Red River Floodway Expansion Project

Notice of Project Alteration

December 2006

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1.0 Introduction

The Red River Floodway Expansion Project (the Project) was initiated to increase the level of flood protection provided to the City of Winnipeg and surrounding areas within the Red River Floodway. The Project was proposed to provide passage of a flood with a probability of being equaled or exceeded once in 700 years while maintaining the existing maximum water elevation of 237.13 m (778 ft) at the Floodway entrance. The design flow within the floodway channel to pass the 1-in-700 flood event was determined to be 3,960 m^3/s (140,000 cfs). An optimization process was used to determine the most efficient and cost effective expansion geometry, with consideration of the impacts on the bridges and other infrastructure. The Project definition also included consideration of activities that would provide added value without significantly affecting the efficiency or cost effectiveness. The result was a Project design that achieved the required hydraulic capacity through a combination of channel widening and modifying the bridges that cross the floodway channel. This design would have included the modification or replacement of 6 highway bridges and 6 railway bridges.

In view of the financial contribution by Canada to the Project and the need for federal departments to approve actions for the purpose of enabling the Project to be carried out, the expansion of the Red River Floodway is a “Project” under the *Canadian Environmental Assessment Act* (CEAA). The Floodway Expansion is also a “Development” that requires a Licence pursuant to *The Environment Act.* The Manitoba Floodway Authority undertook an iterative preliminary design and environmental assessment program that involved stakeholder input to each iteration.

A Proposal was filed on July 28, 2003, and the Environmental Impact Statement (EIS) filed on August 3, 2004. The environmental assessment of the Project was coordinated by Canada and Manitoba through a cooperative assessment process under the provisions of *The Canada-Manitoba Agreement on Environmental Assessment Cooperation*. Following a public hearing by the Manitoba Clean Environment Commission (CEC) and the provision of additional information, the federal Responsible Authorities released the Screening Report prepared pursuant to section 18 of CEAA dated May, 2005. After taking into consideration the Screening Report and the comments filed by the public, the Responsible Authorities determined that the Project was not likely to cause significant adverse environmental effects taking into account the implementation of mitigation measures identified in the Screening Report. After considering the Proposal, EIS, additional information, and the CEC report, the Minister responsible for *The Environment Act* issued Environment Act Licence No. 2691.

The Project as assessed, in addition to the widening of the main channel and works to the 12 bridges, included upgrades to the Inlet Control Structure;

replacement of the Outlet Structure; alterations to the existing utility crossings; and enhancements to the West Dyke.

Due to an escalation of construction costs, the project optimization and added value components were reconsidered. As a result of the project re-evaluation process, the components of the Project were recently revised to include greater emphasis on channel widening and less emphasis on bridge construction. The design hydraulic capacity of 3,960 m^3/s while maintaining an inlet elevation 237.13m remains the primary design criterion. This design objective will be achieved without the modification and reconstruction of the following 4 highway bridges and 2 railway bridges as part of the floodway expansion project: St. Mary's Road Bridge; Greater Winnipeg Water District (GWWD) Railway Bridge; PTH 15 Bridge; PTH 59 North Bridge; CEMR Pine Falls Railway Bridge; and the PTH 44 Bridge.

This Notice of Alteration and supporting environmental assessment are made pursuant to Section 14(1) of *The Environment Act* and to provide the federal Responsible Authorities with additional environmental assessment to consider along with the May 2005 Screening Report to take actions pursuant to Sections 24(1) and 24(2) of the *Canadian Environmental Assessment Act.* The Project Alteration only involves changes within the Floodway Main Channel and will not change the design capacity of the Project nor require additional permits pursuant to the *Navigable Waters Protection Act* or the *Fisheries Act.*

2.0 Project Alteration

An overview of the Project components as provided in the EIS and subsequent submissions was considered in the environment assessment processes. Table 1 describes the nature of the Project Alteration.

