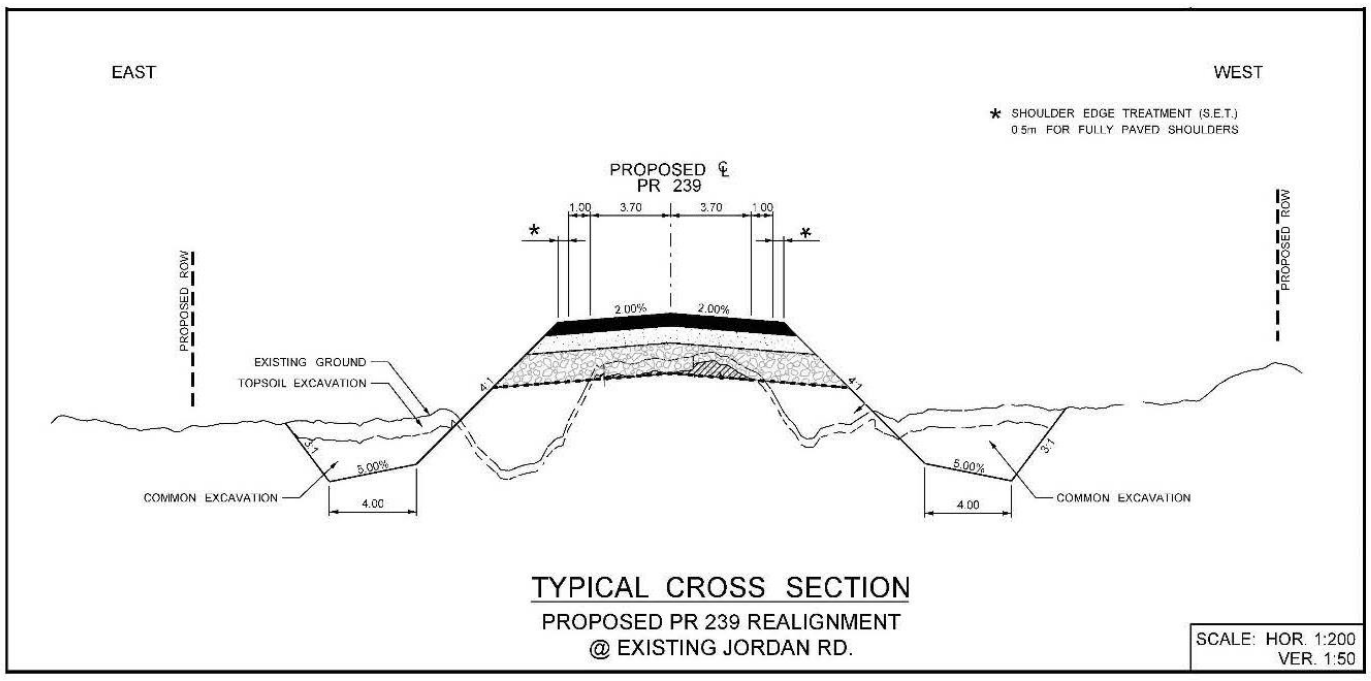


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Figure 3C-14 LMOC Permanent Drainage Plan

