Manitoba Hydro

Pointe du Bois Spillway Replacement

Alteration

August 2012

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1.0 INTRODUCTION

Manitoba Hydro submitted an Environmental Impact Statement (EIS) for the Pointe du Bois Spillway Replacement Project to federal and provincial regulators on June 17, 2011. Environment Act Licence 2988 was issued on January 6, 2012.

During final design, it was determined that a Revised Arrangement to the spillway and dams would reduce cost, schedule and potential environmental effects. It should be noted that, similar to the Original Arrangement, the Revised Arrangement will not alter existing water levels, upstream or downstream of the generating station, or river discharges.

As a result, Manitoba Hydro is seeking regulatory approval for a Revised Arrangement of the principal structures at Pointe du Bois.

This document describes the:

- Physical changes in the development;
- Raw materials or substances used or processed; and
- Environmental effects as compared with the Original Arrangement

Figure 3.1 Rev1 outlines the existing, Original and Revised Arrangements.

To highlight the changes between both arrangements figures used in the June 2011 EIS that have been revised are labeled Rev1 (e.g. Figure 3.1 Rev1).

1.1 Background

The existing dam and spillway structures do not meet current Canadian Dam Association Dam Safety Guidelines for spillway capacity and shows signs of significant concrete deterioration. In response to these concerns, Manitoba Hydro initiated the Pointe du Bois Spillway Replacement Project.

Based on initial project cost and impacts identified during the regulatory review process, an alternative arrangement of the spillway was proposed by the Project team. The arrangement eliminates the secondary spillway, increases the size of the primary spillway from 5 bays to 7 bays and shifts the primary spillway structure and associated approach and discharge channels to the east where construction will primarily occur in the dry rather than within the existing watercourse. The main earthfill dam crossing the river will be constructed mid-way down the spillway shelf rather than adjacent the downstream side of the existing spillway structures.

2.0 PROJECT DESCRIPTION

2.1 Project Components

This section describes alterations to the principal structures and supporting construction infrastructure as a result of the Revised Arrangement. This includes:

- Location and size of spillway (note there is only one larger spillway);
- Earthfill dams (main dam and south dam);
- Transition structures;
- Approach channel guide berm; and
- Cofferdams for east abutment and spillway approach channel construction.

Supporting construction infrastructure and principal structures for the Original and Revised Arrangements are shown in Figures 3.4 and 3.5 and Figures 3.4 Rev1 and 3.5 Rev1, respectively.

2.1.1 Construction Infrastructure

The EIS submitted in June 2011 stated that the construction infrastructure included: work areas; barge landings and other access infrastructure; material sources areas; construction power; an excavated material placement area; cofferdams; townsite access roadway; and construction roadways. The cofferdams are the only construction infrastructure component that is altered as a result of the Revised Arrangement.

2.1.1.1 Cofferdams

The Original Arrangement required three cofferdams:

- Upstream to allow construction of the primary spillway approach channel;
- Downstream to allow construction of the primary spillway discharge channel; and
- Adjacent the powerhouse to allow construction for the powerhouse east abutment.

The Revised Arrangement requires two cofferdams:

- Adjacent the powerhouse to allow construction of the powerhouse east abutment; and
- Between the rockfill dam and spillway structure (Stage II cofferdam).

Cofferdams for construction of the spillway structure and the approach and discharge channels are not required because the channels are now located on the east bank of the river. The Revised Arrangement does not affect the cofferdam adjacent to the powerhouse.

The Stage II cofferdam will provide a water tight seal to protect the earthfill dam construction while the new spillway is in service. It will be of concrete core construction and will be built in the dry prior to watering up the approach channel (Figure 3.20 Rev1). This cofferdam will not be removed.

2.1.2 Principal Structures

The principal structures for the project include the following and are shown on Figure 3.5 Rev1:

- Spillway;
- Spillway approach and discharge channels;
- Earthfill dams (main dam and south dam); and
- Transition structures and wing walls.

The construction activities associated with the principal structures are outlined in Section 2.2 of this document.

2.1.2.1 Spillway

The spillway will be located on the east shore of the Winnipeg River, approximately 200 m east of the spillway location in the Original Arrangement and approximately 80 m east of the high water perimeter of the spillway shelf. The spillway structure remains the same with the addition of two bays (i.e., seven-bay instead of five-bay), Figures 3.17A Rev1 and 3.17B Rev1. The capacity of the spillway at full supply level (FSL) elevation of 299.1 m has increased from 4800 cms (Original Arrangement) to approximately 5000 cms (Revised Arrangement), Figure 3.29 Rev1.

2.1.2.2 Spillway Approach and Discharge Channels

Approach and discharge channels will serve to direct water flow into and out of the new spillway structure. The approach channel will be approximately 230 m in length and 126 m in width. The discharge channel will be approximately 340 m in length and 126 m in width, flaring towards the exit. The approach channel will be excavated to an approximate elevation of 287.0 m immediately upstream of the spillway structure and transition to 290.0 m at the upstream end (Figure 3.19 Rev1).

The elevation of the discharge channel was chosen to be above the normal tailwater level to replicate the manner in which the current spillway discharge plunges off the shelf and across the current fish spawning habitat. It will be excavated to elevation 286.0 m and can be constructed without a downstream cofferdam.

2.1.2.3 Earthfill Dams

Earthfill dams will be constructed downstream of the existing spillways, sluiceways and rockfill dam to as follows:

- Main dam – to be constructed along the lower spillway shelf connecting the spillway to the bedrock outcrop east of the intake channel (center island) and transition into the south dam; and
- South dam – to be constructed adjacent to the existing east gravity dam on the downstream side. It will tie into the powerhouse by a new concrete transition structure. The alignment coming off the center island changes slightly from the Original Arrangement to line up with the new axis of the main dam.

The earthfill dams will be zoned earthfill embankments, each consisting of an impervious core with granular and crushed rock filters and outer rockfill shells (Figure 3.24 Rev1).

2.1.2.4 Transition Structures and Wing Walls

Concrete transition structures will be constructed as a transition between the earth structures and the concrete structures. Transition structures will be required on the west side of the new spillway and on the east side of the existing powerhouse. Wing walls will be used to contain the earth dams where the dams connect to the concrete structures.

2.1.2.5 Approach Channel Guide Berm

The guide berm will be utilized to improve the hydraulic performance of the spillway approach channel. It will be constructed of rockfill material from the channel excavations.

2.2 Project Construction

A summary schedule of the project stages is outlined in Figure 3.6 Rev1 and the general activities associated with each stage of the project are described below. These stages identify the anticipated but approximate durations associated with the various construction activities. Manitoba Hydro and the contractor may identify opportunities to reduce this schedule during detailed design and construction.

Construction will occur in two stages commencing in 2012. Stage I includes the construction activities performed while maintaining the operation of the existing spillway. Stage II includes the construction activities performed with the new spillway operational.

In general, the schedule assumes two ten-hour shifts per day, six days per week. However, to manage schedule risk, construction activities will likely require periods of activities occurring 24 hours per day and seven days per week. With this schedule, the project is anticipated to take approximately three years to complete in contrast to the five years required for the Original Arrangement. It is noted that the activities associated with the schedule are seasonal in nature and delays in the principle structures construction start would result in a full year delay in the completion of the project.

The duration of activities assumes the timing restrictions for environmental protection, such as no in-water work from April 1 to June 30, and no clearing and grubbing during critical bird nesting periods, generally from May 1 to August 1.

2.2.1 Stage I Construction

Figure 3.7A Rev1 illustrates the components of Stage I construction and occurs while maintaining the operation of the existing spillway. As with the Original Arrangement, rockfill will be placed along the east gravity dam. Construction to provide access across the spillway (trestle) will continue. Excavation of the majority of the approach channel, discharge channel and footprint of the spillway structure will occur in the dry. These excavations will be separated from the river by maintaining a solid rock plug on the upstream side and by excavating to only 286.0 m (one metre above normal water levels) on the downstream end. The excavation will be a drill, blast and excavate operation using explosives to fracture the rock. Backhoes, dozers and rock trucks will be used to remove the material. Excess waste material will be hauled to east side material placement areas utilizing temporary haul roads in the work area. Following completion of the excavation, concrete placement for the primary spillway will be conducted. Typical equipment for concrete operations will be used, including cranes, concrete mixers and pumps, transit trucks, welders and hand tools. The spillway gates and hoists will be installed following concrete placement. Equipment used for gate installation includes cranes and scaffolding.

Construction of the Stage II cofferdam required along west side of the intake channel between the west spillway abutment and approach channel will occur in the dry.

Similar to the Original Arrangement excavation of an upstream portion of the approach channel will be conducted in the wet. This work will not take place between April 1 and June 30 of any year. This will require installation of an infill rock mattress to serve as a construction platform from which drill, shoot and excavation operations will be performed (Figure 3.23 Rev1). The infill materials required for the rock mattress will be sourced from the concurrent dry channel excavation operations. Drilling will be undertaken to place explosives to fracture the rock underneath the mattress. Subsequent to the blasting, excavation will start at the outer limit of the rock mattress and work toward the solid rock plug. Rock removal will be performed using equipment such as backhoes and clamshell excavators. The removed rock will be re-used, to the extent possible, in the construction of the earthfill dams and guide berm.

Following completion of the spillway, the approach channel, the discharge channel and the Stage II cofferdam, water will be introduced into the approach channel and the rock plug will be removed by drilling, blasting and excavating. Removal of the rock plug and commissioning of the spillway are expected to occur in February 2014.

2.2.2 Stage II Construction

Figure 3.7B Rev1 illustrates the components of Stage II construction that will occur following commissioning of the spillway.

Construction of earthfill dams will occur as described with the Original Arrangement. An exception is the installation of a box culvert below the main earthfill dam. During construction of the main dam, this culvert will manage seepage water from the existing structure and rock fill dam. The box culvert will be placed at the desired elevation to maintain the consistent water levels in the upstream pond and to dry the footprint of the main earthfill dam work area. After completion of the main earthfill dam, the box culvert will be grouted closed. Construction of the powerhouse east abutment cofferdam will occur as described with the Original Arrangement.

Construction is expected to be completed by December 2014.

2.2.3 Type and Quantity of Materials Required

Types and quantities of materials required for the Revised Arrangement are provided in Table 3.1 Rev1. The primary source of rockfill will be the spillway channel excavation and BR-2 (see Figure 3.15 in EIS). The primary source of clay will be CL-3. Project excavations will total approximately 860,000 m^2 of rock and 69,500 m^2 of unclassified material.

Table 3.1 Rev1: Estimated Borrow Material Quantities

Material	Original Arrangement Quantity (cubic metres)	Revised Arrangement Quantity (cubic metres)
Clay	100,000	53,000
Granular Fill/Crushed Rock	35,000	33,000
Rockfill	275,000	356,000
Riprap	20,000	24,000
Concrete Aggregates	40,000	30,000

2.3 Workforce

Total person hours for construction will decrease by approximately 10% for the Revised Arrangement due to the reduction in structures. However, compression of the construction schedule will result in higher monthly peaks of person hours during the three years of construction.

2.4 Traffic

Traffic volumes associated with the Revised Arrangement are similar to those expected for the Original Arrangement.

2.5 Navigable Water Protection Measures

As discussed in the EIS, measures will be undertaken to comply with the Navigable Waters Protection Act. Safety booms, buoys and signage will be deployed to prevent inadvertent access to dangerous areas. Figure 3.27 Rev1 provides a concept of the navigable waters public safety measures that will be employed.

2.6 Decommissioning

The scope of decommissioning works will include demolition or removal of the existing spillway facilities and construction related infrastructure. In the Revised Arrangement there will no longer be any spillway pier demolition because the secondary spillway no longer exists. Similarly the rockfill dam will not be removed since the primary spillway has been relocated Following completion of the new spillway and earthfill dams, the stoplogs, hoists, electrical equipment, mechanical equipment and railings associated with the existing spillways will be removed. The piers and decking will remain in place (i.e., extending above the water level). Decommissioning is expected to occur from October through December 2014.

2.7 Rehabilitation

Material source and disposal areas, storage areas, quarry sites, work areas, temporary access roads, barge landing sites, winter road access, access road (trestle), settling ponds, and on-land disposal sites will be rehabilitated in accordance with best management practices and regulatory requirements. Rehabilitation activities will primarily occur in 2015 and will remain ongoing as warranted.

Artistic renditions of the completed project are provided in Figures 8.11A Rev1 and 8.11B Rev1.

3.0 POTENTIAL ENVIRONMENTAL EFFECTS

The following section summarizes where effects related to the Revised Arrangement differ from those described in the EIS for the Original Arrangement.

3.1 Physical Environment

3.1.1 Air Quality, Noise, Climate, Woody Debris and, Groundwater

The potential effects to air quality, noise, climate, woody debris and groundwater as described for the Original Arrangement are not expected to change as a result of the Revised Arrangement.

3.1.2 Surface Water Regime

3.1.2.1 Surface Water Levels

Surface water levels and water level variations are not expected to change as a result of the revised arrangement.

3.1.2.2 Water Velocities, Flow Patterns and Depths

Construction

During Stage I construction, water velocities, flow patterns, and depths within the river reaches upstream and downstream of the station will not be affected by the project, as the operation of the existing spillway will be maintained.

During Stage II construction, flows in excess of the powerhouse capacity will be passed through the new spillway. Water velocity changes upstream of the approach channel and existing spillway will be similar for both the Revised Arrangement and the Original Arrangement. Water velocities, flow patterns and depths during Stage II construction are shown in Figures 8.2A Rev1, 8.2B Rev1 and 8.2C Rev1. The estimated change to water velocities between existing conditions and Stage II construction (Revised Arrangement) is shown in Figure 8.3A Rev1. The estimated change to water velocities during Stage II Construction from the Original Arrangement and the Revised Arrangement is shown in Figure 8.3Ai.

Tailrace changes are dependent on the magnitude of spill. The Revised Arrangement will result in similar changes to water velocities immediately downstream of the spillway rapids but with slight differences due to a shifted spillway discharge channel orientation as compared to the Original Arrangement. Refer to Figures 8.3A Rev 1 and 8.3Ai. Beyond 500 m downstream of the spillway discharge channel, there is no notable change in flow patterns or velocity with the Revised Arrangement as compared to the Original Arrangement. Depending on the magnitude of spill, the active flow zone either remains in the centre of the river or is pushed towards the east bank (Figure 8.2 B Rev1).

Similar flow patterns were predicted for the Original Arrangement (see Figure 8.2B in the EIS).

Operation

During the operational phase of the project, estimated water velocities and flow patterns for 5th, 50th and 95th percentile flow conditions are the same as conditions during Stage II construction, with the exception of the new forebay area between the existing spillway and the new main dam. Water velocities, flow patterns and depths under post project conditions are shown in Figures 8.2Ai, 8.2Bi, and 8.2Ci. The estimated changes to velocities as a result of the Revised Arrangement are shown in Figure 8.3Aii . The estimated change to water velocities from the Original Arrangement and the Revised Arrangement are shown in Figure 8.3Aiii. Velocities in the new forebay area will be up to 5 m/s lower, as water depths increase up to 10 m after impoundment.

Downstream of the immediate tailrace area below the spillway rapids, as spillway outflows and powerhouse flows converge, flow patterns will generally be similar to existing conditions.

Depths at some locations near the bottom of the spillway shelf will be 2.5 m shallower than existing condition as flows will be directed down the new spillway discharge channel rather than across the spillway. Depths in a localized area in the tailrace channel near the spillway discharge increase about 0.5 m. Depth increases will be reduced compared to the Original Arrangement.

Conclusions with regard to the residual effects to flow patterns, water velocities and depths as presented for the Original Arrangement do not change for the Revised Arrangement and are considered not significant.

3.1.3 Ice Regime

Potential effects to the ice regime as described for the Original Arrangementare are not expected to change as a result of the Revised Arrangement.

3.1.4 Physiography and Landscape

The area of the spillway and approach and discharge channels on the east side will be permanently altered, approximately 9 hectares of which 7.4 hectares is on dry land.

To accommodate the Revised Arrangement, an additional 2 hectares on the east shore of the Winnipeg River will be cleared that was not identified for the Original Arrangement. Conclusions with regard to residual effects on physiography and landscape as presented for the Original Arrangement do not differ for the Revised Arrangement.

3.1.5 Erosion and Sedimentation

Construction

The Revised Arrangement has the potential to effect sedimentation for the following activities:

- Cofferdam construction / removal;
- Secondary spillway construction and commissioning; and
- Spillway commissioning.

A reduction in sedimentation is expected as a result of fewer/smaller cofferdams and the elimination of the secondary spillway.

There is a potential increase in sedimentation as a result of commissioning of the spillway. The sediment in the approach and discharge channels will consist of some clay and silt present in the existing environment which has accumulated on the bedrock, as well as material left behind during the blasted bedrock excavation. The maximum increase in TSS is predicted to occur during the opening of the first gate for a short duration (approximately 1 hour).

A comparison of TSS increases from the Original Arrangement and the Revised Arrangement is presented in Table 8.4.

In a small area immediately downstream of the spillway discharge channel, flow patterns and velocities will be changed locally during spillway gate commissioning.

The bed material transport downstream of the spillway discharge channel is not expected to change due to the Revised Arrangement.

Table 8.4: TSS Release as a Result of Spillway Commissioning: Comparison of Original and Revised Arrangements

	Original TSS (mg/L)	Revised TSS (mg/L)
Reach 3 Short-term instantaneous (approx 1 hour)	up to 95	up to 180
Reach 4 Short-term instantaneous (approx 1 hour)	40-50	up to 65
Reach 3 Daily average	2-4	3-6
Reach 4 Daily average	1-2	2-3

3.2 Aquatic Environment

3.2.1 Water Quality

As described in Section 3.1.5, there are fewer activities associated with the Revised Arrangement that have the potential to increase TSS in the Winnipeg River. Elimination of two of the cofferdams and the secondary spillway associated with the Original Arrangement eliminates these potential sources of TSS. Increases in TSS during commissioning of the spillway are predicted to be larger with the Revised Arrangement than described in the EIS (see Section 3.1.5). Increases immediately downstream of the spillway rapids are now predicted to be up to 180 mg/L (previous prediction was 95 mg/L) for approximately 1 hour; the daily average increase is predicted to be between 3 and 6 mg/L in Reach 3 (previous estimate was 2-4 mg/L) and between 2 and 3 mg/L in Reach 4 (previous estimate was 1-2 mg/L). As described in the EIS, the largest increases would occur during the opening of the first gate and would occur for approximately 1 hour. Though the concentrations are higher than described in the EIS, the conclusions are unchanged. Specifically, the predicted daily average increases in TSS are within the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOGs) for the 1-day averaging duration (i.e., 25 mg/L increase) and the 30-day averaging duration (i.e., 5 mg/L increase). In addition, the predicted increases are relatively short-term and are not expected to be lethal.

Conclusions with regard to residual effects on nutrients and metals are related to TSS concentrations. There will be fewer activities with the potential to increase metals and nutrients in the Winnipeg River, though increases in the concentrations of nutrients and metals may be higher during commissioning of the spillway than described for the Original Arrangement. However, conclusions respecting nutrients and metals described in the EIS are unchanged (i.e., short-term increases in nutrients and metals associated with mobilized sediments).

Project effects on Dissolved Oxygen (DO) concentrations are expected to be reduced with the Revised Arrangement since Pond 3 will be flooded rather than isolated within the dewatered spillway shelf as in the Original Arrangement. As with the Original Arrangement, DO may still be negatively affected in Pond 2, especially during winter.

Overall, residual effects of construction, decommissioning and operation of the Revised Arrangement on water quality are considered to be not significant.

3.2.2 Sediment Quality

Construction of a greater proportion of the Revised Arrangement in the dry will reduce potential inputs of deleterious substances to the watercourse and potential effects on sediment quality. Conclusions with regard to effects of TSS and metals on sediment quality for the Revised Arrangement do not differ from those described for the Original

Arrangement. Consequently, no additional negative effects to sediment quality are expected as a result of construction of the Revised Arrangement.

3.2.3 Aquatic Habitat

As a result of the Revised Arrangement, the following changes to aquatic habitat will occur:

- Reduction in the area required for the upstream cofferdam/blast mattress;
- Increase in permanent wetted habitat as a result of the approach channel; and
- Increase in permanent wetted habitat in the forebay as a result of moving the main dam downstream.

Overall, the Revised Arrangement will result in a reduction in the alteration, disruption and destruction to fish habitat compared to the Original Arrangement.

The spillway channels will be constructed primarily in "the dry" on the east side of the river thereby avoiding direct effects to aquatic habitat. The Revised Arrangement will not require a cofferdam on the spillway shelf. The cofferdam/blast mattress at the mouth of the approach channel will be smaller than that required for the Original Arrangement. Consequently, negative effects to aquatic habitat during construction as described for the Original Arrangement are expected to be reduced as a result of the Revised Arrangement.

Project effects on aquatic habitat will primarily occur following commissioning of the spillway and will occur through operation (as described below).

The majority of the spillway approach channel, and the entire spillway structure and discharge channel of the Revised Arrangement will be located in an area that is currently terrestrial and therefore will have little direct effect on aquatic habitat post-construction. Flow patterns will change both upstream and downstream of the spillway as both the approach and discharge channels are pushed further to the east and the discharge orientation is shifted westward. Once discharge flows converge with powerhouse flows, little change in flow pattern will be noticeable.

The approach channel of the Revised Arrangement will be larger than the Original Arrangement resulting in creation of additional aquatic habitat. This habitat will be characterized by boulder and bedrock substrates, depths up to 12 m, and still water during non-spill periods (i.e., ~35% of the time) and by increasing velocities as spill events increase in magnitude.

The main dam has been relocated along the lower spillway shelf, downstream of the existing spillways. This will result in permanent watering of approximately 80,000 m^2 of spillway shelf habitat that will become part of the Pointe du Bois forebay. The newly flooded habitat will be characterized by negligible water velocities, and have a variety of depths up to 10 m and a substratum of smooth and coarse rock. The decommissioned

old spillway piers will add to the value of this habitat by providing structure and cover. Inundation of habitats upstream of the main dam with the Revised Arrangement will reduce loss of fish habitat associated with dewatering the spillway shelf that would have occurred with the previous arrangement.

Similar to the Original Arrangement, the lower part of the spillway shelf will be dewatered. Ponds 7 and 8 will not be dewatered with the Revised Arrangement, but will no longer receive inflow during spill events and will not be suitable for supporting fish following commissioning of the spillway.

Design features incorporated into the Original Arrangement to mitigate effects to aquatic environments (see Section 8.5.3.3 of the EIS) were also incorporated into the Revised Arrangement.