Table 1: Scope of the Alteration

Project Element	August 3, 2004 EIS	December 2006 Alteration
Channel Widening	• Widening of channel in varying amounts up to as much as 110 m (350 ft) • Excavation of approximately 20,900,000 m^3 (27,300,000 yd^3)	• Widening of channel in varying amounts up to as much as 110 m (350 ft). • Alteration to increase areas of widening increased between stations o 19+610 to 20+780 o 22+150 to 25+650 o 35+000 to outlet • Excavation of approximately 23,500,000 m^3 (30,600,000 $yd^{3)}$
Restoration/Armouring of the Low Flow Channel	• Infill of previously eroded zones • Placement of riprap protection	• No Project alteration • No Project alteration

Grande Pointe Gap	• Removal of approximately 400 m of embankment to prairie level of 235m (771 ft)	• No Project alteration
St. Mary's Road Bridge	Replacement (raising)	Alter to leave as is
CPR Emerson Bridge	Replacement (raising and channel widening)	No Project alteration
PTH 59 South Bridge	Replacement (raising and channel widening)	No Project alteration
CNR Sprague Bridge	Modification (raising and channel widening)	No Project alteration
TransCanada Highway Bridge	Replacement (raising and channel widened)	No Project alteration
GWWD Bridge	Modification (raising and channel widening)	Alter to leave as is and consider enhanced erosion protection
PTH 15 Bridge	Replacement (raising and channel widening)	Alter to leave as is and consider enhanced erosion protection
CNR Redditt Bridge	Modification (raising and channel widening)	No Project alteration
CPR Keewatin Bridge	Modification (raising and channel widening)	No Project alteration
PTH 59 North Bridge	Replacement (raising and channel widening)	Alter to leave as is and consider enhanced erosion protection
CEMR Pine Falls Bridge	Modification (raising and channel widening)	Alter to leave as is
PTH 44 Bridge	Replacement (raising and channel widening)	Alter to leave as is
Enlargement of outlet Structure	• Increase width by approximately 50m (164 ft) • Improve energy dissipation	No Project alteration
Centreline drainage structure	replacement	No Project alteration
North Bibeau drainage structure	replacement	No Project alteration
Cook's Creek Diversion drainage structure	replacement	No Project alteration
Springfield Road drainage structure	replacement	No Project alteration
Shkolny drainage structure	replacement	No Project alteration
Ashfield drainage structure	replacement	No Project alteration
Transcona (Kildare) Storm Sewer outlet	replacement	No Project alteration
Winnipeg Aqueduct and Deacon Drain	replacement	No Project alteration
West Dyke	• Extend by 15 km (9 miles) • Increase height by up to 2.7 m (8.9 ft) • Fill required 4,600,000m^3 (6,000,000 ft^3)	No Project alteration

Improvements to Inlet Structure	erosion protection and reliability	No Project alteration

3.0 Environmental Effects

The Manitoba Floodway Authority (MFA) has reviewed the EIS and the Screening Report and has assessed the potential environmental effects resulting from the proposed Altered Project as compared to the baseline of the Existing Floodway. Those aspects of the Project that remain unchanged have been considered in this assessment and are reported to identify that the environmental effects also remain unchanged from those reported in the Screening Report, CEC Report, EIS and supplementary information (collectively referred to as the Assessment). The proposed Altered Project is not likely to cause any significant environmental effects. Details of the environmental effects are described in the following sections:

3.1 Physical Environment

The EIS and Screening Report considered the following categories of the physical environment:

- Water regime
- Groundwater
- Erosion and sedimentation
- Drainage
- Ice processes
- Surface water quality
- Climate, noise and air quality, and
- Physiography, geology and soils.

3.1.1 Water Regime

The Project design criterion of providing protection from a flood with a probability of being equaled or exceeded once in 700 years while maintaining the existing maximum water elevation of 237.13m (778 ft) at the Floodway entrance remains unchanged and has been met through the Altered Project.

The effects of the bridges on the channel hydraulics are associated with two factors: the width of the channel and associated head loss at the bridge location and whether the bridge superstructure becomes submerged. The CPR Emerson, PTH 59 South, CNR Sprague, TransCanada Highway, CNR Redditt, and CPR Keewatin bridges would be submerged during the design flood and would have the greatest effect on the channel hydraulic capacity. The replacements or modifications to these 6 bridges will proceed as originally proposed and are not affected by the proposed project alteration. The mitigation

and follow up programs for these works remain unchanged and the resultant environmental effects are unchanged from those described in the Assessment as not significant.

