Table of Contents

Abbreviations and Acronyms

EIS	environmental impact statement
EOC	emergency outlet channel
LAA	local assessment area
LMOC	Lake Manitoba outlet channel
LSMOC	Lake St. Martin outlet channel
NDVI	normalized difference vegetation index
PDA	project development area
RAA	regional assessment area

QUESTION IAAC-23

EIS Guideline Reference: 3.2. Project Activities; 7.1.4 Groundwater and Surface Water

EIS Reference: 6.4.4 Assessment of Residual Environmental Effects on Groundwater; 6.4.6 Project Interactions with Surface Water Environment; 6.4.7. Assessment of Residual Environmental Effects on Surface Water

Context and Rationale

The EIS Guidelines require the proponent to present information to support its assessment of potential changes from the project to wetlands and water quality and quantity, and associated environmental effects.

The EIS notes the LSMOC will pass through the Buffalo Lake wetland and states that effects to the wetland are difficult to determine. Information presented in the EIS appears to be contradictory, making it difficult to assess the effects of the LSMOC on the surrounding wetlands. For example, the EIS concludes that changes in water level caused by the LSMOC on the wetland in proximity to the channel are expected to be similar in distance from the channel as effects from the EOC (i.e., 1600 m); that the effects of the LSMOC would be different than the effects of the EOC due to complexity of hydrology in the wetland area; and that the effects of the LSMOC would be of lesser magnitude than the effects of the EOC because the LSMOC will be constructed and operated with considerations for drainage and wetlands connectivity.

The EIS notes the uncertainty in the effects of the LSMOC on surface water runoff, given that surface water does not flow uniformly through wetlands. The EIS states that the construction and operation of the LSMOC does not physically alter the drainage areas but the location of the LSMOC intercepts drainage from the south and east of the channel to the Buffalo Creek system. The effects of this interception are uncertain. The EIS states that mitigation measures, such as the adjustment of flows, will be applied, but does not provide details on the likely mitigation measures or their anticipated effectiveness.

Further information is required to support an understanding of the potential changes from the Project to wetlands and water, related to the interaction of the LSMOC and Buffalo Lake, and associated effects to the environment.

Information Requests

a) Clarify the potential effects of the construction and operation of the LSMOC on groundwater and surface water interactions, groundwater and surface water quality and quantity, wetlands. Compare these to the effects to water quality and quantity as well as wetlands of the EOC, including details of anticipated similarities, differences, and mitigation. Present analysis and modelling data, where available, to support conclusions drawn and confirm if the changes in water level caused by the LSMOC on the wetland in proximity to the channel are expected to be similar to EOC.

Question IAAC-23

b) Provide details of the follow-up program to confirm the predictions in the EIS regarding changes to the surface water levels in the project development area (PDA) and the affected wetlands in the local assessment area (LAA) and regional assessment area (RAA).

Response IAAC-23

a) The assessment of effects of the Lake St. Martin Outlet Channel (LSMOC) on groundwater and surface water interactions is explained in two parts:

1. Effect of LSMOC on the surface water in the Buffalo Creek system; and

2. Effect of LSMOC on the wetlands adjacent to the LSMOC.

Each assessment of effects is described below.

1) Effect of LSMOC on the surface water in the Buffalo Creek system

The construction and operation of the LSMOC intercepts drainage from the south and east of the channel to the Buffalo Creek system. The Buffalo Creek system is complex, likely fed by both surface and groundwater upwelling. Surface water runoff in a wetland does not flow uniformly; therefore, effects cannot be predicted using typical approaches of measurement of drainage area and flow analysis as was done with the Birch Creek and Watchorn Creek drainage areas to examine the effects of the Lake Manitoba Outlet Channel (LMOC). In addition, Big Buffalo Lake may be supported by limited upward groundwater seepage from the underlying bedrock aquifer, thereby supplying Buffalo Creek with additional water that is difficult to measure and quantify.

Although the construction and operation of the LSMOC will likely cause a reduction in flows, quantification of effects to flows in the Buffalo Creek system (from both changes in groundwater discharge to the surface and flow through the wetlands) cannot be predicted with a high degree of confidence before construction is complete. The amount of flows would need to be determined based on concurrent studies of flows, wetland hydrology and fish habitat to determine the need for and optimization of the mitigation. The emergency outlet channel (EOC) will not be operated for flood control after the construction of the LSMOC. Repurposing of the EOC to allow additional flows to the Buffalo Lakes and Buffalo Creek from Lake St. Martin could potentially replace any flows lost from interception of wetland flows to the creek. Repurposing the EOC is not being considered as an option at this time, but may be considered as a potential option under the *Fisheries Act* Authorization process.