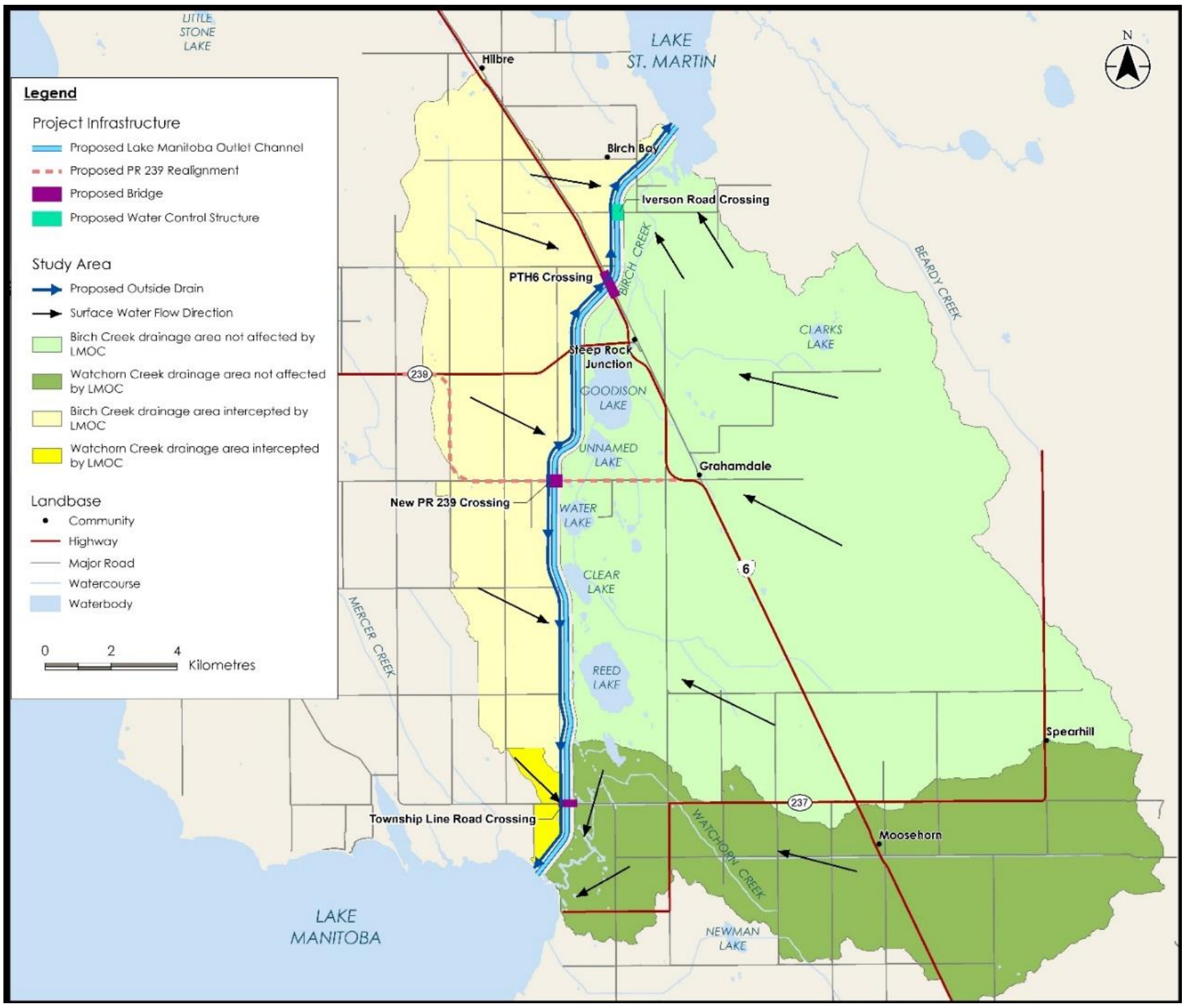

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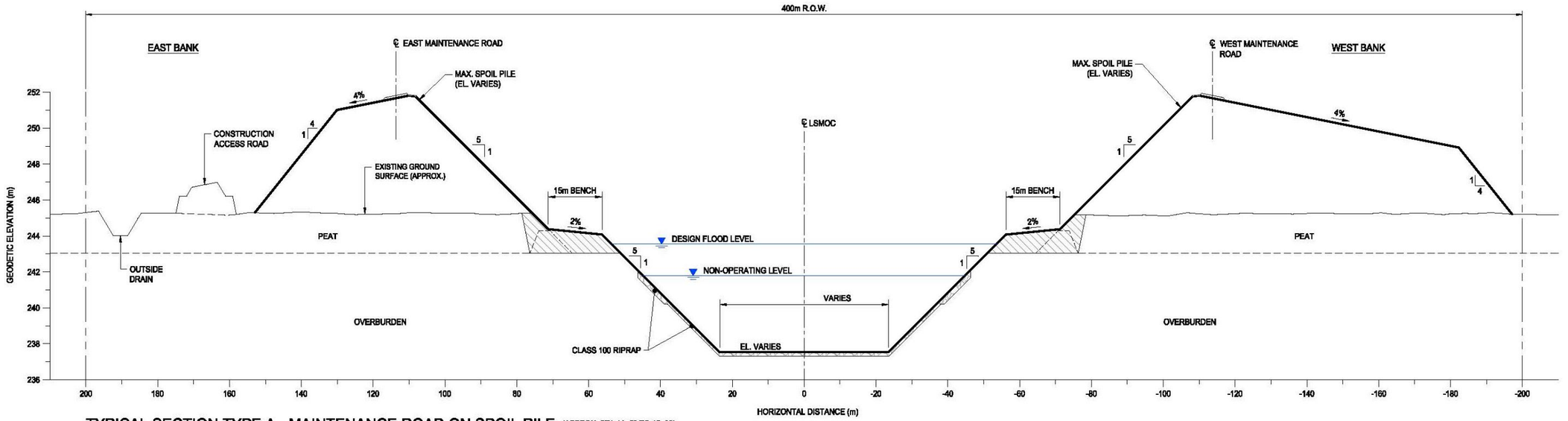
Figure 3C-15a Typical Cross-Section of LSMOC – Type A



TYPICAL SECTION TYPE A - MAINTENANCE ROAD ON SPOIL PILE (APPROX. STA 11+50 TO 45+00)

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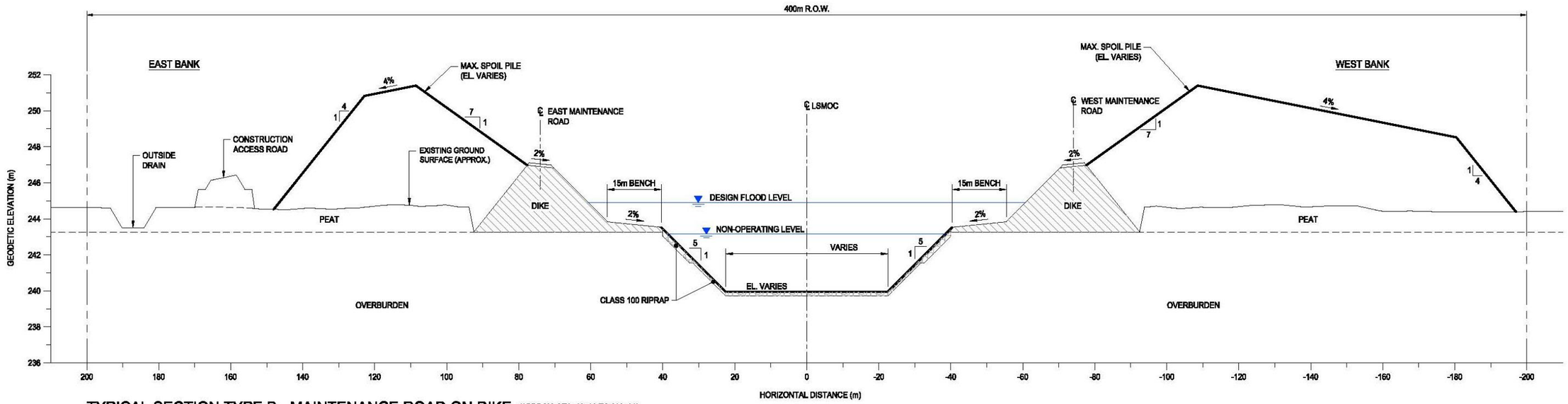
Figure 3C-15b Typical Cross-Section of LSMOC – Type B



TYPICAL SECTION TYPE B - MAINTENANCE ROAD ON DIKE (APPROX. STA. 48+00 TO 232+90)

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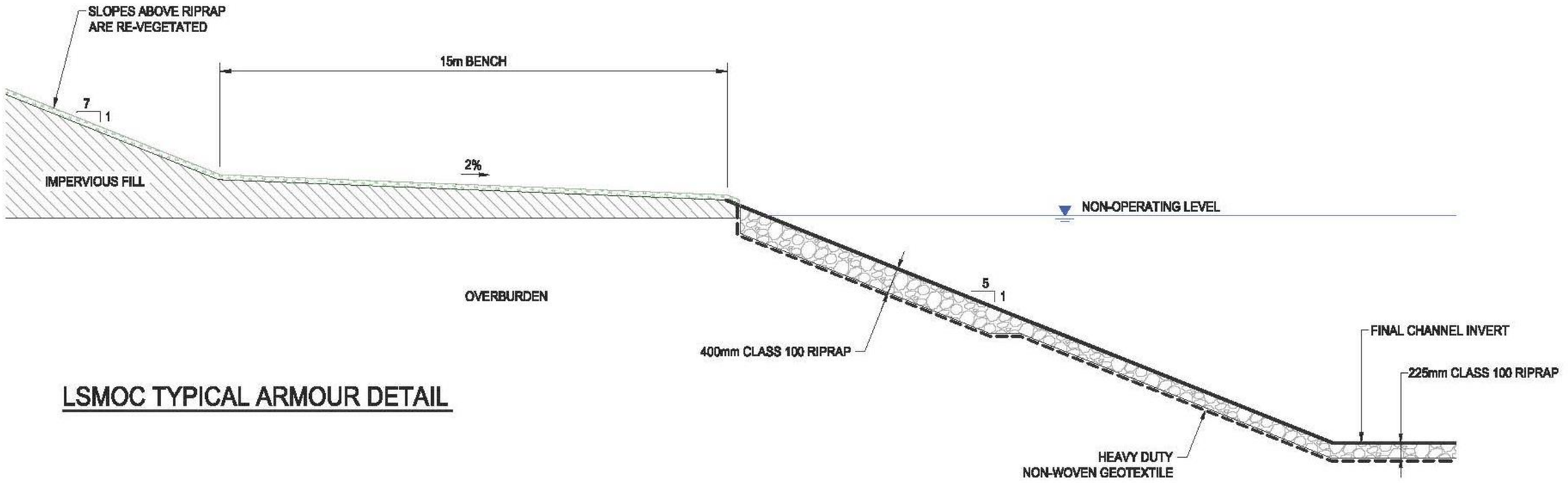
Figure 3C-15c LSMOC Typical Armour Detail