PTH 15 and PTH 59 North Bridges

In the cases of the PTH 15 and PTH 59 North Bridges, the bridge superstructures are above the water elevations of the design flood and accordingly have only a minor effect of the hydraulic capacity (loss of 14 m^3/s and 17 m^3/s respectively) resulting from not widening the channel at the bridges. The hydraulic capacity can readily be attained through additional channel works. Although the beneficial socio-economic effects of replacing these bridges will not be realized, these are value added and not adverse effects. The physical effects of not replacing these bridges are that the lost hydraulic capacity has been recovered and that the increased velocities through the channel under the bridges increases the shear stresses as provided in Table 2.

Table 2. Shear Stresses at Floodway Bridges

Bridge	Shear Stress Limit Grassed Clay/Till (N/m^2)	1997 Flood with Existing Floodway (N/m^2)	Shear Stress for 700 Year Flood with July 2004 Expanded Floodway (N/m^2)	Shear Stress for 700 Year Flood with Dec. 2006 Expanded Floodway (N/m^2)
St. Mary's	17.0	8.0	0.0 [1]	0.0 [1]
CPR – Emerson	17.0	8.5	9.0 [2]	8.5 [4]
PTH 59 South	17.0	9.0	11.0 [3]	10.5 [5]
CNR – Sprague	17.0	9.5	15.5	14.5
TCH	17.0	9.5	15.5	14.0
GWWD	17.0	9.5	14.0	***19.0*** [6]
PTH 15	17.0	10.0	14.0	***21.0*** [6]
CNR – Redditt	17.0	10.0	14.0	14.5
CPR – Keewatin	17.0	10.0	15.5	16.0
PTH 59 North	29.0	13.5	18.0	***29.0*** [6]
CEMR – Pine Falls	29.0	13.0	24.0	16.0
PTH 44	29.0	14.0	26.0	17.0

Notes: (1) Maximum Shear Stress of 13.0 N/m^2 occurs at approximately the 20 year flood.
(2) Maximum Shear Stress of 12.5 N/m^2 occurs at approximately the 300 year flood.
(3) Maximum Shear Stress of 13.0 N/m^2 occurs at approximately the 300 year flood.
(4) Maximum Shear Stress of 13.0 N/m^2 occurs at approximately the 300 year flood.
(5) Maximum Shear Stress of 13.5 N/m^2 occurs at approximately the 300 year flood.
(6) Maximum Shear Stress is at or exceeds the Shear Stress Limit

As indicated in Table 2, the shear stresses at the PTH 15 and PTH 59 North bridges equal or exceed the shear stress limit listed. In these cases additional erosion control measures will be considered during the final design phase. Potential additional erosion control measures are described in Section 3.1.3 below.

PTH 44 Bridge

PTH 44 bridge girders would be below design water levels for floods equal to and greater than the 1-in-300 year return period. The loss of hydraulic capacity from not replacing PTH 44, is due to both not raising the bridge superstructure and not widening the channel at the bridge. The hydraulic loss has been estimated to be 34 m^3/s at the 1-in-700 year event. This hydraulic capacity can be attained through channel widening. Although the beneficial socio-economic effects of replacing these bridges will not be realized these are value added effects. The potential socio-economic effects of replacing the PTH 44 Bridge described in the Assessment will be eliminated and mitigation and follow up are not required. The physical effects of not replacing this bridge are that the lost hydraulic capacity has been recovered through additional channel works and that the increased velocities through the channel under the bridges increases the shear stresses as provided in Table 2. The increase in shear stress is below the shear stress limit and additional erosion protection will not be required.

St. Mary's Road Bridge

The St. Mary's Road Bridge is near the Floodway inlet and upstream of the three embankment gaps. Two of the gaps were constructed prior to the Project and are part of the baseline conditions. The Grande Pointe Gap was completed during 2006 as part of the Project and is not affected by the Project Alteration.

