TECHNICAL SUPPORTING DOCUMENT

# AQUATIC ENVIRONMENT

## PROPOSED NEW POST CREEK HYDROELECTRIC PROJECT

Submitted To:

**Coral Rapids Power Inc.**
**and Ontario Power Generation Inc.**

Prepared By:

**SENES Consultants**

November 2013

# TECHNICAL SUPPORT DOCUMENT
# AQUATIC ENVIRONMENT
# PROPOSED NEW POST CREEK HYDROELECTRIC PROJECT

Submitted to:

| Coral Rapids Power Inc.<br>11 Elm Street North<br>Timmins, Ontario<br>P4N 6A3 | Ontario Power Generation Inc.<br>700 University Avenue<br>Toronto, Ontario<br>M5G 1X6 |
|---|---|

Prepared by:
SENES Consultants

Prepared by: ____________________ November 2013
Dr. Jerry Fitchko, SENES — Date
Sr. Environmental Specialist
EA Consulting Team

Approved by: ____________________ November 2013
Mr. Phil Shantz, SENES — Date
Project Manager
EA Consulting Team

Reviewed by: ____________________ November 2013
Ms. Gillian MacLeod — Date
Sr. Environmental Advisor
Ontario Power Generation Inc.

Accepted by: ____________________ November 2013
Mr. Wayne Ross — Date
President
Coral Rapids Power Inc.

Accepted by: ____________________ November 2013
Mr. Matt MacDonald — Date
Project Manager
Ontario Power Generation Inc.

## EXECUTIVE SUMMARY

Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power Inc. (CRP), a wholly owned corporation of the Taykwa Tagamou Nation (TTN), are proposing the development of the New Post Creek Hydroelectric Project (New Post Creek Project or Project). The proposed Project is located in the District of Cochrane within the Geographic Township of Pinard, approximately 75 km north of the Town of Smooth Rock Falls and 15 km north of the former small community of Fraserdale.

The proposed New Post Creek Project was identified by the Ontario Ministry of Energy (2010) as being under consideration as a clean, renewable, cost-effective hydroelectric generation project in "Ontario's Long-Term Energy Plan".

In 1963, Ontario Hydro constructed the New Post Creek Diversion Dam on the Little Abitibi River in order to supply additional generating capacity at its Otter Rapids Generating Station (GS). The Otter Rapids GS is now owned and operated by OPG under the authority of a Water Power Lease. The dam allows flows to be diverted along the constructed New Post Creek Diversion Channel and New Post Creek to the Abitibi River upstream of Otter Rapids GS. The New Post Creek Project would take advantage of a portion of this diverted flow descending approximately 66 m between New Post Creek and the Abitibi River, all within TTN Traditional Territory to generate approximately 25 MW of electricity.

The proposed New Post Creek Project is subject to the "Class Environmental Assessment for Waterpower Projects" (OWA, 2012a) under the Ontario *Environmental Assessment Act*. This Aquatic Environment Technical Support Document was prepared as part of this Class Environmental Assessment process.

During proposed Project construction, potential effects on the aquatic environment may occur due to soil erosion causing turbidity and sedimentation in surface waters, waste generation, incidental spills, hazardous materials usage, blasting, in-water construction activities and fish habitat enhancement/creation. Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term with no adverse residual effects. Fish habitat enhancement/creation will be greater than fish habitat loss, resulting in a net habitat gain.

During operations, potential effects on the aquatic environment may occur due to incidental spills, reservoir creation, water level and flow fluctuations due to pulsing, fish habitat loss/gain, fish entrainment, increased fish mercury body burden and water use experience diminution. Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Project will have negligible effects on the aquatic environment, with no adverse residual effect.

The proposed New Post Creek Project will not have a negative effect upon the fish communities of New Post Creek or the Abitibi River, although local shifts in community structure are expected due to physical habitat and water temperature changes. Upstream of the proposed intake weir, the headpond will create an additional 131.9 ha of aquatic habitat, and alter an existing 37.5 ha of riverine habitat to be slower flowing and deeper (with a total inundation area of approximately 170 ha). This will provide a greater area and diversity of habitats that could potentially result in a more productive and diverse fish community. Downstream of the proposed intake weir a set of seasonally appropriate minimum flows will ensure that the habitat components and functions in New Post Creek are maintained, including the important Walleye spawning habitat below the waterfalls. The downstream area altered is approximately 32.8 ha. Reductions in downstream habitat area under minimum flows cannot be quantified with the available information, but are considered to be minor. The tailrace discharging to the Abitibi River will not result in the loss of habitat, but will increase habitat diversity in the vicinity of the tailrace.

With respect to fish mercury body burden, it is anticipated that mercury concentrations in Walleye in New Post Creek below the waterfalls will be comparable to the pre-development mercury concentrations in Walleye. This will be confirmed by post-inundation fish mercury body burden monitoring programs.

Environmental protection during proposed New Post Creek Project construction and operation will be ensured by adherence to the site-specific Environmental Management Plan to be developed by the Design Build Contractor, as well as compliance with regulatory standards and guidelines.

The Environmental Management Plan ensures that environmental protection will be achieved during construction by describing government agency requirements, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan and Waste Management Plan.

During operation, environmental protection will be achieved by adherence to the Spills Emergency Preparedness and Response Plan and the amended Abitibi River Water Management Plan, deployment of public safety measures and environmental monitoring.

# TABLE OF CONTENTS

**Page No.**


EXECUTIVE SUMMARY ES-1
1.0 INTRODUCTION 1-1
1.1 Regulatory Framework 1-4
1.2 Project Description 1-5
1.2.1 Alternatives Analysis 1-5
1.2.2 Preferred Alternative 1-9
1.2.3 Proposed General Layout 1-9
1.3 Project Activities 1-29
1.3.1 Construction 1-29
1.3.1.1 Inundation and Total Cleared Areas 1-35
1.3.1.2 Requirements for Off-site Land Use and Other Ancillary Features 1-36
1.3.1.3 Construction Schedule and Strategy 1-38
1.3.2 Operation 1-39
1.3.2.1 Proposed New Post Creek Hydroelectric GS 1-39
1.3.2.2 Operating Regime 1-41
1.3.2.3 Transmission Facilities 1-43
1.3.3 Decommissioning 1-44
1.4 Description of the Study Areas 1-44
1.5 Study Approach 1-47
1.6 Structure of Report 1-47
2.0 BASELINE AQUATIC ENVIRONMENT CONDITIONS 2-1
2.1 Water Resources 2-1
2.1.1 Site Surface Hydrology 2-1
2.1.2 Groundwater Hydrology 2-1
2.1.3 Abitibi River 2-2
2.1.3.1 Hydrology 2-2
2.1.3.2 Morphology and Bathymetry 2-6
2.1.4 New Post Creek 2-7
2.1.4.1 Hydrology 2-7
2.1.4.2 Morphology and Bathymetry 2-11
2.2 Aquatic Environment Resources 2-23
2.2.1 Water Quality 2-23
2.2.2 Sediments 2-28
2.2.3 Aquatic Vegetation 2-29
2.2.3.1 Significant Plant Species 2-30
2.2.4 Plankton 2-31
2.2.5 Benthic Macroinvertebrates 2-33
2.2.6 Fisheries Resources 2-41
2.2.6.1 Existing Aquatic Habitat 2-43
2.2.6.2 Fish Migration Barriers 2-53
2.2.6.3 Fish Community and Spawning Studies 2-54
2.2.6.4 Fish Community Composition 2-55
2.2.6.5 Walleye Spawning 2-58
2.2.6.6 Lake Sturgeon Spawning 2-58
2.2.6.7 Lake Whitefish Spawning 2-61
2.2.6.8 Other Fish Species Spawning 2-61