LSMOC TYPICAL ARMOUR DETAIL

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Figure 3C-16 LSMOC Profile

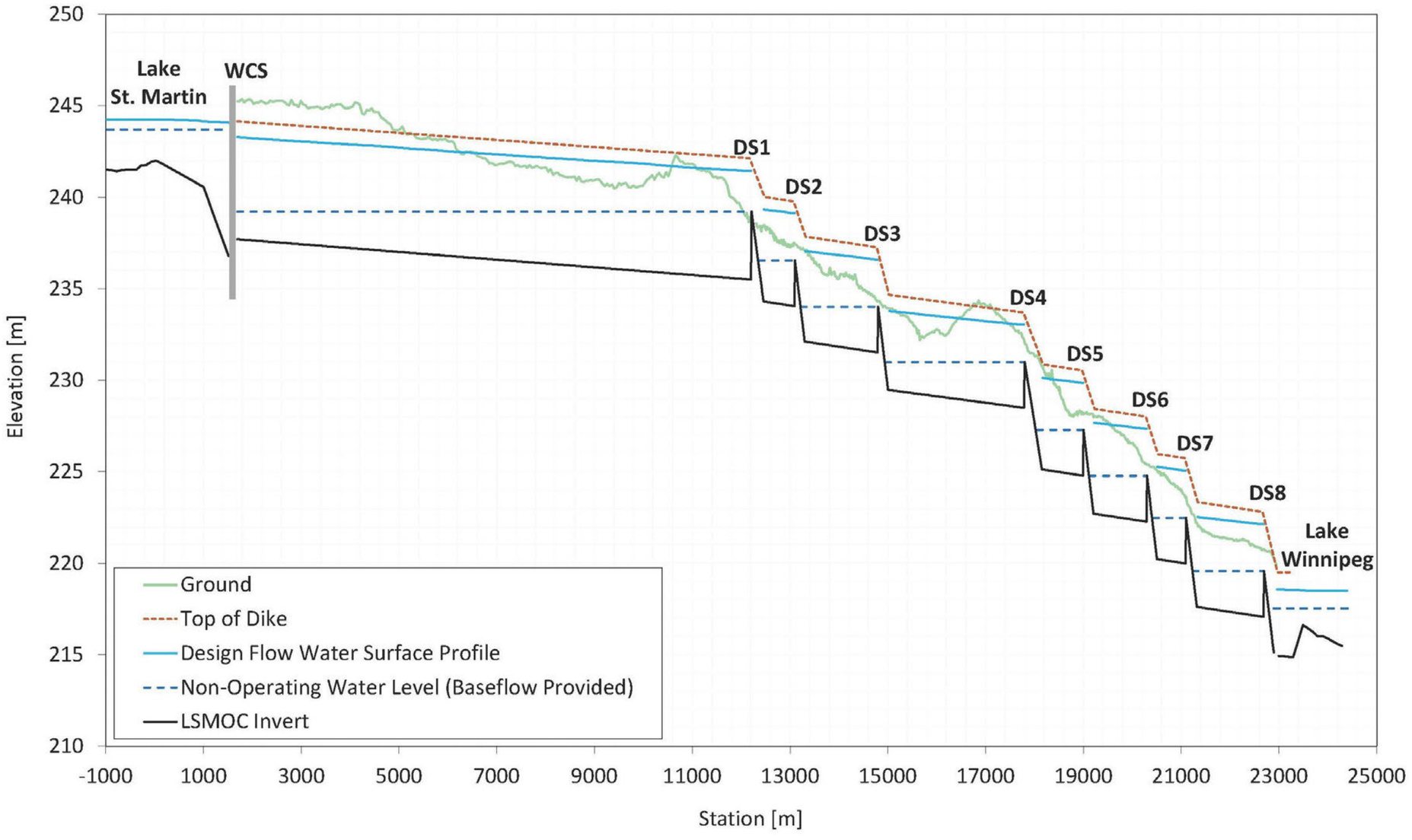

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Figure 3C-17 LSMOC Inlet Plan

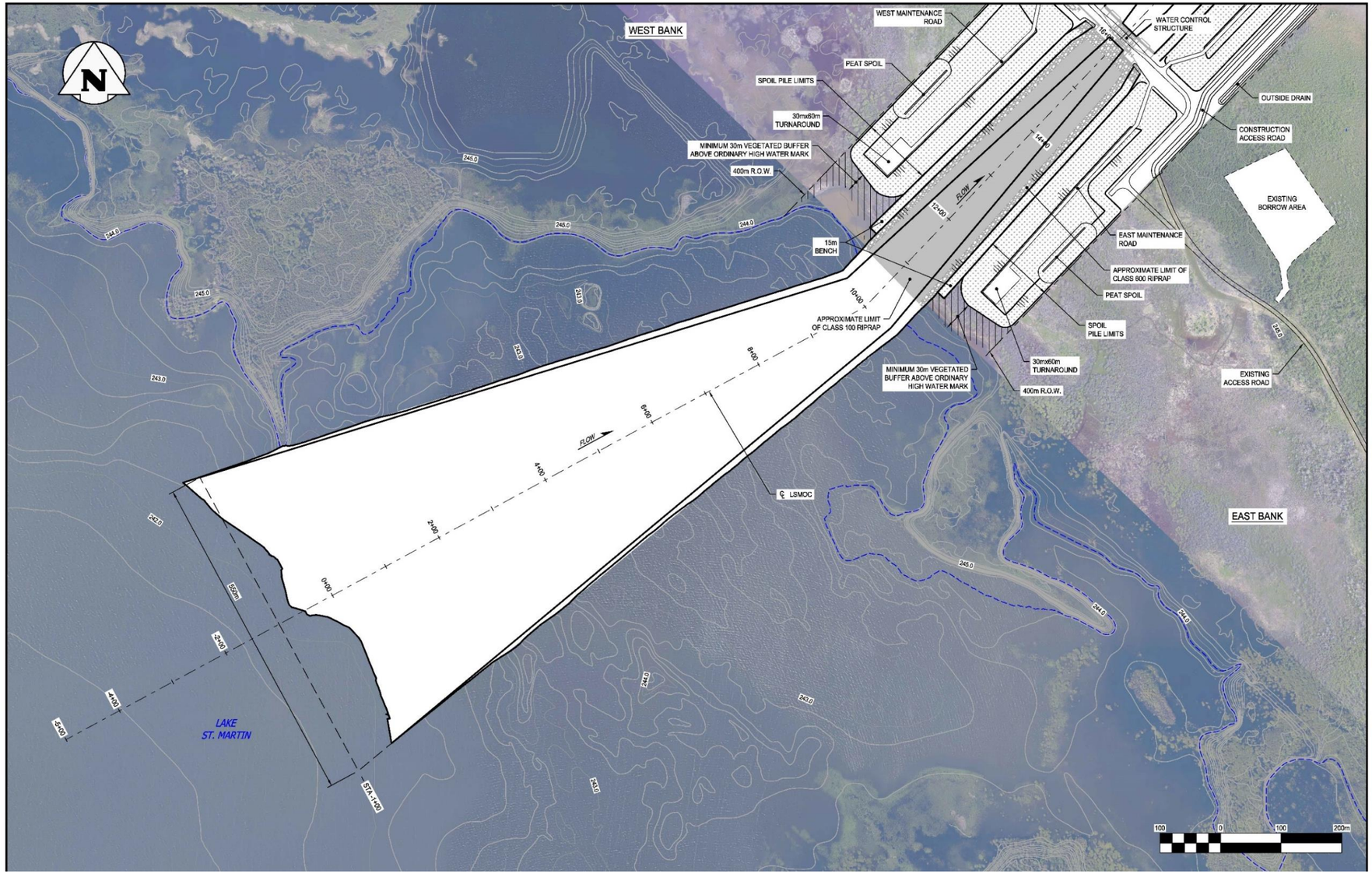

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Figure 3C-18 LSMOC Outlet Plan