The EIS considered raising the St. Mary's Bridge superstructure elevation and not widening the channel. The bridge location along the channel is important to the channel hydraulics since it is upstream of the gaps and the gaps carry more of the flow into the channel as the size of flood increases. The base of the West Gap is at elevation 233.0 m, the East Gap is at elevation 234.5 m and the new Grande Pointe Gap is at elevation 236.4 m. Accordingly flow through the gaps begins when flood water reach those elevations. Figures 4.3-2 and 4.3-3 from the EIS have been re-plotted to graphically present the results of the hydraulic modeling that was carried out to optimize the gap designs. Figure 4.3-3 shows that for floods near elevation 233.0 m at the inlet structure the flow through the Floodway Channel Inlet reaches a peak of approximately 1,200 m^3/s. Figure 4.3-4 shows that for flood events at this water elevation the floodway is operated under Rule 1 and no artificial flooding upstream of the inlet structure occurs. For larger flood events the increased flow is passed through the gaps, downstream of the St. Mary's bridge.

The bottom girders of the St. Mary's bridge are at elevation 235.0 m. For flood events where the St. Mary's Bridge girders become submerged the increased flow is passed through the gaps downstream of the bridge and the bridge has no significant effect on the upstream water levels (Figure 4.3-3) or a loss of hydraulic capacity.

It should be noted that the lines for the "Total Flow in Floodway" and the "Flow through the Floodway Inlet" shown in Figure 4.3-3 differ from what was provided in the EIS submission. During the preparation analysis of the effects of the Altered Project, it was noted that the lines shown in Figure 4.3-3 in the EIS had not been updated to represent the engineering findings. Therefore, to update the relationships shown in Figure 4.3-3 of this report, as a result of the Altered Project, the July 2004 flow curves were also corrected.

GWWD and CEMR Bridges

The modifications to the GWWD and CEMR Bridges proposed in the original EIS included raising the bridges and channel widening. For floods greater than the 1-in-100 flood event the hydraulic capacity of the Floodway is currently reduced by the superstructure of the GWWD and CEMR Bridges. Removing the bridge superstructures became a consideration during and after the 1997 flood event. At that time, removal of bridge superstructures was identified as an item to be included when the Emergency Preparedness Plan for Floodway operation was developed.

The hydraulic capacity numerical model analysis of the proposed alteration confirmed that the loss of hydraulic capacity from not raising these two bridges can be attained by removing the bridge superstructures. In addition to the hydraulic capacity provided by channel widening rather than modifying the above noted bridges, the Emergency Preparedness Plan to be developed for the Red River Floodway will address the removal of the GWWD and CEMR bridge superstructures. The hydraulic capacity effects from not widening the channel at the GWWD and CEMR bridge sites can be attained by widening the channel elsewhere.

As considered during the environmental assessment processes, the Emergency Preparedness Plan will be prepared in cooperation with other agencies that are involved with flood protection including the City of Winnipeg, Manitoba Emergency Measures Organization and Manitoba Water Stewardship. The Emergency Preparedness Plan will eventually become a component of the Operational Phase Environmental Protection Plan required by Environment Act Licence No. 2691 and as discussed in the Accidents and Malfunctions section of the Screening Report. This strategy has not changed as a result of the Project Alteration.

The physical effects of not replacing these bridges are that the lost hydraulic capacity has been recovered through additional channel works and removal of the superstructures, if required, at the time of a major flood event. The increased velocities through the channel under the bridges increases the shear stresses as provided in Table 2. The increase in shear stress at the GWWD Bridge is above the shear stress limit listed and additional erosion protection will be considered

during the detailed phase of the Project. The shear stress at the CEMR Bridge is below the shear stress limit and additional erosion protection will not be required.

Channel Widening

The physiography, geology and soil aspects of the alterations to the channel widening component of the Project are described and discussed in Section 3.1.8 below. The following discussion describes the water regime aspects of the Altered Project. The design concepts and potential environmental effects of the outlet structure and river bank protection remain unchanged from those considered in the Screening Report and Environment Act Licence No. 2691.