The Revised Arrangement will result in a reduction in the alteration, disruption and destruction to fish habitat compared to the Original Arrangement.

3.2.4 Lower Trophic Levels

The reduction in total area dewatered will be reduced with the Revised Arrangement. Consequently the Revised Arrangement is expected to have no further effects on lower trophic levels than those described for the Original Arrangement.

3.2.5 Fish Community

In comparison to the Original Arrangement, the Revised Arrangement will have a greater proportion of the spillway structure constructed in the dry and have reduced footprints of the cofferdams and rockfill mattress within existing aquatic habitats. Consequently the Revised Arrangement is expected to have no further effects on the fish community during construction than those described for the Original Arrangement.

Residual effects to fish habitat are expected to be site-specific and confined to reaches 1, 2, and 3. Habitat created by re-watering the area between the main dam and the existing dam and spillway will be of benefit to Walleye and Northern Pike as well as several other species of fish inhabiting the Pointe du Bois forebay. Fish will also make limited use of the approach channel for foraging during non-spill events. The upstream flow regime change (shift to the east) and rockfill mattress remnant are considered neutral with respect to effects on the fish community. Consequently, the upstream fish population will experience increased benefits with the Revised Arrangement compared to the Original Arrangement due to the residual increase in wetted habitat.

Effects to fish populations downstream of the Revised Arrangement will be similar to those described for the Original Arrangement. The notable difference is the orientation and location of the flow from the discharge channel. Changes to water velocities and flow patterns in the immediate vicinity of the spillway and downstream to Eight Foot Falls during operation of the new spillway facilities have the potential to alter localized

habitat suitability for fish spawning in Reach 3, particularly for Lake Sturgeon. Three and five variable habitat suitability index modeling results show that the Revised Arrangement will result in a net gain in weighted useable area for Lake Sturgeon spawning habitat post-project under all flow scenarios (50th, 75th, 85th and 95th percentiles), refer to Attachment 3.1 for results. Figures 8.8A Rev1 and 8.8B Rev1(V1 and V2) illustrate post-project habitat suitability scenarios generated by the five variable model for 50th and 95th percentile flows, respectively. There are two versions of the HSI model for the 95th percentile flows because there are two possible spawning barriers based on channel alignment and velocity distributions with the Revised Arrangement.

Mitigation measures proposed for the Original Arrangement (see Section 8.5.5.3 of the EIS) will be implemented for the Revised Arrangement. Overall, no negative residual effects to Lake Sturgeon, Walleye or Northern Pike or their habitat are anticipated as a result of the Revised Arrangement.

Adaptive management opportunities for Lake Sturgeon spawning for the Revised Arrangement include flow manipulation through the spillway and substrate enhancements. There is no provision for spills on the spillway shelf with the Revised Arrangement.

3.2.6 Fish Quality

Effects to fish quality are not expected to change as a result of the Revised Arrangement.

3.3 Terrestrial Environment

Approximately 2 hectares of additional terrestrial habitat will be cleared to facilitate construction of the southern portion of the discharge channel. Mitigation measures as outlined for the Original Arrangement will be implemented. There are no changes to the residual effects of the Revised Arrangement after mitigation, as compared to those described for the Original Arrangement.

3.4 Socio-Economic Environment

3.4.1 Economy

The Revised Arrangement will result in only a minor reduction in workforce. Conclusions with regard to residual effects to the economy for the Revised Arrangement do not differ from those described for the Original Arrangement.

3.4.2 Property Ownership and Land Use

There is no change to the residual effects of the Revised Arrangement on property ownership and land use after mitigation, as compared to those described for the Original Arrangement.

3.4.3 Infrastructure and Services

There is no change to the residual effects of the Revised Arrangement on infrastructure and services as compared to the Original Arrangement.

3.4.4 Personal, Family and Community Life

The duration of adverse effects related to esthetics will be decreased for the Revised Arrangement compared to those described for the Original Arrangement. Residual effects to personal, family and community life do not differ from those described for the Original Arrangement.

3.4.5 Municipal and Local Government District Controls

There is no change to the residual effects of the Revised Arrangement on municipal and local government controls as compared to the Original Arrangement.

3.4.6 Commercial Resource Use

There is no change to the residual effects of the Revised Arrangement on commercial resource use as compared to the Original Arrangement.

3.4.7 Recreational Use and Tourism

Effects related to recreational use and tourism as described for the Original Arrangement will be reduced with the Revised Arrangement due to a shorter construction schedule. No residual effects to recreation and tourism are anticipated.

3.4.8 Heritage Resources

Due to the Revised Arrangement, a known heritage site is now within direct impact of the spillway discharge channel. Mitigation by way of site excavation and monitoring has been recommended by the Historic Resources Branch, as specified under Section 12(2) of The *Heritage Resources Act* (1986). With the adoption of mitigation stated above, the effect to heritage resources is considered to be not significant.

4.0 MONITORING AND FOLLOW-UP

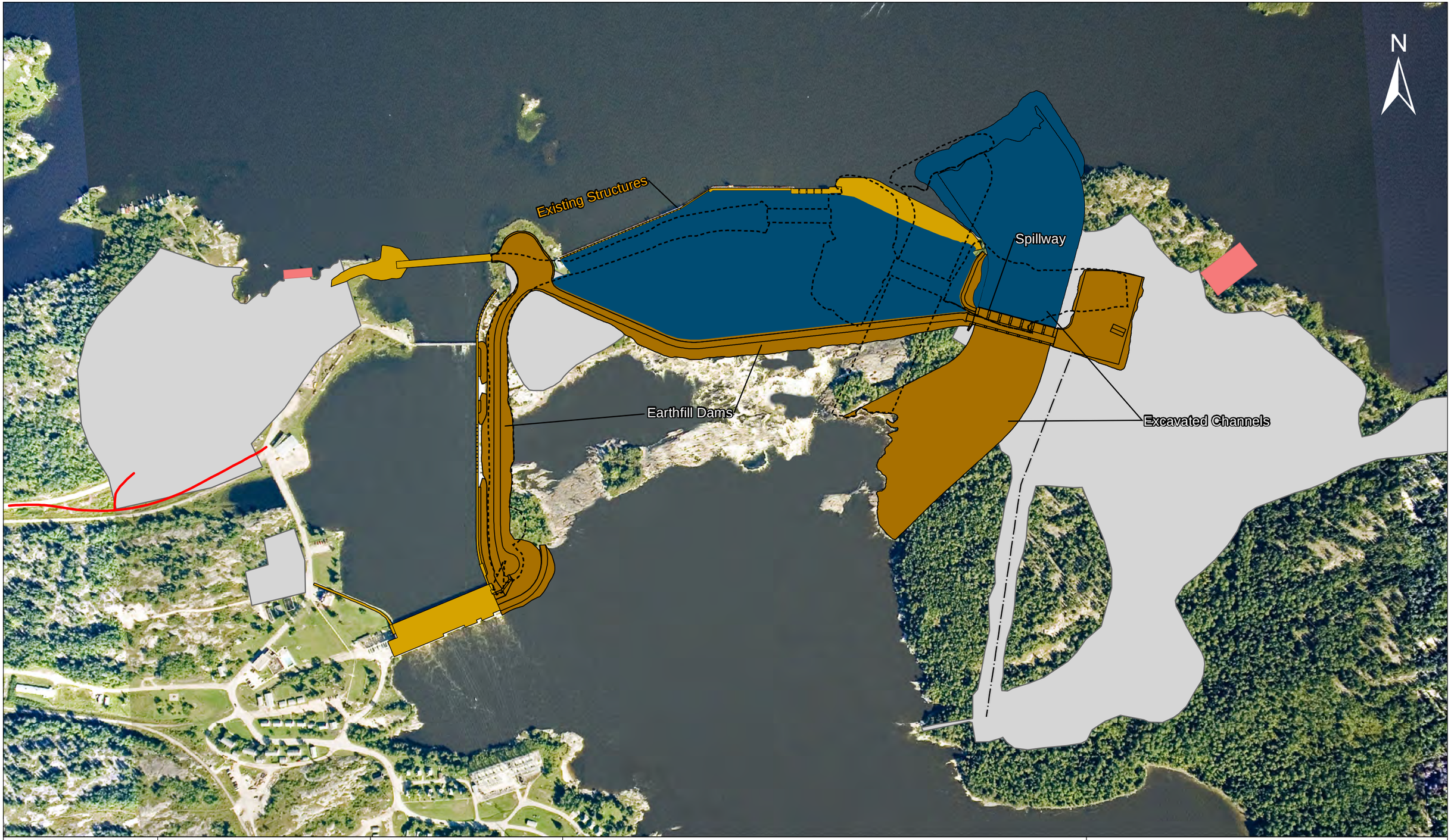
As with the Original Arrangement, an Environmental Protection Progam will be developed for the Revised Arrangement.

5.0 SUMMARY

The Revised Arrangement to the Pointe du Bois Spillway Replacement Project will result in reduced costs and schedule when compared to the Original Arrangement.

The effects assessment demonstrates that the potential environmental effects as a result of the Revised Arrangement are not adverse and in some cases positive. Specifically, the Revised Arrangement has the following environmental benefits compare with the Original Arrangement:

- Reduction in sedimentation as a result of fewer cofferdams and the elimination of the secondary spillway;
- Reduction to the alteration; disruption and destruction to fish habitat; and
- Reduction in construction schedule which reduces impacts to those that utilize the area.



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.1 0.2 Kilometres

0 0.05 0.1 Miles

DATA SOURCE:		
Manitoba Hydro, KGS Group		
DATE CREATED:	CREATED BY:	
06 JULY 2012	KGS Group	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION: 2.0	13 AUG 2012	

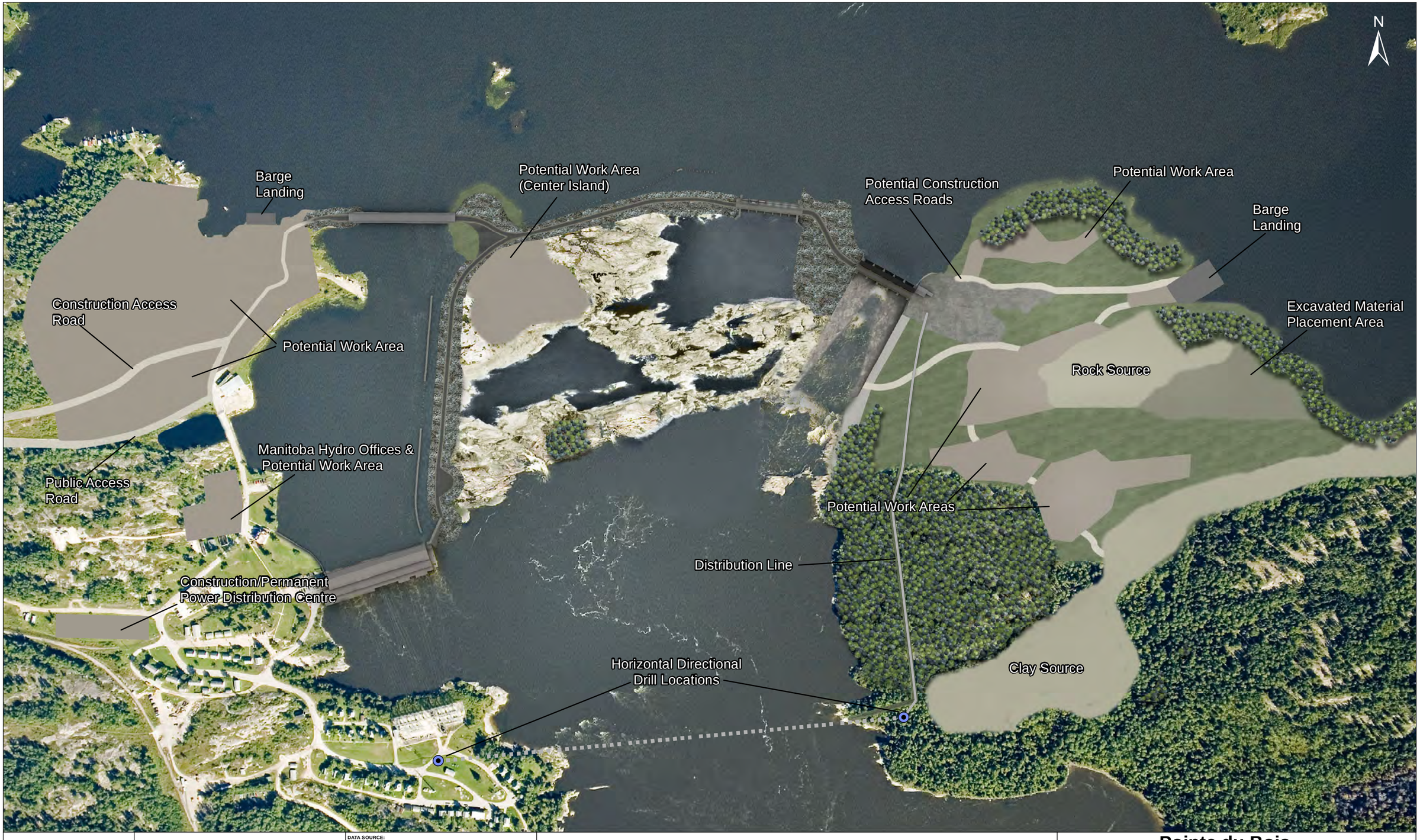
Legend

- Existing Structures
- Flooded Areas of New Arrangement
- New Arrangement (2012)
- Barge Landing
- Old Arrangement (June 2011)
- Distribution Line

Pointe Du Bois Spillway Replacement Project

Original and Revised Arrangements

Figure: 3.1 Rev 1



Manitoba Hydro

0 0.1 0.2 Kilometres
0 0.05 0.1 Miles

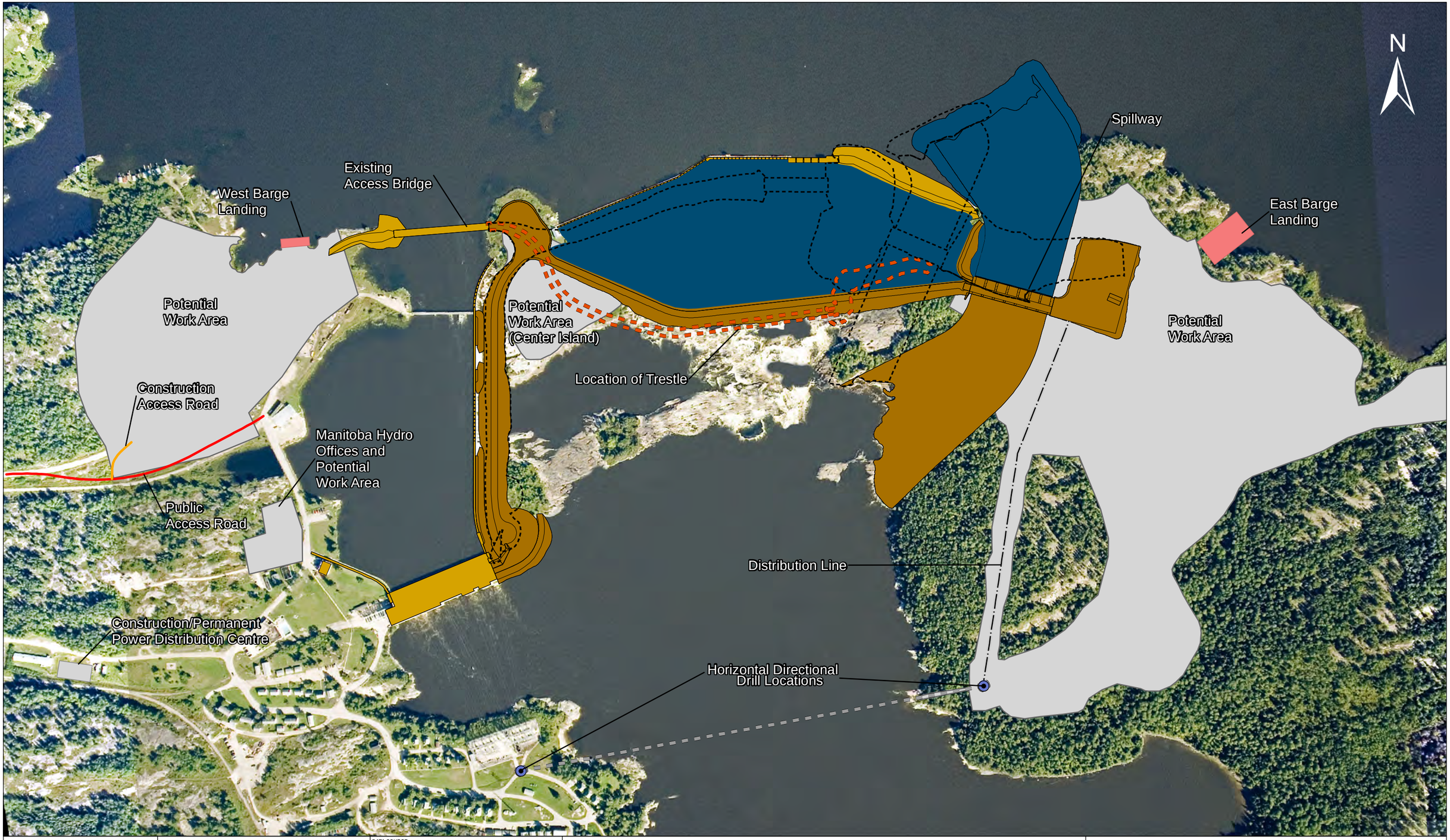
DATA SOURCE: Manitoba Hydro, KGS Acres		
DATE CREATED: 12 MAY 2011	CREATED BY: HPP - GIS & Special Studies	
REVISION NO: VERSION: 1.0	REVISION DATE: 26 MAY 2011	QA/QC: RHP, MWZ, BMP

File Location:

Pointe du Bois Spillway Replacement Project

Supporting Infrastructure

Figure: 3.4



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.1 0.2 Kilometres

0 0.05 0.1 Miles

DATA SOURCE:		
Manitoba Hydro, KGS Group		
DATE CREATED:	CREATED BY:	
06 JULY 2012	KGS Group	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION: 2.0	13 AUG 2012	

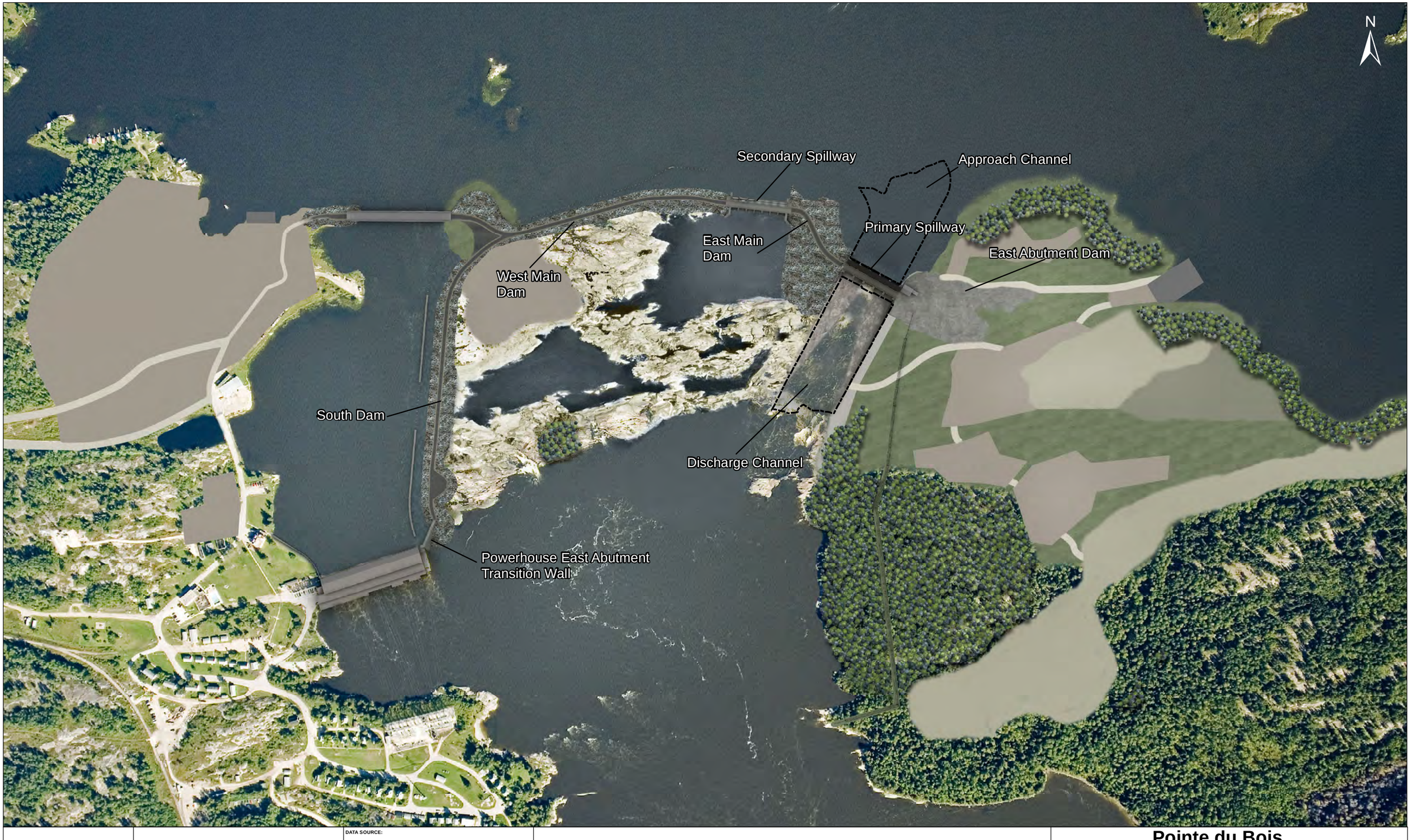
Legend

- Existing Structures
- Flooded Areas of New Arrangement
- New Arrangement (2012)
- Old Arrangement (June 2011)