2.2.6.9 Fish Mercury Body Burden ..... 2-62
2.2.6.10 Fish Consumption Advisories ..... 2-78
2.2.7 Aquatic Avifauna ..... 2-80
2.2.8 Significant Species ..... 2-81
2.3 Watercourse Uses ..... 2-81
2.3.1 Traditional Uses ..... 2-81
2.3.2 General Recreation ..... 2-83
2.3.3 Recreational Boating ..... 2-83
2.3.4 Outfitter Excursions ..... 2-84
2.3.5 Fishing ..... 2-84
2.3.6 Hydropower Facilities ..... 2-85
3.0 EFFECTS ASSESSMENT AND MITIGATION MEASURES ..... 3-1
3.1 Potential Construction Effects and Associated Mitigation ..... 3-2
3.1.1 Surface and Groundwater Hydrology ..... 3-2
3.1.2 Water Quality ..... 3-3
3.1.2.1 Erosion and Sediment Control ..... 3-3
3.1.2.2 In-water Construction Activities ..... 3-5
3.1.2.3 Use of Explosives ..... 3-5
3.1.2.4 Acid Rock Drainage Potential ..... 3-6
3.1.2.5 Management and Control of Hazardous Materials, Construction Wastes and Incidental Spills ..... 3-8
3.1.2.6 Stormwater Management ..... 3-8
3.1.3 Aquatic Habitat ..... 3-9
3.1.3.1 Timing of In-Water Construction ..... 3-9
3.1.3.2 Use of Explosives ..... 3-9
3.1.3.3 Sediments ..... 3-10
3.1.3.4 Plankton ..... 3-10
3.1.3.5 Aquatic Vegetation ..... 3-10
3.1.3.6 Benthic Macroinvertebrates ..... 3-10
3.1.3.7 Site-Specific Fish Habitat Considerations ..... 3-11
3.1.3.8 Aquatic Avifauna ..... 3-13
3.1.3.9 Watercourse Uses ..... 3-13
3.2 Potential Operational Effects and Associated Mitigation, Enhancement and Monitoring Measures ..... 3-14
3.2.1 Surface Hydrology ..... 3-14
3.2.1.1 Minimum Flow Considerations ..... 3-14
3.2.1.2 Minimum Flow Establishment Process ..... 3-17
3.2.1.3 Minimum Flows Proposed by MNR and Ontario Parks ..... 3-30
3.2.2 Groundwater Hydrology ..... 3-35
3.2.3 Water Quality ..... 3-35
3.2.4 Sediment Erosion and Transport ..... 3-37
3.2.5 Plankton, Aquatic Vegetation and Benthic Macroinvertebrates ..... 3-38
3.2.6 Walleye Spawning ..... 3-40
3.2.7 Other Fish Species Habitat Utilization ..... 3-40
3.2.8 Fish Habitat Loss and Gain/Enhancement ..... 3-43
3.2.9 Fish Entrainment and Survival ..... 3-50
3.2.10 Mercury ..... 3-52
3.2.10.1 Background ..... 3-52
3.2.10.2 Potential Mercury Biomagnification in Fish ..... 3-53
3.2.10.3 Summary and Conclusions ..... 3-57

3.2.11 Aquatic Avifauna ........ 3-58
3.2.12 Watercourse Uses ........ 3-60
3.3 Summary of Mitigation, Enhancement and Monitoring Measures ........ 3-61
4.0 SUMMARY AND CONCLUSIONS ........ 4-1
5.0 REFERENCES ........ 5-1
6.0 ACRONYMS AND ABBREVIATIONS ........ 6-1
7.0 GLOSSARY ........ 7-1
APPENDIX A: FISHERIES SURVEY REPORTS (Coker and Portt, 2012a, b, c, d; 2013a, b, c, d, e)
APPENDIX B: BENTHIC MACROINVERTEBRATE TAXA RECORDED IN THE ABITIBI RIVER (Fiset, 1995)
APPENDIX C: AQUATIC ASSESSMENT OF PROPOSED MINIMUM FLOWS IN NEW POST CREEK (Coker and Portt, 2012e)

## LIST OF TABLES

**Page No.**

Table 1.1 Proposed New Post Creek Project Hydraulic Characteristics ..........1-28
Table 1.2 Proposed New Post Creek Project Components..........1-28
Table 1.3 Quantification of Areas Affected by Proposed Project Components ..........1-35

Table 2.1 Minimum, Maximum, as well as Monthly and Annual Mean Discharges ($m^3/s$) of the Abitibi River..........2-4
Table 2.2 Annual Regulated Flow Metrics for the Abitibi River ..........2-6
Table 2.3 Estimated Natural (Pre-diversion) Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River ..........2-7
Table 2.4 Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River (1975 to 2012) ..........2-9
Table 2.5 Annual Regulated Flow Metrics for the Little Abitibi River at New Post Creek Diversion Dam ..........2-11
Table 2.6 Summary of Changes to Channel Planform for a New Post Creek Reach ..........2-19
Table 2.7 New Post Creek and Diversion Dam Shoreline Composition..........2-20
Table 2.8 New Post Creek and Diversion Dam Shoreline Vegetation Type..........2-20
Table 2.9 New Post Creek and Diversion Dam Shoreline Erosion Conditions..........2-21
Table 2.10 Abitibi River and Little Abitibi River Water Quality Data ..........2-24
Table 2.11 TSS Concentrations in the Abitibi River near Onakawana..........2-25
Table 2.12 TSS Concentrations in New Post Creek..........2-26
Table 2.13 New Post Creek Water Quality Data ..........2-26
Table 2.14 Particle Size Distribution in New Post Creek Surficial Sediment..........2-28
Table 2.15 Aquatic Macrophyte Species Observed within the Proposed Project Study Area..........2-29
Table 2.16 Significant Aquatic Plant Species Recorded in the Abitibi River Watershed..........2-32
Table 2.17 Benthic Macroinvertebrate Community Composition in the Abitibi River ..........2-34
Table 2.18 Benthic Macroinvertebrate Community Composition in New Post Creek..........2-37
Table 2.19 Fish Species Recorded in the Abitibi River[1] ..........2-41
Table 2.20 Fish Species Collected in the Abitibi River, New Post Creek and their Tributaries ..........2-57
Table 2.21 Historic Fish THg Body Burden Data for the Abitibi River (Island Falls to Onakawana)..........2-63
Table 2.22 THg Concentrations in Walleye (Muscle Tissue)..........2-75
Table 2.23 THg Concentrations in Slimy Sculpin (Whole Fish)..........2-77
Table 2.24 Provincial Consumption Restrictions for 40 cm Walleye and 55 cm Northern Pike ..........2-79
Table 2.25 Summary of Fish Consumption Advisories..........2-79
Table 2.26 Aquatic Breeding Bird Species Recorded within 10-km by 10-km Square Grids Overlapping the Proposed Project Area ..........2-81
Table 2.27 Fishing Seasons in Fisheries Management Zone 8..........2-85
Table 2.28 Summary of Hydroelectric Facilities and Dam Structures in the Abitibi River Watershed..........2-86

## LIST OF TABLES (Cont'd)

**Page No.**

Table 3.1 Acid Base Accounting Results ....................3-7
Table 3.2 Revised MNR Flow Requirements for New Post Creek ....................3-29
Table 3.3 Lengths and Drainage Areas of New Post Creek Tributaries to be Affected by the Proposed Inundation ....................3-47
Table 3.4 Summary of Fish Habitat Alterations....................3-48
Table 3.5 Summary of Potential Effects and Recommended Mitigation/ Remedial Measures ....................3-62

## LIST OF FIGURES

**Page No.**

Figure 1.1 Proposed Project Location ....1-2
Figure 1.2 Proposed Project Site Location ....1-3
Figure 1.3 Location of Deregulated Area and Replacement Lands ....1-6
Figure 1.4 Alternative Hydroelectric Development Locations on New Post Creek ....1-8
Figure 1.5 Project Location, Site Area Plan and Transmission Line Route ....1-10
Figure 1.6 General Arrangement Project Site and Temporary Facilities ....1-11
Figure 1.7 General Arrangement and Penstock Profile ....1-13
Figure 1.8 Intake, Spillway and Dam General Arrangements....1-15
Figure 1.9 Forebay Extent for FSL = 187 m.a.s.l. ....1-17
Figure 1.10 Penstock Profile ....1-19
Figure 1.11 Powerhouse General Arrangement ....1-21
Figure 1.12 Alternative Transmission Line Routes ....1-24
Figure 1.13 Proposed Transmission Line Route ....1-25
Figure 1.14 Transmission Line Plan and Profile/Interconnection General Arrangement ....1-27
Figure 1.15 Preliminary Fencing, Signage and Safety Boom Locations ....1-30
Figure 1.16a Phase I – Excavations ....1-31
Figure 1.16b Phase II – Removal of Rock Plug ....1-31
Figure 1.16c Phase III – Construction of Earth Dam ....1-32
Figure 1.16d Phase IV – Removal of Cofferdam ....1-33
Figure 1.17 Powerhouse Excavation behind Earth Plug and Sheet Piling Cofferdam ....1-34
Figure 1.18 Proposed Project Access ....1-37
Figure 1.19 Abitibi River Watershed Generating Stations and Dams ....1-45
Figure 1.20 Local Study Area ....1-46
Figure 1.21 Site-specific Study Area ....1-48