The modified bridge renewal plan will require a total additional discharge capacity of approximately 127 m^3/s (4,500 cfs) to meet the design target of 3,960 m^3/s (140,000 cfs) required to provide the 1-in-700 year flood protection. The Altered Project will partially achieve the target 1-in-700 year flood protection criterion by increasing the amount of widening at various segments of the channel between 19+610 to 20+800 (TCH to Centreline Drain), 22+150 to 25+650 (GWWD Rail Bridge to PTH 15) and station 35+000 (PTH 59 North Bridge) to the outlet structure in addition to the originally identified works at 6 bridges and channel widening. Additional channel widening will provide 79 m^3/s (2,800 cfs) of the 127 m^3/s (4,500 cfs) required.

Vegetation Control

The Project considered throughout the environmental assessment processes included the provision for improved vegetation management along the Floodway Main Channel. However, the hydraulic benefit of a dedicated vegetation management program was not quantified.

KGS Group has now analyzed the hydraulic effect of willow growth within the channel and the availability of additional hydraulic capacity that could be realized through a dedicated willow management program. The analysis estimates that the hydraulic benefit of a dedicated willow management program would range between 150 to 300 m^3/s (5,300 to 10,600 cfs). KGS Group recommends that a conservative safety factor be applied when considering the hydraulic benefit from this program. Accordingly, approximately 75 m^3/s (2,650 cfs) additional hydraulic capacity from a dedicated willow management program is the maximum that is being considered in this report. The MFA is responsible for maintenance and has begun a program of willow clearing.

Water Regime Effects

The predicted water levels have been recalculated to determine the effects on the water regime resulting from the Altered Project. The effects of the Project as assessed in the Screening Report and Environment Act licensing process, were summarized in Tables 5.3-2, 5.3-3 and 5.3-4 from the EIS. Summaries of the

recalculated effects on water elevations are presented in revised tables provided in this report. The only change in the water regime effects from those predicted and considered in the Assessment is a slight decrease in the benefit at the inlet for the 1-in-120 year flood. The Assessment considered the benefit to a decrease in water elevation of 0.75 m (2.46 ft). The recalculated water elevation for this flood event is a benefit of 0.74 m (2.44 ft). This change in water elevation, although reportable, could not be perceived during an actual flood event.

Although the total beneficial effects predicted in the Assessment will not be realized the environmental effects of the Altered Project are positive upstream of the floodway. There were no predicted changes to the water regime considered during the Assessment.

The EIS presented Figures 4.3-5 and 5.3-4 to demonstrate the effects of the Project on water levels. These figures have been re-plotted and illustrate the predicted water elevations at the inlet for the existing and expanded floodway concepts.

As described above, the reasons for the water regime effects not changing are that the gaps in the east embankment improve the hydraulic condition from the inlet to the Grande Pointe Gap east of PTH 59 South and the additional channel works that retain the hydraulic capacity of the channel at 3,960 m^3/s. The reason that the 1-in-225 year flood event reduces the upstream benefit is that at that water elevation the St. Mary's Bridge superstructure is involved in the flood but the water levels are not sufficient to fully utilize the flow capacity of the gaps. This is illustrated by Figure 4.3-2(b) which demonstrates the flow distribution for the 1-in-300 year flood event.

Although the Alteration will continue to provide protection to the areas within the Floodway from the 1-in-700 year flood event as originally proposed and the river water elevations outside the Floodway will not change, the hydraulic profile along the floodway channel will change slightly. Figure 4.3-6 from the EIS has been re-plotted and presented in this report. The change in hydraulic profile during flood events does not change the environmental effects of the Project from those described in the EIS and Screening Report.

The proposed Altered Project will not result in any significant changes to the upstream or downstream water levels from those identified in the EIS and considered in the Screening Report or the Environment Act Licence.

Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration will be negligible and the resultant environmental effects on the water regime will be beneficial. Accordingly, the environmental effects of the Altered Project will not be significant.

