

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

Question IAAC-28a

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Abbreviations and Acronyms

EIS	environmental impact statement
EPP	environmental protection plan
GUDI	groundwater under direct influence
GWMP	groundwater management plan
LAA	local assessment area
LMOC	Lake Manitoba outlet channel
LSMOC	Lake St. Martin outlet channel
m asl	meters above sea level
PER	Project Environmental Requirement
ROW	right-of-way

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EIS Guideline Reference: 7.1.4 Groundwater and Surface Water; 7.2.2 Predicted Changes to Groundwater; 9.2 Monitoring

EIS Reference: 6.4.4 Assessment of Residual Environmental Effects on Groundwater; 12.4. Groundwater and Surface Water

Context and Rationale

The EIS guidelines require the proponent to present information on the potential effects of the Project on groundwater, including associated effects to drinking water quantity.

Section 6.4.4.2 of the EIS states that the maximum potential for drawdown at drinking water wells will be less than 3 m, which is within the seasonal variability of water levels in the area. It is then concluded, based on these results, that the Project would have no impact on domestic well operation during the construction phase of the project. This conclusion is based on the assumption that all drinking water supply wells have greater than 3 m of available drawdown during dry periods of the year. No supporting evidence has been provided to demonstrate that available drawdown is sufficient to handle drawdown during the construction phase. If available drawdown is not sufficient, drinking water wells may go dry during the construction phase.

Additionally, as shown on Figure 6.4B-5, many domestic wells are within the three km buffer surrounding the LMOC. These wells may experience more than three m of drawdown based on the results provided on Plate D6-5, of Deliverable 6 (KGS, 2017a).

Regarding groundwater quantity throughout all phases of the project, the EIS does not contain sufficient information on the alignment of the LSMOC to adequately assess potential impacts on groundwater. With respect to the LMOC, the EIS states that there is potential for perpetual passive dewatering north of the control structure. The EIS states that the associated drawdown would be lower than during the construction phase, and within the ROW for the LMOC. The required groundwater elevations during the operations phase are not provided on KGS 2017a Deliverable D5, Plate D5-10. Details on the assessment of drawdown extent associated with this passive dewatering are not provided in KGS 2017a. The information provided is not sufficient to confirm that the long-term passive dewatering will not affect drinking water wells.

In Section 6.4.4.2, the EIS states that the surficial aquifer is not suitable for drinking water purposes because it is too shallow, but the overall quantity is enough to provide water to wetlands in the LSMOC area (page 6.151). The proponent has committed to conducting further aquifer investigation and modelling to determine the effect of construction dewatering on specific private wells in the potentially affected area of the LMOC. The proponent also stated that observation wells will be installed prior to construction dewatering to monitor the effects in the area during dewatering of each section during construction.

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An outline of the monitoring plan should be included in the EIS. This outline should include a description of monitoring locations where foreseeable. This information is not provided in Section 12.4.1.4.

This information is required to evaluate the potential for the Project to interact with groundwater that may be used as drinking water and to determine requirements for mitigation.

Information Requests

- a) Discuss the likely available drawdown for domestic wells within the LAA for the LMOC. Provide updated figures that show the predicted drawdown contours based on the modeling.
- b) Provide an assessment of potential risks to the confined carbonate aquifer (a potential source for drinking water) and possible mitigation measures to minimize the potential for contamination to influence the water quality of the aquifer.
- c) Discuss the feasibility of drilling new (deeper) groundwater wells in terms of the potential depth required, and the potential quality and quantity of water at this greater depth.
- d) Include an analytical assessment of groundwater drawdown associated with the passive dewatering during the operations phase of the project. The assessment should be completed for steady-state conditions, and should consider the potential range in required drawdown based on the range in operating levels in the LMOC.
- e) Provide details of the additional investigations and modelling proposed for the Groundwater Management Plan. Include information on groundwater wells to be used in the follow-up program to monitor the effects on groundwater quality. Include a discussion of likely groundwater level monitoring locations, and depth interval. The discussion should also include the intended purpose of the monitoring location.