Figure 2.1 Moose River Drainage Basin ....2-2
Figure 2.2 Major Physiographic Regions of the Moose River Basin ....2-3
Figure 2.3 Annual Daily Regulated Flow Hydrographs for the Abitibi River at Abitibi Canyon GS ....2-5
Figure 2.4 Daily Regulated Flow Hydrographs for the Abitibi River at Otter Rapids GS ....2-5
Figure 2.5 Annual Daily Regulated Flow Hydrographs for the Little Abitibi River at New Post Creek Diversion Dam ....2-10
Figure 2.6 Post-diversion New Post Creek Morphological Characteristics ....2-12
Figure 2.7 Morphology and Bathymetry of Pre-diversion New Post Creek ....2-14
Figure 2.8 Benthic Macroinvertebrate Sampling Locations ....2-35
Figure 2.9 Locations of Habitat Mapping and Assessment in New Post Creek and the Abitibi River ....2-43
Figure 2.10 New Post Creek Tributaries Upstream of the Proposed Project Weir ....2-49
Figure 2.11 Relationships between Walleye THg Concentrations and Length and Weight ....2-64
Figure 2.12 Relationships between Northern Pike THg Concentrations and Length and Weight ....2-68
Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight ....2-70
Figure 2.14 Relationships Between THg Concentrations and Length and Weight for Walleye from New Post Creek and the Abitibi River (2011) ....2-76
Figure 2.15 Comparison of THg Concentrations in Standard Length of Walleye (40 cm) for Different Locations in Canada ....2-78

## LIST OF FIGURES (Cont'd)


| | | Page No. |
|---|---|---|
| Figure 3.1 | Principal Walleye Spawning Habitat Parameters of Water Depth, Water Velocity at 10 $m^3/s$ and Substrate | 3-19 |
| Figure 3.2 | The Spatial Extent of Suitable Water Depth, Water Velocity and Substrate Type Required by Walleye for Spawning at Flow of 10 $m^3/s$ | 3-20 |
| Figure 3.3 | Principal Walleye Spawning Habitat Parameters of Water Depth, Water Velocity at 30 $m^3/s$ and Substrate | 3-21 |
| Figure 3.4 | The Spatial Extent of Suitable Water Depth, Water Velocity and Substrate Type Required by Walleye for Spawning at Flow of 30 $m^3/s$ | 3-22 |
| Figure 3.5 | The Spatial Extent at 10 and 30 $m^3/s$ of Potential Walleye Spawning Habitat, where Suitable Flow Velocities, Water Depths and Substrate Types Overlap | 3-23 |
| Figure 3.6 | Graph of Potential Optimal Walleye Spawning Habitat Area versus Flow | 3-24 |
| Figure 3.7 | Median New Post Creek Flows | 3-25 |
| Figure 3.8 | Primary (solid line) and Secondary (dashed lines) Flows in New Post Creek Channels Below the Waterfalls | 3-27 |
| Figure 3.9 | Histogram of Flow Redistribution during the Walleye Spawning Period due to Flow Diversion and Minimal Flow Adherence | 3-31 |
| Figure 3.10 | Histogram of Flow Redistribution during the Walleye Fry Emergence Period due to Flow Diversion and Minimal Flow Adherence | 3-33 |
| Figure 3.11 | New Post Creek Tributaries Affected by Proposed Inundation | 3-45 |
| Figure 3.12 | Relationships between THg Concentrations and Length and Weight for Northern Pike in Little Abitibi Lake (1997) | 3-59 |

## LIST OF PHOTOGRAPHS


| | | Page No. |
|---|---|---|
| Photograph 1.1 | Bedrock Outcrop | 1-14 |
| Photograph 1.2 | View Along the Abitibi River Shoreline in the Vicinity of the Proposed Tailrace | 1-22 |
| Photograph 2.1 | Pre-diversion New Post Creek at KP 7.24 (see Figure 2.7) (looking downstream) | 2-15 |
| Photograph 2.2 | Pre-diversion New Post Creek at KP 7.56 (see Figure 2.7) (looking upstream) | 2-15 |
| Photograph 2.3 | Pre-diversion New Post Creek at KP 7.56 (see Figure 2.7) (looking downstream) | 2-16 |
| Photograph 2.4 | Pre-diversion New Post Creek at KP 14.99 (see Figure 2.7) (looking upstream) | 2-16 |
| Photograph 2.5 | Pre-diversion New Post Creek at KP 14.99 (see Figure 2.7) (looking downstream) | 2-17 |
| Photograph 2.6 | Pre-diversion (1947) New Post Creek | 2-18 |
| Photograph 2.7 | Post-diversion (2005) New Post Creek | 2-18 |
| Photograph 2.8 | New Post Creek Waterfalls, May 26, 2010, Discharge = 30.8 $m^3/s$ | 2-21 |
| Photograph 2.9 | New Post Creek Waterfalls, 1899 (Bell, 1904) | 2-22 |
| Photograph 2.10 | New Post Creek Waterfalls, October 28, 2009, Discharge = 11.26 $m^3/s$ | 2-23 |
| Photograph 2.11 | View of Rapids below New Post Creek Waterfalls | 2-47 |
| Photograph 3.1 | New Post Creek Waterfalls, September 17, 2011, Average Daily Flow of 9.17 $m^3/s$ | 3-34 |

# 1.0 INTRODUCTION

In April 2006, a Memorandum of Understanding (MoU) was signed between Ontario Power Generation Inc. (OPG) and the Taykwa Tagamou Nation (TTN) to jointly explore hydroelectric development opportunities within the Abitibi River drainage basin, north of Highway 11. As a result of this initiative, a potential waterpower generation location was identified on New Post Creek, a tributary of the Abitibi River.

In 1963, Ontario Hydro constructed the New Post Creek Diversion Dam on the Little Abitibi River in order to supply additional generating capacity at its Otter Rapids Generating Station (GS). The Otter Rapids GS is now owned and operated by OPG under the authority of a Water Power Lease. The dam allows flows to be diverted from the Little Abitibi River along the constructed New Post Creek Diversion Channel and New Post Creek to the Abitibi River upstream of Otter Rapids GS. With a drainage area increase of approximately 9.5 times (from 319 to 3,025 $km^2$), mean flow in New Post Creek has increased from approximately 4.4 to 42 $m^3/s$ (based on 1975-2012 data), with a 1:100 year flood event flow of 296 $m^3/s$. The New Post Creek Hydroelectric Project (New Post Creek Project or Project), proposed by OPG with its partner Coral Rapids Power Inc. (CRP), a corporation wholly owned by the TTN, would take advantage of a portion of this diverted flow descending approximately 66 m between New Post Creek and the Abitibi River, all within TTN Traditional Territory, to generate approximately 25 MW of electricity, or about 125 GWh annually.