Table 5.3-2
Differences in Maximum Water Elevations Following Floodway Expansion

Location	Magnitude of Flood Event			
	1 in 100 Year Flood	1 in 120 Year Flood	1 in 225 Year Flood	1 in 700 Year Flood
Morris	0	0	0	0
Ste. Agathe	0	0	-0.50 m (-1.63 ft)	0
St. Adolphe	-0.14 m (-0.46 ft)	-0.32 m (-1.06 ft)	-0.88 m (-2.91 ft)	0
Inlet of Floodway	-0.29 m (-0.95 ft)	-0.74 m (-2.44 ft)	-1.06 m (-3.47 ft)	0
James Ave.	-0.36 m (-1.17 ft)	+0.08 m (+0.28 ft)	+0.01 m (+0.03 ft)	-1.60 m (-5.26 ft)
St. Andrews Church	-0.05 m (-0.16 ft)	+0.11 m (+0.36 ft)	+0.05 m (+0.16 ft)	-0.24 m (-0.79 ft)
Red River at Floodway Outlet	+0.05 m (+0.16 ft)	+0.12 m (+0.39 ft)	+0.06 m (+0.20 ft)	+0.27 m (+0.89 ft)
Lower Fort Garry	+0.02 m (+0.07 ft)	+0.08 m (+0.26 ft)	+0.04 m (+0.13 ft)	+0.13 m (+0.43 ft)
Selkirk	+0.02 m (+0.07 ft)	+0.08 m (+0.26 ft)	+0.04 m (+0.13 ft)	+0.13 m (+0.43 ft)
PTH 4	+0.02 m (+0.07 ft)	+0.07 m (+0.23 ft)	+0.04 m (+0.13 ft)	+0.10 m (+0.33 ft)
Breezy Point	0	+0.02 m (+0.07 ft)	+0.01 m (+0.03 ft)	+0.05 m (+0.16 ft)

Notes: "-" indicates a decrease in the maximum water level
"+" indicates an increase in the maximum water level

Table 5.3-3
Location of Magnitude of Largest Water Level Increase
Due to the Floodway Expansion Project

Flood Scenario	Location of Largest Increase	Project Increase in Water Level
1 in 100 Year Flood	Red River at Floodway Outlet	+0.05 m (+0.16 ft)
1 in 120 Year Flood	Red River at Floodway Outlet	+0.12 m (+0.39 ft)
1 in 225 Year Flood	Red River at Floodway Outlet	+0.06 m (+0.20 ft)
1 in 700 Year Flood	Red River at Floodway Outlet	+0.27 m (+0.89 ft)

Table 5.3-4
Location of Magnitude of Largest Water Level Decreases
Due to the Floodway Expansion Project

Flood Scenario	Location of Largest Increase	Project Increase in Water Level
1 in 100 Year Flood	James Avenue	-0.36 m (-1.17 ft)
1 in 120 Year Flood	Floodway Inlet	-0.74 m (-2.44 ft)
1 in 225 Year Flood	St. Adolphe	-0.89 m (-2.91 ft)
	Floodway Inlet	-1.06 m (-3.50 ft)
1 in 700 Year Flood	James Avenue	-1.60 m (-5.26 ft)

3.1.2 Groundwater

The Alteration will eliminate the groundwater effects that might have occurred during groundwater depressurization required to construct the bridges. Since the proposed Alteration eliminates work at 6 bridges, the resultant environmental effects due to bridge construction are reduced from the original proposal and will not be significant.

The possibility for the increased channel widening to increase the amount of groundwater discharge into the Floodway channel has been reviewed by KGS Group. The proposed additional channel widening will be a continuation of the channel bottom geometry, sloping upward at approximately 2% inland, into the Right-of-Way bench. For the sections along construction segments C4 and C7, the additional widening by approximately 10% of the channel bottom width, will be excavated within the low permeability lacustrine clay. For construction segment C8, the additional widening will be primarily within lacustrine clay (4,900 m) and partially within silty clay till (2,200 m). Most of the additional channel widening is proposed along the east side of the channel, with only 600 m (4%) on the west side.