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- a) The environmental impact statement (EIS) states that wells within 3 to 5 km of the Lake Manitoba outlet channel (LMOC) may be impacted and may need to be mitigated. The EIS discusses this in EIS Volume 2, Section 6.4.4.2 Changes in Local Groundwater Flows, Levels and Quality (pg. 6.157) as “At the channel, the drawdown would be about 14 m, reducing to a drawdown of 1.5 m to 3.3 m at the 3 km distance from the segments of the channel being depressurized. It will further decrease to an estimated 0.9 m to 2.7 m at 5 km distance.”

The required mitigation, as stated in Volume 2 on page 6.161 could include:

- Domestic wells
 - lower existing pump if feasible or necessary
 - supply new pumps if needed

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- drill new wells if needed
- provide water tanks to affected well users
- Artesian livestock water wells
 - bring water from construction dewatering pumps to dugouts, supplied by pressure relief artesian wells”

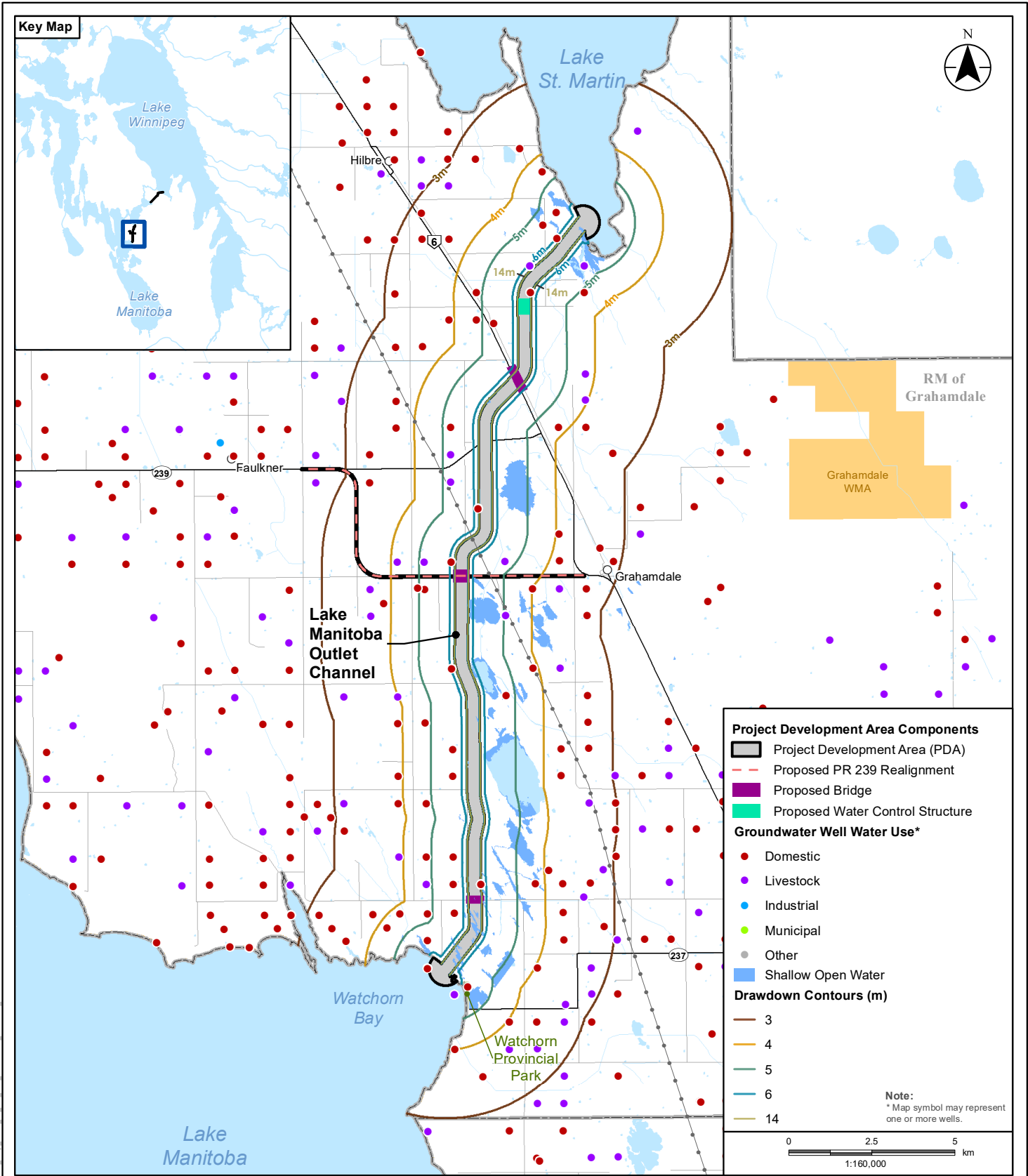
The available drawdown at domestic wells are not available at this time and will be determined in the Engineering phase and discussed with landowners (see (e) below). The expected drawdown contours of effects of the Project on groundwater during construction are shown on Map 28-1. Note that construction will take place in stages along the channel and each stage will create a single drawdown contour so the effects are not occurring simultaneously away from the entire channel. Areas of active construction along the LMOC will have a 3-5 km drawdown around it. The contours shown are the overlapping effects of each of the construction dewatering stages. The details of construction staging are not currently known.

