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Abbreviations and Acronyms

AEMP	Aquatic Effects Monitoring Plan
DMP	Debris Management Plan
EIS	environmental impact statement
EMP	Environmental Management Program
EOC	emergency outlet channel
ESCP	Erosion and Sediment Control Plan
LAA	local assessment area
LMOC	Lake Manitoba outlet channel
LSMOC	Lake St. Martin outlet channel
RAA	regional assessment area
SMP	Sediment Management Plan
TSS	total suspended solids

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EIS Guideline Reference: 7.1.3 Topography and Soil; 7.2.2 Changes to groundwater, surface water, and fluvial geomorphology; 7.3.1 Fish and Fish Habitat

EIS Reference: 3.5.2.13 Revegetation

Context and Rationale

Section 7.1.3 of the EIS guidelines requires the proponent to identify potential for soil instability and erosion as a result of the Project. In addition, Section 7.2.2 requires the proponent to consider the predicted changes to surface water quality as a result of erosion and sedimentation, and Section 7.3.1 requires the identification of potential adverse effects to fish and fish habitat, including as a result of water quality and sediment quality changes from storing water in and releasing water from the channels.

Section 3.5.2.13 of the EIS states that revegetation is required to mitigate the potential for surface water erosion, and that revegetation activities will include test plots using varying soil thickness and soil amendments that are being installed in the Project region and monitored over the summer of 2019 in order to optimize vegetation growth on the channel slopes. The EIS also indicates that Erosion and Sediment control plans for the channels will be developed and will include information on revegetation.

Further information on potential erosion rates under maximum flow conditions is required to assess the effects of the Project on fish and fish habitat.

Information Requests

a) Provide information on potential erosion rates under maximum flow conditions, and the potential effects of erosion to fish and fish habitat.

b) Describe associated mitigation measures, including a discussion of the effectiveness informed by the test plot studies, and assess significance of residual effects to fish and fish habitat.

c) Discuss associated monitoring and follow up.

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a) The release and transport of sediment is a natural process in all fluvial and lacustrine systems and has occurred historically, and is currently ongoing, in Lake Manitoba, Fairford River, Lake St. Martin, Dauphin River and Sturgeon Bay. During flood events in natural systems, especially during extreme events, erosion and associated suspended sediments are typically substantially higher than during non-flood conditions, as areas that have remained dry for long periods are exposed to wetting and erosive forces. Once constructed, the Lake Manitoba Outlet Channel (LMOC) and the Lake St. Martin Outlet Channel (LSMOC) will reduce water levels during flood events and, therefore, will reduce the erosive forces related to the release and transport of sediment in these waterbodies during those

events. While the relatively temporary release and transport of some sediment from construction activities, such as excavation of the outlet channels, is unavoidable, the channels are being designed and constructed to minimize the release and transport of sediment during operation and the potential effects to fish and fish habitat. Project planning also includes mitigation measures to reduce the release and transport of sediment during construction activities, such as the use of cofferdams to isolate in-water work areas, and installation of jetties at inlet and outlet areas to reduce sediment movements in these areas. Once in place, the channels will only operate during flood events to mitigate flood effects.

Release and transport of sediment may occur when the channels are in use during extreme floods; however, as stated above, release and transport of sediment is a natural process and would be expected to occur in the LMOC and LSMOC, similar to natural watercourses in the same drainage area. The amount of sediment sourced from the LMOC and LSMOC and released and transported to Lake St. Martin and Lake Winnipeg, respectively, is expected to be greatest during commissioning and then gradually decrease over time. However, total sediment outputs during commissioning are expected to be substantially less than the sediment outputs that were estimated to have occurred during operation of the emergency outlet channel (EOC) in 2011-2012 (8,900 m^3) and 2014-2015 (11,100 m^3), which represented 12-20% increases from inputs to Sturgeon Bay that would have occurred without the Project (KGS Group 2016). This is because the majority of the EOC was within the Buffalo Creek watershed and was not engineered to minimize erosion.

The LMOC and LSMOC are expected to contribute a substantially smaller percentage of sediment compared to the EOC. Operation of the EOC re-routed high flows that would have otherwise been conveyed by the Dauphin River, resulting in high flows through the Buffalo lakes and Buffalo Creek system. These flow volumes were unprecedented for this system and resulted in the erosion and transport of sediment and various large and small organic or woody debris (i.e., soil, peat, grasses, shrubs, trees) from these areas to Dauphin River and Sturgeon Bay. This effect will no longer occur because flows will be routed through the LMOC and LSMOC, and no high flows will be passed through the Buffalo lakes and Buffalo Creek system as part of the operation of the LMOC and LSMOC.

