Pointe du Bois Spillway Replacement Project

PHYSICAL ENVIRONMENT MONITORING PLAN

DRAFT

Manitoba Hydro

October 2012

POINTE DU BOIS
SPILLWAY REPLACEMENT PROJECT

Physical Environment Monitoring Plan

DRAFT

Report Prepared for

Manitoba Hydro

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1.0 OVERVIEW

This document describes the Physical Environment Monitoring Plan (PEMP) for the Pointe du Bois Spillway Replacement Project (the Project) at the Pointe du Bois Generating Station (GS) on the Winnipeg River in southeastern Manitoba. The location and Study Area for the Project are shown in **Figure 1.1**.

1.1 Project Description

The Project involves replacing the existing spillways and sluiceway a new 7-bay spillway, at the east shore of the Winnipeg River, and two 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 dams will be zoned earthfill embankments, each consisting of an impervious core with granular and crushed rock filters and outer rockfill shells.

Manitoba Hydro will complete construction of the Project, decommissioning of existing facilities, and site restoration over a period of approximately three years and thereafter will operate the Project.

1.2 Environmental Protection Program and the PEMP

The PEMP is one of the parts of an integrated Environmental Protection Program (EPP) developed for the Project. Implementation of the EPP is an application of Manitoba Hydro's Corporate Environmental Management Policy under the company's ISO14001-certified Environmental Management System. The EPP for the Project will assist Manitoba Hydro and its contractors to be compliant with the corporate environmental policy and all regulatory requirements. Additionally, it will provide an opportunity for adaptive management to mitigate unexpected adverse effects, should they be detected during monitoring.

The Environmental Protection Program for the Pointe du Bois Spillway Replacement Project includes the following:

- Environmental Protection Plans (EnvPP), which provide detailed, site-specific directions to contractors to minimize environmental impact. For the Pointe du Bois Spillway Replacement

Project, the EnvPPs are organized by construction component, highlighting measures to reduce the impacts of specific work activities, such as tree clearing and erosion and sediment control;

- Environmental Management Plans, which are focused documents that address specific environmental issues. For the Pointe du Bois Spillway Replacement Project they include a Sediment Management Plan for In-stream Construction (SMP, Manitoba Hydro, 2012a) and a Fish Habitat Compensation Plan (NorthSouth Consultants Inc, 2011); and
- Environmental Monitoring Plans, which provide instructions for monitoring the effects of construction and operational activities on the physical, biophysical and socio-economic environments. For the Pointe du Bois Spillway Replacement Project they include the following individual plans:
  - Aquatic Effects Monitoring Plan (AEMP, Manitoba Hydro, 2012b),
  - Terrestrial Effects Monitoring Plan (TerEMP, Manitoba Hydro, 2012c),
  - Physical Environment Monitoring Plan (PEMP, this document), and
  - Socio-economic Monitoring Plan (SEMP, Manitoba Hydro, 2012d).

The predicted environmental effects of the Project were described in the Pointe du Bois Spillway Replacement Project Environmental Impact Statement (Manitoba Hydro, 2011a) (the EIS). As summarized in the EIS, the design of the Project overall, including its construction methods and mitigation measures, has minimized the likelihood of significant environmental effects.

Where it has been predicted that significant effects may occur as a result of the Project, quantitative estimates of those effects have been prepared and have been reported in the EIS. The PEMP, as one of the Environmental Monitoring Plans for the Project, is intended as a guide for the collection and reporting of relevant data on the physical environment during the construction and operational phases of the Project in order to confirm the impact predictions in the EIS.

The PEMP builds on the assessment studies conducted for the EIS, using established monitoring sites and sampling protocols that will be maintained through the period of construction and into the period of operation of the Project. The monitoring plan is adaptive in that the observed results will be evaluated on an on-going basis to modify the plan as necessary.