Pointe Du Bois Spillway Replacement Project

Supporting Infrastructure

Figure: 3.4 Rev 1



Manitoba Hydro

0 0.1 0.2 Kilometres
0 0.05 0.1 Miles

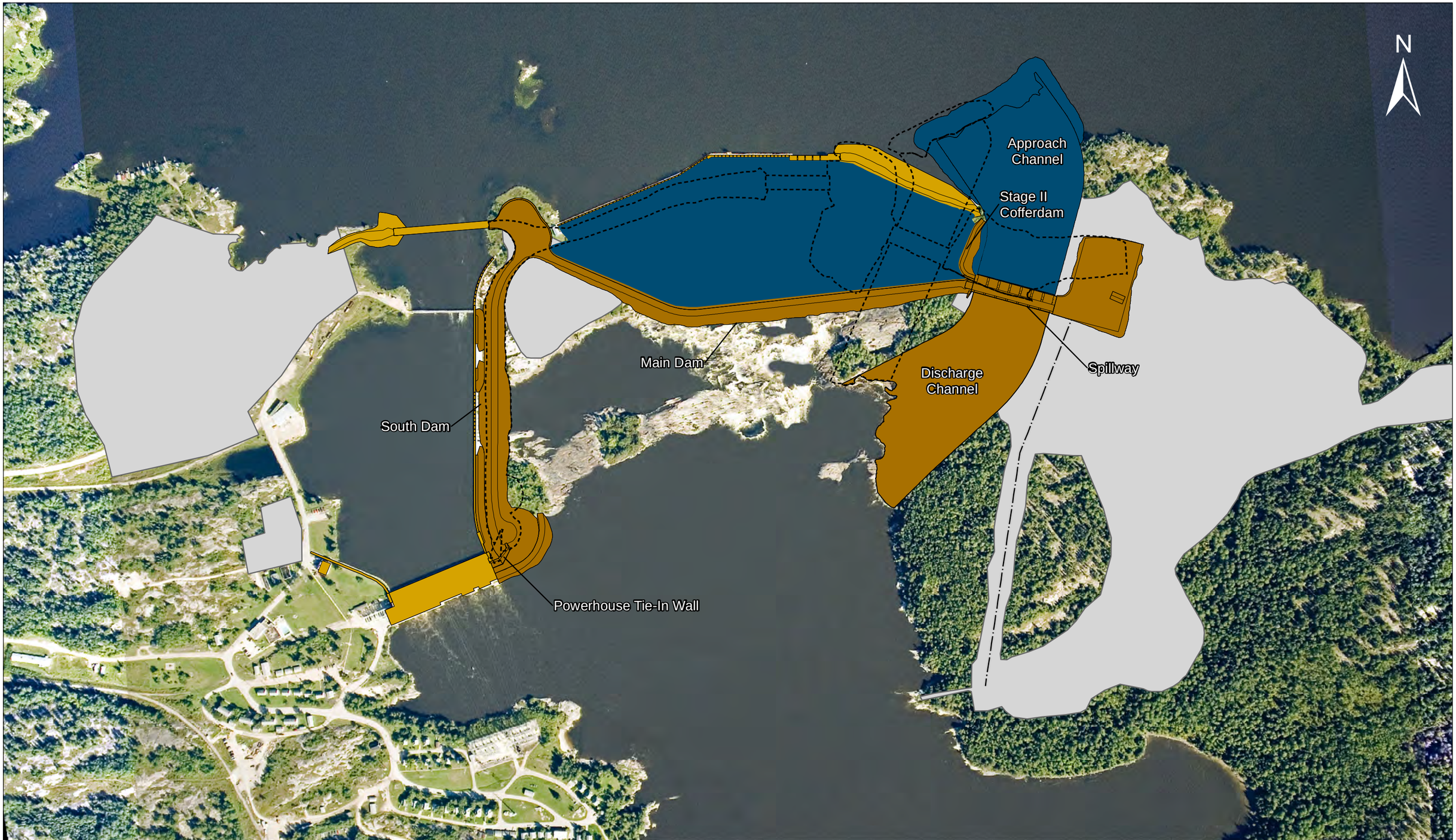
DATA SOURCE: Manitoba Hydro, KGS Acres		
DATE CREATED: 12 MAY 2011	CREATED BY: HPP - GIS & Special Studies	
REVISION NO: VERSION: 1.0	REVISION DATE: 31 MAY 2011	QA/QC: RHP, MWZ, BMP

File Location:

Pointe du Bois Spillway Replacement Project

Principal Structures

Figure: 3.5



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.1 0.2 Kilometres

0 0.05 0.1 Miles

DATA SOURCE:		
Manitoba Hydro, KGS Group		
DATE CREATED: 06 JULY 2012	CREATED BY: KGS Group	
REVISION NO: VERSION: 2.0	REVISION DATE: 13 AUG 2012	QA/QC:

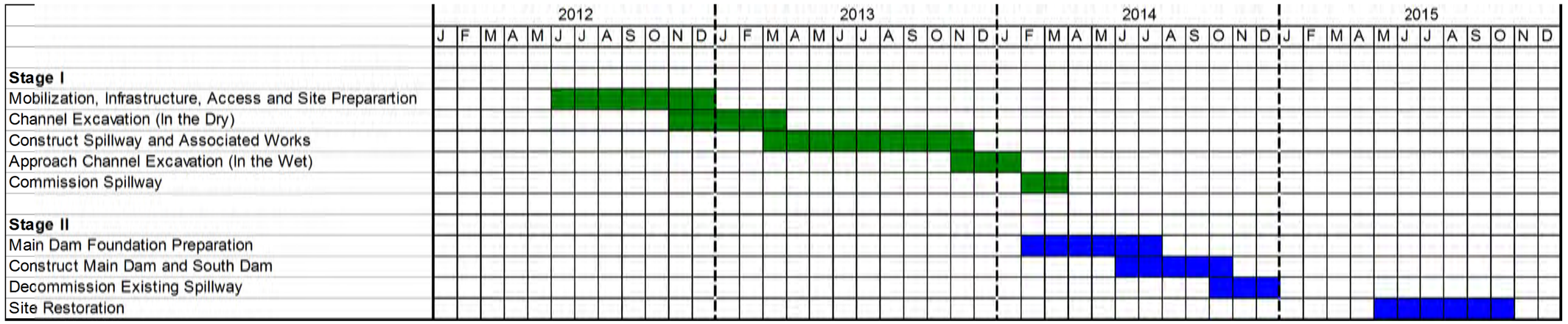
Legend

- Existing Structures
- Flooded Areas of New Arrangement
- New Arrangement (2012)
- Old Arrangement (June 2011)
- Distribution Line

Pointe Du Bois Spillway Replacement Project

Principal Structures

Figure: 3.5 Rev 1



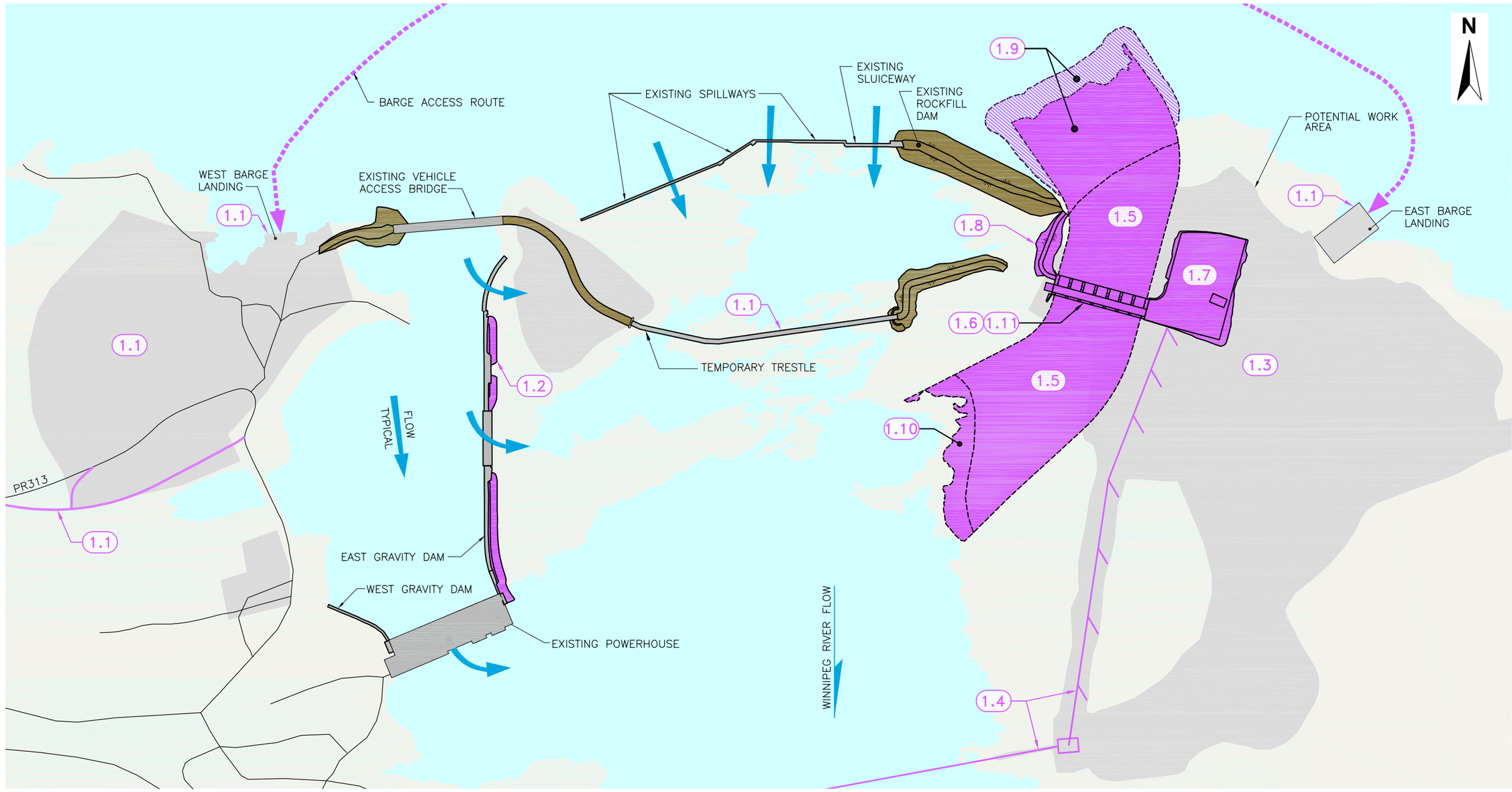
DATA SOURCE :
Manitoba Hydro, KGS Group

DATE CREATED :	CREATED BY :	
06 JUL 2012	KGS Group	
REVISION No.	REVISION DATE :	QA/QC :
VERSION 2.0	13 AUG 2012	

Pointe du Bois Spillway Replacement Project

Project Construction Stages

Figure: 3.6 Rev 1



STAGE I

1.1 CONSTRUCT NEW LOCAL ACCESS ROAD, WEST SIDE SUPPORTING INFRASTRUCTURE, BARGE LANDINGS AND TEMPORARY TRESTLE
1.2 CONSTRUCT EAST GRAVITY DAM ROCKFILL SUPPORT
1.3 DEVELOP EAST SIDE WORK AREA
1.4 CONSTRUCTION POWER
1.5 CHANNEL EXCAVATION (IN THE DRY)
1.6 CONSTRUCT SPILLWAY
1.7 CONSTRUCT ANCILLARY BUILDING
1.8 CONSTRUCT STAGE II COFFERDAM
1.9 CONSTRUCT ROCKFILL MATTRESS AND APPROACH CHANNEL EXCAVATION (IN THE WET)
1.10 COMPLETE DISCHARGE CHANNEL EXCAVATION
1.11 COMMISSION SPILLWAY

Manitoba Hydro

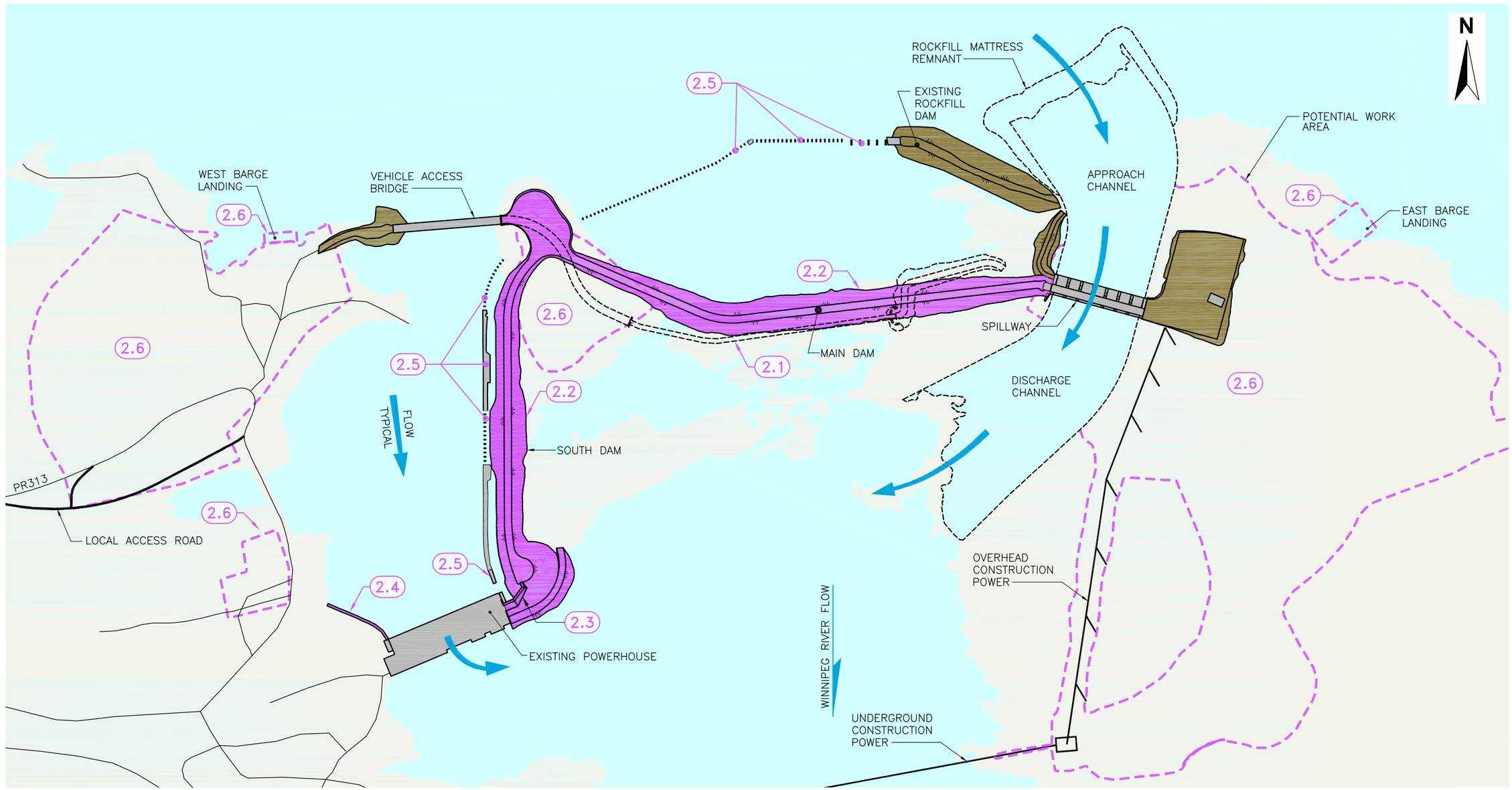
50 0 50 100 150m
SCALE 1:3200 METRIC

DATA SOURCE : Manitoba Hydro, KGS Group
DATE CREATED : 06 JUL 2012
CREATED BY : KGS Group
REVISION No. VERSION 2.0
REVISION DATE : 13 AUG 2012
QA/QC :

Pointe du Bois Spillway Replacement Project

STAGE 1 Mobilization, Excavation & Spillway Construction

Figure: 3.7A Rev 1



STAGE II

2.1 REMOVE TRESTLE
2.2 CONSTRUCT MAIN DAM & SOUTH DAM
2.3 CONSTRUCT POWERHOUSE TIE–IN WALL
2.4 REHABILITATE EXISTING WEST GRAVITY DAM & ABUTMENT
2.5 DECOMMISSION AND PARTIALLY DEMOLISH EXISTING SPILLWAY AND SLUICEWAY STRUCTURES AND REMOVE PORTION OF EAST GRAVITY DAM
2.6 REHABILITATE WORK AREAS & BARGE LANDINGS

Manitoba Hydro

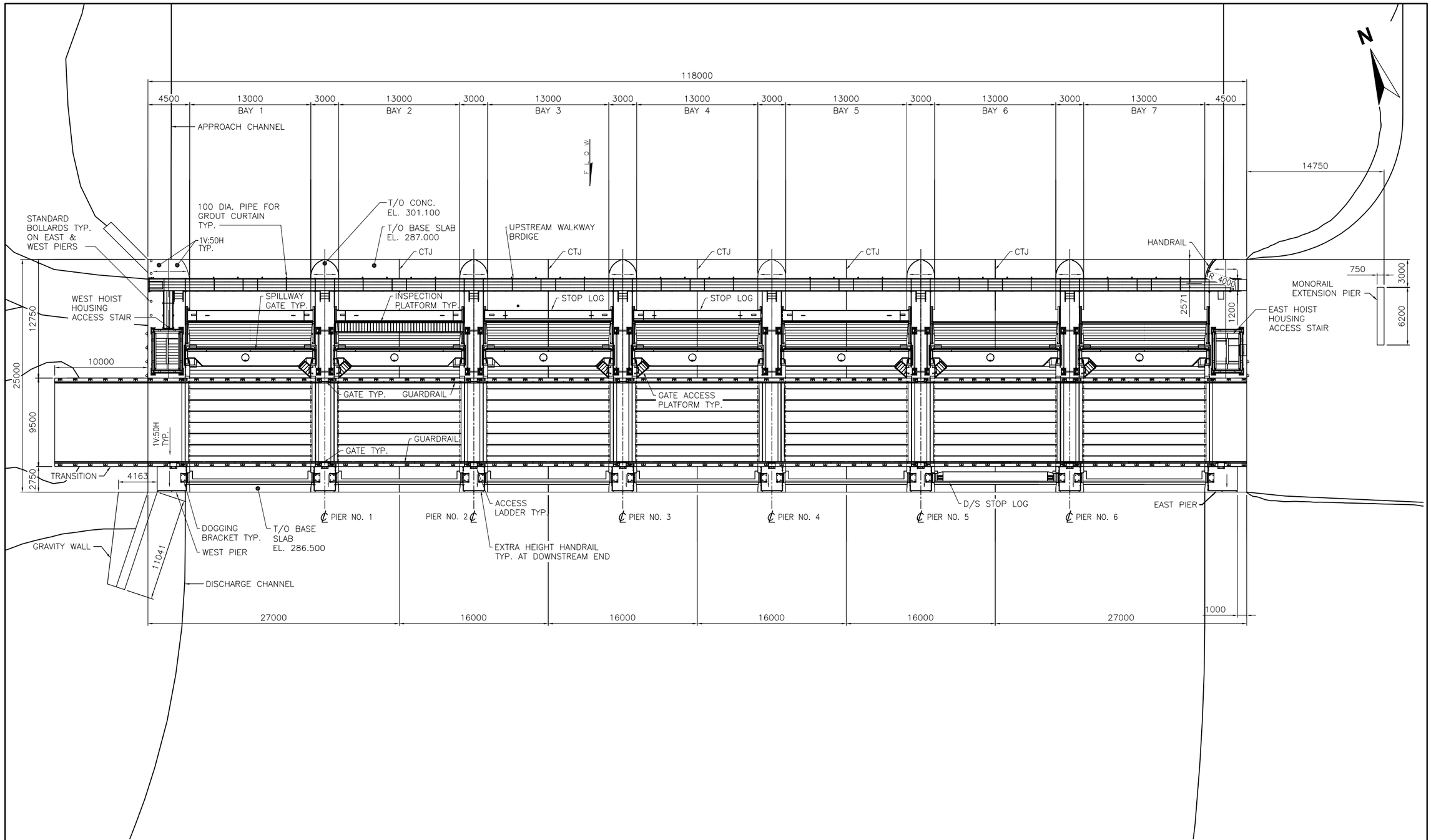
50 0 50 100 150m
SCALE 1:3200 METRIC

DATA SOURCE : Manitoba Hydro, KGS Group
DATE CREATED : 06 JUL 2012
CREATED BY : KGS Group
REVISION No. VERSION 2.0
REVISION DATE : 13 AUG 2012
QA/QC :

Pointe du Bois Spillway Replacement Project

STAGE 2 Construction, Decommissioning & Rehabilitation

Figure: 3.7B Rev 1



Manitoba Hydro

5000 0 5000 10000mm

SCALE 1:400 METRIC

DATA SOURCE : Manitoba Hydro, KGS Group

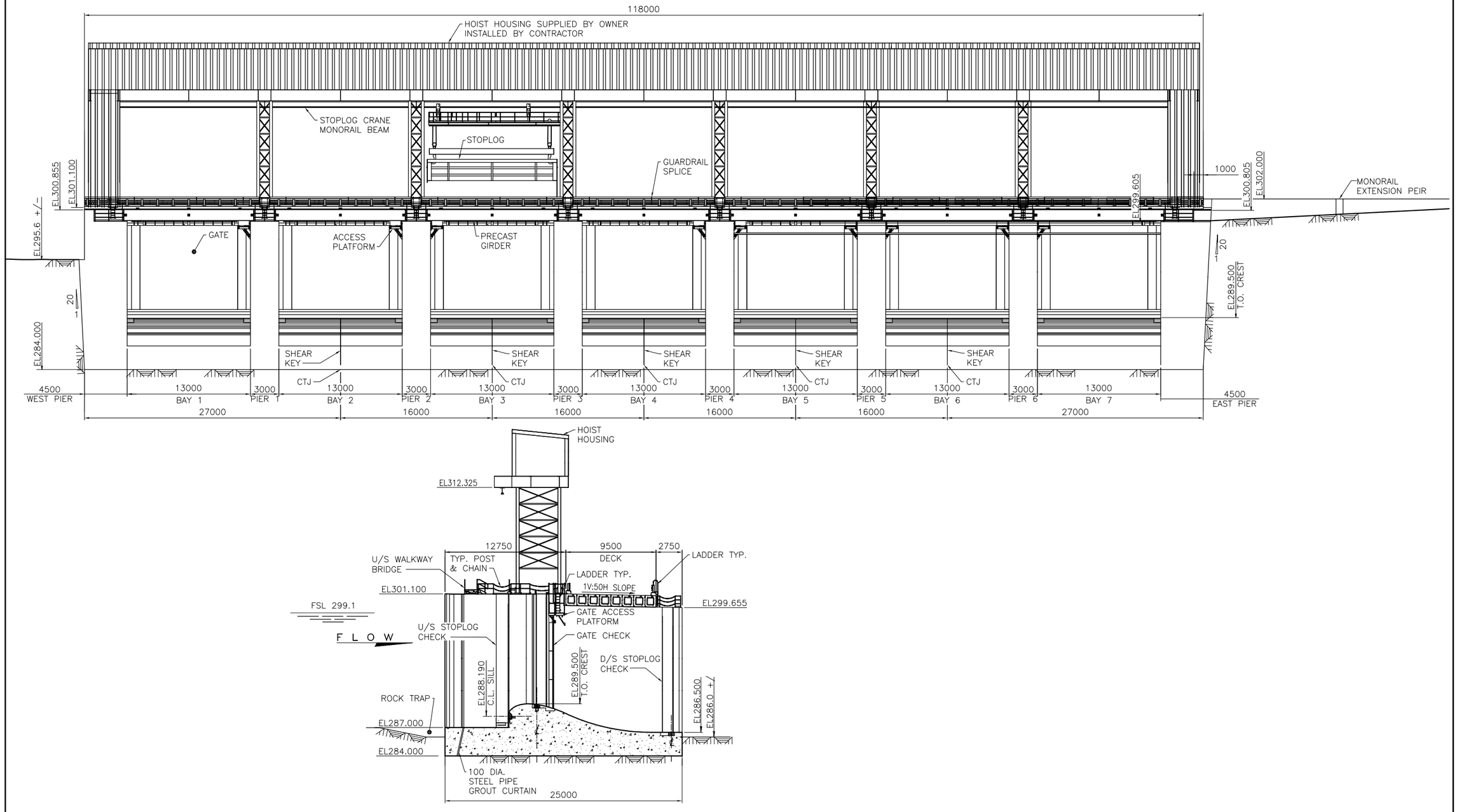
DATE CREATED :	CREATED BY :
06 JUL 2012	KGS Group