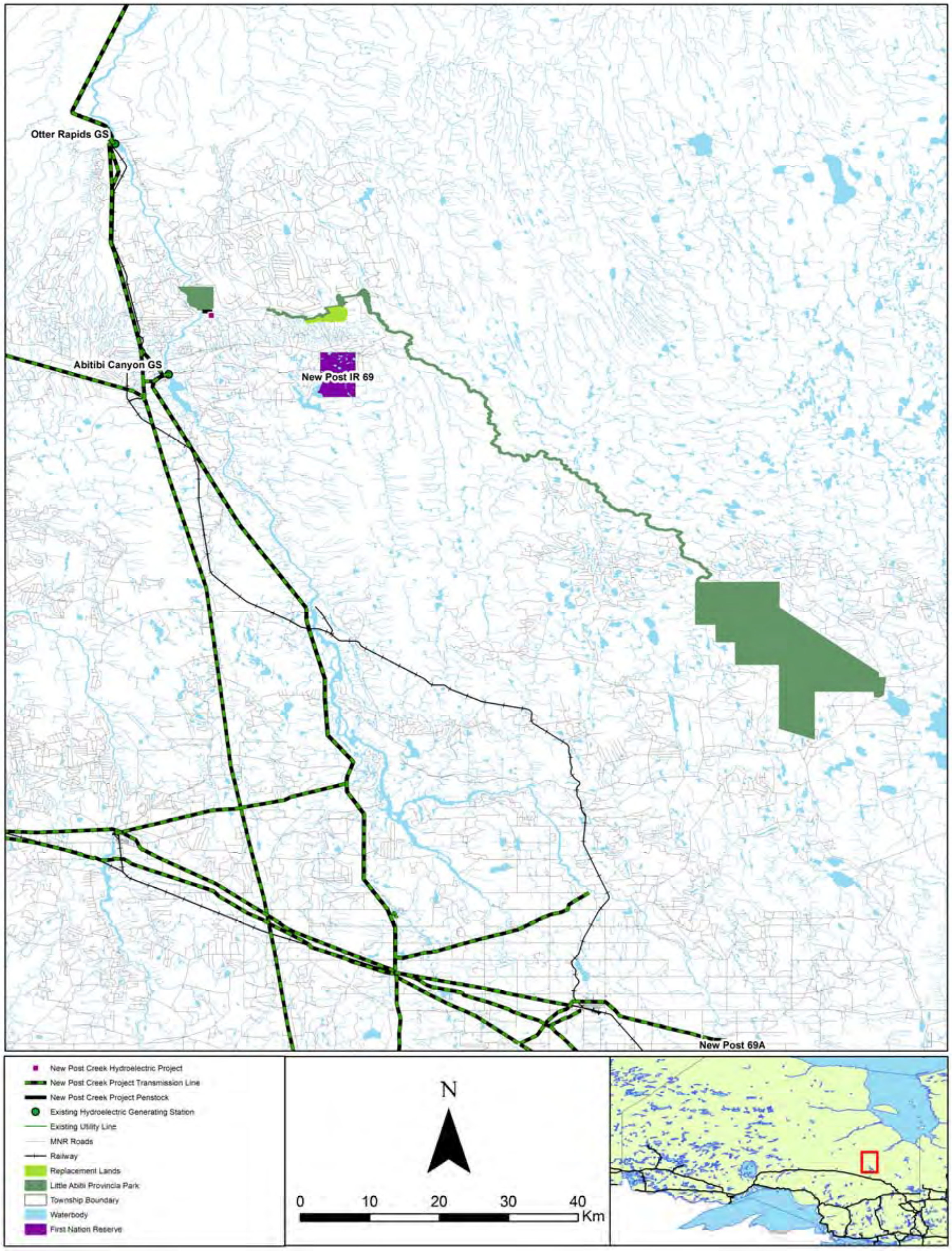
The proposed New Post Creek Project was identified by the Ontario Ministry of Energy (2010) as being under consideration as a clean, renewable, cost-effective hydroelectric generation project in "Ontario's Long-Term Energy Plan".

The proposed New Post Creek Project provides some unique opportunities for economic and social development for TTN and its members. TTN's equity share in the proposed Project will provide a steady flow of revenue to use as a source on which to build future development within TTN Traditional Territory. There will also be opportunities for employment during the Construction Phase of the proposed Project.

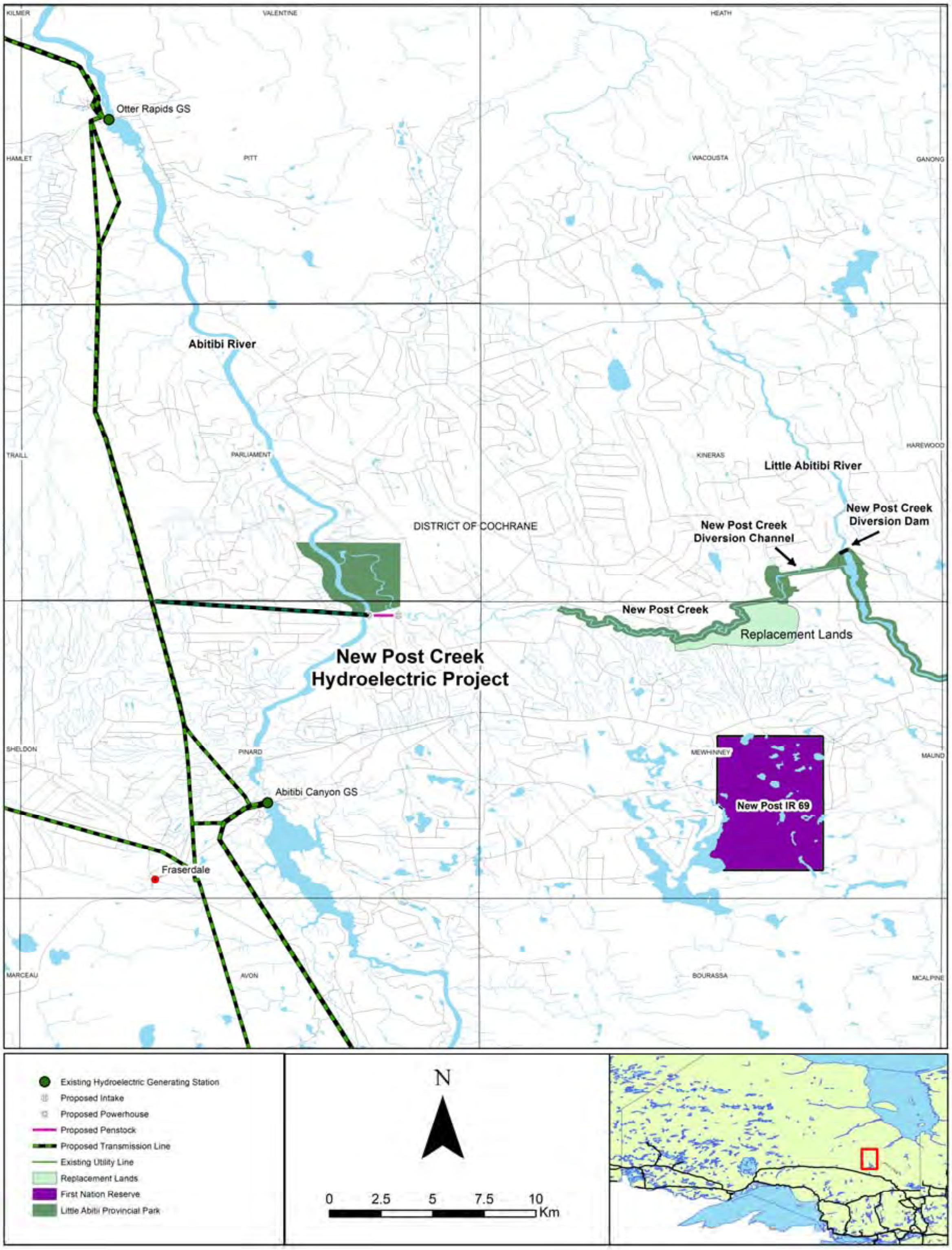
The utilization of water resources and the establishment of a GS in an area already manipulated by human influence represent a preferred option over a project proposed on an unaffected watercourse.

The proposed Project is located in the District of Cochrane within the Geographic Township of Pinard, approximately 75 km north of the Town of Smooth Rock Falls and 13 km northeast of Abitibi Canyon GS (Figure 1.1). The proposed New Post Creek Hydroelectric GS tailrace would be located on Abitibi River shore lands with the intake at New Post Creek approximately 3 km southwest of its outlet to the Abitibi River (Figure 1.2). The actual creek channel length between its outlet and the proposed intake location is approximately 5.7 km.

**Figure 1.1 Proposed Project Location**



## Figure 1.2 Proposed Project Site Location



## 1.1 REGULATORY FRAMEWORK

In Ontario, proposed waterpower facilities are subject to the *Environmental Assessment Act* (*EA Act*). The Ontario Waterpower Association (OWA, 2012a) developed the Class Environmental Assessment for Waterpower Projects (OWA Class EA) process which was approved by the Ontario Minister of the Environment and the Lieutenant Governor in Council in 2008. The *EA Act* formally recognizes the OWA Class EA process which outlines the requirements for Environmental Assessment (EA) approval.