1.3 Overall PEMP Monitoring Schedule

The planned PEMP monitoring schedule is organized as follows:

- Construction Phase (including decommissioning of existing facilities and site cleanup) – approximately three years – monitoring during construction for relevant physical environment components, especially those for which mitigation measures have been proposed on the basis of the environmental assessment which is detailed in the EIS;

- Construction Phase Review – assessment of Project effects during construction in comparison to predictions; optimization of PEMP for Operations Phase;
- Operations Phase – first five years of operation of the Project – monitoring of physical environment variables whose effects may extend beyond the construction phase;
- Operations Phase Review - following five years of operation of the Project – assessment of PEMP monitoring results as part of overall project monitoring review, including whether unexpected effects are occurring, whether mitigation measures need modification, and whether monitoring should be continued, and, if so, the appropriate variables, approach, and schedule.

1.4 PEMP Management and Reporting

Manitoba Hydro will coordinate and manage all planning, fieldwork, instrumentation, analysis, and reporting, for all components of the PEMP. Some PEMP monitoring tasks will support and be conducted simultaneously with monitoring work done under the Project's SMP (Manitoba Hydro, 2012a) and AEMP (Manitoba Hydro, 2012b). Contractors may be deployed for some activities, under the direction of Manitoba Hydro.

Throughout the duration of the PEMP, information will be provided to the regulatory authorities on a yearly basis. All reports will be submitted in an appropriate digital format.

During the Construction Phase of the Project monitoring, annual reports integrating the results of all components of the PEMP will be prepared in the year following data collection. The annual reports will include:

- A summary of monitoring activities conducted;
- Results of monitoring, including field observations, and comparison to pre-project conditions, where relevant;
- Information on atypical or unexpected occurrences that may have affected the monitoring results;
- A brief summary of the PEMP monitoring results to date, including unexpected effects, if any, mitigation or changes to mitigation undertaken, and recommendations for modifications, if any, to the monitoring plan.

During the Operations Phase, results of PEMP monitoring will be presented in annual reports prepared in the year following collection of the data. The reports will continue the same annual content and depth of coverage as the annual reports of the Construction Phase, as outlined above.

At the end of the Operations Phase, an overall review of the PEMP results will be undertaken and a summary report on the PEMP monitoring will be prepared. The report will include:

- Detailed analysis of the data collected to date, with reference to changes documented from pre-Project conditions;
- The effects of the Pointe du Bois Spillway Replacement Project on the physical environment during the construction and operating phases;

- Effects that were not anticipated in the EIS;
- Recommendations on whether PEMP monitoring should be continued beyond the Operations Phase, and if so, the proposed parameters of the monitoring and the proposed reporting schedule.

2.0 PEMP MONITORING COMPONENTS AND SCHEDULE

A comprehensive range of variables describing the existing physical environment relevant to the Project has been studied and the anticipated effects of the project on those variables has been estimated and reported upon in the EIS. No specific environmental monitoring is planned for physical environment subject areas where no significant Project effects are expected. Those areas include air quality, noise, ice regime, physiography and landscape, long-term shoreline erosion, woody debris, and groundwater.

Summarized below are the plans for monitoring within physical environment subject areas where there is a potential effect or where physical environment parameters also support other monitoring programs. The planned PEMP monitoring schedule is summarized in **Table 2.1**.

2.1 Climate

A temporary meteorological data collection platform will be installed at the Project site to monitor local temperature and precipitation during the Construction Phase in support of water quality management, specifically the presence, source, and movement of suspended sediment in the Winnipeg River. Monitoring will be continued during the Operations Phase as necessary.

2.2 Surface Water Regime

As part of the PEMP, local flow velocities and flow directions will be measured in the Winnipeg River from the Pointe du Bois powerhouse and spillway facilities down to Eight Foot Falls, along the transects shown in **Figure 2.1**, in order to characterize the local flow patterns during the Construction and Operations Phases. Geo-referenced velocity measurements in the water column will be made using an Acoustic Doppler Current Profiler (ADCP), the same equipment that was used to characterize the existing local flow patterns. The PEMP measurements will be used to validate the three-dimensional hydraulic model which was developed to predict the flow patterns resulting from the Project and which was calibrated using the pre-Project measurements.