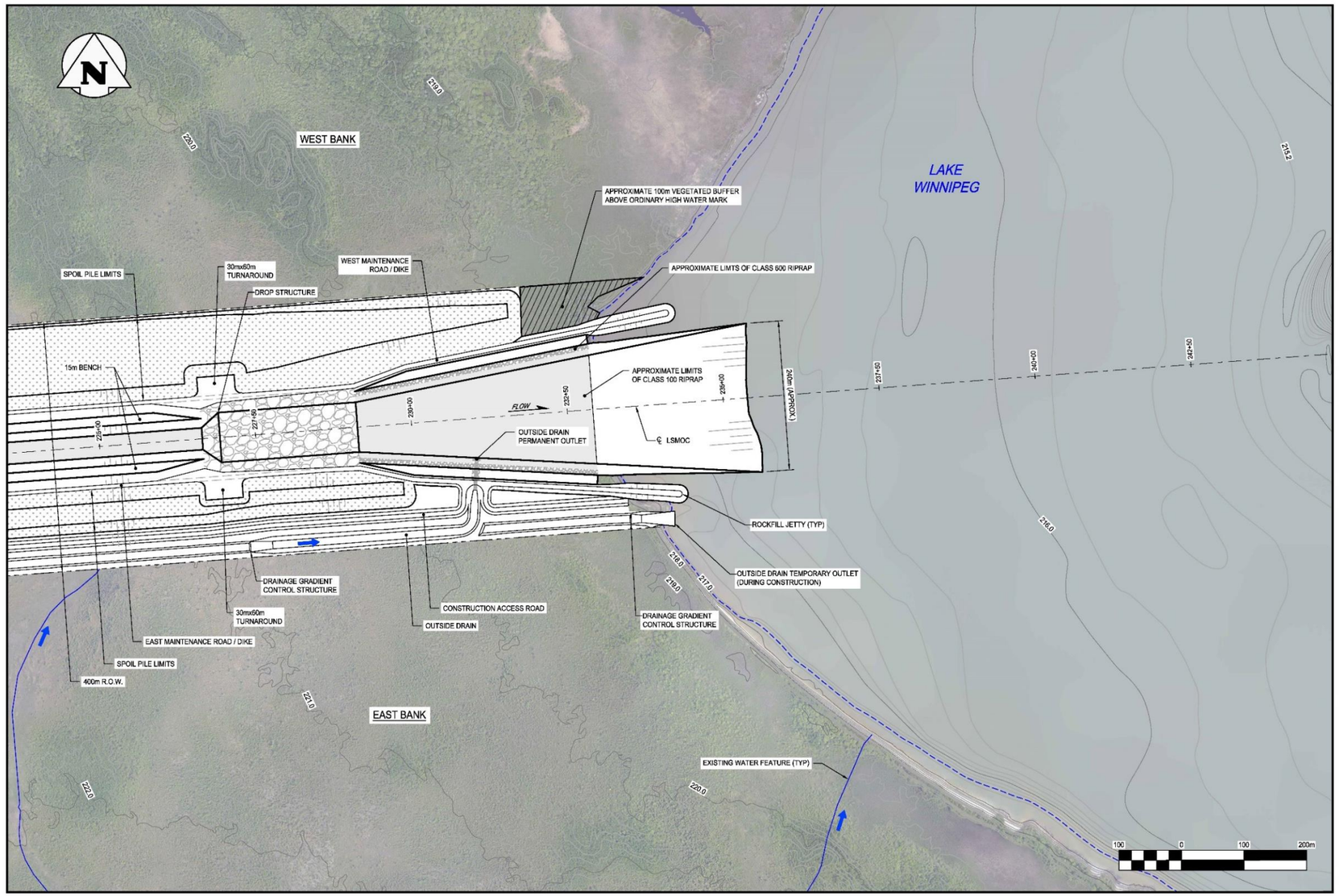

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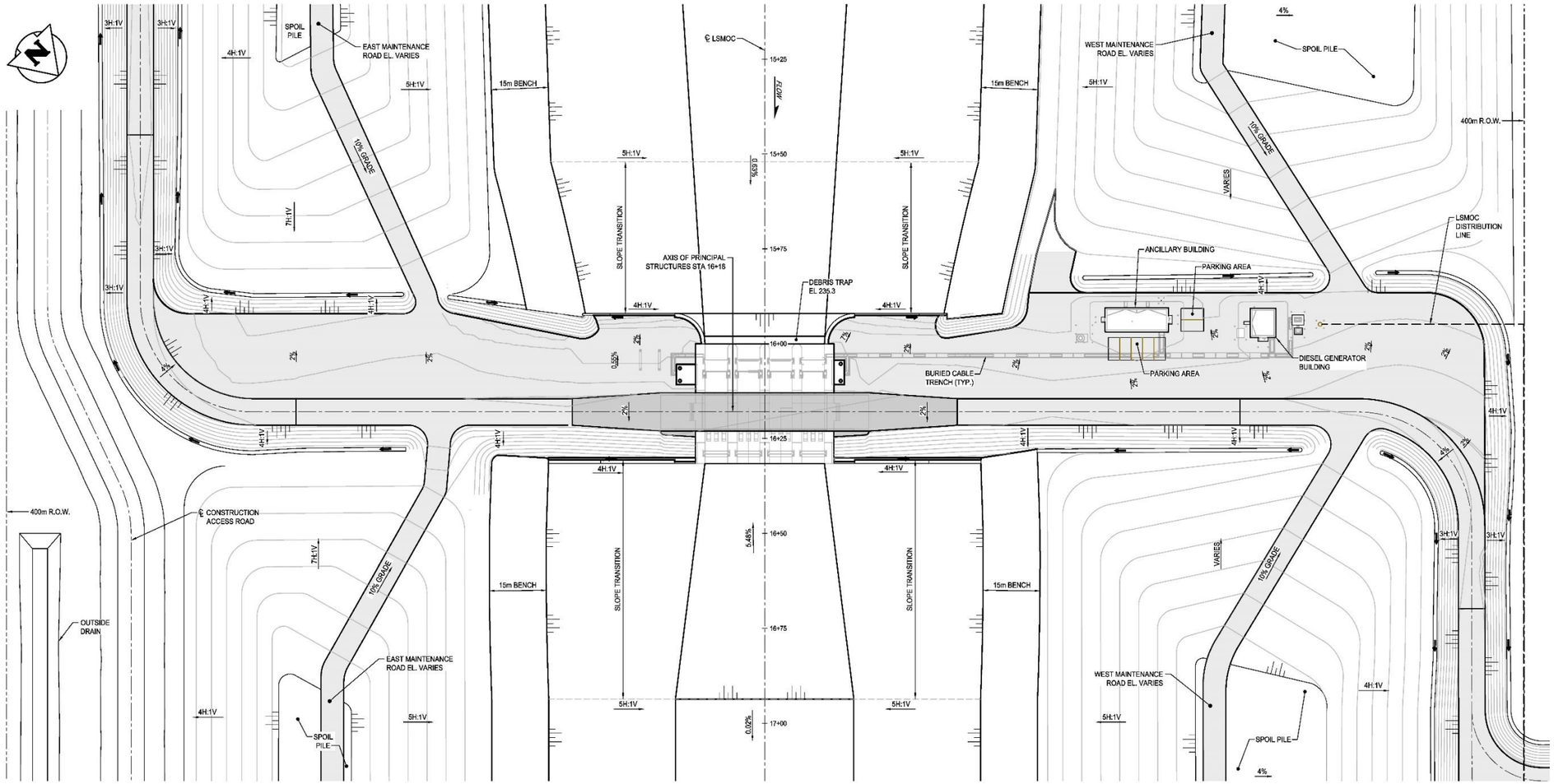
Figure 3C-19a LSMOC Water Control Structure – General Arrangement