Under the OWA Class EA, the proposed New Post Creek Project is classified as a "New Project on Managed River System". Provided the requirements of the OWA Class EA planning process are met and a Part II Order request for a "bump-up" to an Individual EA is not made (or denied), a project is considered approved under the *EA Act*.

This Aquatic Environment Technical Support Document (TSD) for the proposed Project Environmental Report (ER) was prepared as part of this OWA Class EA process.

Prior to July 2012, projects like the proposed New Post Creek Project that were subject to the Ontario *EA Act* may also have been subject to the federal EA process under the *Canadian Environmental Assessment Act* (*CEAA*) if they required federal funding, were located on federal lands and/or required any federal authorization, permit or approval ("triggers" of the federal EA process) enabling the project to be carried out in whole or in part. A "Project Description for Federal Agency Review – New Post Creek Hydroelectric Project" (SENES, 2011a) was submitted to the Canadian Environmental Assessment Agency in July 2011 for determination of the applicability of the federal EA process. As part of the federal government plan for Responsible Resource Development, which seeks to modernize the regulatory system for project reviews, the *CEAA* (S.C. 1992, c.37) was repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force. The permit as "trigger"-based approach under *CEAA* has been replaced with a project list approach set out in regulation. As the proposed New Post Creek Project has not been listed under *CEAA 2012,* a federal EA is not required. All other applicable federal legislative, regulatory and constitutional requirements must still be fulfilled.

The generation of electricity is not permitted within a Provincial Park as stipulated by the *Provincial Parks and Conservation Reserves Act* (*PPCRA*). Since part of the proposed New Post Creek Project was located within Little Abitibi Provincial Park (LAPP), a deregulation of a small area of the specific Project site from LAPP accompanied by a concurrent regulation of suitable "Replacement Lands" was proposed and accepted in accordance with section 9(5)(c) of the *PPCRA*, and the agreed to Ontario Ministry of Natural Resources (MNR) processes for the deregulation. Section 9(5)(c) of the *PPCRA* enables the Lieutenant Governor in Council to dispose of an area in a provincial park that is 50 ha or more if the disposition is being made as part of a transaction that increases the size of the provincial park and enhances ecological integrity. MNR and TTN participated in the identification of Replacement Lands that compensated for the removal of the small portion of land related to the proposed Project. OPG, CRP and TTN had been working with MNR and Ontario Parks since 2006 to (i) discuss mechanisms for allowing the hydroelectric facility to be built on lands currently within LAPP, and (ii) discuss the required site release process since the existing MNR Site Release Process does not allow for this. OPG, CRP and TTN came to an agreement with MNR and Ontario Parks for a coordinated process to deregulate a small portion out of LAPP and regulate the proposed Replacement Lands into LAPP. This required that the OWA Class EA for the proposed New Post Creek Project be coordinated with the MNR (2005) "Class Environmental Assessment for Provincial Parks and Conservation Reserves". Figure 1.3 shows the location of the Replacement Lands.

Through consultations between MNR, Ontario Parks and the TTN Community, an approximately 440 ha area, immediately south of LAPP in the vicinity of the New Post Creek Diversion Dam, was proposed as the Replacement Lands (Figure 1.3). The transaction was consistent with the provisions of the *PPCRA* that would allow for the deregulation of land to facilitate the proposed New Post Creek Project. The approximately 228 ha of land along New Post Creek within LAPP that was deregulated represents approximately 1.1% of the total LAPP area (20,296 ha). Basically, approximately 228 ha of land (including the creek bed and 120 m on either side of the high water mark) has been removed from LAPP and exchanged for an approximately 440 ha parcel of land referred to as the Replacement Lands. An Ecological Integrity Assessment was undertaken by Beacon (2010) which compared the land removed from LAPP and the Replacement Lands proposed by the TTN Community. Beacon (2010) concluded that the land exchange would increase the size of LAPP and enhance its ecological integrity. However, land deregulation resulted in the disjunction of LAPP as the waterway class portion is no longer a continuous system.

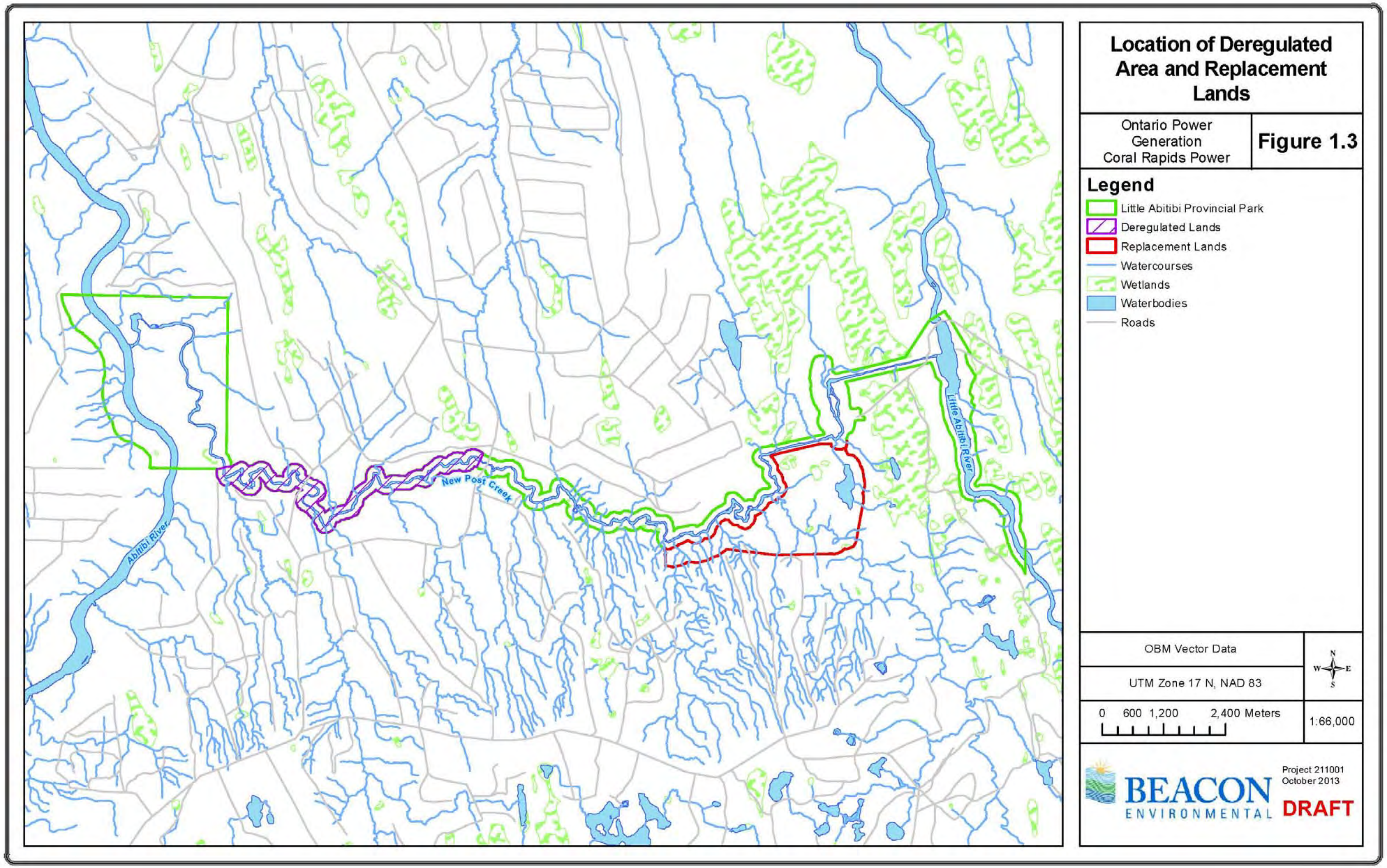
On November 21, 2011, MNR posted a policy proposal on the Environmental Registry for a major land use amendment to re-designate portions of LAPP and the adjacent Northern Resource and Commercial Recreation General Use Area to enable a boundary regulation change. Provincial, regional and local stakeholders were notified by mail of this policy proposal. No comments were received during this involvement opportunity. The land use amendment was approved on April 13th, 2013 and a decision has been posted on the Environmental Registry to reconfigure the park boundary that will increase the overall size and enhance ecological integrity of the park. The MNR boundary amendment process is proceeding internally with an expected date for regulation early in 2014.