REVISION No.	REVISION DATE :	QA/QC :
VERSION 2.0	13 AUG 2012	

Pointe du Bois Spillway Replacement Project

New Spillway Plan and Sections

Figure: 3.17A Rev 1



Manitoba Hydro

5000 0 5000 10000mm

SCALE 1:400 METRIC

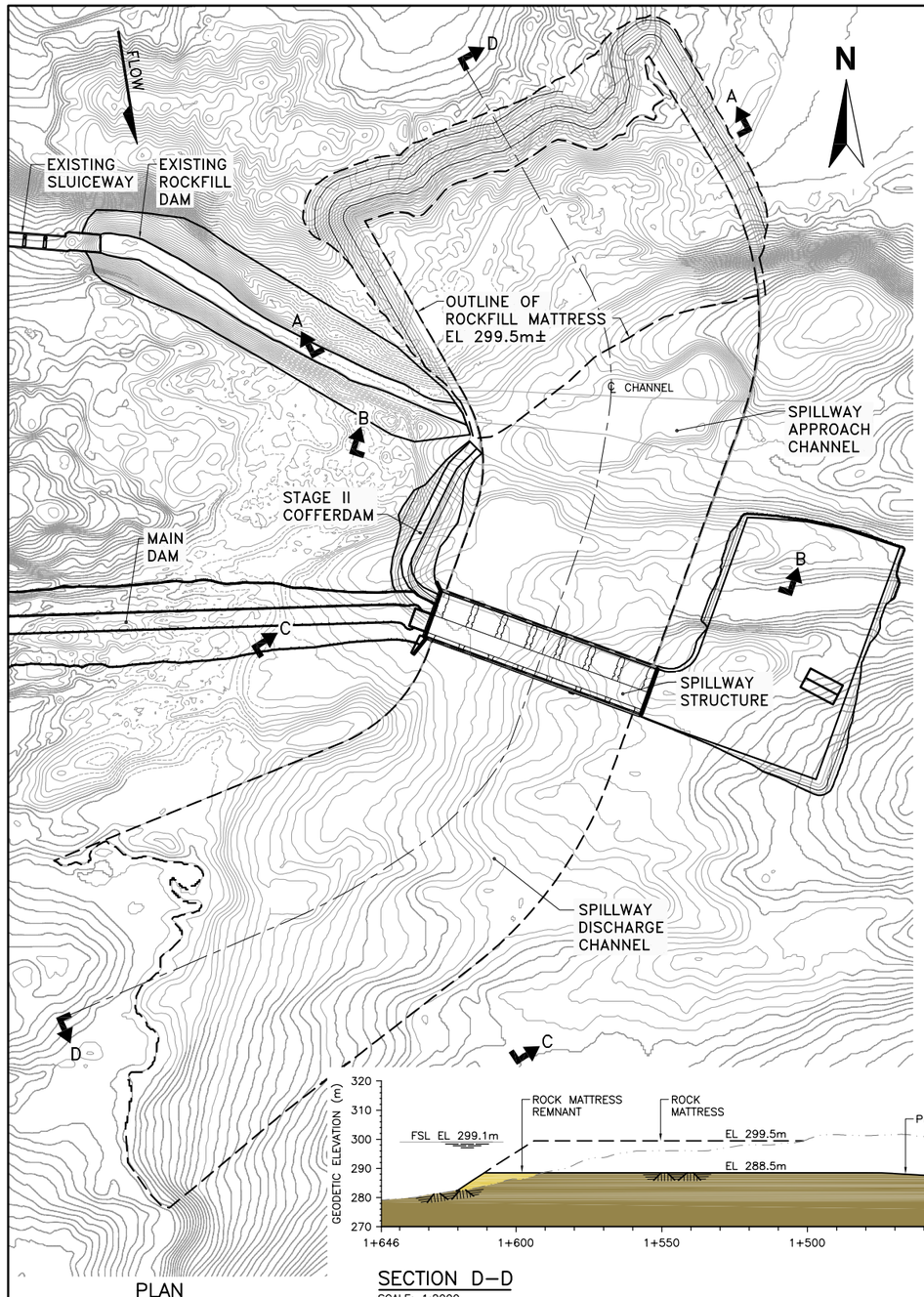
DATA SOURCE: Manitoba Hydro, KGS Group

DATE CREATED:	CREATED BY:	
06 JUL 2012	KGS Group	
REVISION No.	REVISION DATE:	QA/QC:
VERSION 2.0	13 AUG 2012	

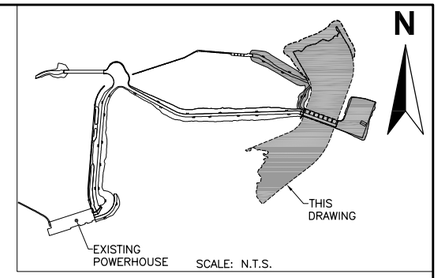
Pointe du Bois Spillway Replacement Project

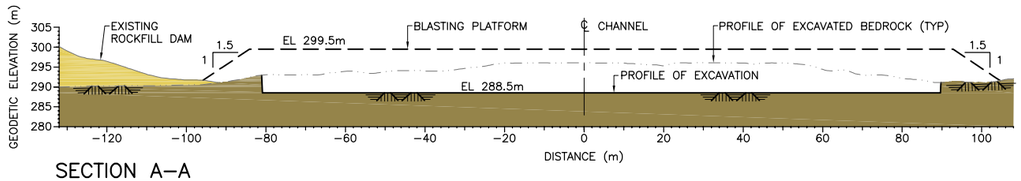
New Spillway Elevation and Section

Figure: 3.17B Rev 1



PLAN





SECTION A–A
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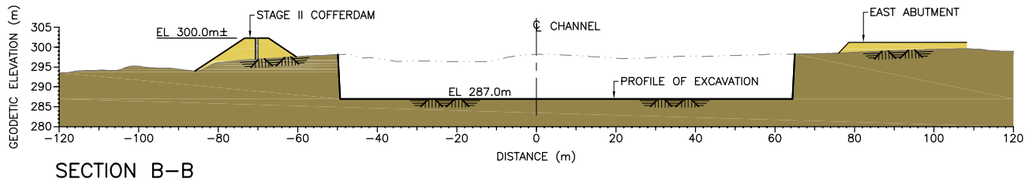

SECTION B–B
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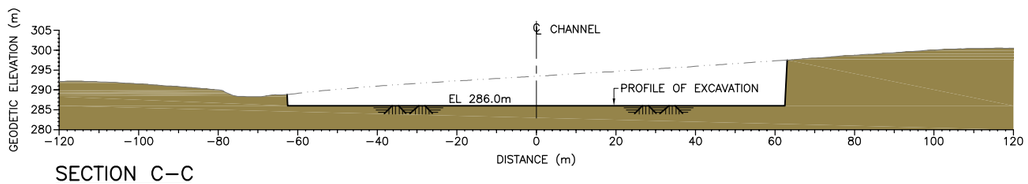
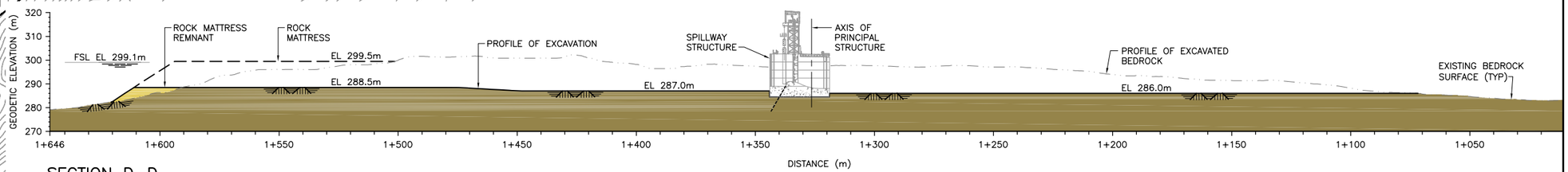


SECTION C–C
SCALE: 1:1500



SECTION D–D
SCALE: 1:2000

Manitoba Hydro

25 0 25 50 75 100
SCALE 1:3000 METRIC

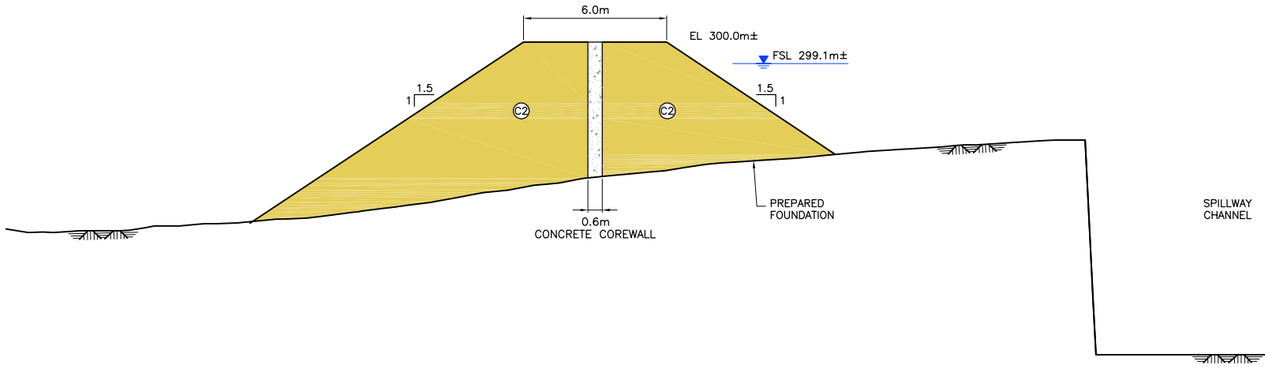
DATA SOURCE: Manitoba Hydro, KGS

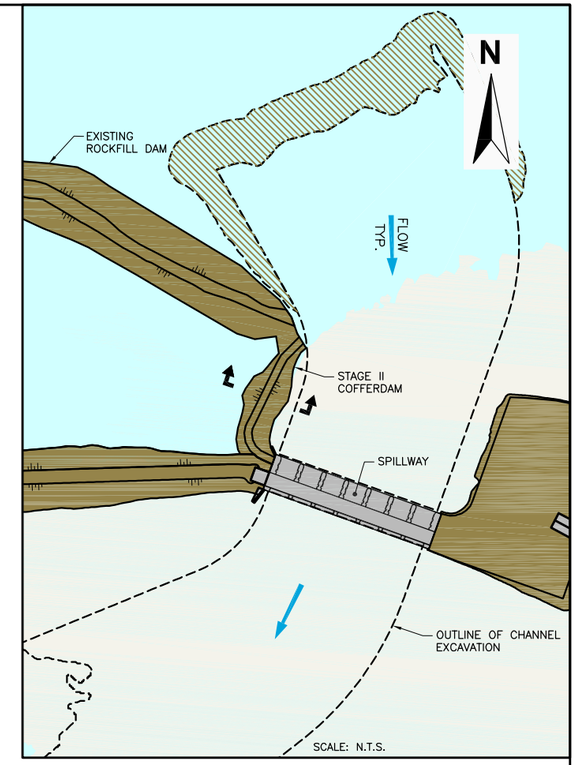
DATE CREATED:	CREATED BY:	
06 JUL 2012	KGS GROUP	
REVISION No.	REVISION DATE:	QA/QC:
VERSION 2.0	13 AUG 2012	

Pointe du Bois Spillway Replacement Project

Spillway Approach and Discharge Channels

Figure: 3.19 Rev 1





Manitoba Hydro

2.5 0 2.5 5 7.5

SCALE 1:250 METRIC

DATA SOURCE:
Manitoba Hydro, KGS

DATE CREATED:	CREATED BY:
06 JUL 2012	KGS GROUP

REVISION No.	REVISION DATE:	QA/QC:
VERSION 2.0	13 AUG 2012	

Legend

C2 ROCKFILL

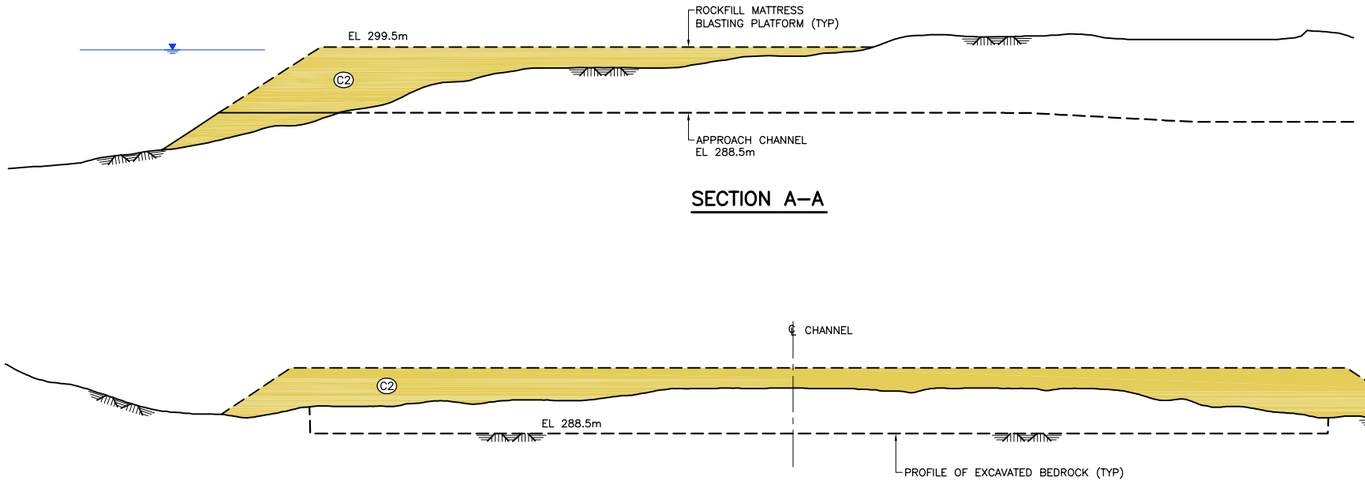
WATER LEVEL

BEDROCK SURFACE

Pointe du Bois
Spillway Replacement Project

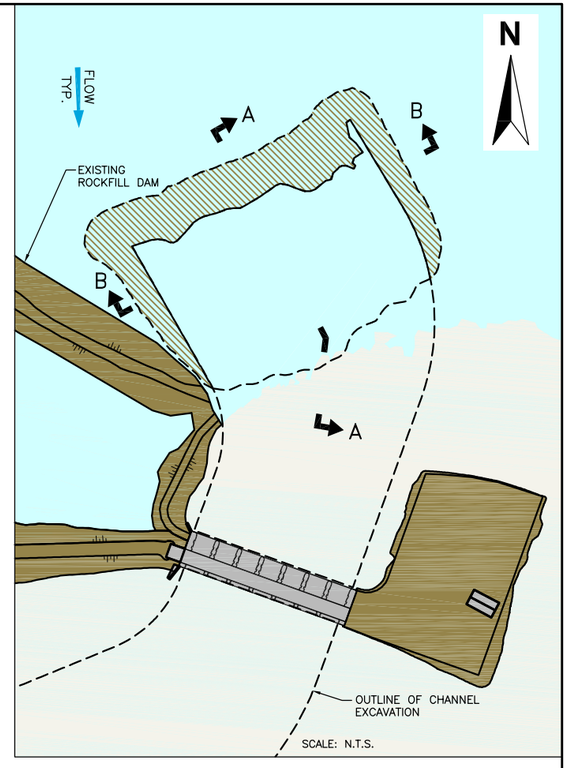
Stage II Cofferdam

Figure:
3.20
Rev 1



SECTION A–A

SECTION B–B



Manitoba Hydro

10 0 10 20 30m

HORIZONTAL SCALE 1:1000 METRIC

DATA SOURCE :
Manitoba Hydro, KGS

DATE CREATED :	CREATED BY :
06 JUL 2012	KGS GROUP

REVISION No.	REVISION DATE :	QA/QC :
VERSION 2.0	13 AUG 2012	

Legend

C2 ROCKFILL

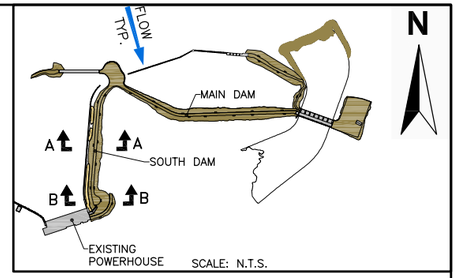
WATER LEVEL

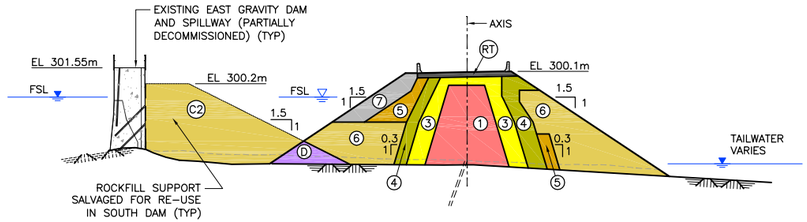
BEDROCK SURFACE

Pointe du Bois Spillway Replacement Project

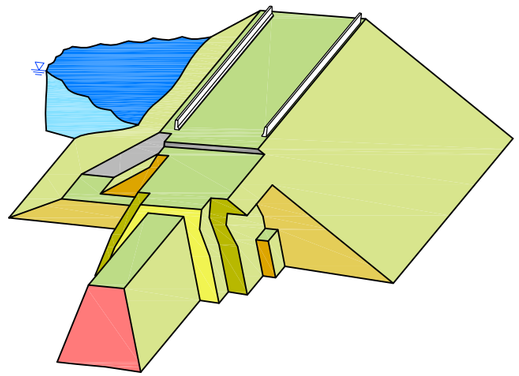
Rockfill Mattress

Figure: 3.23 Rev 1

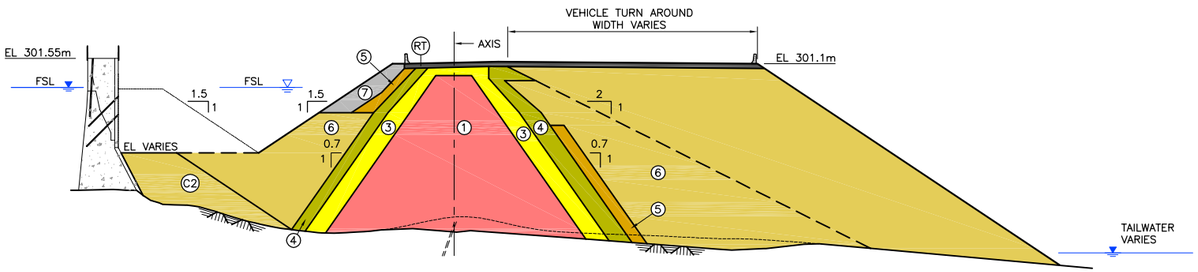




A–A SOUTH DAM AND MAIN DAM



EARTHFILL DAM (ISOMETRIC)
(SOUTH AND MAIN DAM)



B–B SOUTH DAM AT TURN AROUND

Manitoba Hydro

5 0 5 10 15m

SCALE 1:500 METRIC

DATA SOURCE: Manitoba Hydro, KGS

DATE CREATED: 06 JUL 2012

CREATED BY: KGS GROUP

REVISION No. VERSION 2.0

REVISION DATE: 13 AUG 2012

QA/QC:

Legend

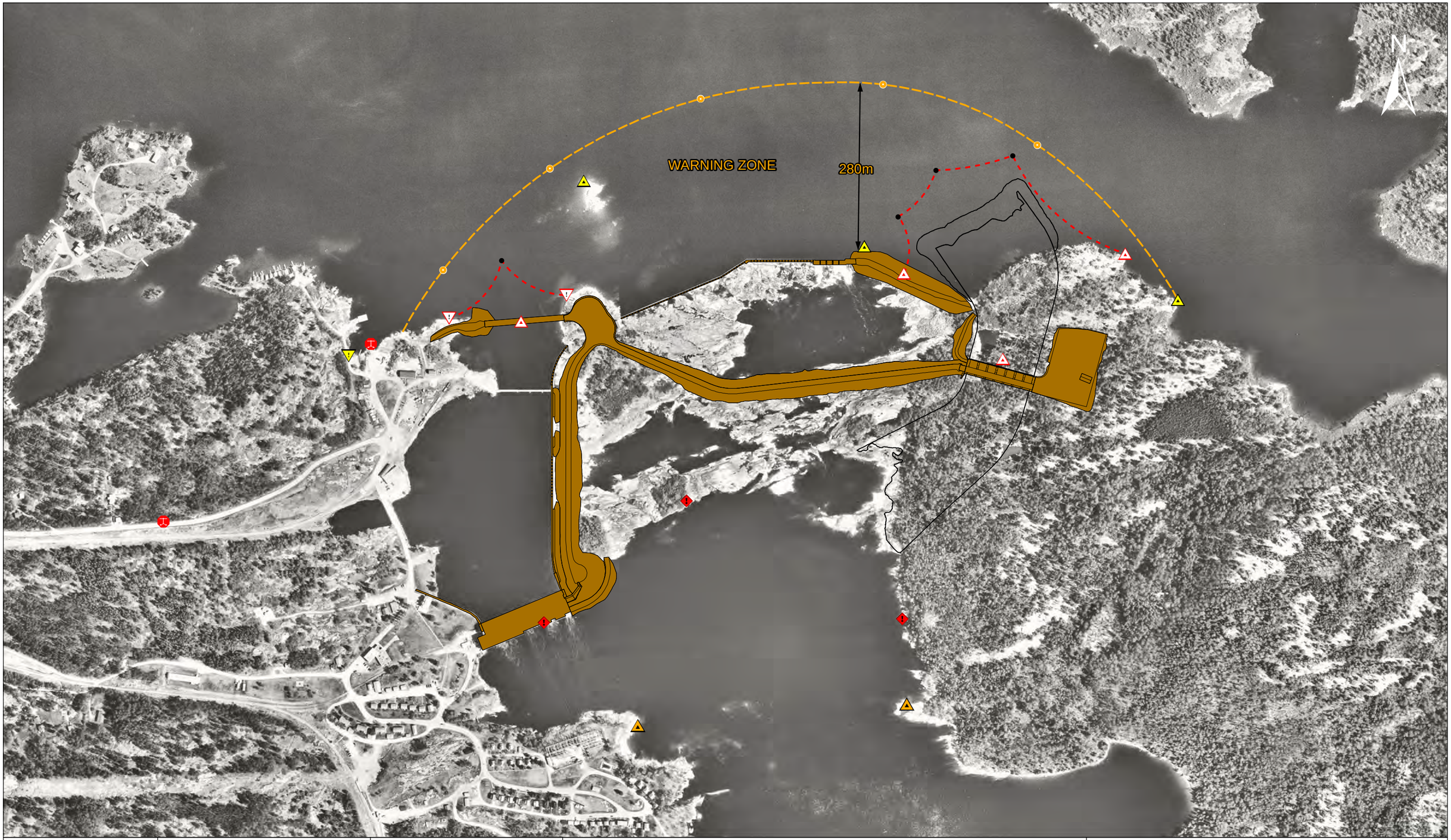
DAM FILL

- RT ROAD TOPPING
- 1 IMPERVIOUS FILL
- 3 FINE GRANULAR
- 4 COARSE GRANULAR
- 5 RIPRAP BEDDING
- 6 ROCKFILL
- 7 RIPRAP
- C2 ROCKFILL (SELECT SHOT–ROCK)
- D LARGE DIAMETER RIPRAP
- WATER LEVEL
- BEDROCK SURFACE

Pointe du Bois Spillway Replacement Project

Earthfill Dams - Sections

Figure: 3.24 Rev 1



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.1 0.2 Kilometres

0 0.05 0.1 Miles

DATA SOURCE:		
Manitoba Hydro, KGS Group		
DATE CREATED:	CREATED BY:	
06 JULY 2012	KGS Group	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION: 2.0	13 AUG 2012	

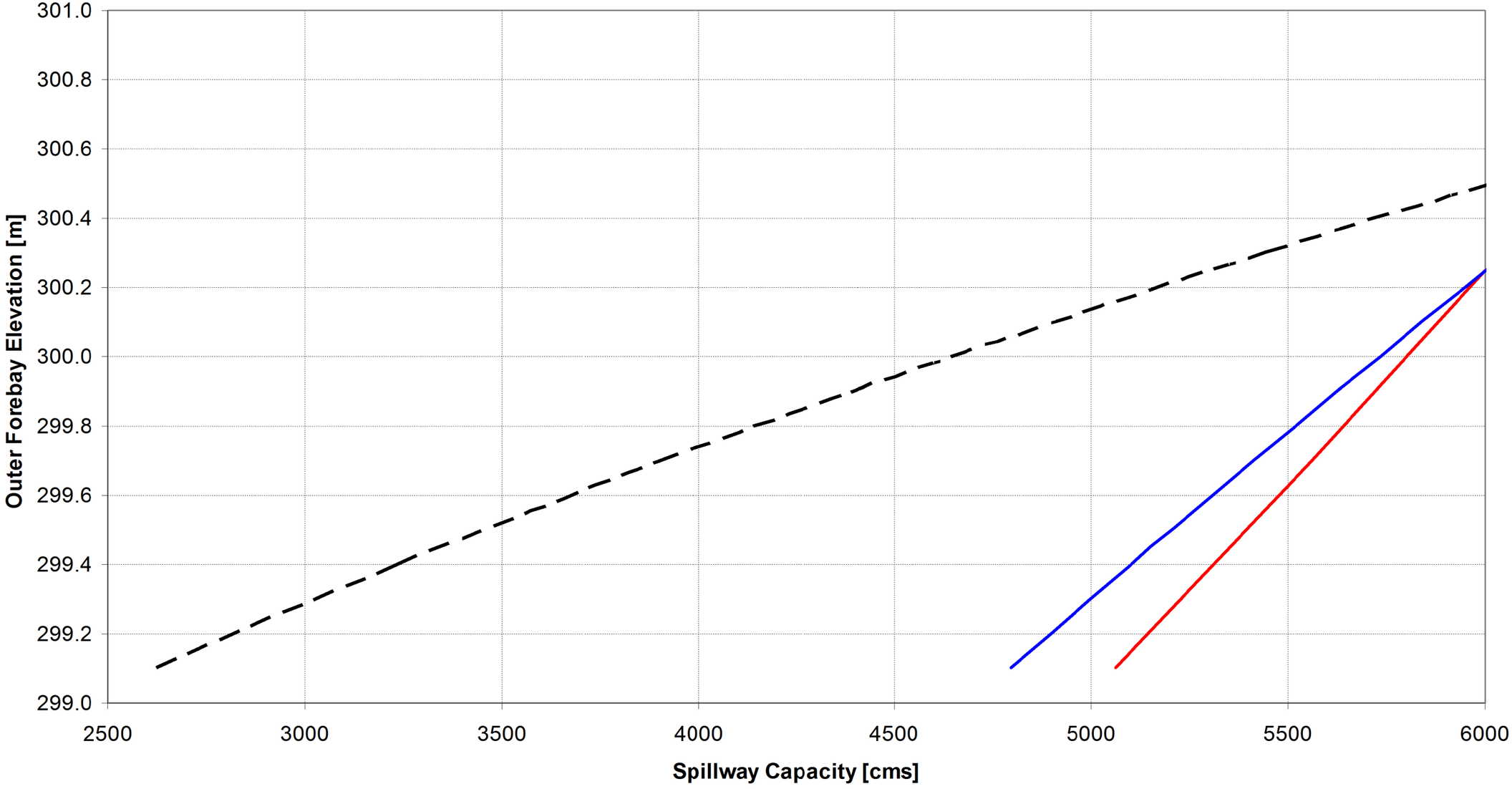
Legend

- New Warning Sign and Use Designated Portage Route Sign
- New Upstream Danger Sign
- New Downstream Danger Sign
- New Downstream Danger Sign and Use Designated Portage Route Sign
- New Buoys
- Existing Danger Sign
- Existing Warning Sign
- Boat Launch Closed Sign
- Boom
- Warning Zone

Pointe Du Bois Spillway Replacement Project

Preliminary Navigable Waters Public Safety Measures

Figure: 3.27 Rev 1



Manitoba Hydro

DATA SOURCE : Manitoba Hydro, KGS Group

DATE CREATED :	CREATED BY :	
06 JUL 2012	KGS Group	
REVISION No.	REVISION DATE :	QA/QC :
VERSION 2.0	13 AUG 2012	

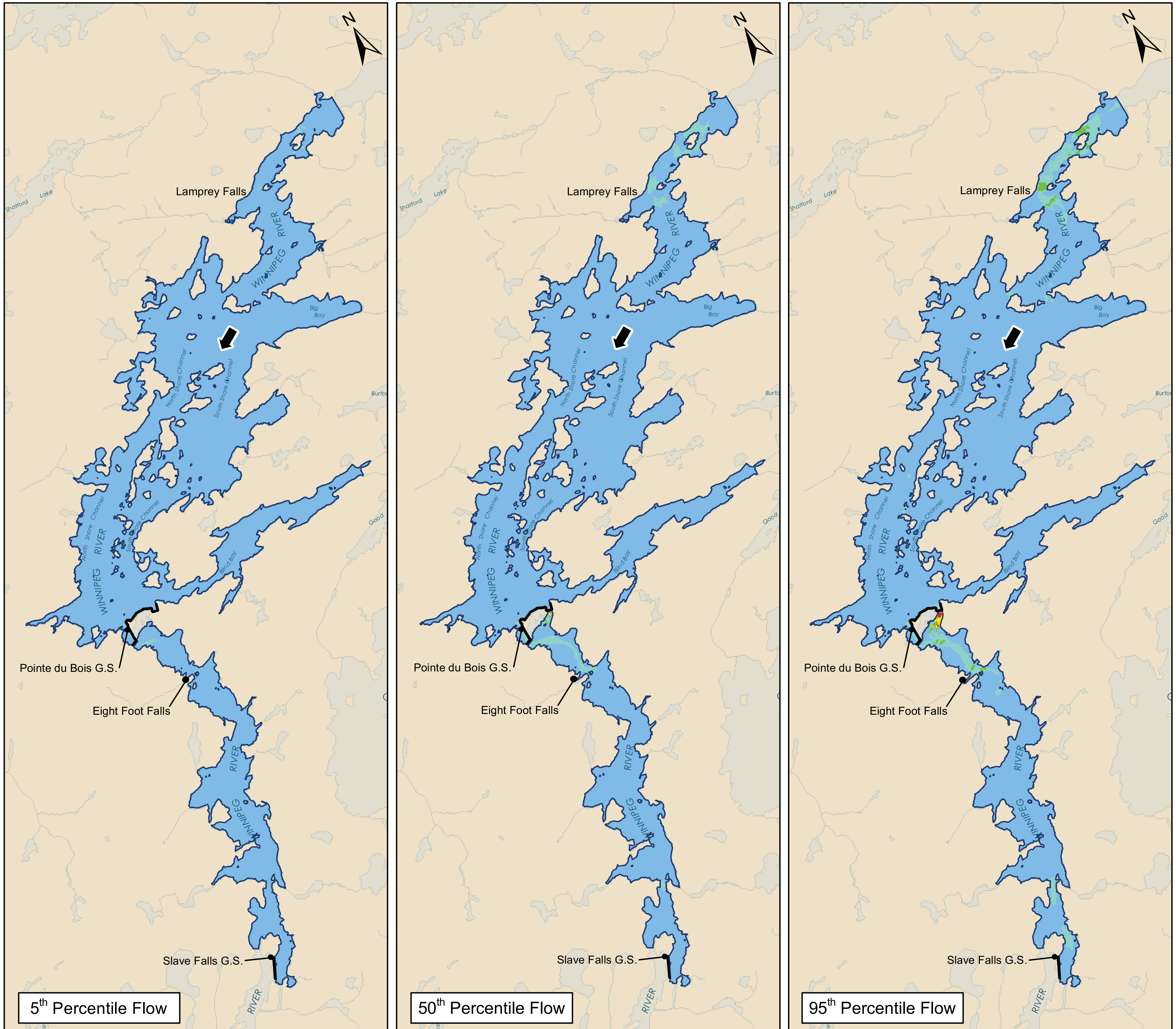
Legend

- Existing Spillway Rating Curve
- Proposed Spillway 2012 (Post-Project) Rating Curve (Preliminary)
- Proposed Spillways 2011 (Post-Project) Combined Rating Curve

Pointe du Bois Spillway Replacement Project

Existing Environment and Post Project Spillway Discharge Rating Curves

Figure: 3.29 Rev 1



Manitoba Hydro

Coordinate System: UTM Zone 14N

0 1.5 3 6 Kilometres
0 1 2 4 Miles

DATA SOURCE: Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 DEC 2010	Water Resources Engineering	
REVISION NO: VERSION 1.0	REVISION DATE: 13 AUG 2012	QA/QC: KMS / MWZ

Legend

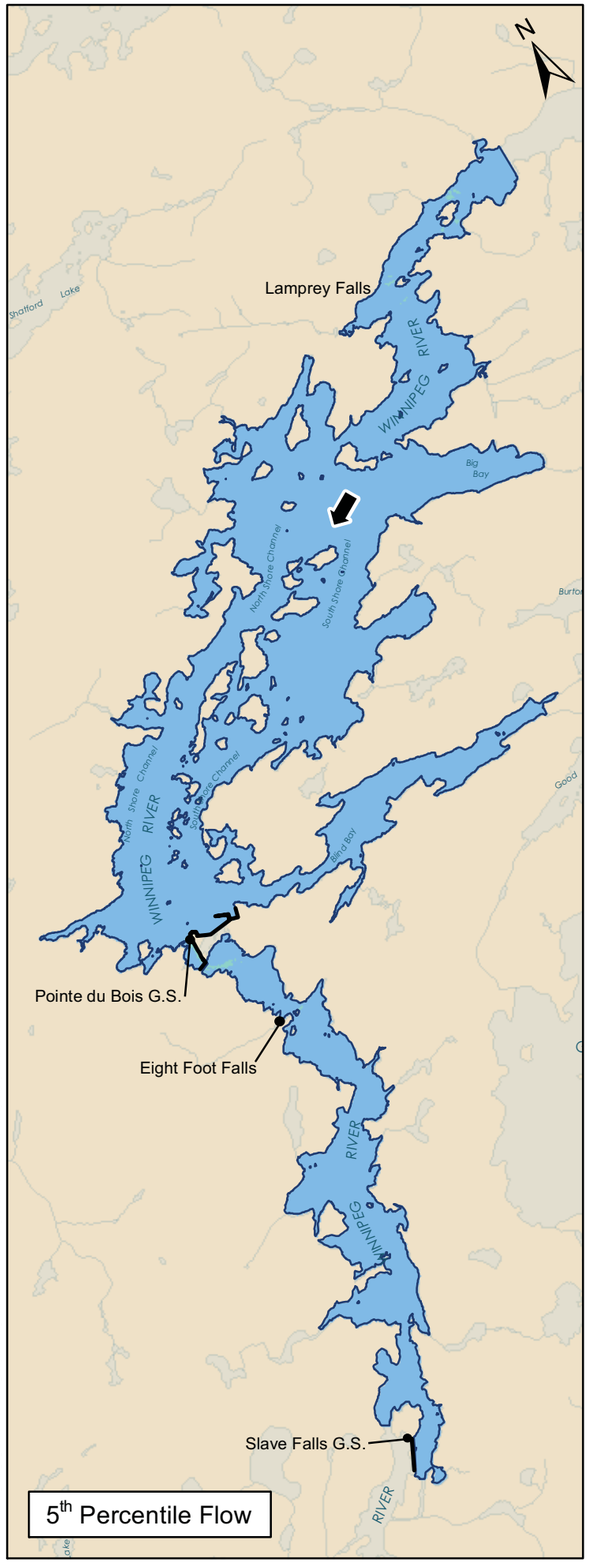
Velocity [m/s]

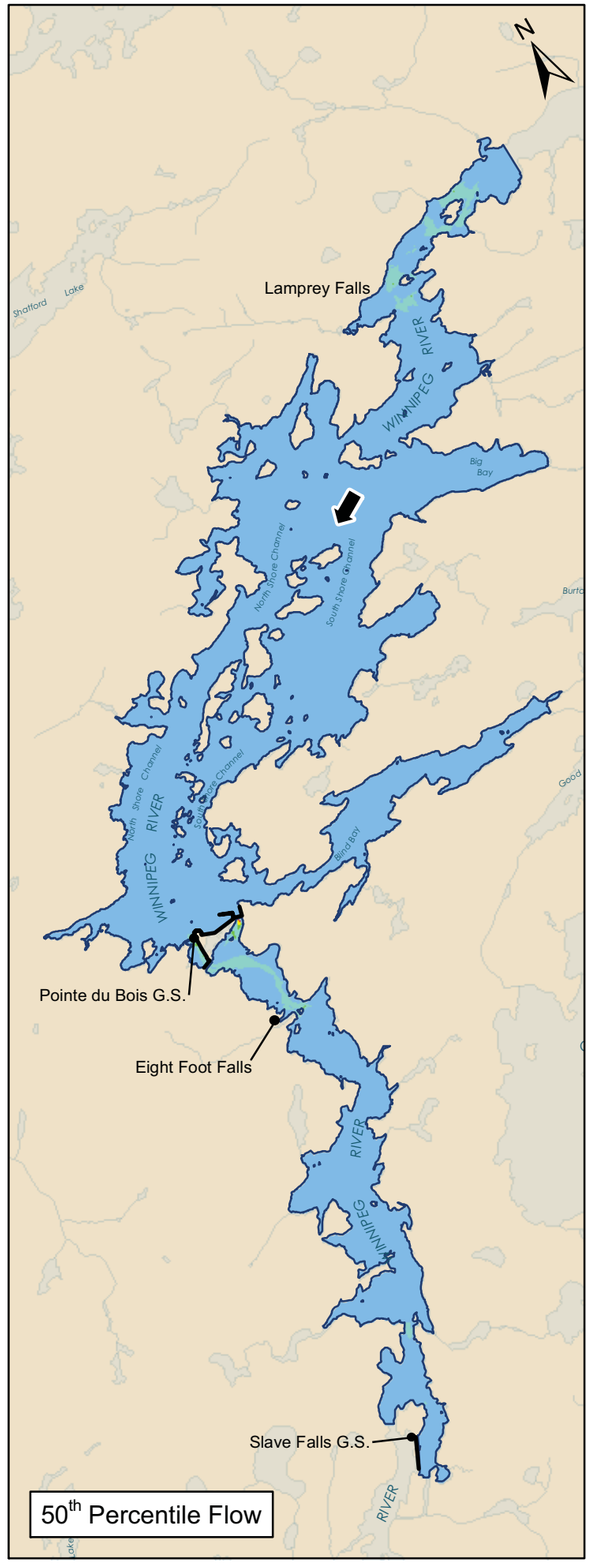
- 0 - 0.5
- 0.5 - 1.5
- 1.5 - 3
- 3 - 5
- Greater than 5
- Direction of Flow
- Generating Station (G.S.)

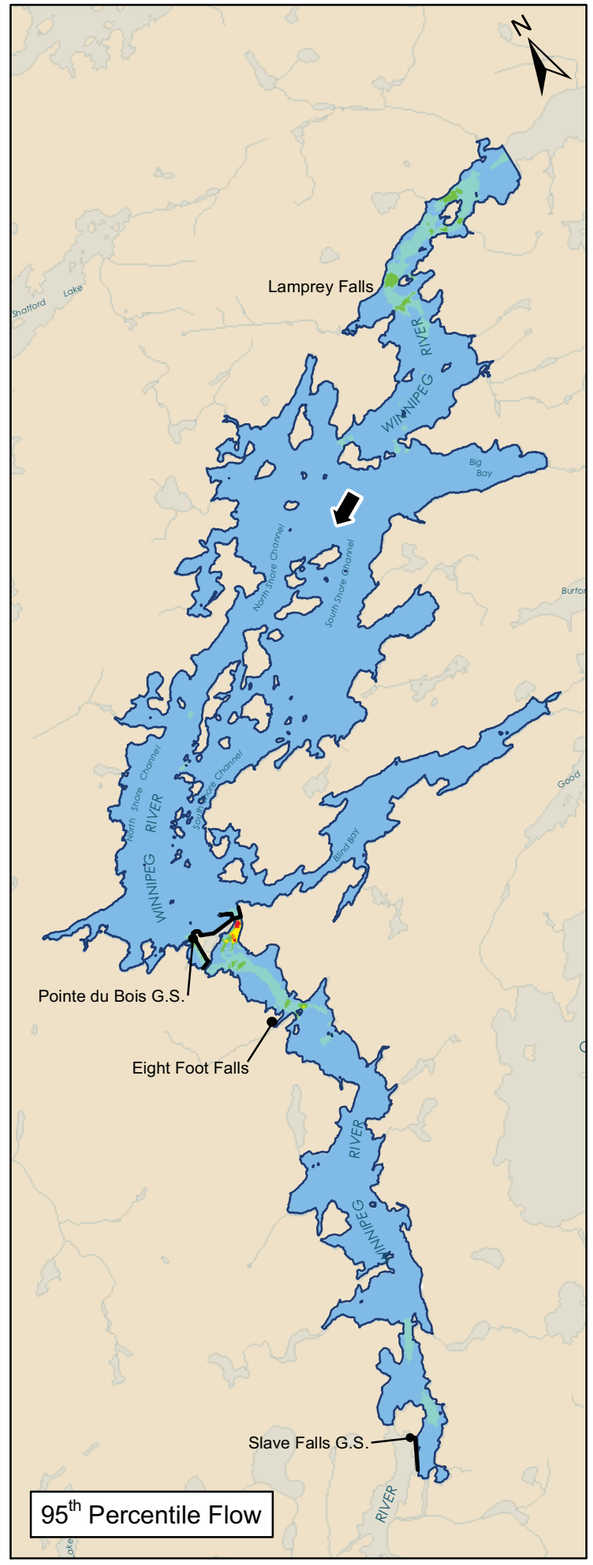
Pointe du Bois Spillway Replacement Project

Stage 2 Construction
Water Velocity Lamprey Falls to Slave Falls G.S.