The confined carbonate aquifer is artesian and will consistently remain artesian throughout temporary construction and long-term operation of the LMOC. The siting of the LMOC was selected to prevent Groundwater Under Direct Influence (GUDI) conditions within water wells local to the LMOC. This is discussed in the EIS in Volume 1, Section 2.4.2 Alternative Means of Carrying Out the Project. The selection of the route for the LMOC was the major mitigation measure to protect groundwater quality. Since the upward hydraulic gradient condition will exist along the channel, the potential risk of adversely affecting the bedrock groundwater quality is highly unlikely.

The Environmental Protection Plan (EPP), Project Environmental Requirements (PERs), Waste Management Plan, Construction Decommissioning Plan, Hazardous Materials Management Plan and Emergency Response Plan will include mitigation measures that will protect groundwater and surface water resources, and mitigation measures specific to the protection of groundwater. There will also be a feedback loop whereby monitoring will facilitate the determination of the effectiveness of the mitigation measures and need for additional procedures. The response provided to IAAC-15 (part b) and Section 3.7.2 Construction Environmental Management Program of the EIS discusses the process and measures.

The greatest potential threat to creating GUDI conditions at local domestic water supply wells is flooding conditions at ground surface without the Project. The goal of the LMOC is to minimize that potential.

The carbonate aquifer at the Lake St. Martin outlet channel (LSMOC) is expected to remain artesian during non-active operational conditions. A baseflow is expected to discharge from the aquifer to the channel; the LSMOC design will be optimized to maintain this. If there is short term inflow into the aquifer during active operation of the LSMOC, it will be flushed out during the non-active operational conditions. The nearest domestic wells are located 5 to 6 km away from the LSMOC and will not be affected.



Project Development Area Components

- Project Development Area (PDA)
- Proposed PR 239 Realignment
- Proposed Bridge
- Proposed Water Control Structure

Groundwater Well Water Use*

- Domestic
- Livestock
- Industrial
- Municipal
- Other
- Shallow Open Water

Drawdown Contours (m)

- 3
- 4
- 5
- 6
- 14

Note:
* Map symbol may represent one or more wells.

0 2.5 5 km
1:160,000

- Legend**
- Existing Transmission Line
 - Provincial Highway (PTH/PR)
 - Municipal Road
 - Wildlife Management Area
 - Provincial Park
 - Rural Municipality

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Governments of Manitoba and Canada, Manitoba Infrastructure
3. Last Update: 5/5/2020 9:59:52 AM



MANITOBA INFRASTRUCTURE
Lake Manitoba & Lake St. Martin Outlet Channels Project
Environmental Impact Statement

**Extent of Draw Down Contours
During Construction of the LMO**

DRAFT IR Map 28-1

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- b) If supply from a groundwater well is interrupted by the LMOC construction or operation, drilling a new (deeper) groundwater well is the likely long-term mitigation measure or supplying water by truck in the short-term. Groundwater quality within the bedrock aquifer is suitable for drinking purposes. There is no expectation that this condition will change, considering the pressure within the bedrock aquifer in the Project area.