## 1.2 PROJECT DESCRIPTION

### 1.2.1 Alternatives Analysis

In 1982, Ontario Hydro carried out an assessment of the hydroelectric potential of the diverted flows on New Post Creek. The study focussed on two sections of the creek below the diversion dam, one of which was similar to that presently proposed.

**Figure 1.3 Location of Deregulated Area and Replacement Lands**



In 1996, Ontario Hydro revisited the site and conducted another review. This study used a head of 68 m, with a plant capacity of 26.4 MW and annual energy production of 175.8 GWh. The location is believed to have been near the New Post Creek waterfalls, located approximately 4.5 km downstream of the proposed Project intake weir location and 1.2 km upstream of the creek outlet to the Abitibi River, but few supporting details are currently available.

In 2006, following the signing of the MoU between OPG and TTN to jointly explore hydroelectric development opportunities within the Abitibi River drainage basin, a concept study was performed for four potential hydroelectric development options (alternatives) on New Post Creek near the waterfalls and within LAPP (KGS Group, 2006). The previous studies maximized the available head by going to local topographic maximums using dykes up to 8 m in height, altering a portion (<1 $km^2$) of the watershed and shoreline. The 2006 concept study reduced the proposed forebay elevation to minimize flooding of the existing creek shoreline and the flooded shore area within LAPP, thereby also reducing potential impacts on those portions of the creek with erodible silt and sand banks. The locations of the four alternatives assessed by KGS Group (2006) are presented in Figure 1.4.

A summary description for each alternative is provided below:

- **Alternative 1**: Most of this option is located south of LAPP with only the intake and a small section of penstock located in the Park. The in-stream spillway and intake are located at a bedrock outcrop extending across the creek approximately 4.4 km upstream from the waterfalls.

- **Alternative 2**: Farther north of Alternative 1, Alternative 2 is entirely within LAPP. Compared to Alternatives 3 and 4, a smaller area of the Park would require deregulation. The spillway and intake for Alternative 2 are conceptually identical to Alternative 1. However, there is no exposed bedrock and the presence of an old river meander and oxbow indicates the bank and channel are erodible at this location.

- **Alternative 3**: This option required a smaller length of penstock; however, its location in the middle of LAPP and its proximity to the culturally significant Hudson's Bay Company (HBC) New Post site made it unattractive. The spillway and intake for Alternative 3 are conceptually identical to Alternative 1 and would be located on exposed bedrock.

- **Alternative 4:** This option is located at the northernmost section of the Park, adjacent to the New Post Creek waterfalls. This option had the smallest footprint, but was eliminated due to adverse impact to waterfalls aesthetics. In addition, this option would have required the deregulation of the largest area of LAPP. The spillway and intake for Alternative 4 are conceptually similar to that of Alternative 1.

**Figure 1.4 Alternative Hydroelectric Development Locations on New Post Creek**

The gross head available for each alternative decreases as one proceeds north along New Post Creek, with the riverbed at Alternative 1 being +59 m above the Abitibi River, while the riverbed at Alternative 4 is in the order of 53 m above the Abitibi River. Based on the technical and environmental data collected and presented in the KGS Group (2006) concept study, preliminary ranking indicated that constructing a project at or just south of the Park (Alternative 1) was the preferred development alternative, with a transmission line built to the west of the proposed powerhouse to connect with the Otter Rapids GS to Abitibi Canyon GS transmission line.

In 2009, a study was performed to update and refine the technical feasibility of the Alternative 1 option based on updated topography and surveys, field exploration and reconnaissance of the proposed site, updated project costs, and updated energy production estimates (KGS Group, 2010). On the basis of the 2009 geotechnical investigation (KGS Group, 2013a, b), as well as the feasibility update and review, the project layout was revised and updated. It confirmed that the hydroelectric development potential of New Post Creek at the preferred alternative location (the current proposed New Post Creek Project) appears technically and economically feasible. In addition to technical benefits, this preferred option (Alternative 1) required the least amount of footprint to be located in LAPP, therefore having the least impact on the Park when compared to the other alternatives.

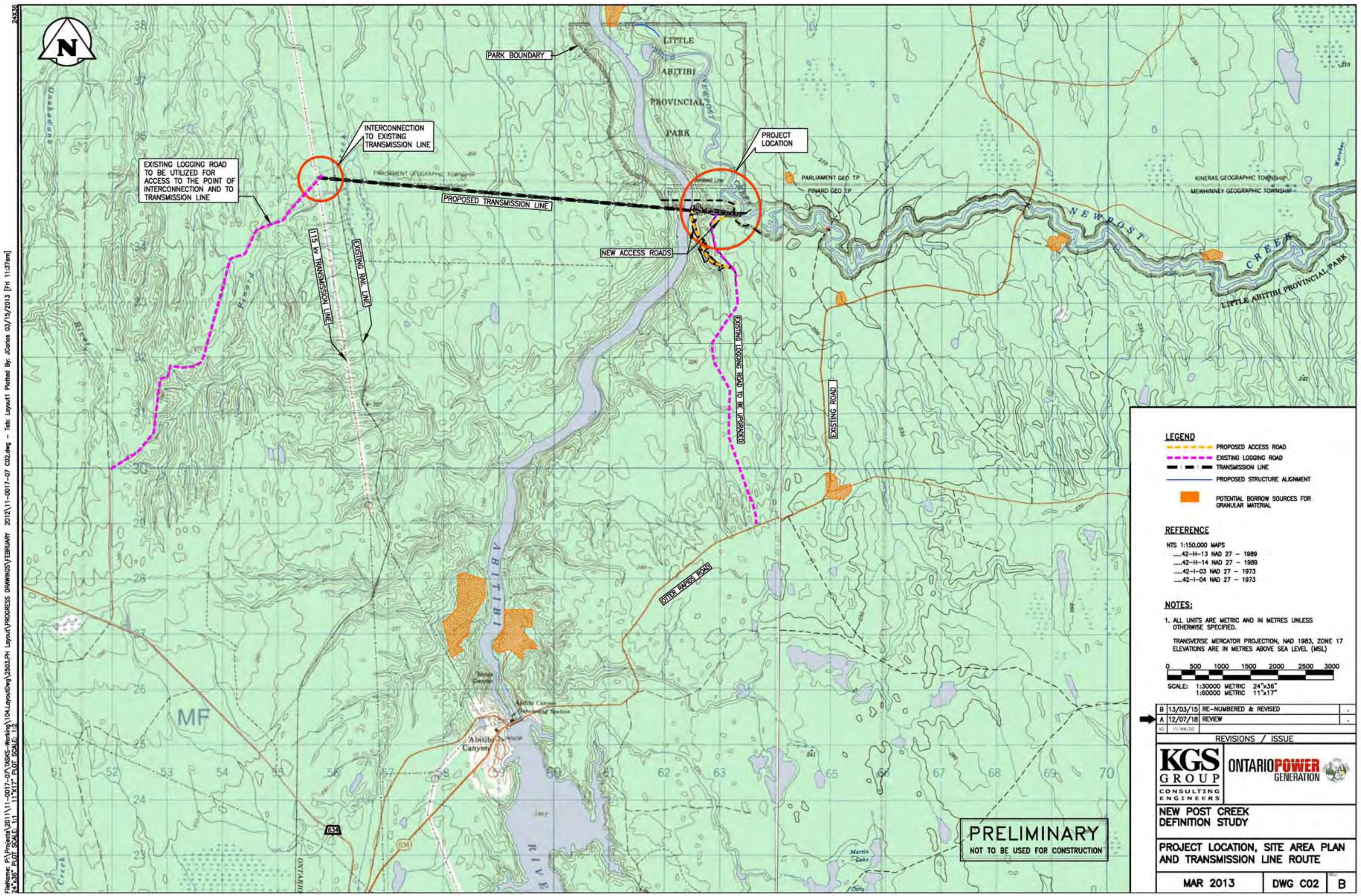
### 1.2.2 Preferred Alternative

As indicated in Section 1.2.1, Alternative 1 is the preferred alternative. The proposed New Post Creek Project is a 25 MW facility utilizing historic flows diverted from the Little Abitibi River into New Post Creek by the New Post Creek Diversion Dam constructed in 1963 to augment hydroelectric generation at Otter Rapids GS, as well as the natural inflow originating within the New Post Creek catchment area. A small portion of the proposed Project was located within LAPP; however, with subsequent land deregulation and incorporation of the Replacement Lands, all of the proposed Project is located outside of LAPP (see Section 1.1), A transmission line approximately 7 km long will be constructed to the west of the proposed powerhouse to connect to the existing Hydro One Networks Inc. (Hydro One) 115 kV transmission line extending from Otter Rapids GS to Abitibi Canyon GS. The proposed transmission line is also located outside of LAPP.