The Operation-Inactive effects on the groundwater levels adjacent to the channel due to the additional widening are anticipated to be very small (<0.5 m lowering) and contained within the Right-of-Way limits. Potential effects of additional widening on water levels at wells adjacent to widened areas are predicted to be negligible, with no adverse effects on adjacent wells and no remedial measures required. Although Operation-Inactive effects are anticipated to be of long term duration and are not expected to be reversible the magnitude of the effects are small and therefore are not considered significant. These effects on groundwater levels are unchanged from the effects reported in the EIS and considered in the Screening Report and Environment Act licensing process.

For the Operation-Active condition, the zone of surface water infiltration is expected to widen directly proportional to the additional channel widening but does not affect the depth of infiltration or the recapture of water into the Floodway as described in the EIS and considered in the Screening Report. Groundwater flow within the bedrock aquifer is from east to west, with the hydraulic gradient toward the channel. Accordingly, additional temporary surface water infiltration to the east is expected to be reversible, and infiltration to the west (only 600 m of the 15,500 m length) may be reversible. The infiltration effects are temporary and are of very small magnitude within the lacustrine clay areas, and small magnitude within the silty clay tills (15% till or 2,200 m length along the east side of construction segment C8) and may be reversible. The expected change to infiltration would be well within the sensitivity analysis presented in the EIS (Figure 5.4-8) and considered in the Screening Report and Environment Act

licensing process. Figure 5.4-8 is re-produced in this report for information. Accordingly, the environmental effects are predicted to be not significant.

Considering the mitigation proposed, the resultant change to the groundwater effects due to the Altered Project will be small and will not be significant.

3.1.3 Erosion and Sedimentation

The proposed changes to the Project will result in slightly greater hydraulic velocities in the areas of channel not being widened near the bridges. The increased velocities will result in increased shear stress as described in Section 3.1.1 and listed in Table 2 of this report. The existing erosion protection will be enhanced if required to mitigate any increased erosion potential.

Enhanced erosion protection has been considered by KGS. Alternatives for erosion protection at the bridge sites to mitigate the increased erosion potential include providing additional riprap, articulated concrete blocks, and turf reinforcement mats. The decision on which alterative or combination of alternatives will be considered during the detailed design phase.

As well, the proposed Alteration will result in a slight increase in the amount of excavation required to provide the design hydraulic capacity. The erosion and sediment control strategy for the channel excavation currently in place to mitigate erosion and sediment releases will adequately address the proposed Alteration.

Considering the mitigation proposed, the resultant change to the environmental effects of the Altered Project will be negligible and will not be significant.

3.1.4 Drainage

The Alteration will not change the proposed works associated with drainage or the drainage structures. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.1.5 Ice Processes

The proposed Alteration will not affect the flows or water elevations from those described in the EIS as shown in Tables 5.3-2 and 5.3-3. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.1.6 Surface Water Quality

The only potential for surface water quality effects resulting from the proposed Alteration are associated with increased erosion and sedimentation and the associated herbicide and fertilizer programs. These effects will be addressed through the erosion and sediment control measures previously considered to mitigate these effects. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.1.7 Climate, Noise and Air Quality

As a result of the proposed Alteration, the use of excavation equipment will increase slightly resulting in a slight increase in carbon dioxide, dust and noise emissions. The degree of change will be proportional to the increase in the amount of material to be excavated. These emissions will be mitigated as described in the EIS. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant

3.1.8 Physiography, Geology, and Soils

As has been the case with all previous channel widening segments, the detailed geometry of the channel segments will be developed during the final design and contract preparation phase of the Project. Figure 4.3-4 from the EIS has been revised to provide a revised Floodway channel configuration and identify the locations and extent of channel widening. The channel widening indicated between the inlet and station 19+610 occurred as a result of the detailed design process and has been completed or is underway.