There are no drinking water wells in proximity of the LSMOC.

- c) There is a high potential that passive depressurization would occur at, and north of, the LMOC control structure due to the relatively thin cover of till over the bedrock. However, to prevent basal heave (uplift of the till) along the bottom of the channel, depressurization could occur along the length of the LMOC. The depressurization zone of influence in the bedrock associated with passive depressurization is expected to be similar to that encountered during construction. According to the analytical modelling results (KGS 2017, Appendix C Deliverable D6) the lateral extent of the dewatering zone of influence is most sensitive to the transmissivity of the aquifer (i.e., low sensitivity to the depth of drawdown). Therefore, the dewatering zone of influence associated with long term depressurization should be considered consistent with the analyses shown on Plate D6-5 of the Groundwater Study (KGS 2017) and shown on Map 28-1. The drawdown at the channel would be within the range of the channel operation of 245 m asl (Lake St. Martin elevation) to 248 m asl (Lake Manitoba elevation). Drawdown estimates during construction at the channel are estimated at 2.5 m to 13 m depending on the current bedrock groundwater piezometric pressure elevation. During operation, slightly less drawdown is estimated from between approximately 1 to 11 m, with the most drawdown in the areas of highest artesian pressures as shown in Deliverable D-5 Plate D5-10.

If there is no passive depressurization along some reaches of the channel, then the drawdown contours in the bedrock will be less than shown in Map 28-1; however, there will be a drawdown in the surficial aquifer near the channel. Effects on surficial geology (soils and till) will occur due to improved drainage around the LMOC. Effects are expected to remain within the right-of-way (ROW) of the channels.

- d) The Groundwater Management Plans (GWMPs) in Preliminary Engineering Design programs for the LMOC and LSMOC will be supported by additional drilling to define the thickness and strength of the till. Monitoring of piezometric levels and further pump tests will be performed to estimate aquifer parameters.

For the LMOC, additional work on design of potential passive depressurization systems will be developed to reduce the risk of basal heave. Groundwater modelling using the additional understanding of the geology and hydrogeology will be undertaken to design the passive systems and can be used to update the impact on the aquifer in general and on local wells. Both short term (construction) and long term (passive depressurization) effects will be further refined and information shared with the community. Manitoba Infrastructure is working to contact landowners to inquire about their groundwater use (i.e., location of wells) and their concerns about the Project. The specific details of the monitoring plan will be worked out during engineering design prior to construction through

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engagement with local landowners. Results of updated modelling will be shared with the public at that time. Some key objectives of the groundwater monitoring program, as part of the GWMP, and general locations on monitoring are discussed below:

- Monitoring of groundwater levels and quality will continue near the Project. Approximately four groundwater quality and four groundwater elevation monitoring locations will be located within the ROW near the project.
- Wells will be located away from the Project in the areas near local well users. Locations and numbers of wells will be determined in consultation with the landowners. These wells will monitor water quality and/or pressure head.
- Wells will be located to determine water levels (heads) near the wetlands along Birch Creek in the bedrock and in the till.
- Some domestic wells will be monitored for water quality.

For the LSMOC, the design will be optimized to limit the risk of surface water entering the aquifer or high groundwater pressure impacting water control structure stability. Wells to monitor groundwater elevations and quality will be located in proximity to the Project. Sentinel wells will monitor groundwater quality within the Dauphin River First Nation (see Volume 2, Map 6.4B-6 in the EIS) community located approximately 6 km northeast of the LSMOC.

The groundwater monitoring program will occur prior to construction, during construction and post construction (during active and nonactive use of the LMOC and LSMOC).

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.

KGS Group Consulting Engineers. May 2017. Investigations and Preliminary Engineering for LMB Outlet Channels Options C and D Summary Report Appendix E. Geotechnical Investigations and Analyses (Deliverable D8)