### 1.2.3 Proposed General Layout

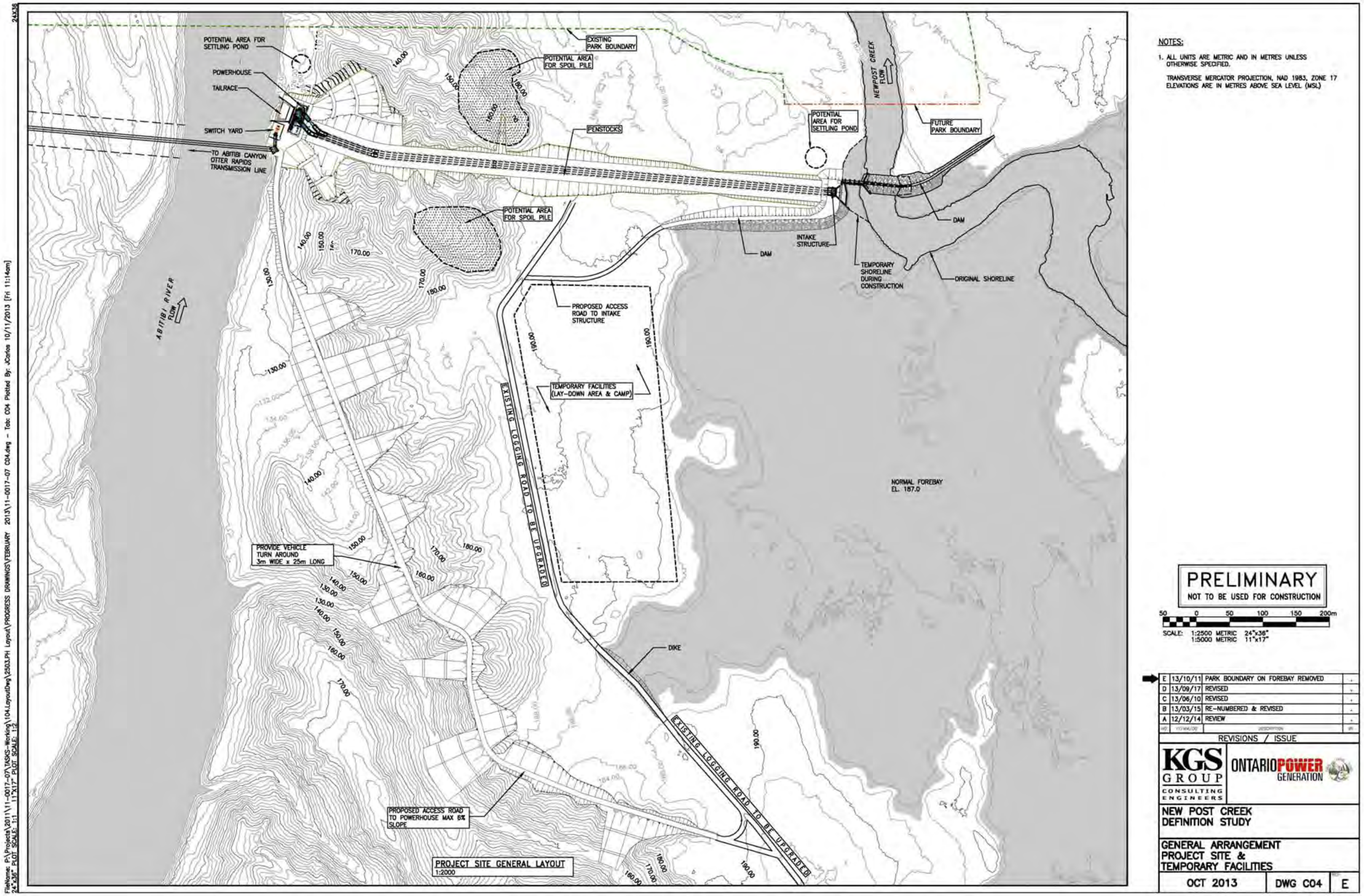
The location of and general arrangement for the proposed Project are shown in Figures 1.5 and 1.6, respectively. However, it should be noted that the final layout of the proposed Project would be selected by the successful Design Build Contractor (DBC), who is chosen based on a competitive bidding process.

**Figure 1.5 Project Location, Site Area Plan and Transmission Line Route[1]**




[1] It should be noted that Figure 1.5 shows the previous LAPP boundary prior to land deregulation and replacement (see Section 1.1).

**Figure 1.6 General Arrangement Project Site and Temporary Facilities**



The layout will consist of the following primary Project components/structures:

- intake headworks, spillway structures and earth embankments;
- water conveyance system that includes two shallow buried penstocks and potentially a portion of open water canal;
- powerhouse structures equipped with two Francis turbine units;
- tailrace between the powerhouse and the Abitibi River;
- cofferdams at the intake and tailrace during construction;
- substation adjacent to the powerhouse;
- transmission line; and
- interconnection switchyard.

The proposed Project general arrangement, i.e., from the intake structure to the powerhouse, and penstock profile are presented in Figure 1.7.

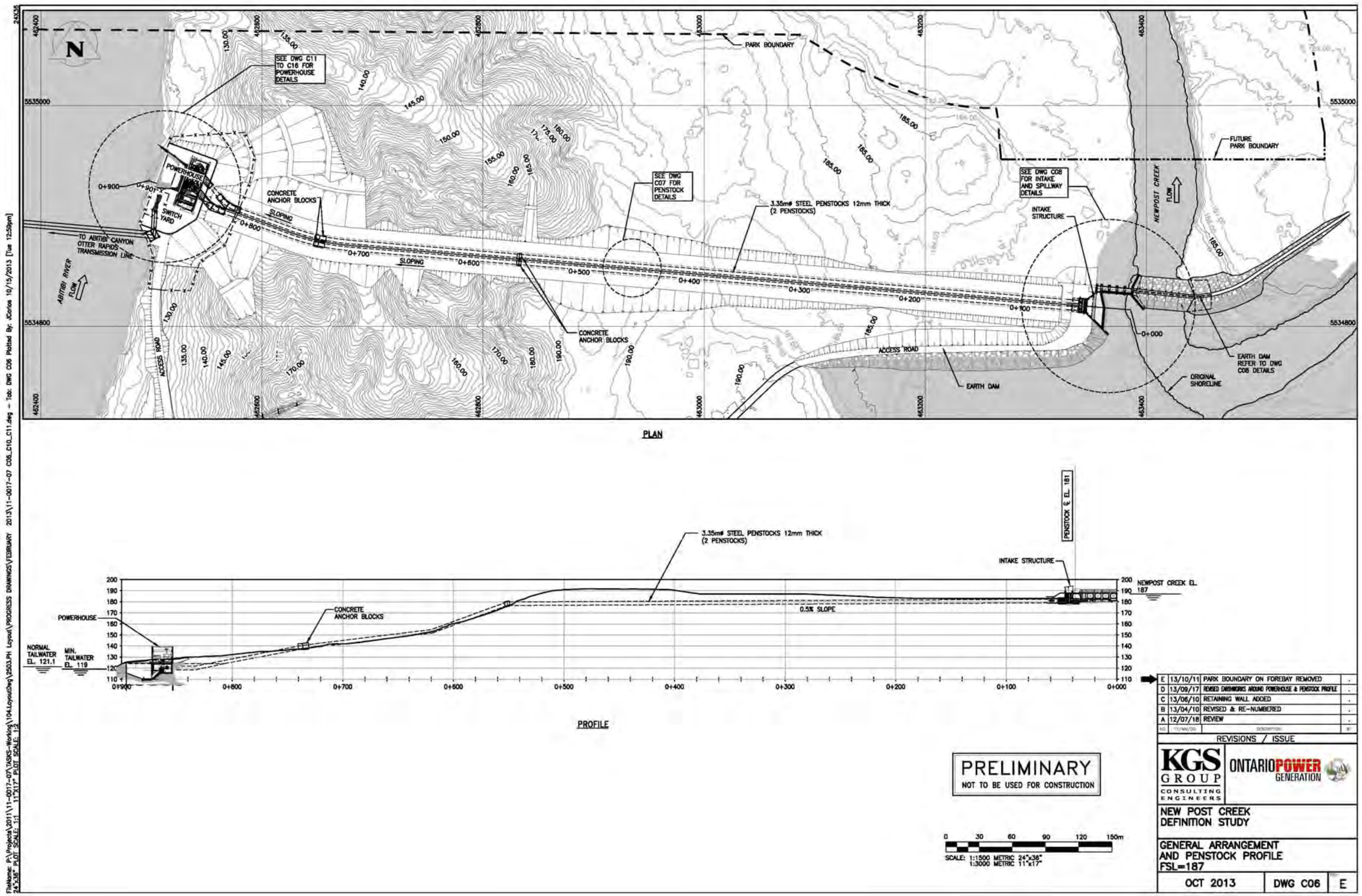
From the intake the flow will be carried by underground penstocks, or with a combination of a power canal and underground penstocks, and discharged through the powerhouse located on the east side of the Abitibi River. The anticipated powerhouse location is approximately 850 m west of the intake and just south of the Park boundary. Over 80% of the penstocks length (and potential power canal), the powerhouse and tailrace will be founded on sands, gravels and till, with bedrock located +15 m below the powerhouse draft tubes and tailrace.