In addition to the planned locations for ADCP transects downstream of the powerhouse and spillway structures (V_Tsec1 to V_Tsec4, as shown in **Figure 2.1**), it is planned to include three additional transects (V_Eddy1 to V_Eddy3) in the west bay area downstream of the structures, where a dominant rotational current prevails under most discharge conditions and has long been a popular fishing spot. The three-dimensional hydraulic modeling has indicated that a rotational flow pattern at this location will continue throughout the Construction and Operations Phases of the Project. The PEMP ADCP

measurements at transects V_Eddy1 to V_Eddy3 will be used to quantify the flow patterns and validate the model results for this location.

Timing of the ADCP measurement programs will be opportunistic and undertaken in correspondence with the occurrence of low, average, and high flow events whose Winnipeg River discharges will characterize the range of utilization of the new spillway and the flow patterns that will result. The PEMP ADCP monitoring results also will be used to support the AEMP studies and other investigations outside the scope of the PEMP. It is anticipated that the ADCP monitoring of local flow patterns will be completed during Construction Phase and within the first five years of the Operations Phase, subject to the occurrence and measurement of the required full range of flow conditions.

Local and regional discharge and water surface elevation data from established long-term hydrometric stations on the Winnipeg River and elsewhere to support Project operating license compliance reporting and Project operations will continue to be acquired by Manitoba Hydro outside the scope of the PEMP. There will be no changes to Winnipeg River discharges or water levels in the reaches upstream or downstream of the generating station or to the operation of the generating station, the powerhouse capacity, or the frequency of spill as a result of the Project.

2.3 Erosion and Sedimentation

The effectiveness of the Project design, its construction practices, and mitigation measures to minimize erosion and release of sediment during the Construction Phase (including in-stream construction, commissioning of new structures and decommissioning existing structures) and, afterward, during the Operations Phase, will be monitored as part of the PEMP.

Short-term erosion that may result from Project construction activities will be tracked through quantification of sediments being mobilized and transported by the moving water and being accumulated at potential deposition sites downstream.

Long-term shoreline and riverine erosion processes upstream and downstream of the immediate area of construction activities, which are characterized in the EIS, are not expected to be changed as a result of the Project, because the Project will not alter or affect the water level and flow regimes there.

2.3.1 Suspended Sediment Load

The building of the new spillway and the changing of the locations of spill will result in localized changes to flow patterns and velocities both upstream and downstream of the structures. It is anticipated that increased velocities potentially may mobilize materials from an area of the existing river bottom immediately upstream of the proposed spillway approach channel during the commissioning of the spillway and during the initial handling of high flows during the Operations Phase. Consequently there is potential for temporary increases in sediment load downstream of the Project. Construction activities

such as cofferdam construction, river management, and decommissioning of the existing structures also carry potential for temporary releases of sediment.

A sediment monitoring program will be undertaken to confirm the prediction of the magnitude, spatial, and temporal sediment load increase in the Winnipeg River during the Construction and Operations Phases. The program will include the collection of the following parameters:

- Total Suspended Solids (TSS) and discrete Turbidity (Tu) sampling on a monthly basis during the open water season along five TSS transects (T2 to T6) during the Construction Phase and the first five years of the Operations Phase;
- Continuous Turbidity measurement at four Turbidity sites (TU1 to TU4) during the Construction Phase;
- Continuous Turbidity measurement at two Turbidity sites (TU2 and TU4) during the first five years of the Operations Phase.

Turbidity (Tu) loggers will be used to provide estimates of TSS concentration in the water column using a Tu-TSS relationship established for the Winnipeg River. Data collected downstream of the Project will be compared with data collected at upstream reference sites to provide an indication of the level of Project-related changes to TSS.

Turbidity sites TU1 to TU4 will also serve as the monitoring sites for the Sediment Management Plan (SMP) during Construction Phase to provide an estimate of the mobilized sediment as TSS concentration in the water column.