WATER CONTROL STRUCTURE GENERAL ARRANGEMENT

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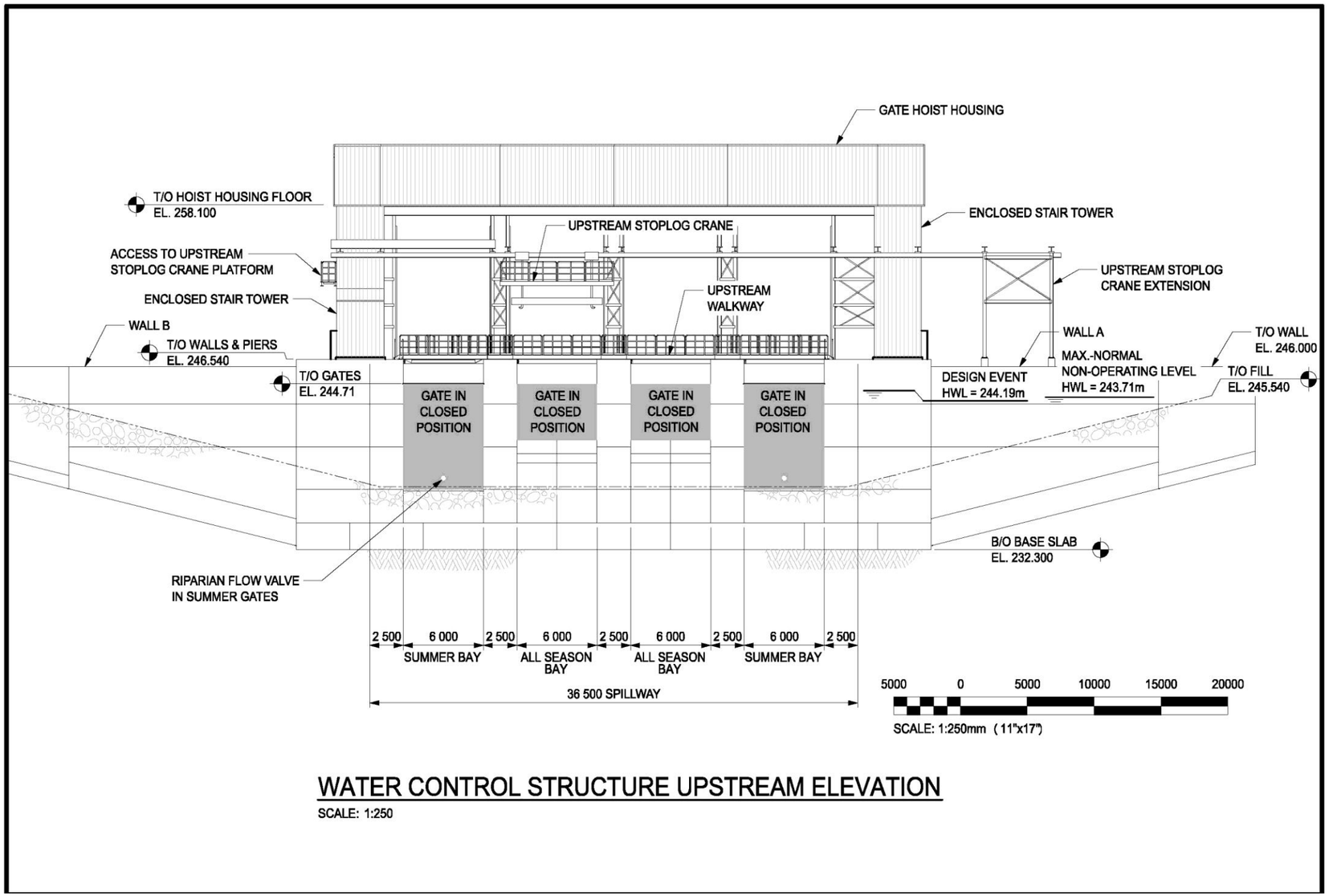
Figure 3C-19b LSMOC Water Control Structure – Upstream Elevation



WATER CONTROL STRUCTURE UPSTREAM ELEVATION
SCALE: 1:250

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Figure 3C-19c LSMOC Water Control Structure – All-Season Bays