Without the Project, high flows would continue to pass through the Fairford River to Lake St. Martin and through the Dauphin River to Sturgeon Bay. With the Project, flows that cannot be conveyed by the rivers without flooding will be diverted through the constructed channels, while the remainder of the flows will continue to be conveyed by the rivers. This will reduce the runoff volumes conveyed by the rivers and therefore decrease erosion and transport of sediment to Lake St. Martin and Sturgeon Bay. This is because less flow will entrain and transport less sediment and debris. In addition, the outlet channels will be engineered to convey flow and minimize erosion, and the associated potential effects to fish and fish habitat.

b) The Project design will incorporate several features to specifically address potential erosion and sediment transport that could occur due to construction, operation, or maintenance activities. First, the outlet channels will primarily be excavated in the dry and will be designed to be non-erodible for the range of operating conditions that the channel is designed for (i.e., designed to prevent significant

movement of the bed material). Second, the Conceptual Designs include an examination of the channel configurations (e.g., gradient and cross-sectional geometry of the channel) required to convey design flows, while also minimizing erosion and sediment transport. The design concepts necessary to understand and minimize erosion and sediment transport are being examined and developed as the Preliminary Design and Detailed Design advances. These studies include examination of the maximum permissible shear stresses of *in-situ* material found at the Project site to determine the design shear stress for the channels and development of other erosion design criteria for the Project. Third, to address potential erosion and sediment transport at the channel inlet and outlet areas, rock-filled jetties are included as part of the design to reduce changes in shoreline geomorphology and help prevent erosion. Fourth, channel banks will be revegetated to increase bank stability and minimize erosion potential. Revegetation studies along the EOC (test plot studies) are ongoing. These studies will provide information on the appropriate seed mixes, soils and plant types that will optimize the effectiveness of measures to address soil stability along the channel slopes and reduce the potential for erosion in these areas. Specific areas deemed to be susceptible to erosion will be reinforced with rip rap. Finally, the contractor will employ mitigation and adaptive management measures, such as those described in Manitoba Infrastructure's Project Environmental Requirements (EIS Volume 1, Appendix 3F) during construction of the channels; during operation in flood events any increases in sediments from the channel would be less than current conditions.

Sediment inputs from the channels are not anticipated to be substantially different from those experienced during current conditions and are not expected to have a significant negative effect on fish and fish habitat. As mentioned above, this is because the channels will be used only during extreme floods and will only convey the excess flow that could not otherwise be conveyed by the Fairford and Dauphin rivers without flooding Lake St. Martin, and because the channels will be designed to include mitigation measures to minimize soil erosion and sediment transport. As a result, erosion and sediment transport to Lake St. Martin and Sturgeon Bay during extreme flood events is expected to be lower than what occurs under current conditions without the Project. Fish inhabiting Lake Manitoba, Lake St. Martin and Lake Winnipeg are adapted to living in turbid water conditions and, therefore, can tolerate a wide range of total suspended solids (TSS) concentrations. Should increases in TSS concentrations occur near point source introductions, it is expected that fish will be able to temporarily move out of these areas before appropriate mitigation or adaptive management is undertaken. Changes to TSS concentrations attributable to the Project within surrounding waterbodies are not expected to exceed guidelines during construction or operation of the channels due to the mitigation measures identified above.

Sediments introduced from the upstream lakes, rivers, and channels are expected to move rapidly through the system into Sturgeon Bay and eventually settle in the mid-basin of Lake Winnipeg. Effects to local habitat are expected to be short-term and negligible. Overall, the effects of sediment will extend to the regional assessment area (RAA); however, with mitigation, total inputs from the channels are expected to form a negligible percentage of total inputs to the main basin of Lake Winnipeg. Effects to fish and fish habitat from erosion and sediment deposition are not expected to be significant.

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c) Project monitoring and follow-up programs are being developed concurrently with the advancement of Project design to address any uncertainties in the assessment. The Project Environmental Management Program (EMP) describes the environmental management processes that will be followed during construction, operation, and maintenance (additional information on the Project EMP and associated environmental protection plans can be found in the response to IAAC-15). The EMP includes an Erosion and Sediment Control Plan (ESCP), a Sediment Management Plan (SMP) and a Debris Management Plan (DMP). The Aquatic Effects Monitoring Plan (AEMP) will contribute to confirming the predicted effects to fish resulting from sediment inputs. TSS concentrations in waterbodies within the local assessment area (LAA) will be monitored to determine the effectiveness of sediment and erosion mitigation. Monitoring of the benthic invertebrate community composition and density, and fish reproduction will provide evidence of potential effects to fish habitat. Monitoring of fish abundance will provide evidence of potential effects to fish populations. As noted in IAAC-39, the AEMP will be implemented at a frequency that will allow prompt implementation of additional mitigation and/or adaptive management, should it be necessary. It will establish objectives for mitigation and adaptive management, and triggers for implementation. The Aquatic Effects Monitoring Plan (AEMP) will be made available to the Fisheries and Oceans Canada for comment prior to its submission as part of the Application for *Fisheries Act* Authorization for the Project.

References

KGS Group. 2016. Lake St. Martin Emergency Relief Channel Monitoring and Development of Habitat Compensation. Physical Processes DRAFT / MIT-009-13_002_REV B. A report prepared by KGS Group for Manitoba Infrastructure and Transportation.13-0431-001 March 2016. 877 p