2) *Effect of LSMOC on the wetlands adjacent to the LSMOC*

Along the LSMOC, there is no obvious existing drainage network. The assessment of potential catchment area changes in response to the LSMOC construction included an empirical analysis of effects associated with the EOC. The EOC was constructed in the same wetlands complex within the region of the LSMOC. A comparison of vegetation conditions before and after construction of the EOC was done using satellite imagery and a normalized difference vegetation index (NDVI)

analysis (see Figure IAAC-23-1). The analysis compared changes in light reflectance as a measure of plant health and suggested that effects to soil drainage/wetness (using vegetation as a proxy) along the EOC have extended perpendicular to the EOC up to a maximum of 1,600 m upgradient and a maximum 600 m downgradient (these were maximum extents of apparent effects). The areas with darker red noted on Figure IAAC-23-1 are where the vegetation has been affected by the EOC. Although the effect did extend up to a maximum of 1600 m generally, the effects were less than 300 m perpendicular to the EOC. The 1,600 m effect is likely caused by backwater effects from the channel blocking the flow in the wetland causing higher water level and therefore impacting vegetation. These effects due to the presence of the EOC were not mitigated by the design of the EOC because the EOC has no outside drain on the upstream gradient.

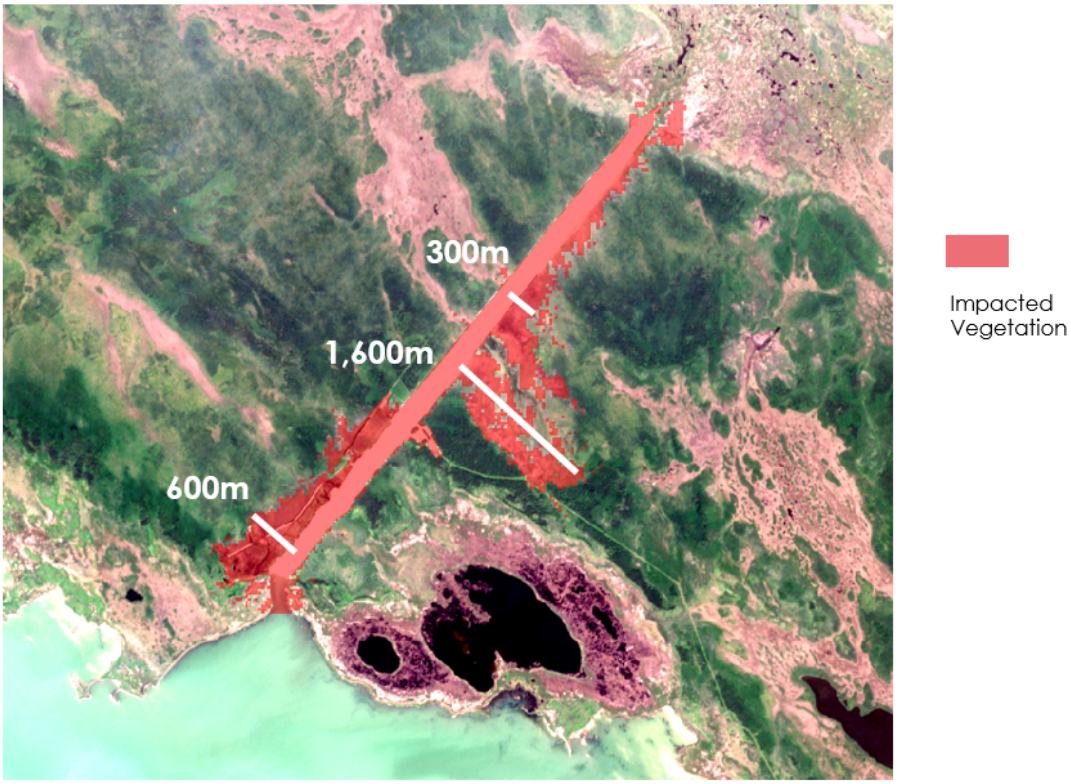

Figure IAAC-23-1 A Comparison of Vegetation Conditions before and after Construction of the EOC using a Normalized Vegetation Index (NDVI) Analysis

The outside drainage that will be designed and built for the LSMOC will prevent a “backwater” effect in the wetland. (see Volume 1, Section 3.4.3.9 Drainage Realignment in the Project Description of the environmental impact statement (EIS) for a description of the outside drain) The drain will maintain water level at natural levels and discharge excess water into the LSMOC. These drainage channels are anticipated to mitigate potential effects associated with "wetting-up" of soils on the upgradient side of the channels. Therefore, the 1,600 m upgradient extent of effects on the EOC are not anticipated to occur on LSMOC and are anticipated to occur over a reduced

distance perpendicular to the channels. The design of a drainage system (i.e., outside drain), will lessen the larger effects seen on the EOC, which had no pre-engineered drainage system. It is anticipated that the larger effects greater than 500 m can be eliminated. For the LSMOC, an upgradient distance of 500 m is considered a conservative estimate considering the implementation of mitigation.

The experience of the EOC indicated that most of the area along the channel is affected for much less than 500 m and often there appears to be no effect immediately adjacent to the EOC (see Figure IAAC-23-1). The total estimated area of effects to LSMOC (1000 m x 24,000 m = 2,400 ha), assumes the entire length of the channels will be affected on both sides to a distance of 500 m perpendicular to the channels. As confidence in this estimate is not high, the conservative estimate, assuming continuous 500 m effects on both sides of the LSMOC for the entire length, has been used.

b) Groundwater and Surface Water Management plans are being developed that will identify the monitoring of water levels in the wetlands and aquifers in the area. The results of monitoring will inform whether additional mitigation is required and then whether the mitigation is effective. Additional wetland surveys may be conducted to further characterize wetlands potentially affected by the Project. The need for further surveys will be determined following release of regulatory requirements.