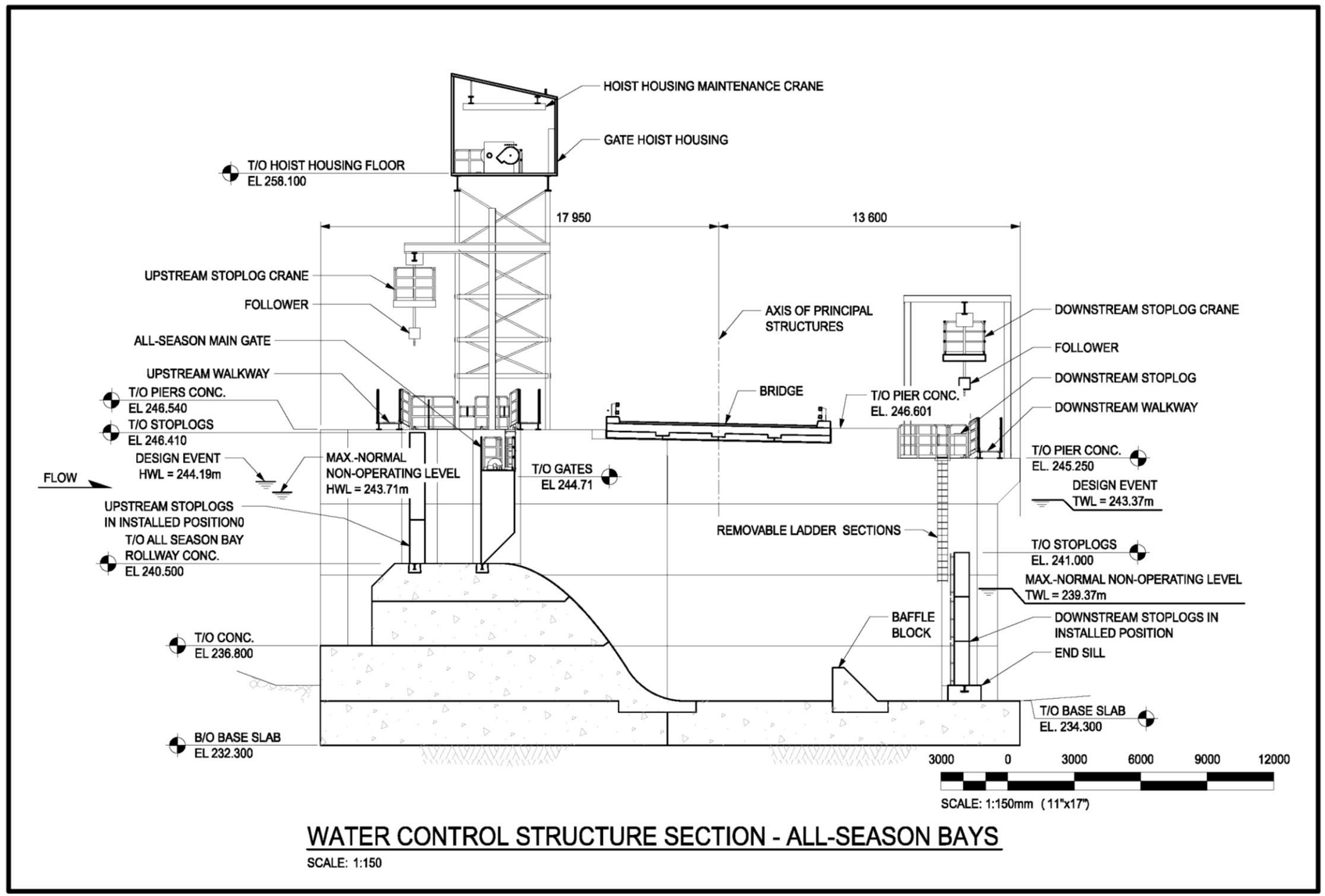

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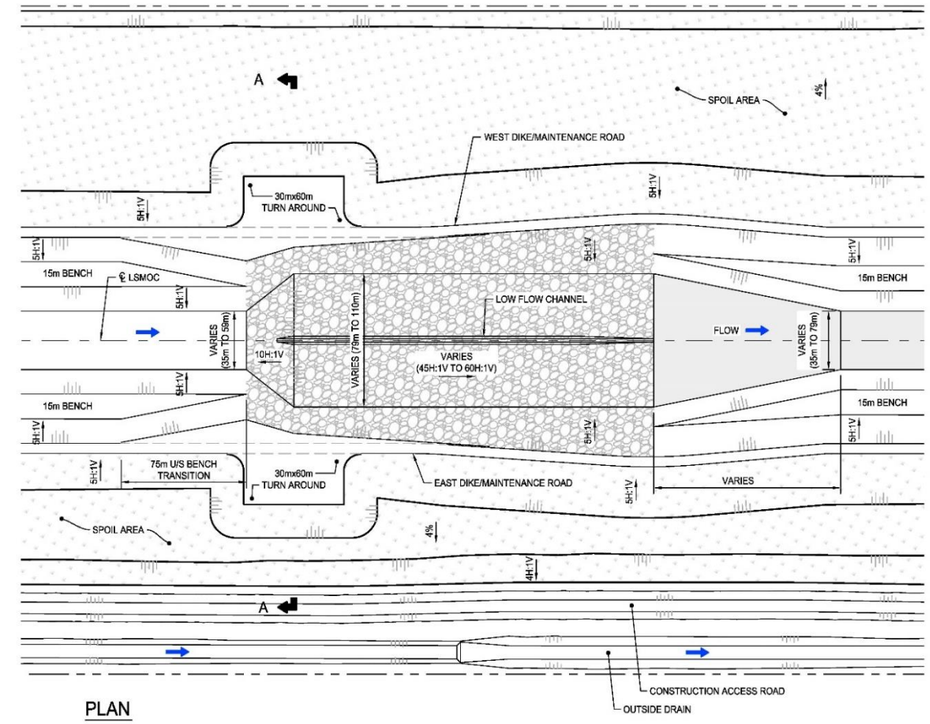
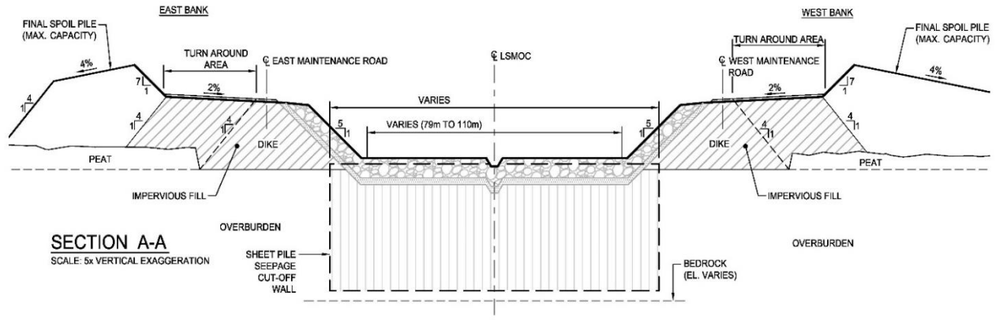
Figure 3C-20 LSMOC Typical Drop Structure