The specific channel segments being altered are from the TCH Bridge to Centreline Drain (construction segment C3C), the GWWD Rail Bridge to PTH 15 (construction segment C4); the PTH 59 North Bridge to the Dunning Road Crossing (construction segment C7); and from Dunning Road Crossing to the Red River Floodway Outlet Structure (construction segment C8) and are shown geographically on Figure 1. The amounts and locations of the additional channel widening work are summarized in Table 3 of this report.

The additional channel widening for the construction segment C3C has not yet been finalized and will conceptually be limited to approximately 10m. The additional excavation in this area will involve approximately 100,000 m^3 of material.

Table 3 Additional Channel Widening Summary

CONTRACT	SIDE	APPROXIMATE STATION INTERVAL TO (M)	APPROXIMATE LENGTH (M)	ADDITIONAL WIDENING (M)
C4	East	22+300 to 23+300	1,000	≤ 20
C4	West	23+100 to 23+700	600	Average 10 (max 20)
C4	East	24+400 to 25+400	1,000	Average ≤ 20 (max 35 m)
C7	East	35+200 to 41+100	5,800	≤ 20
C8	East	41+100 to 48+200	7,100	≤ 20

The amount of additional channel widening for construction segment C4 will vary along the channel up to approximately 35 m (Table #3) and will require the disposal of approximately 600,000 m^3 of additional material over the original plan of 985,000 m^3. The drawings reflecting the final excavation and disposal embankment geometry for this construction segment are attached in Appendix A.

The construction geometry for channel segments C7 and C8 have not yet been finalized. Recovery of additional channel capacity will be achieved by expanding the amount of channel widening in these segments by at approximately 20 m and are depicted conceptually in Figure 4.3-4 and listed in Table 3. The increase widening will involve the excavation and placement of approximately 1,900,000 m^3 of additional material.

The increased widening and related placement of spoil material within all construction segments will remain within the existing Floodway right-of-way and will not require a change to the land requirements from those presented in the EIS and considered in the Screening Report and Environment Act licensing process.

The footprint of the channel will change slightly as demonstrated in Figure 4.3-4. The channel and spoil piles footprint will remain in the area of the existing floodway right-of-way and has previously been extensively disturbed. The resultant change to the environmental effects of the Project as a result of the proposed Alteration will be negligible and will not be significant.

3.2 Aquatic Environment

None of the additional works involved with the proposed Alteration will be in water and the Project components associated with the Inlet Control Structure,

Low Flow Channel regarding/armouring, and Outlet Control Structure are unchanged. The reduction of bridge work will eliminate the Low Flow Channel crossings, construction and demolition activities previously planned for those bridges and the associated risk to the aquatic environment. Accordingly, considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.3 Terrestrial Environment

All of additional works involved with the proposed Alteration will be in areas assessed and reported in the EIS and the environmental effects are determined to be not significant. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.4 Socio-Economic Environment

The proposed Alteration will cause minor changes to the environmental effects to the physical, aquatic, or terrestrial environments as described above. The resultant effect of the proposed Alteration is that the total benefits associated with the provision of enhanced bridge crossings previously proposed will not be fully realized and effects will be neutral in comparison to the existing conditions. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.5 Heritage Resources

All of the areas involved in the proposed Alteration will be in areas previously assessed and reported in the EIS and determined to be not significant. Considering the mitigation proposed, the resultant change to the environmental effects of the Project as a result of the proposed Alteration remain as considered in the Screening Report and Environment Act Licence No. 2691 and will not be significant.

3.6 Sustainability

The proposed Alteration will not change the Project as previously assessed and reported in the EIS.

4.0 Follow Up Programs

Follow up programs have been developed in accordance with the Screening Report. These programs include groundwater monitoring, surface water monitoring, re-vegetation monitoring fish studies, historic resources assessments, and emergency response. The existing follow up programs will continue and will apply to the Altered Proposal.

5.0 Environment Act Licence

The proposed Alteration does not change the fundamental purpose of or the environmental effects associated with the Project. The only change required to Environment Act Licence No. 2691 is the rewording of Clause 1 to redefine the works to be undertaken. The environmental protection limits, term, conditions, and specifications prescribed by the Licence adequately address the environmental effects and need not be amended to accommodate the proposed Alteration.