

**LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT
RESPONSE TO IAAC TECHNICAL INFORMATION REQUESTS**

Question IAAC-24

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Abbreviations and Acronyms

EIS	environmental impact statement
IAAC	Impact Assessment Agency of Canada
LMOC	Lake Manitoba outlet channel
LSMOC	Lake St. Martin outlet channel
PDA	project development area
VCs	valued components

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EIS Guideline Reference: 7.1.4 Groundwater and Surface Water; 7.2.2 Changes to groundwater, surface water and fluvial morphology

EIS Reference: 6.4.2. Project Interactions with Groundwater; 6.4.4. Assessment of Residual Environmental Effects on Groundwater

Context and Rationale

The EIS Guidelines require the proponent to include current baseline information in sufficient detail to identify how the project could affect VCs and provide an analysis of those effects. The EIS guidelines require the proponent to present information to support the assessment of effects related to changes in quantity of groundwater discharging to surface water.

Section 6.4.2.2 of the EIS states that ground water flow radiates out from uplands in all direction towards major lakes and that the aquifer likely discharges into surface water bodies, including Lake Manitoba, Lake St. Martin and Lake Winnipeg.

Regarding the LSMOC, there is potential for a change in groundwater discharge rates to the lakes and small wetlands in the Birch Creek drainage system due to proximity to the LMOC. This change would be related to a reduction in groundwater elevations in the underlying till due to either a lateral connection to the LMOC, or a lowering of the bedrock artesian pressure.

Prediction of bedrock drawdown related to the construction of the LMOC does not include the prediction of pressure reduction within the till unit. Without this information it is not possible to assess potential changes in groundwater discharging to surface water.

The Birch Creek drainage system is in close proximity to the LMOC, however the potential for groundwater surface water interactions within this drainage system is not discussed. Without characterization of these interactions on this drainage system it is not possible to evaluate potential changes resulting from the long term operation (and associated groundwater depressurization) for the LMOC.

Regarding the LSMOC, any changes in the quantity of groundwater discharging to surface water should also be assessed. Drop structures at the outlet end of the LSMOC will expose bedrock under artesian pressure in an area with known spring discharge. Insufficient information has been provided to assess potential changes to spring discharge or groundwater levels in the bedrock aquifer related to construction and long term operation of the LSMOC.

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Information Requests

- a) Regarding the LMOC, provide an assessment of changes in groundwater discharge to surface water that accounts for reductions in groundwater elevations within the till as a result of lowering of groundwater pressures within the bedrock.
 - i. Discuss potential for groundwater surface water interactions for the small lakes along the Birch Creek drainage system and wetlands near the LSMOC. This discussion should include an approximation of lake depth, overburden thickness, and potential seasonal variability in surface water levels as they relate to the potential for groundwater discharge.
- b) Regarding the LSMOC, complete an assessment of the reduction in groundwater elevations associated with the construction and operation of the LSMOC. The assessment should include a discussion of potential changes in the quantity of groundwater discharging to surface water. The assessment should include:
 - i. A cross-section showing bedrock topography, overburden stratigraphy, channel inverts, channel operation levels, and groundwater elevations required for construction and operation.
 - ii. An assessment of the hydraulic conductivity of the bedrock aquifer
 - iii. An assessment of the groundwater elevations within the bedrock aquifer
 - iv. A map showing the locations of spring discharge and the associated extent of groundwater drawdown resulting from the construction and operation of the LSMOC.

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- a) On May 7, 2020, the Impact Assessment Agency of Canada (IAAC) clarified that the request for IAAC-24 a) i. was meant for the Lake Manitoba Outlet Channel (LMOC) only and not for Lake St. Martin Outlet Channel (LSMOC). An assessment of water level changes in nearby surface water features is discussed in the environmental impact statement (EIS) Volume 2, Section 6.4.4.3 Changes in Local Groundwater/Surface Water interactions and also in Section 2.3.2.2 of the Surface Water Study Report (KGS 2017). The glacial till soils underlying LMOC, which is generally greater than 15 m in thickness, function as a barrier (i.e., confining layer), limiting upward seepage or discharge to surface water from the underlying artesian bedrock aquifer. The report concluded that the low permeability till beneath the wetland (i.e. lakes and small wetlands along Birch Creek) limits or precludes water level changes due to any groundwater piezometric pressure drawdown in the bedrock aquifer in response to channel construction or operations.
 - i. Maps of overburden thickness along the LMOC are provided within the Regional Geological Setting Report (Deliverable D5 – KGS 2017). Plate D5-9 shows overburden thickness, beneath the lakes along Birch Creek, which is interpreted to be in the range of 8 to 20 m. As discussed above, the low permeability till beneath the small lakes along the Birch Creek drainage system

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should limit or preclude surface water level changes in response to groundwater control measures within the bedrock during channel construction or operations.