The locations of the planned TSS transects (T2 to T6) and the planned locations of the Tu loggers (TU1 to TU4) are shown in **Figure 2.2.**

2.3.2 Sediment Deposition

Sands, gravels and coarser sizes of material that may be mobilized in the Winnipeg River as a result of the construction and, later, the commissioning and the operation of the new spillway are expected to settle out mostly between the area immediately below the new structures and Eight Foot Falls, with particle size in the new deposits decreasing in the downstream direction. Finer sizes of mobilized materials are expected to be carried beyond Eight Foot Falls and into the Slave Falls forebay reservoir where the waters are deeper and the velocities are lower.

As part of the PEMP, and in support of the AEMP studies of Project effects on Lake Sturgeon and their habitat, sediment traps will be placed and monitored for catch throughout the year in five locations. The sediments collected by the traps, if any, will be analyzed in the laboratory for sediment volume and

particulate size. The laboratory results will be compared with the estimated deposition rates of fine particles (clay to very fine sand) that were derived through numerical modelling.

Each sediment trap that will be used in this program comprises a set of five clear polycarbonate tubes (76 cm long and 10 cm in diameter), as shown in Figure 2.3. Three of the tubes each have a set of 12 holes about 18 mm in diameter and equally spaced around the circumference at a height of 50 cm above the river bottom. These tubes are intended to collect sediments as water flows through the trap. The top ends of these three tubes are closed. The other two tubes are open at the top and without holes in their sides, and are intended to collect sediments as they settle through the water column. The sediment accumulating at the bottom of each tube is funneled into its own collection bottle and stored until pick-up.

Two traps will be positioned where it has been estimated that Lake Sturgeon eggs may be deposited, immediately below the spillway rapids and new structures area (within the designated area shown in **Figure 2-4**). The actual locations of these traps may be adjusted in the field based on consideration of factors such as safety, accessibility and ambient conditions (i.e. high river flow or water velocity, bed topography). Sediment traps also will be positioned in three locations where juvenile Lake Sturgeon have been captured, one of them about halfway between the Pointe du Bois generating station / spillway rapids area and Eight Foot Falls, and the other two about 0.8 and 2.4 kilometers downstream of Eight Foot Falls, respectively.

The monitoring of Project-related sedimentation will be continued throughout the Construction Phase and the first 5 years of the Operations Phase of the Project. The traps will be deployed at the beginning of open water season of each year and retrieved at the end of this season to be redeployed for winter period. The planned locations for the placement of the five sediment traps are shown in Figure 2.4.

3.0 REFERENCES

MANITOBA HYDRO. 2011a. Manitoba Hydro Pointe du Bois Spillway Replacement Project, Environmental Impact Statement. Winnipeg, Manitoba.

MANITOBA HYDRO. 2011b. Pointe du Bois Spillway Replacement Project, Stage IV Studies, Open Water Hydraulics, P-1.3.2.1.0380, Winnipeg, Manitoba.

MANITOBA HYDRO. 2012a. Pointe du Bois Spillway Replacement Project, Sediment Management Plan, Winnipeg, Manitoba.

MANITOBA HYDRO. 2012b. Pointe du Bois Spillway Replacement Project, Aquatic Effects Monitoring Plan, Winnipeg, Manitoba.

MANITOBA HYDRO. 2012c. Pointe du Bois Spillway Replacement Project, Terrestrial Effects Monitoring Plan, Winnipeg, Manitoba.

MANITOBA HYDRO. 2012d. Pointe du Bois Spillway Replacement Project, Socio-economic Monitoring Plan, Winnipeg, Manitoba.

NORTH/SOUTH CONSULTANTS INC. 2011. Pointe du Bois Spillway Replacement Project Environmental Studies Program, Fish Habitat Compensation Plan, Draft Report #11-01 prepared for Manitoba Hydro.