Figure: 8.2A Rev 1







Manitoba Hydro

Coordinate System: UTM Zone 14N

0 1.5 3 6 Kilometres

0 1 2 4 Miles

DATA SOURCE:
Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 1.0	13 AUG 2012	KMS / MWZ

Legend

Velocity [m/s]

- 0 - 0.5
- 0.5 - 1.5
- 1.5 - 3
- 3 - 5
- Greater than 5
- Direction of Flow

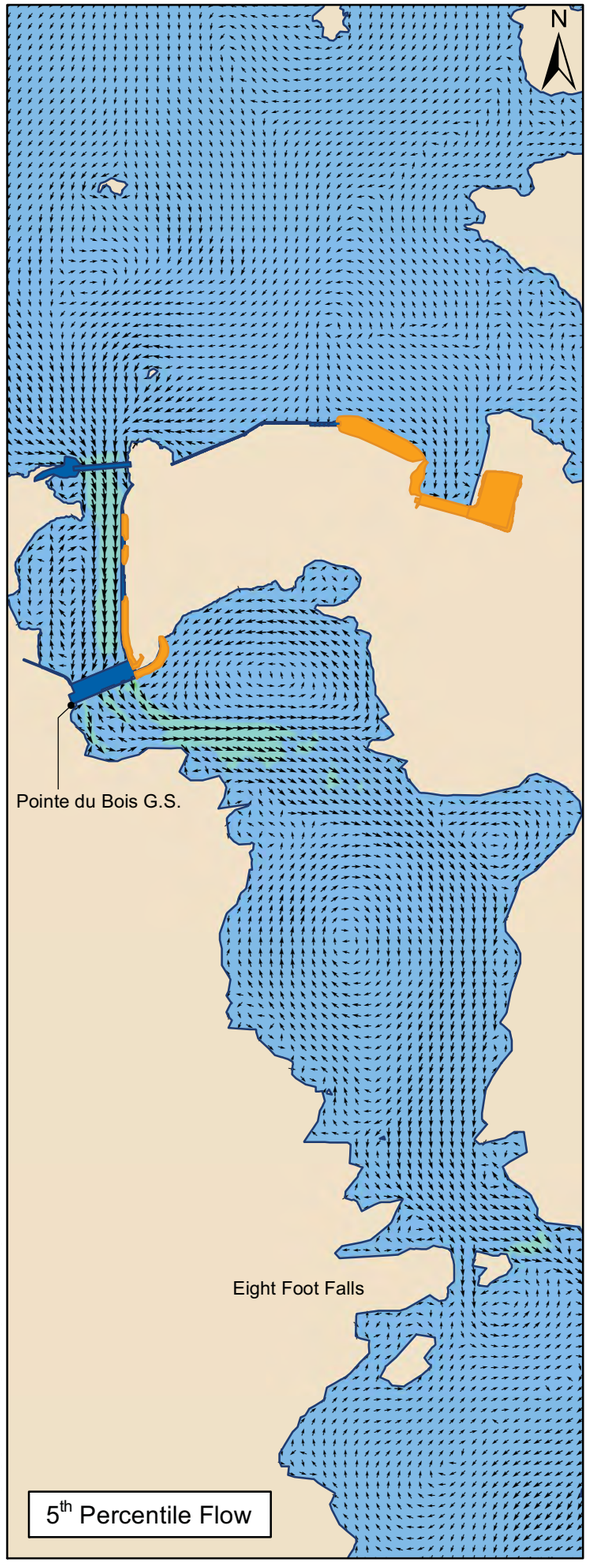
Generating Station (G.S.)

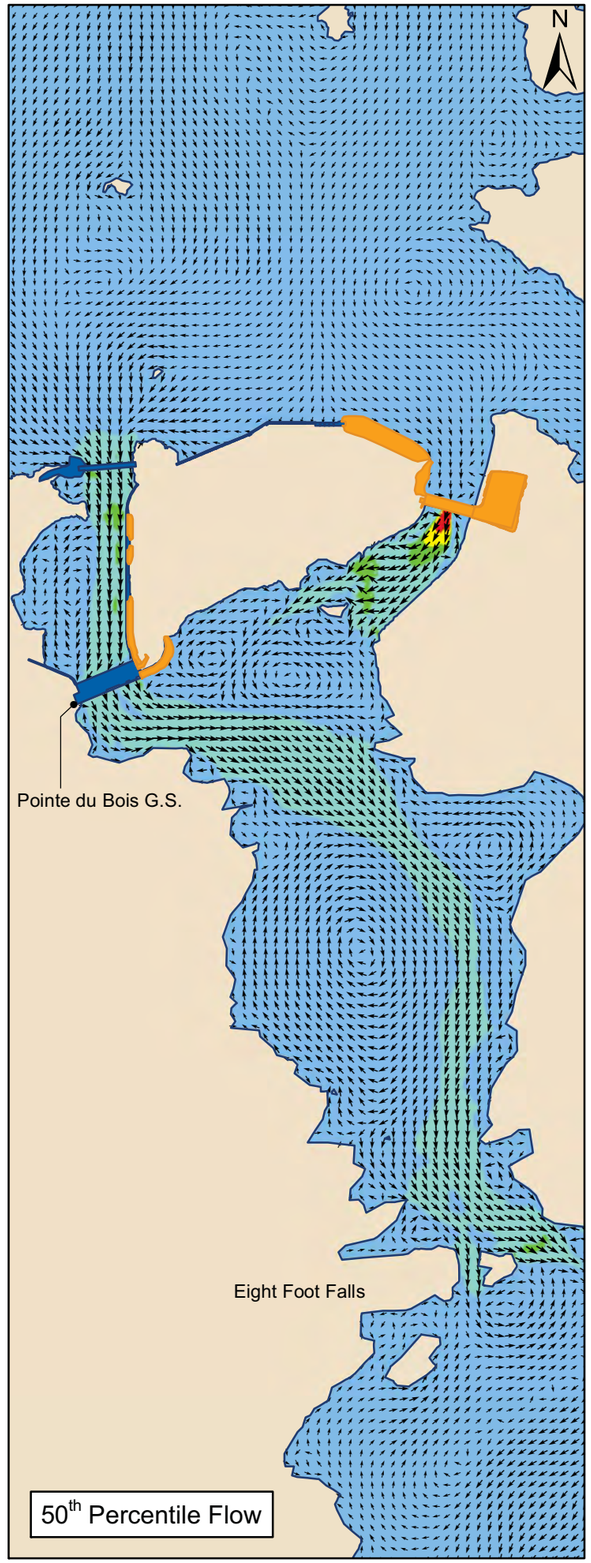
Pointe du Bois Spillway Replacement Project

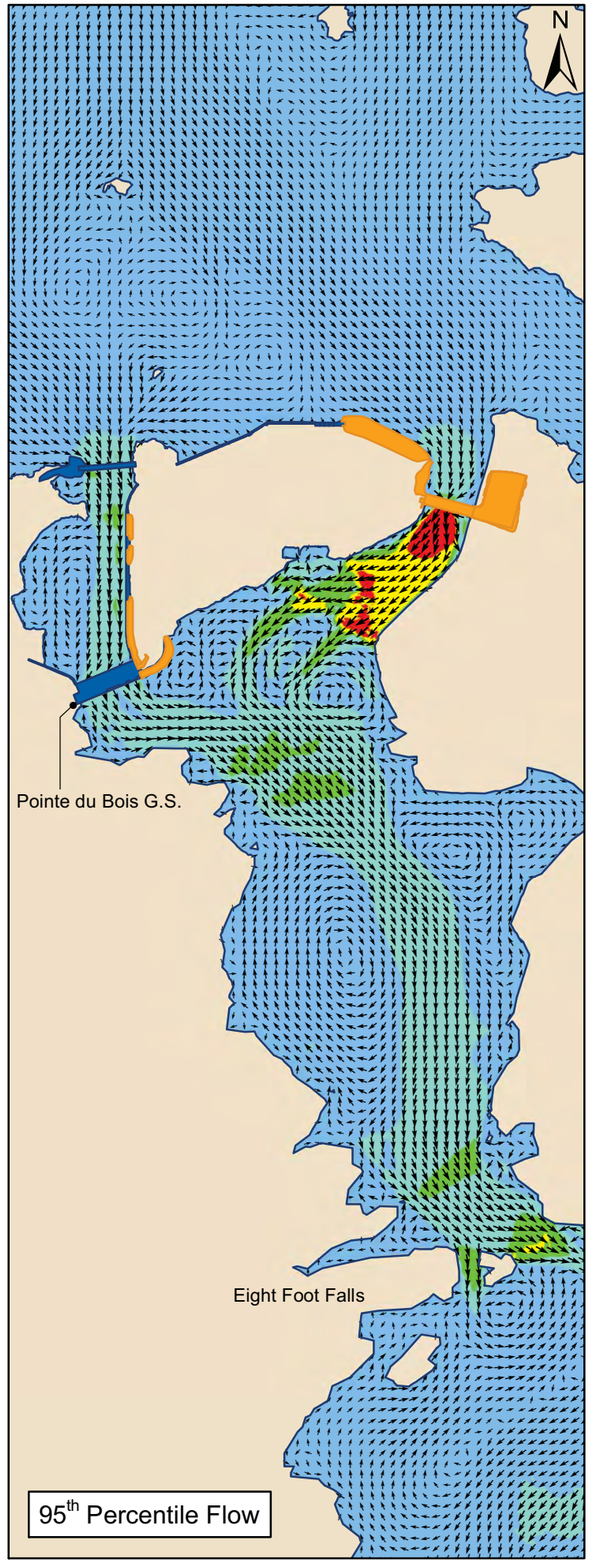
Post Project
Water Velocity Lamprey Falls to Slave Falls G.S.

Figure: 8.2Ai

File Location: T:\MW\2_Pointe_du_Bois\Work\Active\EIS\PdB_Bis\Option 7B Alignment\MXD\Archive 11Jul2012\Figure 8.2Ai - Post Project Water Velocity Lamprey Falls to Slave Falls GS.mxd







Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE:
Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 1.0	17 AUG 2012	KMS / MWZ

Legend

Velocity [m/s]

- 0 - 0.5
- 0.5 - 1.5
- 1.5 - 3
- 3 - 5
- Greater than 5

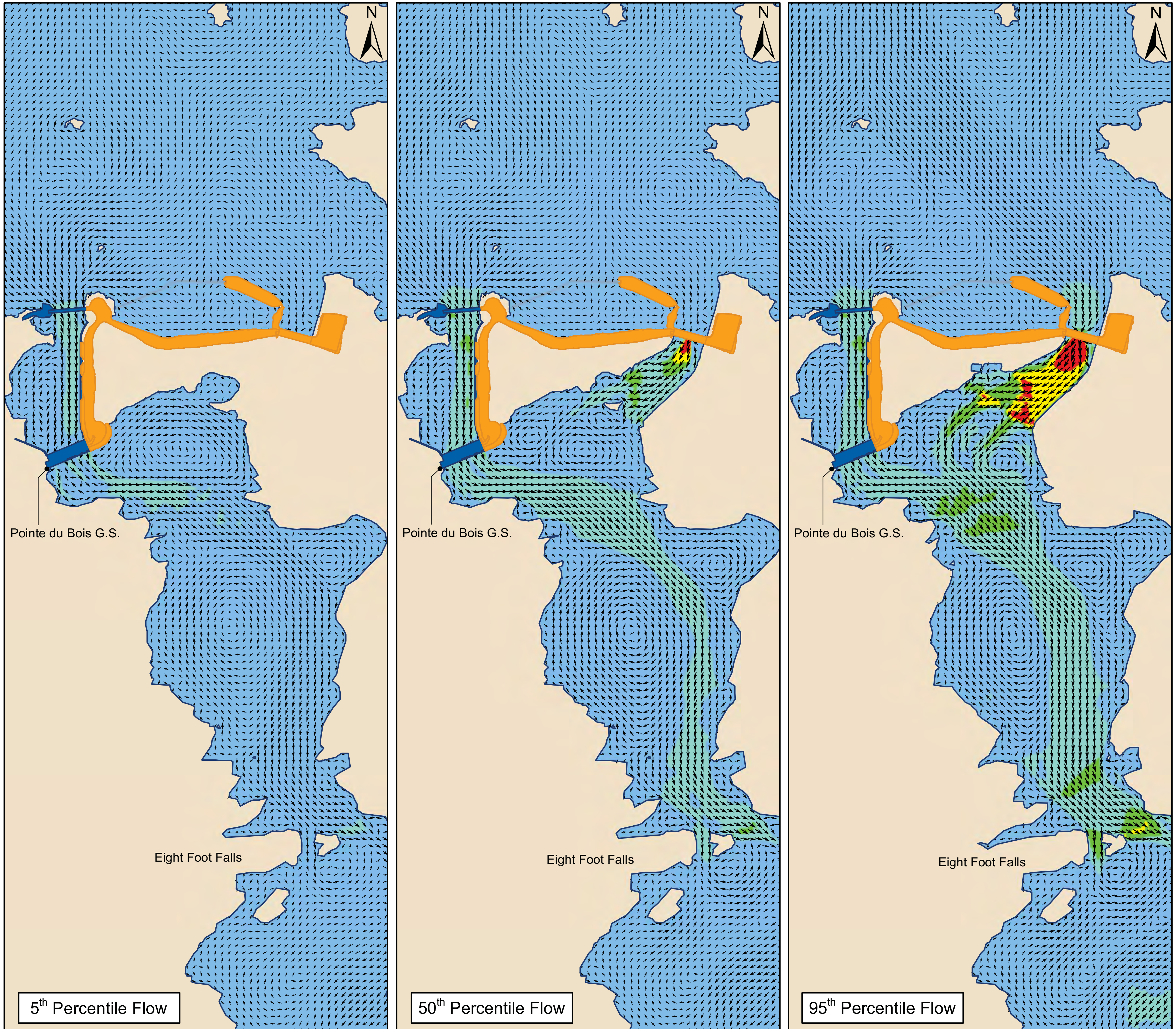
Velocity Vectors NTS

Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Stage 2 Construction
Water Velocity and Flow Patterns

Figure: 8.2B Rev 1



Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE:

Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 1.0	17 AUG 2012	KMS / MWZ

Legend

Velocity [m/s]

- 0 - 0.5
- 0.5 - 1.5
- 1.5 - 3
- 3 - 5
- Greater than 5

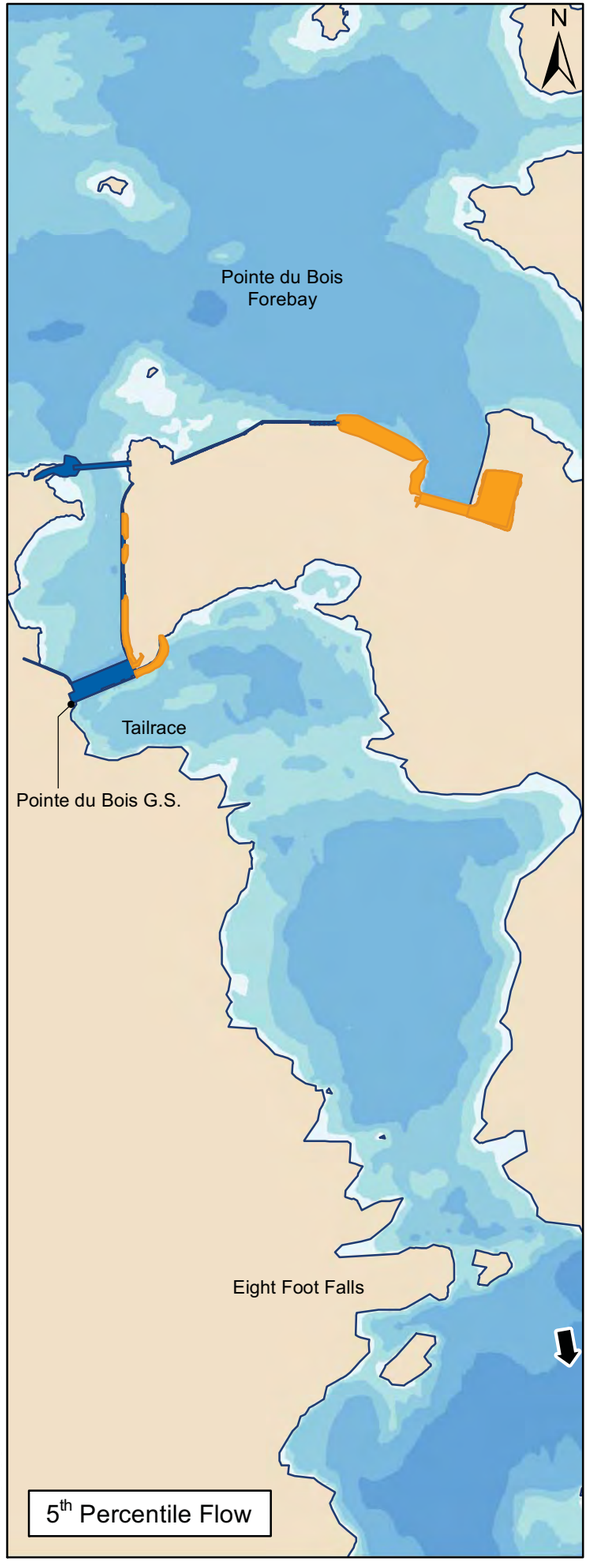
Velocity Vectors NTS

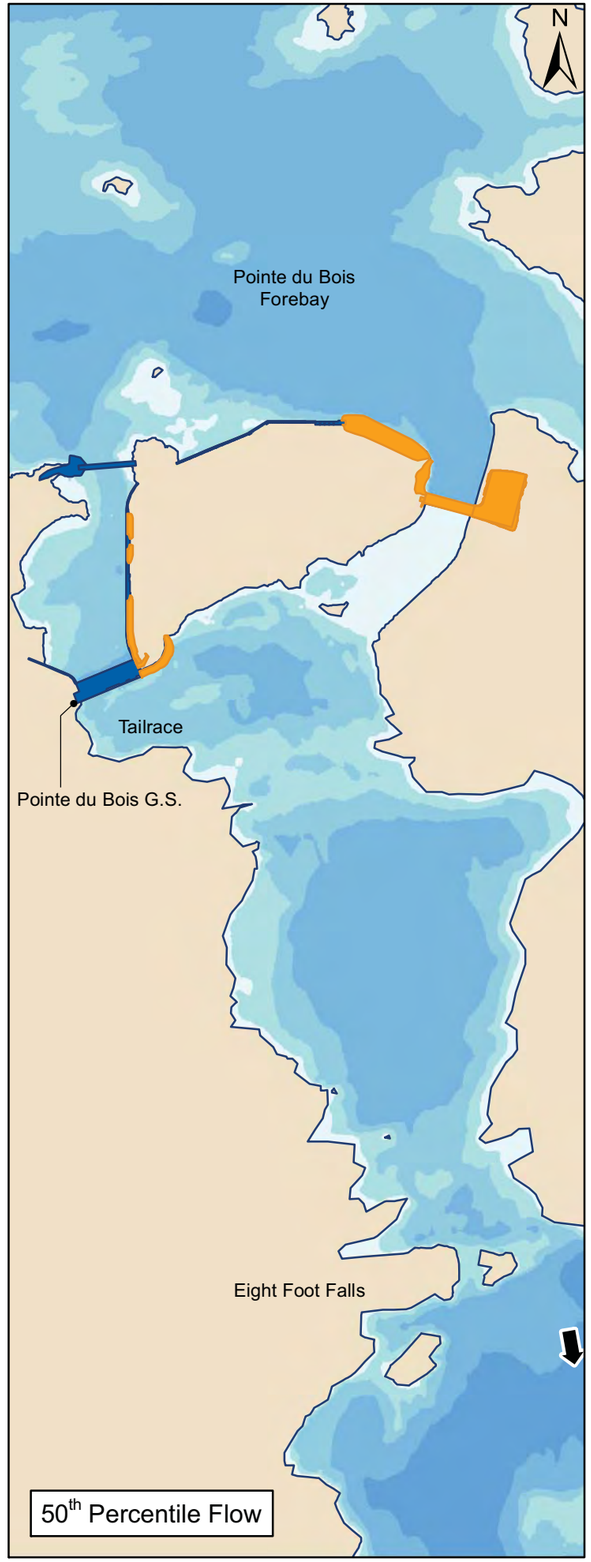
Generating Station (G.S.)

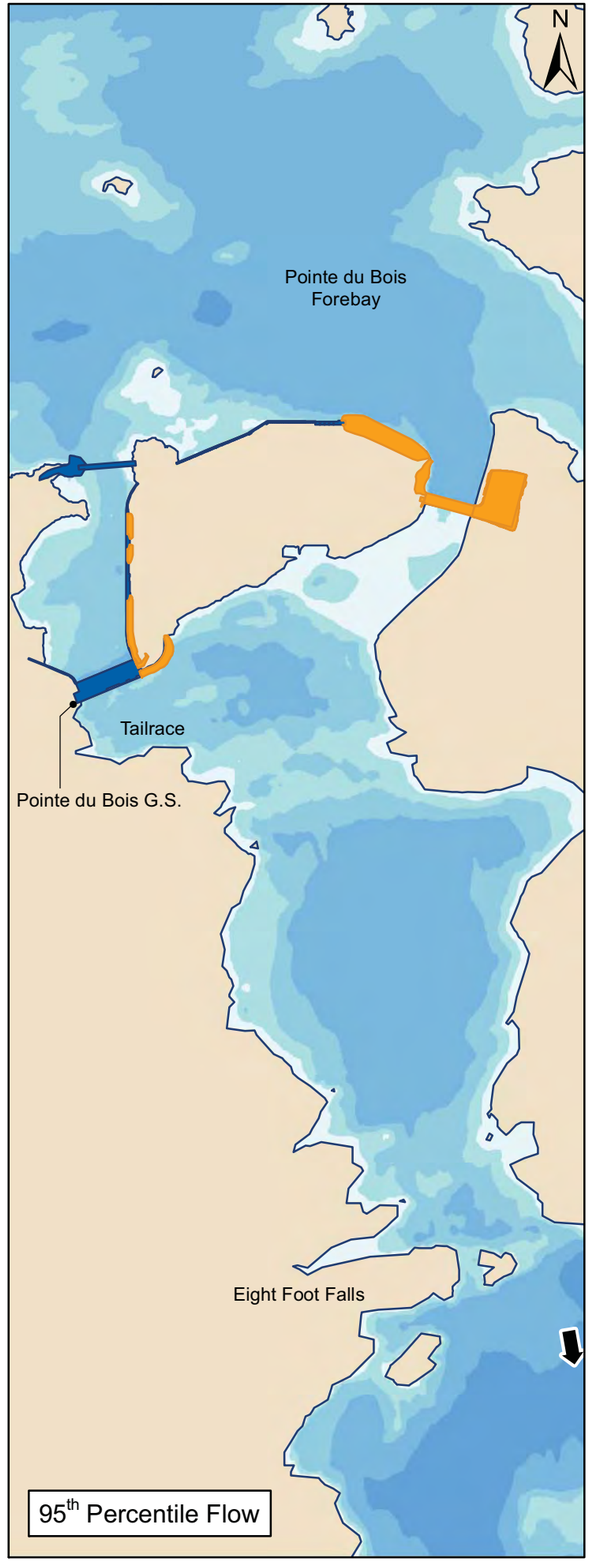
Pointe du Bois
Spillway Replacement Project

Post Project
Water Velocity and Flow Patterns

Figure: 8.2Bi







Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE:
Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 1.0	17 AUG 2012	KMS / MWZ

Legend

Depth [m]

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 30
- Greater than 30
- Direction of Flow

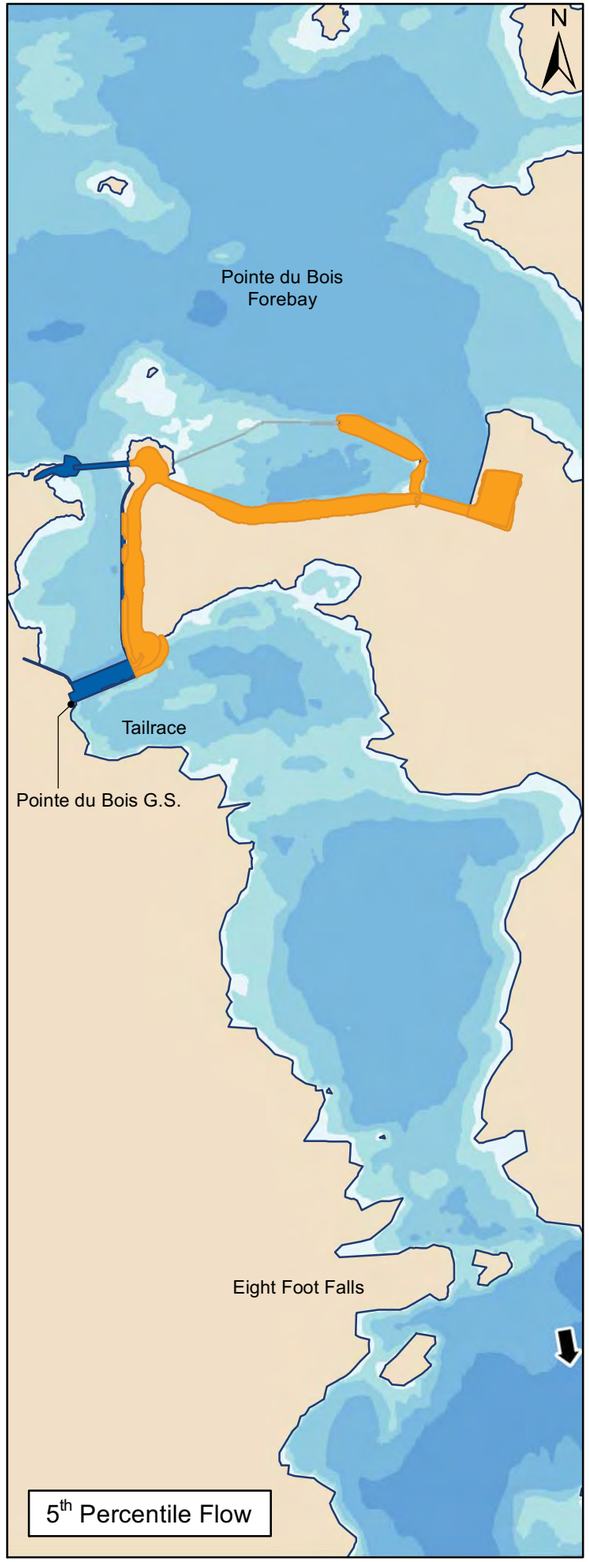
Generating Station (G.S.)