In addition, a groundwater pumping test was done and determined the reaction of pressure in the till in the vicinity of the wetlands near the LMOC. Deliverable D5 – KGS 2017 (page 39) states “Although the bedrock pumping well produced a drawdown of 10.6 m in the bedrock observation well ED-01P, drawdown in upper and lower vibrating wires installed in the till at ED-01 P (not shown on the plot) had a negligible response, indicating that a minimal amount of leakage through the till if any would be anticipated during pumping of the bedrock aquifer.”

- b) No hydrogeological information was available within the LSMOC project development area (PDA) prior to the EIS filing in August 2019. In order to complete the assessment of groundwater at the LSMOC, different information was used to assess how potential changes in groundwater elevation and flow patterns from the Project would affect other valued components (VCs) directly. The integrated effects of changes in groundwater levels and flows were assessed for both construction and operation. See response to IAAC 21 and 23 for discussion on how groundwater was assessed in the EIS in the region of the LSMOC.

In 2019 and 2020, a geotechnical and hydrogeological field investigation program was initiated within the LSMOC PDA by KGS Group (KGS) as part of the Preliminary Design field study phase of the Project. Technical reporting for these investigations is in progress; as such, these data are not yet available for analysis and interpretation. However, this information will be used in developing groundwater and surface water monitoring programs and management plans when fully available.

For the purposes of assessing the potential effects of groundwater control measures within the LSMOC PDA, hydrogeological parameters within the LSMOC PDA were considered to be similar to those observed within the LMOC PDA. The glacial till soils, that are known to confine the bedrock aquifer within the LMOC, are expected to be regionally extensive and extend along most of the LSMOC PDA, however, there is still potential for construction to intersect the bedrock below the channel. In areas away from the channel and outside the PDA, the till is thin and seepage into the aquifer (i.e., recharge zones) does occur, however these areas will not be disturbed as part of channel excavation. Groundwater pressures are expected to be flowing upwards from the bedrock towards the surface in the region of the LSMOC. This was illustrated in the existing regional groundwater description shown in Volume 2, Figure 6.4B-3 of the EIS. This upward pressure will preclude contamination of the aquifer from contamination from surface water during and after construction. A groundwater management plan will be developed to ensure groundwater is monitored and protected during preconstruction, construction and operation of the LSMOC.

The following provides specific responses to (i) to (iv).

- i. A hydrogeological cross-section along the LSMOC PDA is not currently available. No hydrogeological information was available within the LSMOC PDA prior to the EIS filing in August 2019. In 2019 and 2020, a geotechnical and hydrogeological field investigation program was initiated within the LSMOC PDA by KGS as part of the Preliminary Design field study



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phase of the Project. Technical reporting for these investigations is in progress; as such, these data are not yet available for analysis and interpretation. However, this information will be used in developing a groundwater management plan when fully available.

- ii. Following on the discussion provided above, in (i), regarding the lack of hydrogeological field study data availability along the LSMOC, no hydraulic conductivity information is currently available for the bedrock aquifer.
- iii. Following on the discussion provided above, in (i) regarding the lack of hydrogeological field study data availability along the LSMOC, no groundwater elevation information is currently available for the bedrock aquifer.
- iv. The EIS states in Volume 2, on page 6.151 that "Bedrock topography is such that groundwater seepage to surface is likely where surficial till is very thin; typical artesian groundwater spring sites occur where ground surface slope is relatively steep, near Lake Winnipeg, generally along the 240 m asl contour line (Volume 2, Appendix 6B, Figure 6.4B-3). Near the northeast part of the LSMOC, groundwater discharges through springs and to Lake Winnipeg as well."

Regarding potential impacts on springs, the EIS states in Volume 2, Section 6.4.4.3 Changes in Local Groundwater/Surface Water interactions that "Bedrock surface is shallow at the proposed location of the most upstream drop structure, to a point that the carbonate aquifer might be exposed to surface (referred to as daylighting; Volume 2, Appendix 6B, Figure 6.4B- 6). Hydraulic head at this location is at a higher elevation than the channel invert. Consequently, artesian pressure will be relieved at this location, locally depressurizing the carbonate aquifer. The depressurization zone of influence will expand over a limited distance, centered on the artificially created groundwater discharge. Based on hydrogeological conditions, springs are likely present in that general area. Provided that depressurization is expanding to the point of reaching a spring originating from the carbonate aquifer, the flow of this spring could decrease; the closer the spring, the greater the flow could decrease." (EIS Volume 2, p. 6.165).

Following on the discussion provided above, in (i), regarding the lack of hydrogeological field study data availability along the LSMOC, no further information on the location of springs and the extent of groundwater drawdown (in response to the LSMOC construction and operation) is currently available.

References

KGS Group Consulting Engineers. May 2017. Investigations and Preliminary Engineering for LMB Outlet Channels Options C and D Summary Report. Appendix B – Deliverable D5. Regional Geological Setting.

KGS Group Consulting Engineers. May 2017. Investigations and Preliminary Engineering for LMB Outlet Channels Options C and D Summary Report. Appendix C – Deliverable D6. Groundwater Study.

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KGS Group Consulting Engineers. May 2017. Investigations and Preliminary Engineering for LMB Outlet Channels Options C and D Summary Report. Appendix D – Deliverable D7. Surface Water Study.