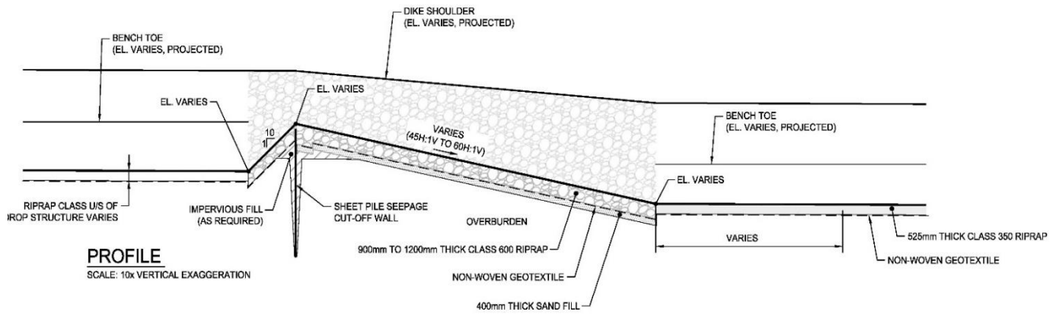


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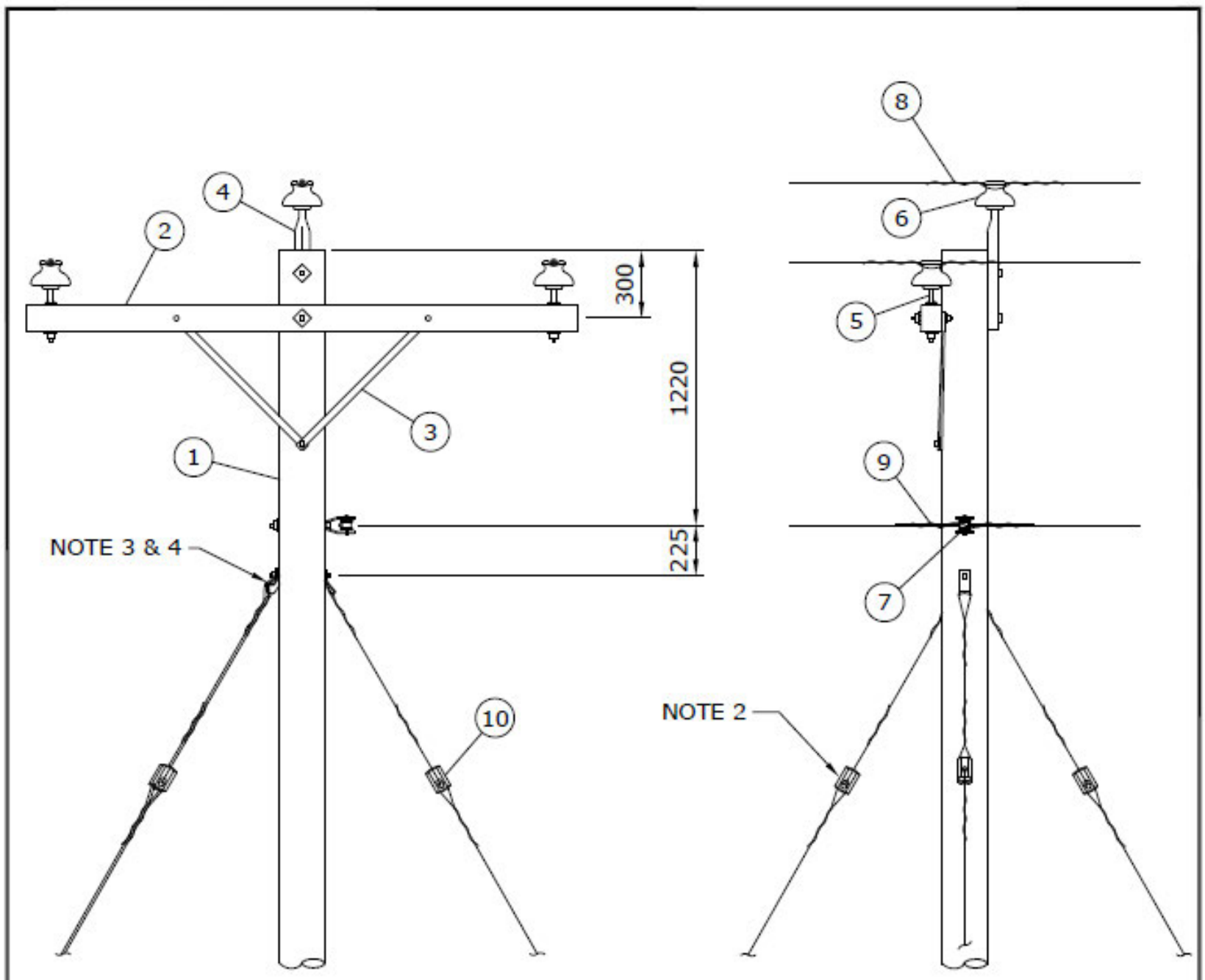
Figure 3C-21 Distribution Line Wood Pole Structure



POLE LENGTH	SETTING DEPTH
40' 12.2m	6'-0" 1.85m
45' 13.7m	6'-6" 2.0m
50' 15'2m	7'-0" 2.15m
55' 16.7m	7'-6" 2.3m

NOTE:
DIMENSIONS SHOWN ARE MILLIMETRES.

50' AND 55' POLES ACROSS ROAD WAY, MAY BE SWAMP GUYED
TO BE DETERMINED WHEN GEO TECH COMPLETED OR BY FIELD STAFF ON SITE.

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Figure 3C-22 LSMOC Permanent Drainage Plan

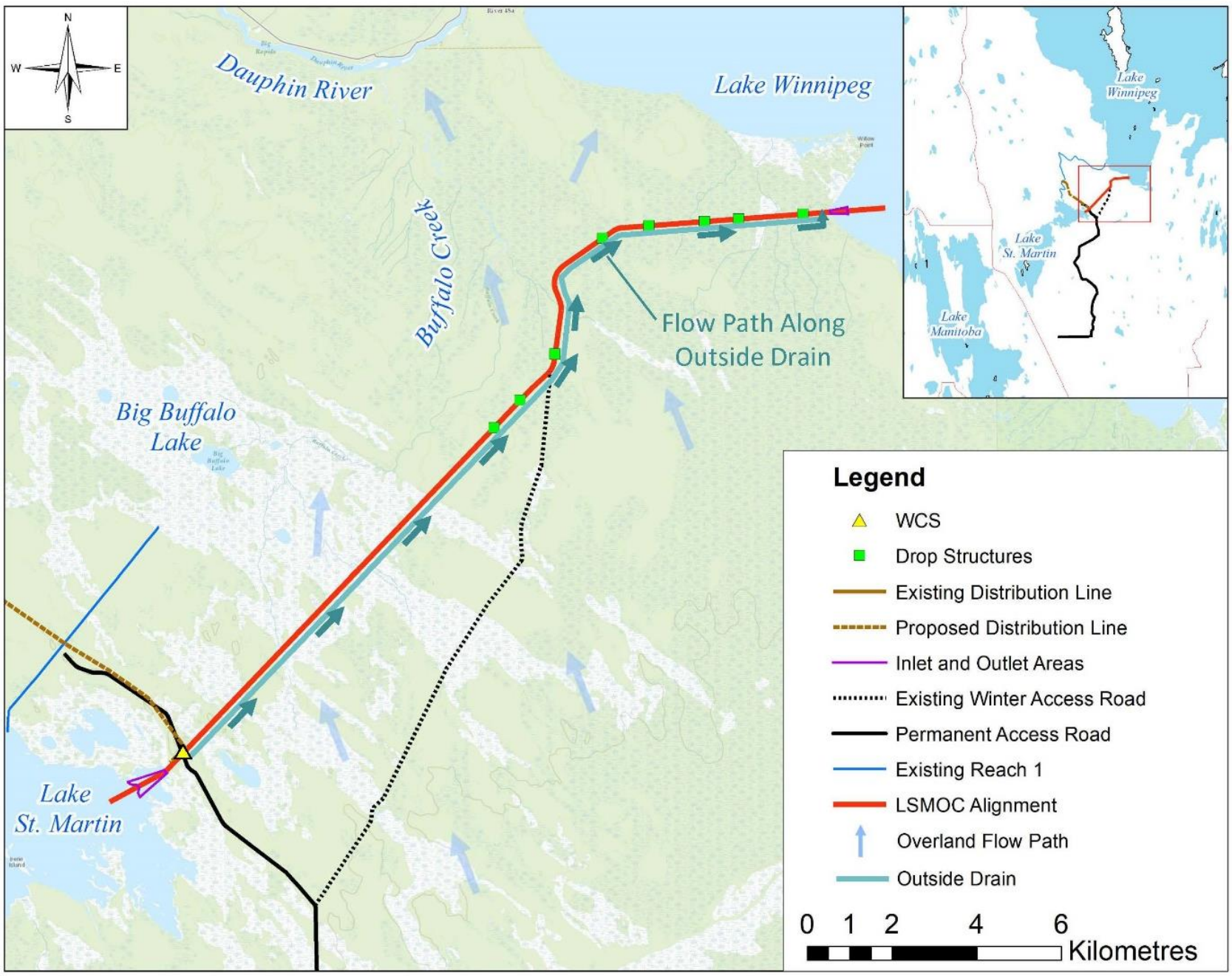

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Figure 3C-23 Typical Cross-Section of LSMOC Outside Drain