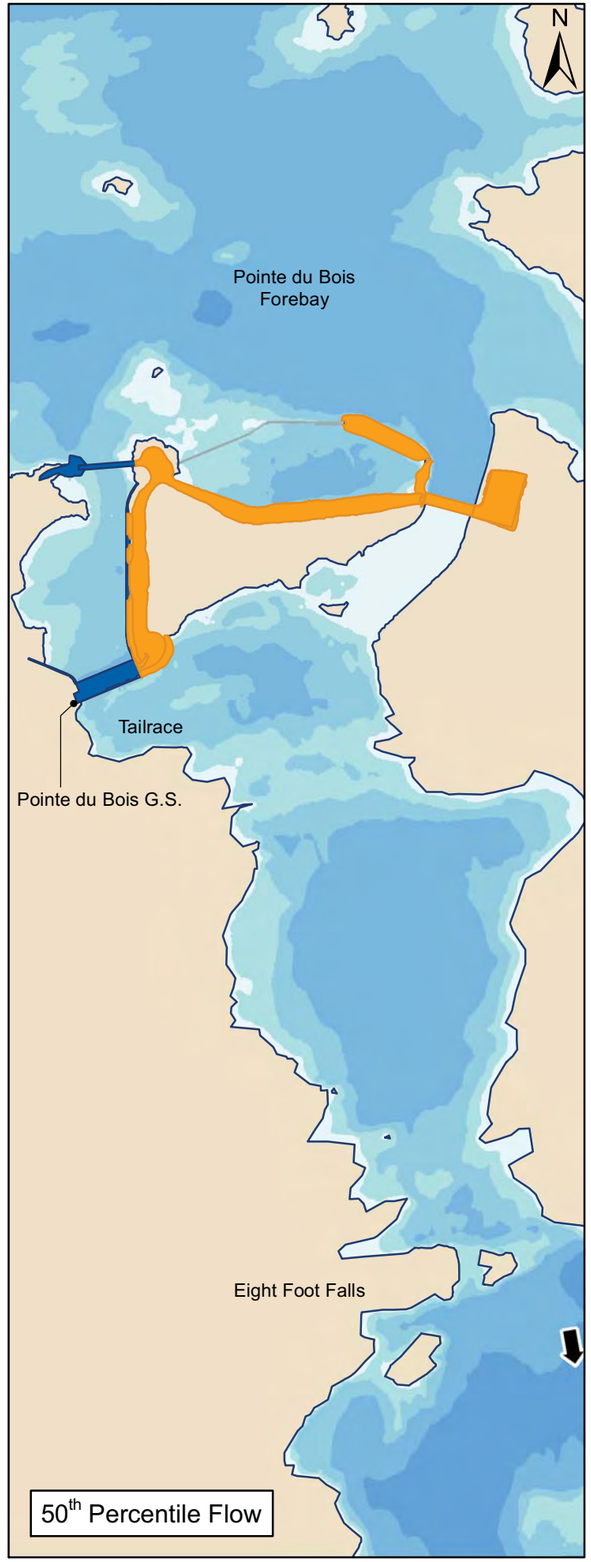
Pointe du Bois Spillway Replacement Project

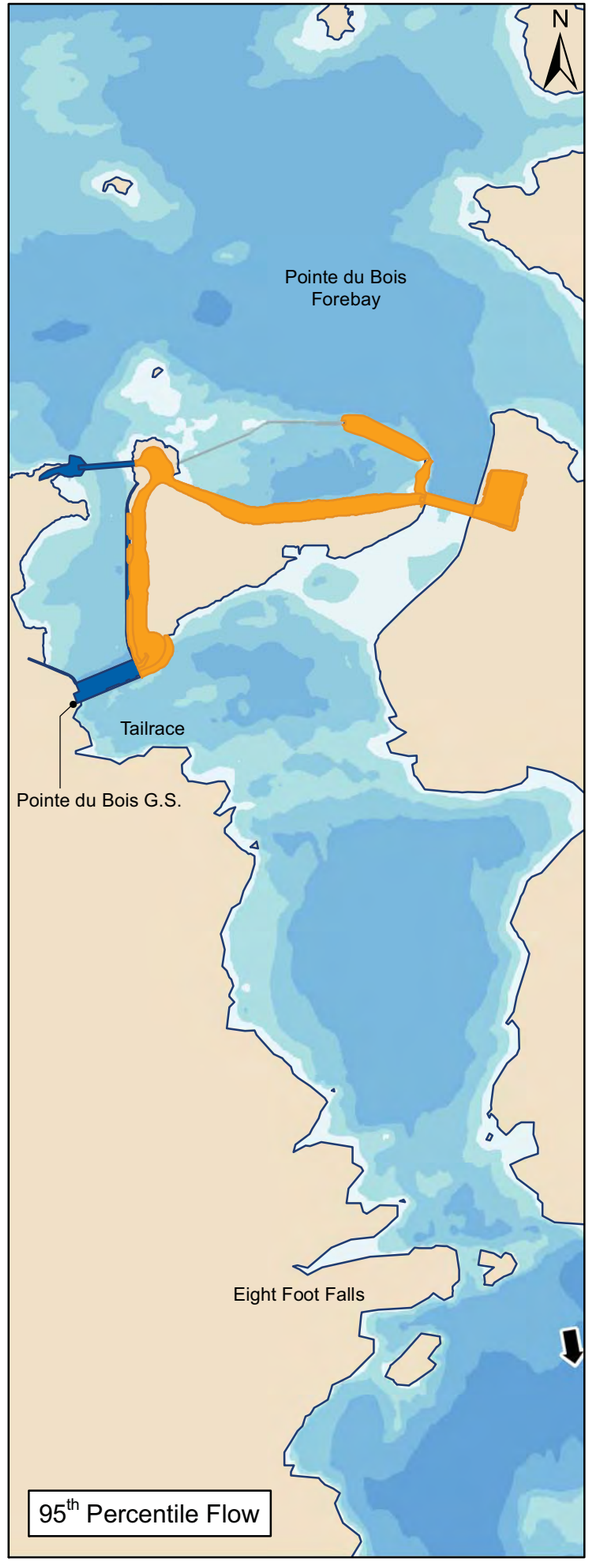
Stage 2 Construction
Water Depth Near Pointe du Bois G.S.

Figure: 8.2C Rev 1

File Location: T:\96192_Pointe_du_Bois\Work\Arcs\EIS\PHB_2bd Option 7B Alignment\MXD\Archive 1\Aug2011\Figure 8.2C Rev1 - Stage 2 Construction Water Depth Near Pointe du Bois G.S.mxd







Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE:
Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 1.0	17 AUG 2012	KMS / MWZ

Legend

Depth [m]

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 30
- Greater than 30
- Direction of Flow

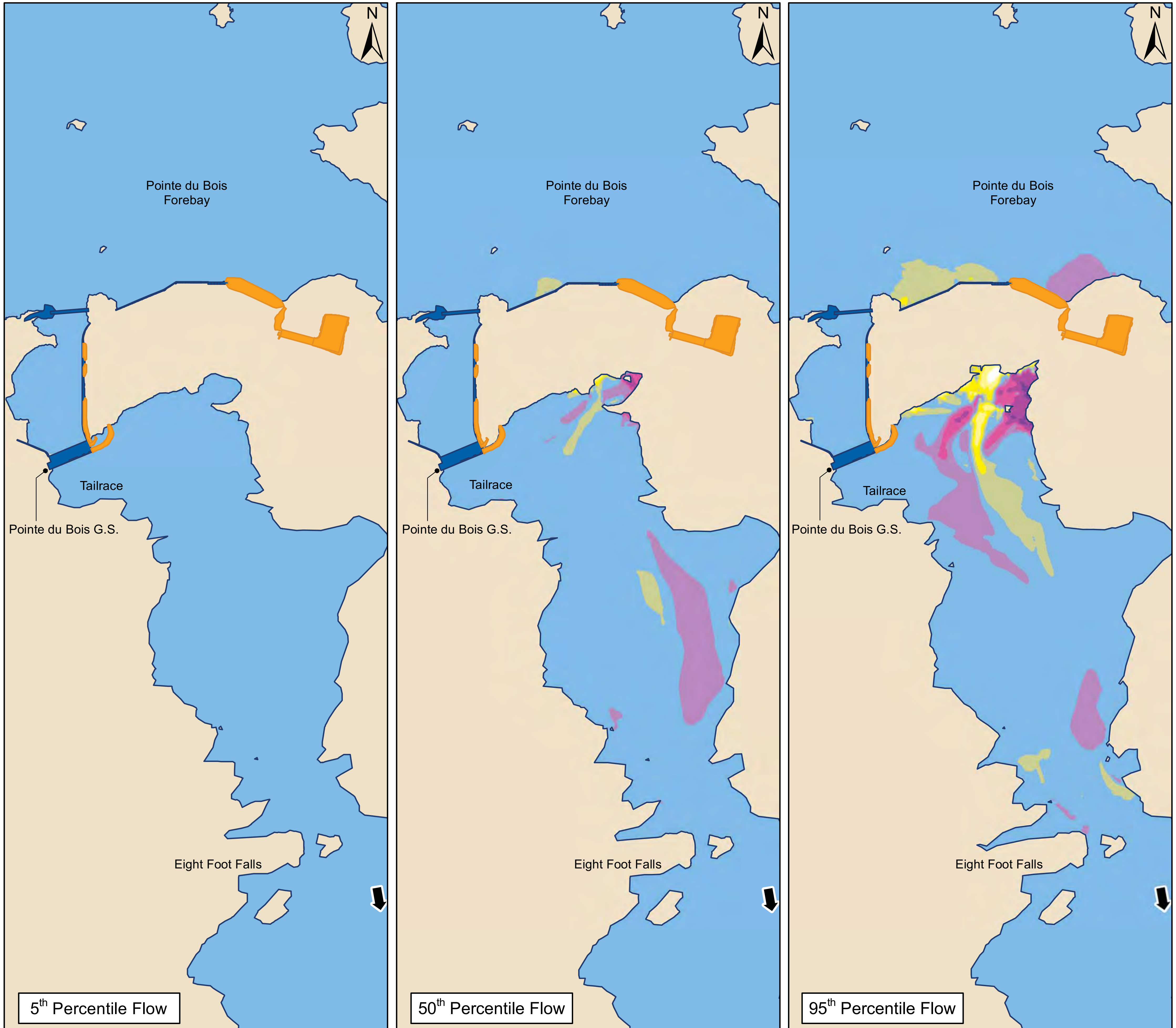
Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Post Project
Water Depth Near Pointe du Bois G.S.

Figure: 8.2Ci

File Location: T:\MH32_Pointe_du_Bois\Work\Arcs\EIS\PHB_Std Option TS Alignment\MXD\Archive 1\Aug2012\Figure 8.2Ci - Post Project Water Depth Near Pointe du Bois G.S.mxd



Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres
0 0.15 0.3 0.6 Miles

DATA SOURCE:
Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO: VERSION 1.0	REVISION DATE: 17 AUG 2012	QA/QC: KMS / MWZ

Legend

Velocity Change [m/s]

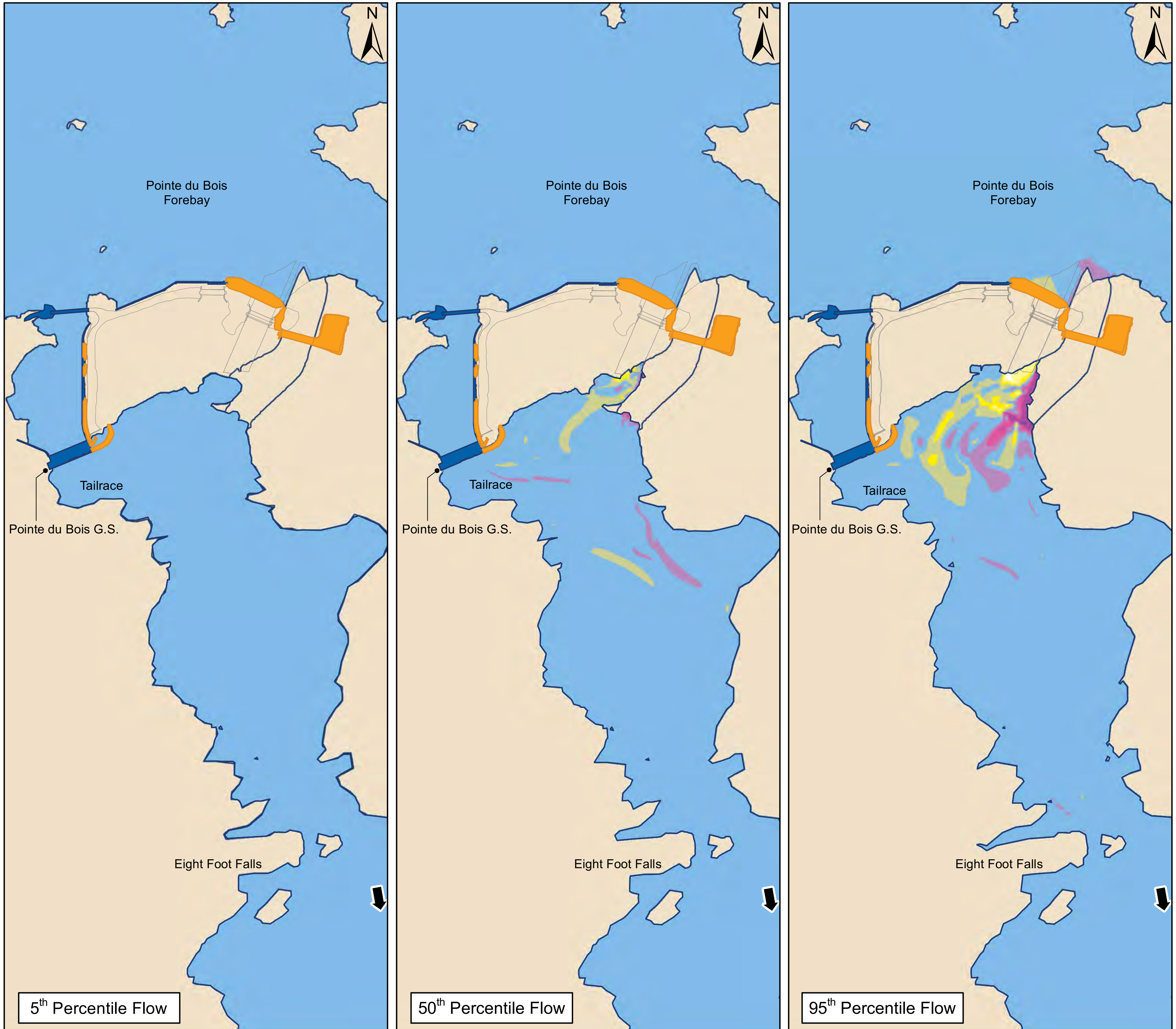
- Less than -5
- -5 - -2
- -2 - -1
- -1 - -0.25
- -0.25 - 0.25
- 0.25 - 1
- 1 - 2
- 2 - 5
- Greater than 5
- Direction of Flow

Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Stage 2 Construction Estimated Velocity Changes Existing Conditions vs Revised Arrangement

Figure: 8.3A Rev 1



Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE: Manitoba Hydro

DATE CREATED: 24 JUL 2011	CREATED BY: Water Resources Engineering	
REVISION NO: VERSION 1.0	REVISION DATE: 17 AUG 2012	QA/QC: KMS / MWZ

Legend

Velocity Change [m/s]

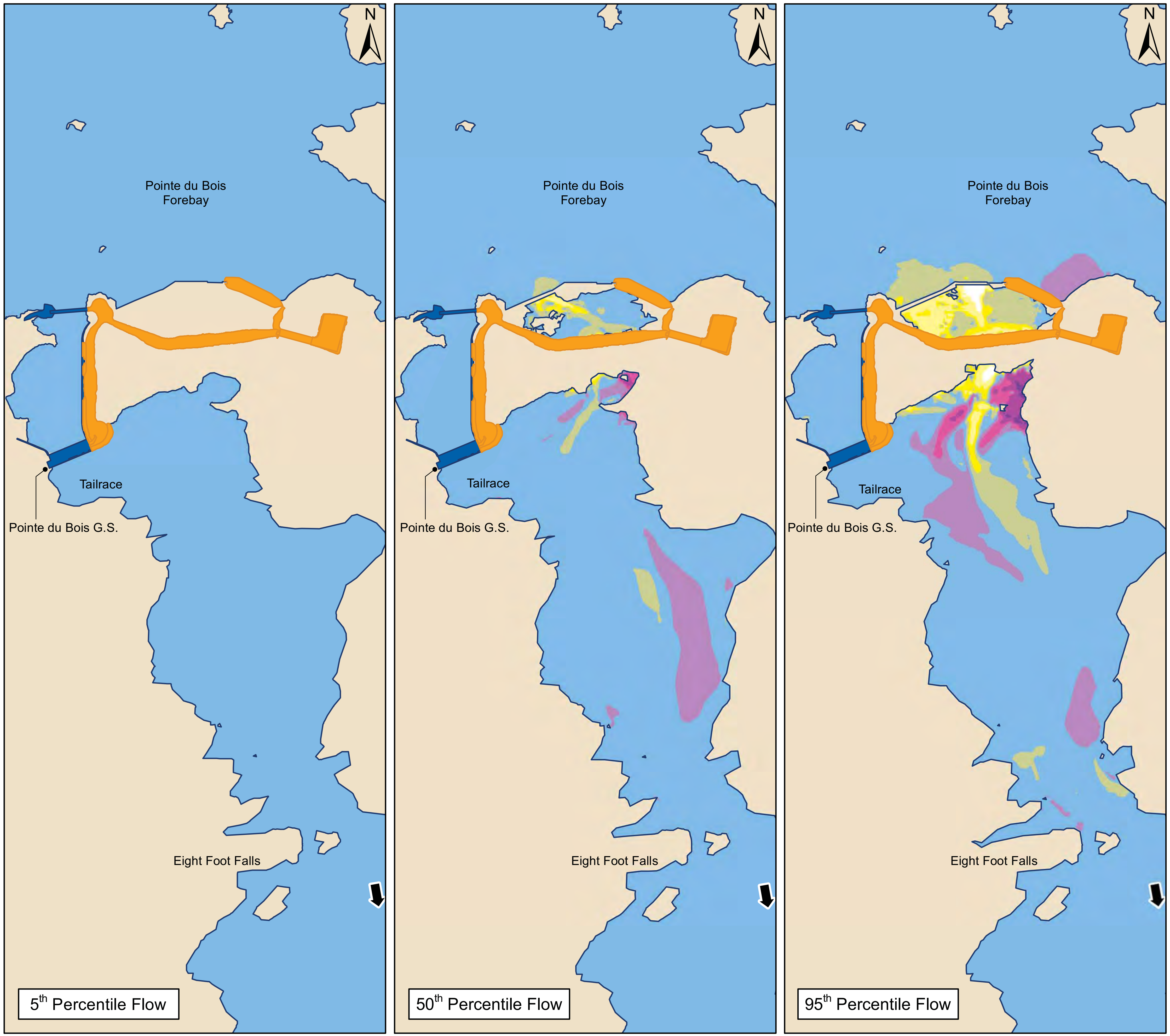
- Less than -5
- -5 - -2
- -2 - -1
- -1 - -0.25
- -0.25 - 0.25
- 0.25 - 1
- 1 - 2
- 2 - 5
- Greater than 5
- Original Arrangement
- Direction of Flow

Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Stage 2 Construction Estimated Velocity Changes Original Arrangement vs Revised Arrangement

Figure: 8.3Ai



Manitoba Hydro

Coordinate System: UTM Zone 14N

0	0.25	0.5	1 Kilometres
0	0.15	0.3	0.6 Miles

DATA SOURCE: Manitoba Hydro

DATE CREATED: 24 JUL 2011	CREATED BY: Water Resources Engineering	
REVISION NO: VERSION 1.0	REVISION DATE: 17 AUG 2012	QA/QC: KMS / MWZ

Legend

Velocity Change [m/s]