TABLES AND FIGURES

Table 2-1. Summary of Physical Environment Monitoring Phases Point du Bois Spillway Replacement Project										
Program	**Construction Phase**				**Operations Phase**					
Year of Program	**1**	**2**	**3**	**R**	**1**	**2**	**3**	**4**	**5**	**R**
Climate										
- Partial Meteorological Station (Air Temperature & Precipitation)	Continuous				Continuous (as necessary)					
Surface Water Regime										
- ADCP Velocity Transects	To characterize high, average, low flow conditions			●	To characterize high, average, low flow conditions					●
Erosion and Movement of Sediments										
- Turbidity Loggers: TU1 - TU4	Continuous, 4 sites				Continuous, 2 sites					
- Turbidity Transects: T2 T3 T4 T5 T6	1 X per month (during open water)				1 X per month (during open water)					
- TSS Transects: T2 T3 T4 T5 T6	1 X per month (during open water)				1 X per month (during open water)					
Sediment Deposition										
- Sediment Traps, 5 locations	Continuous: 2 X per year (open water & winter)				Continuous: 2 X per year (open water & winter)					

● Phase-end review of all components of PEMP.

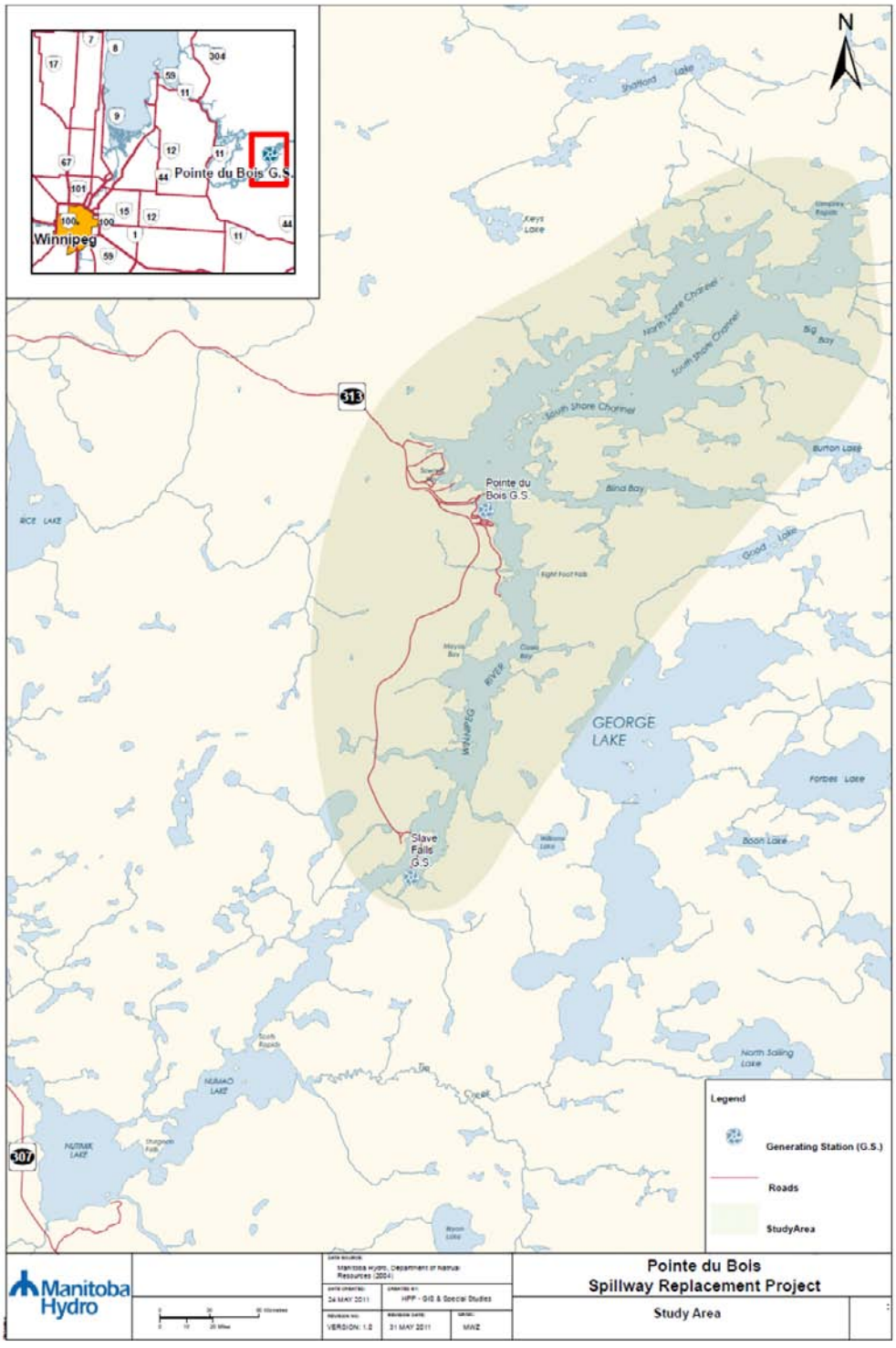

Figure 1-1. Project location and study area, Pointe du Bois Spillway Replacement Project (after Manitoba Hydro 2011a).

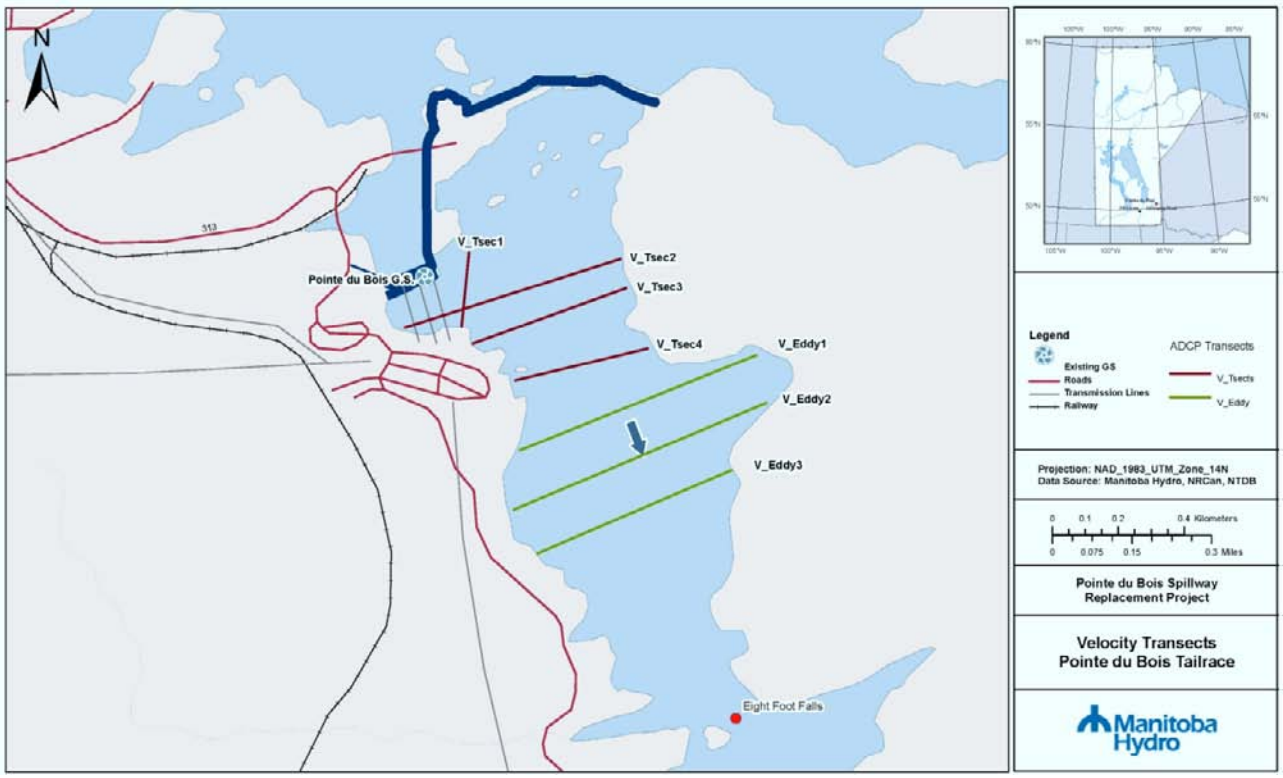

Figure 2-1. ADCP velocity transect monitoring sites, spillway – tailrace area, Pointe du Bois Spillway Replacement Project.