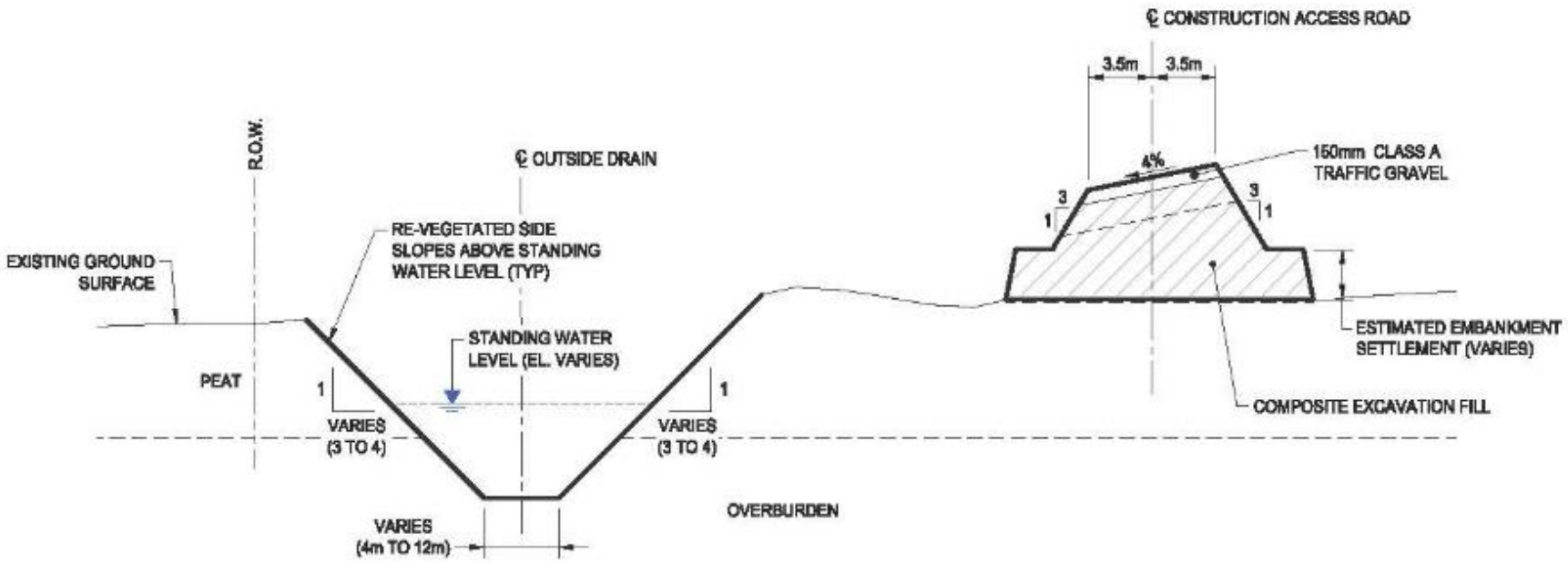

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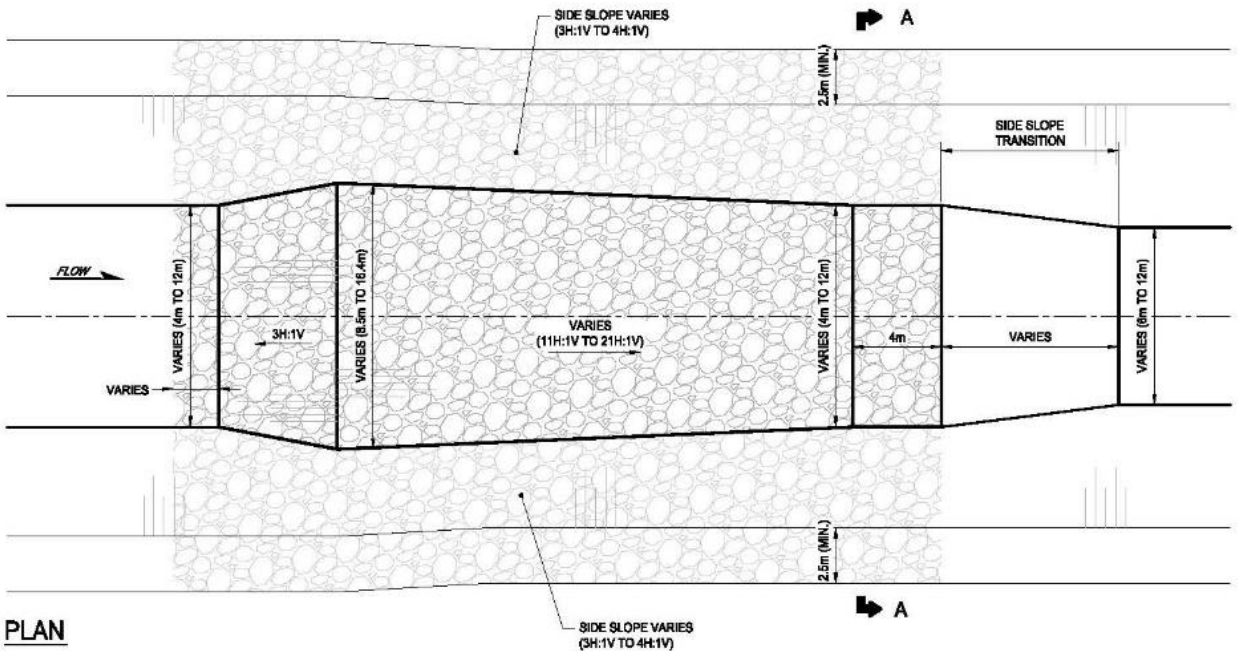
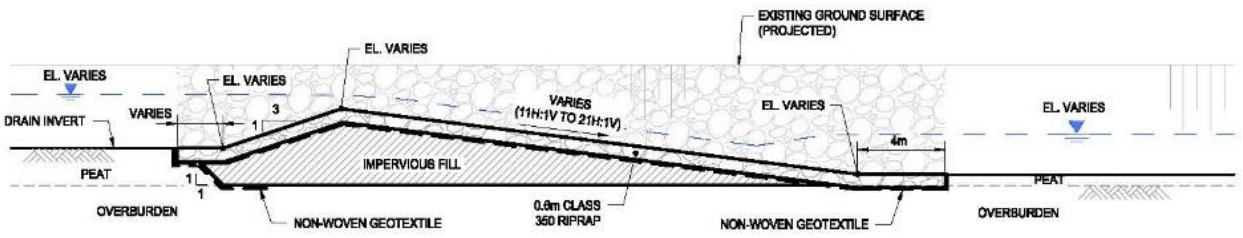
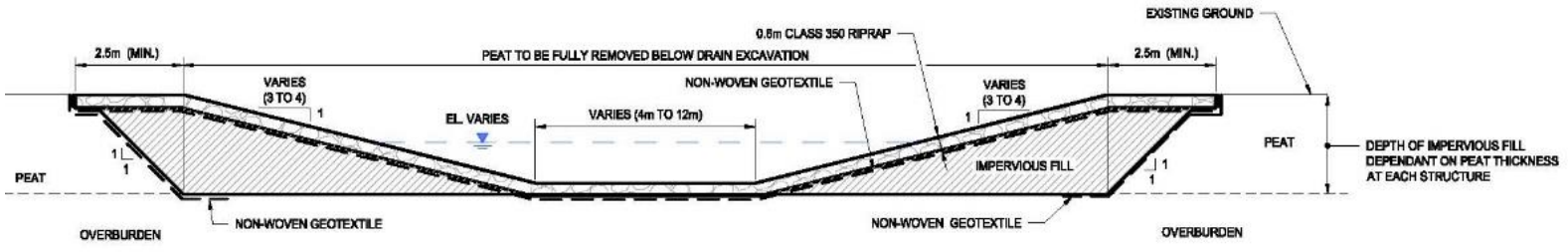
Figure 3C-24 Rockfill Gradient Control Structures





PROFILE



SECTION A-A

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Figure 3C-25 LSMOC Temporary Drainage Plan