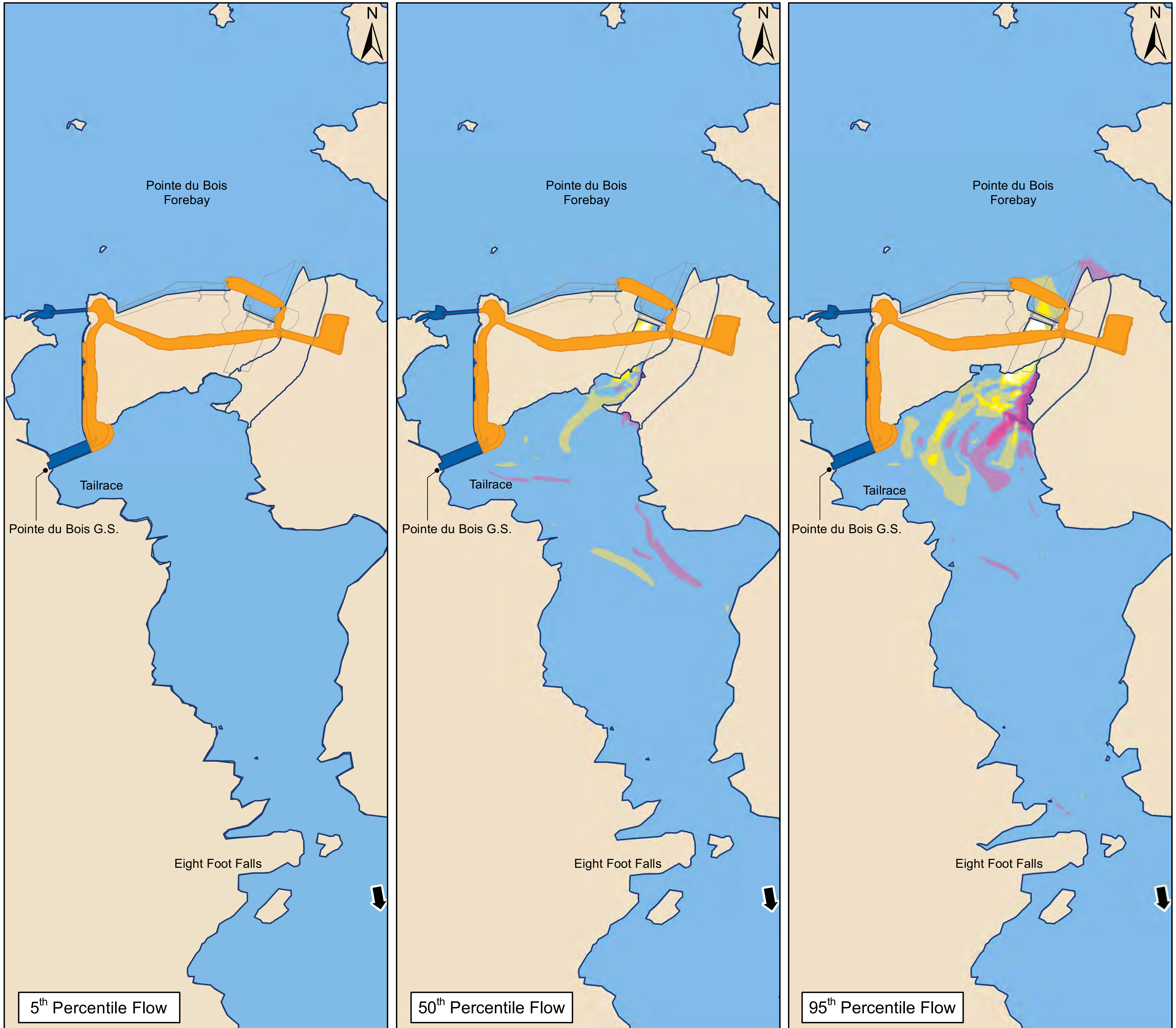
- Less than -5
- -5 - -2
- -2 - -1
- -1 - -0.25
- -0.25 - 0.25
- 0.25 - 1
- 1 - 2
- 2 - 5
- Greater than 5
- Direction of Flow

Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Post Project Estimated Velocity Changes Existing Conditions vs Revised Arrangement

Figure: 8.3Aii



Manitoba Hydro

Coordinate System: UTM Zone 14N

0 0.25 0.5 1 Kilometres

0 0.15 0.3 0.6 Miles

DATA SOURCE: Manitoba Hydro

DATE CREATED:	CREATED BY:	
24 JUL 2011	Water Resources Engineering	
REVISION NO: VERSION 1.0	REVISION DATE: 17 AUG 2012	QA/QC: KMS / MWZ

Legend

Velocity Change [m/s]

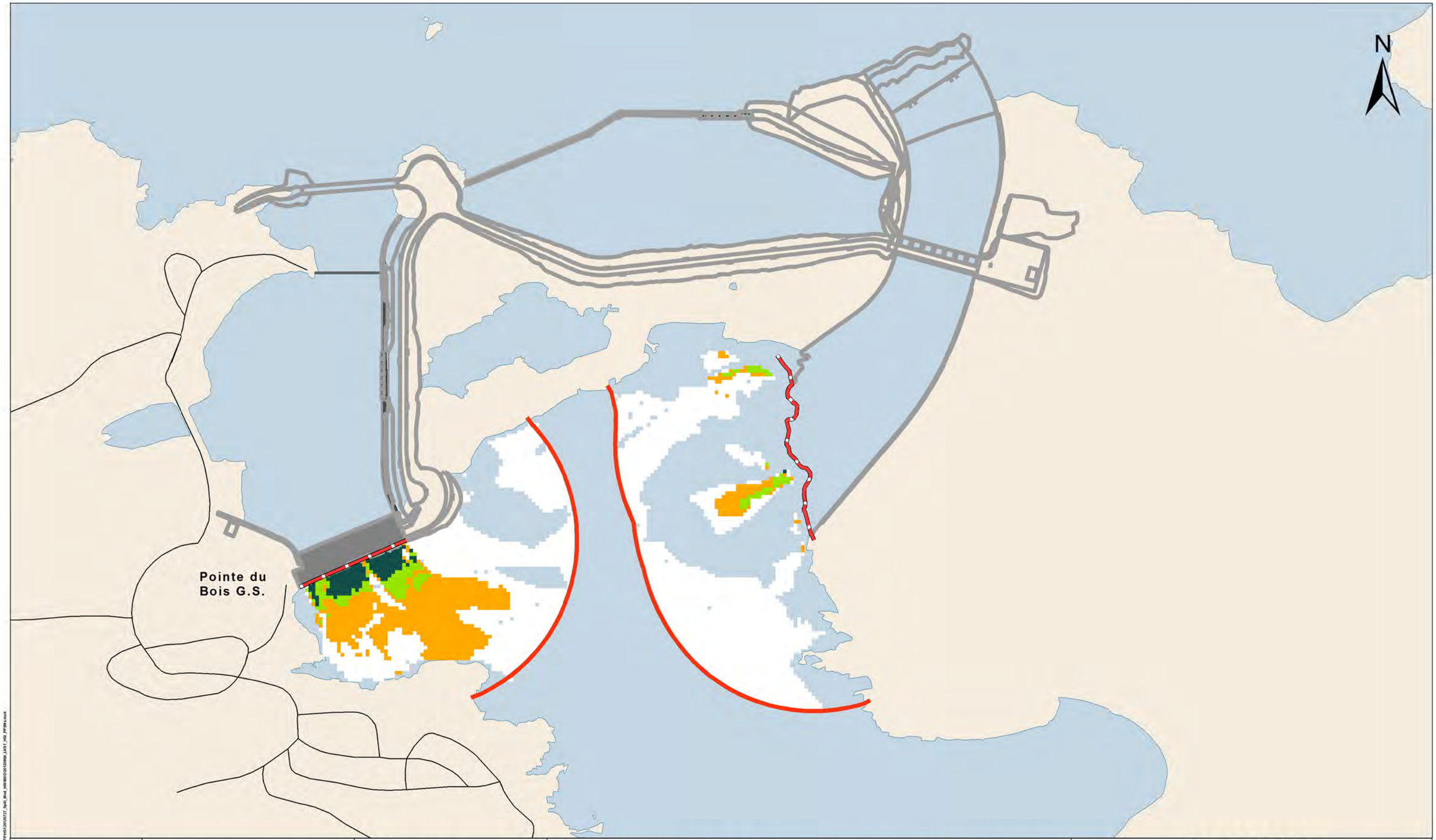
- Less than -5
- -5 - -2
- -2 - -1
- -1 - -0.25
- -0.25 - 0.25
- 0.25 - 1
- 1 - 2
- 2 - 5
- Greater than 5
- Direction of Flow
- Original Arrangement

Generating Station (G.S.)

Pointe du Bois Spillway Replacement Project

Post Project Estimated Velocity Changes
Original Arrangement vs Revised Arrangement

Figure: 8.3Aiii



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.095 0.19 Kilometres

0 0.045 0.09 Miles

DATA SOURCE: Manitoba Hydro, North/South Consultants

DATE CREATED:	CREATED BY:	
8 August 12	North/South Consultants	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 2.0	14 Aug 12	SB/MWZ

Legend

- Spawning Barrier
- Critical Distance (238m)
- Post Project Infrastructure
- Existing Infrastructure

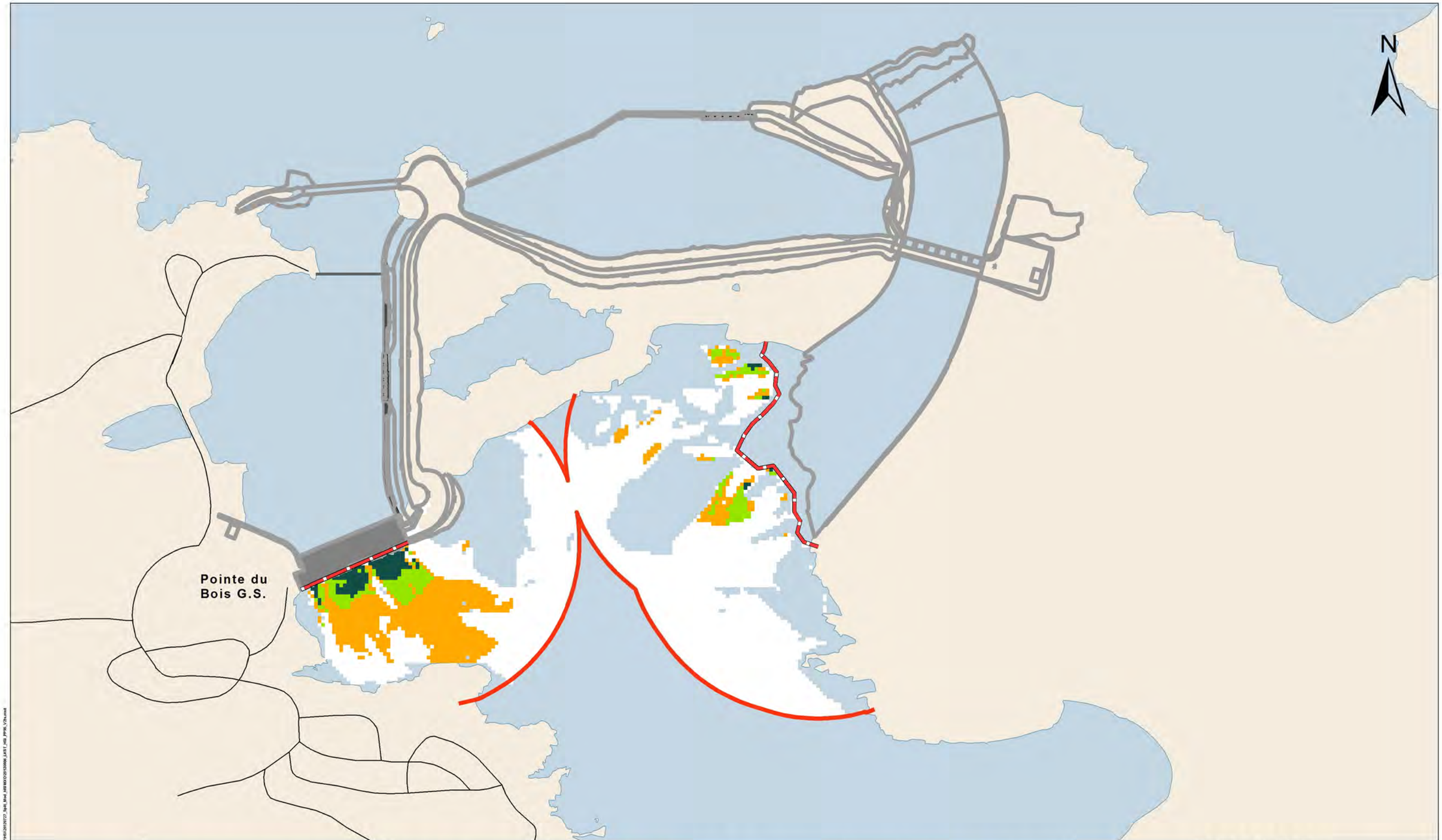
Habitat Suitability Index (5 Variable)
(Egg Deposition)

- 0.01 - 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1

Pointe du Bois Spillway Replacement Project

50th Percentile Flow Conditions
Lake Sturgeon Habitat Suitability Index
Post Project

Figure: 8.8A Rev1



Manitoba Hydro

Coordinate System: UTM NAD 1983 Z14

0 0.095 0.19 Kilometres

0 0.045 0.09 Miles

DATA SOURCE: Manitoba Hydro, North/South Consultants

DATE CREATED:	CREATED BY:	
8 August 12	North/South Consultants	
REVISION NO:	REVISION DATE:	QA/QC:
VERSION 2.0	14 Aug 12	SB/MWZ

Legend

- Spawning Barrier
- Critical Distance (238m)
- Post Project Infrastructure
- Existing Infrastructure

Habitat Suitability Index (5 Variable)
(Egg Deposition)

- 0.01 - 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1

Pointe du Bois Spillway Replacement Project

95th Percentile Flow Conditions
Lake Sturgeon Habitat Suitability Index
Post Project

Figure: 8.8B Rev1

Manitoba Hydro

DATA SOURCE :
Manitoba Hydro, KGS

DATE CREATED :	CREATED BY :	
06 JUL 2012	KGS GROUP	
REVISION No.	REVISION DATE :	QA/QC :
VERSION 2.0	13 AUG 2012	

Pointe du Bois Spillway Replacement Project

Artistic Rendition - View of Spillway Facing Downstream

Figure: 8.11A Rev 1

Manitoba Hydro

DATA SOURCE: Manitoba Hydro, KGS

DATE CREATED: 06 JUL 2012

CREATED BY: KGS GROUP

REVISION No.: VERSION 2.0

REVISION DATE: 13 AUG 2012

QA/QC:

Pointe du Bois Spillway Replacement Project

Artistic Rendition - View of Spillway Facing Upstream

Figure: 8.11B Rev 1

Attachment 3.1A

Summary of post-project changes in area (m^2) and WUA at 50^{th}, 75^{th}, 85^{th} and 95^{th} percentile flows for the three variable (water velocity, depth, substrate) model.

Habitat Suitability Index Category	50th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	69900.00	0.00	65425.00	0.00	0.00	0.00	62850.00	0.00	0.00	0.00
> 0 - 0.25	461100.00	44730.00	472600.00	57480.30	12750.30	28.51	436575.00	45152.10	422.10	0.94
0.25 - 0.50	182425.00	56333.30	169125.00	52939.10	-3394.20	-6.03	196875.00	61363.60	5030.30	8.93
0.5 - 0.75	14550.00	9460.17	17300.00	11329.60	1869.43	19.76	19475.00	12665.80	3205.63	33.89
0.75 - 1.00	22500.00	21357.60	25875.00	24184.00	2826.40	13.23	27100.00	25529.60	4172.00	19.53
Total	**750475.00**	**131881.07**	**750325.00**	**145933.00**	**14051.93**	**10.66**	**742875.00**	**144711.10**	**12830.03**	**9.73**

Habitat Suitability Index Category	75th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	63525.00	0.00	63475.00	0.00	0.00	0.00	64600.00	0.00	0.00	0.00
> 0 - 0.25	407700.00	40828.50	428275.00	48259.60	7431.10	18.20	390650.00	42596.40	1767.90	4.33
0.25 - 0.50	226000.00	69254.80	207275.00	64388.40	-4866.40	-7.03	230975.00	71650.00	2395.20	3.46
0.5 - 0.75	19600.00	12924.00	18825.00	12253.70	-670.30	-5.19	27250.00	18082.00	5158.00	39.91
0.75 - 1.00	29975.00	28243.80	31425.00	29741.60	1497.80	5.30	34525.00	33103.00	4859.20	17.20
Total	**746800.00**	**151251.10**	**749275.00**	**154643.30**	**3392.20**	**2.24**	**748000.00**	**165431.40**	**14180.30**	**9.38**

Habitat Suitability Index Category	85th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	68200.00	0.00	66325.00	0.00	0.00	0.00	68250.00	0.00	0.00	0.00
> 0 - 0.25	407350.00	41857.00	389350.00	45811.00	3954.00	9.45	401900.00	43814.90	1957.90	4.68
0.25 - 0.50	224700.00	68377.60	242125.00	76158.20	7780.60	11.38	222950.00	69718.00	1340.40	1.96
0.5 - 0.75	19450.00	12861.60	20575.00	13354.00	492.40	3.83	25475.00	16988.20	4126.60	32.08
0.75 - 1.00	31600.00	29843.90	33700.00	32046.10	2202.20	7.38	32475.00	30984.10	1140.20	3.82
Total	**751300.00**	**152940.10**	**752075.00**	**167369.30**	**14429.20**	**9.43**	**751050.00**	**161505.20**	**8565.10**	**5.60**

Habitat Suitability Index Category	95th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	75650.00	0.00	68725.00	0.00	0.00	0.00	62850.00	0.00	0.00	0.00
> 0 - 0.25	396025.00	45210.90	361900.00	40863.70	-4347.20	-9.62	436575.00	45152.10	-58.80	-0.13
0.25 - 0.50	232700.00	71335.60	263275.00	82167.70	10832.10	15.18	196875.00	61363.60	-9972.00	-13.98
0.5 - 0.75	18000.00	11847.00	26725.00	17571.80	5724.80	48.32	19475.00	12665.80	818.80	6.91
0.75 - 1.00	31525.00	29843.80	33450.00	31862.60	2018.80	6.76	27100.00	25529.60	-4314.20	-14.46
Total	**753900.00**	**158237.30**	**754075.00**	**172465.80**	**14228.50**	**8.99**	**742875.00**	**144711.10**	**-13526.20**	**-8.55**

Attachment 3.1B

Summary of post-project changes in area (m^2) and WUA at 50^{th}, 75^{th}, 85^{th} and 95^{th} percentile flows for the five variable (water velocity, depth, substrate, flow direction and distance from an hydraulic feature) model.

Habitat Suitability Index Category	50th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	595900	0.00	559950	0.00	0.00	0.00	601025	0.00	0.00	0.00
> 0 - 0.25	54550	3786.91	95375	5826.85	2039.94	53.86819	73625	5841.07	2054.16	54.2437
0.25 - 0.50	22875	7923.8169	21400	7499.38	-424.437	-5.35647	26200	9058.72	1134.903	14.32268
0.5 - 0.75	3450	2167.0447	4325	2661.92	494.8753	22.83641	4500	2763.9	596.8553	27.54236
0.75 - 1.00	3800	3187.3357	3850	3233.48	46.1443	1.447739	3875	3262.57	75.2343	2.360413
Total	**680575**	**17065.1073**	**684900**	**19221.63**	**2156.523**	**12.63703**	**709225**	**20926.26**	**3861.153**	**22.62601**

Habitat Suitability Index Category	75th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	620050.00	0.00	596325.00	0.00	0.00	0.00	602900.00	0.00	0.00	0.00
> 0 - 0.25	67750.00	5014.39	97800.00	8070.78	3056.39	60.95	80400.00	7376.98	2362.59	47.12
0.25 - 0.50	25500.00	9082.25	21800.00	7478.04	-1604.21	-17.66	32675.00	11352.00	2269.75	24.99
0.5 - 0.75	6100.00	3657.38	7000.00	4298.23	640.85	17.52	7050.00	4175.89	518.51	14.18
0.75 - 1.00	4575.00	3897.40	3475.00	2854.21	-1043.19	-26.77	4200.00	3559.36	-338.04	-8.67
Total	**723975.00**	**21651.42**	**726400.00**	**22701.26**	**1049.84**	**4.85**	**727225.00**	**26464.23**	**4812.81**	**22.23**

Habitat Suitability Index Category	85th Percentile Comparison									
	Existing Environment		Post Project 2012		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	620025.00	0.00	589689.00	0.00	0.00	0.00	602375.00	0.00	0.00	0.00
> 0 - 0.25	68225.00	4639.68	104170.00	6064.25	1424.57	30.70	79750.00	5707.60	1067.92	23.02
0.25 - 0.50	25250.00	9050.58	22707.90	5506.75	-3543.83	-39.16	30475.00	9742.88	692.30	7.65
0.5 - 0.75	7750.00	4691.14	6758.72	2895.91	-1795.23	-38.27	6200.00	3729.42	-961.72	-20.50
0.75 - 1.00	5225.00	4419.76	3611.80	2089.12	-2330.64	-52.73	4300.00	3621.20	-798.56	-18.07
Total	**726475.00**	**22801.16**	**726937.42**	**16556.03**	**-6245.13**	**-27.39**	**723100.00**	**22801.10**	**-0.06**	**0.00**

Habitat Suitability Index Category	95th Percentile Comparison									
	Existing Environment		PP 2012 Barrier @ Base of Spillway		Change	%Change	Post Project 2011		Change	%Change
	Total Area	WUA	Total Area	WUA	WUA	WUA	Total Area	WUA	WUA	WUA
Not Suitable	589000.00	0.00	545875.00	0.00	0.00	0.00	600375.00	0.00	0.00	0.00
> 0 - 0.25	55000.00	4240.23	108275.00	9139.29	4899.06	115.54	80725.00	7371.53	3131.30	73.85
0.25 - 0.50	23000.00	8216.60	21800.00	7519.57	-697.03	-8.48	30375.00	10277.00	2060.40	25.08
0.5 - 0.75	5325.00	3246.64	5975.00	3646.98	400.34	12.33	6650.00	4100.30	853.66	26.29
0.75 - 1.00	5925.00	5165.04	3425.00	2816.79	-2348.25	-45.46	4475.00	3755.76	-1409.28	-27.28
Total	**678250.00**	**20868.50**	**685350.00**	**23122.63**	**2254.13**	**10.80**	**722600.00**	**25504.59**	**4636.09**	**22.22**