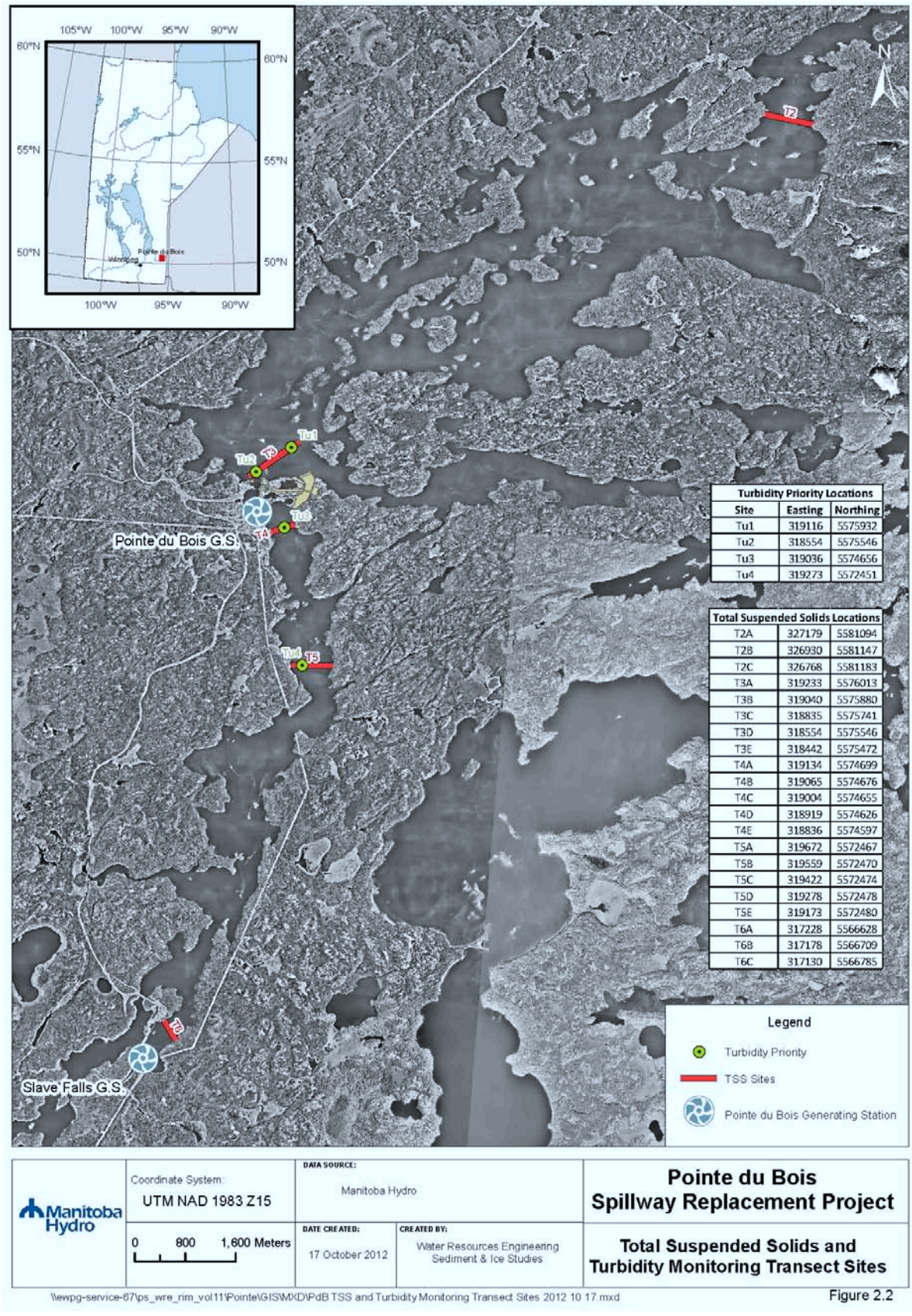

Figure 2-2. Total suspended solids and turbidity monitoring transect sites, Pointe du Bois Spillway Replacement Project (after MH 2011a).

Figure 2-3. Sedimentation monitoring equipment (Sediment traps), Pointe du Bois Spillway Replacement Project.

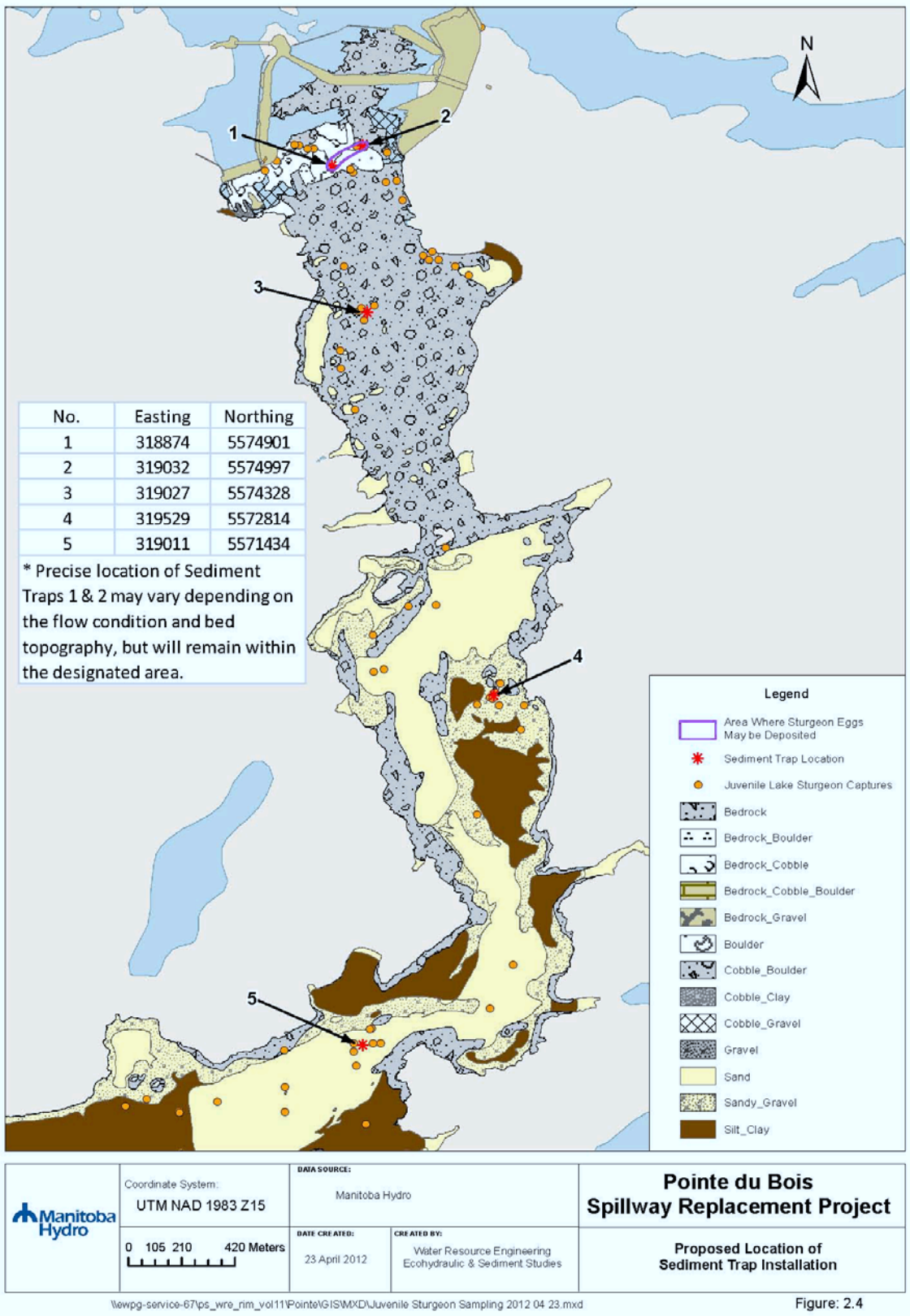

Figure 2-4. Sedimentation monitoring locations, Pointe du Bois Spillway Replacement Project.