Flow that is not utilized for power production will be discharged over the proposed spillway, taking into account prescribed minimum flow commitments downstream (see Sections 1.3.2.2 and 3.2.1.3), particularly at the base of the waterfalls. The proposed Project would utilize the flows and the head drop of approximately 66 m between the forebay elevation upstream of the spillway and the Abitibi River to generate sustainable power in the order of 125 GWh annually.

As presented in Figure 1.5, there are existing access roads south and east of the site that would be upgraded and extended (approximately 2,500 m) to the powerhouse and intake site. The access road to the intake will also serve as a water retaining dyke under high flood flow conditions.

As shown on Figure 1.6, the site will require some areas to be used for construction purposes. This includes settling ponds in the vicinity of the proposed powerhouse and intake for the dewatering of the excavations, an area to be used for lay down, trailers, equipment maintenance and possibly the batch plant, space to accumulate the extra excavated material, and new and upgraded access roads.

**Figure 1.7 General Arrangement and Penstock Profile**



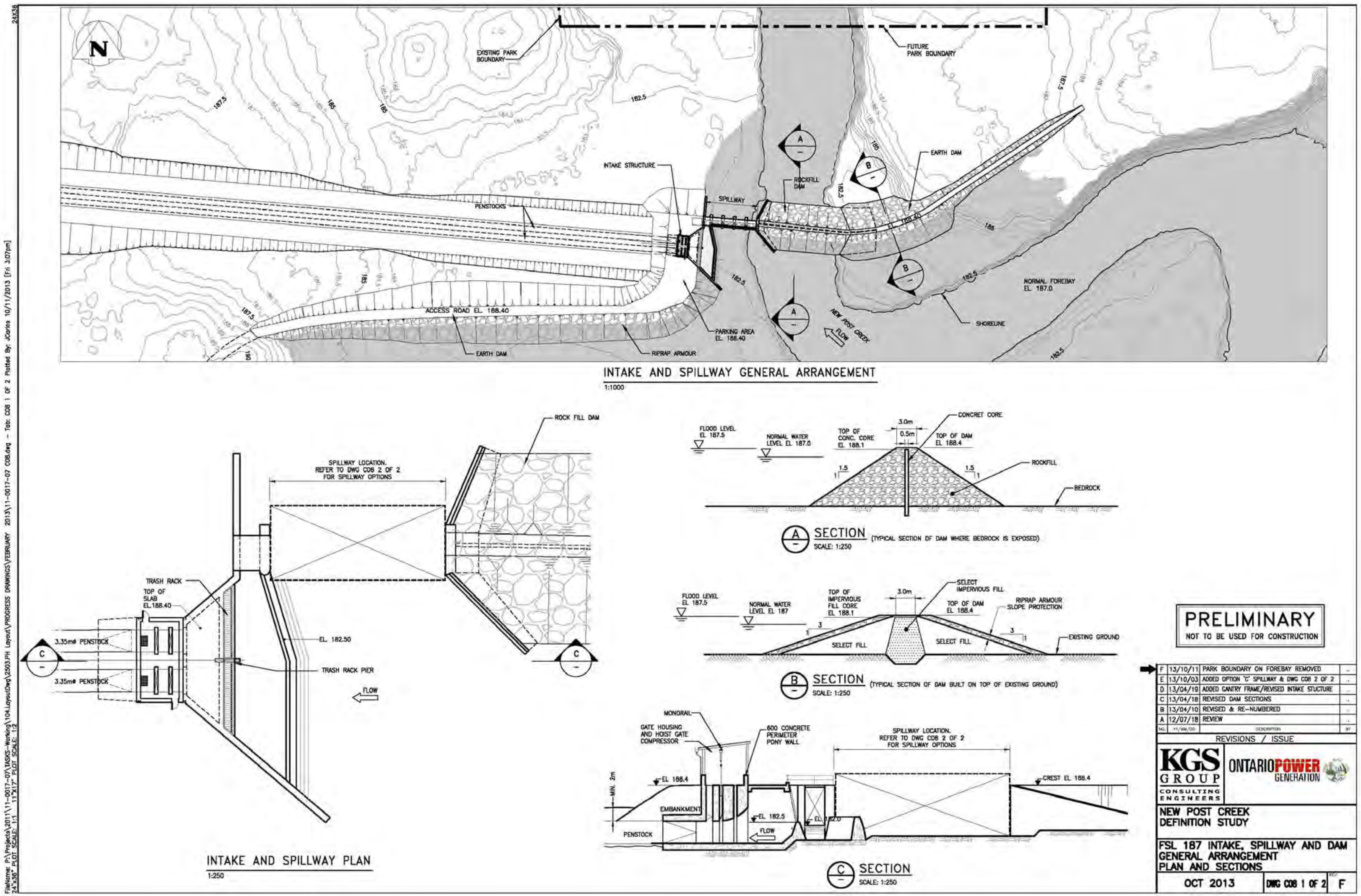
Intake and Spillway Structures

The proposed intake and spillway structures are located approximately 4.5 km upstream of the New Post Creek waterfalls near a bedrock (granitic gneiss) outcrop that extends across New Post Creek (Photograph 1.1). Due to its competence and good quality, the bedrock will provide an excellent foundation for the intake and spillway, with no settlement concerns. Most bedrock on the proposed Project site is not acid generating (see Section 3.1.2.4).

The proposed intake and spillway structures are separate but immediately adjacent to each other. The general arrangement of the spillway and intake structures is presented in Figure 1.8. The intent of the spillway and intake layout selected is to minimize inundation upstream while still ensuring flow withdrawals during all flow periods.

**Photograph 1.1 Bedrock Outcrop**

**Figure 1.8 Intake, Spillway and Dam General Arrangements**



The spillway structure consists of gates to maintain minimum flow requirements, gates or devices to manage high flow periods and maintain forebay levels and possibly an additional gate to provide means to evacuate sediment accumulation. The final choice of the type of equipment used will be determined by the DBC but the current concepts consist of either a series of stop logs (see Figure 1.8) or of an in-stream low (3.7 m high) steel crest gate section and an uncontrolled (fixed) concrete weir. The steel crest gate would be an Obermeyer type, which is operated by a pneumatic bladder. The combination of a gated or rubber dam section with a fixed concrete weir results in minimal incremental inundation upstream.

Control of the forebay water level is somewhat different when different types of spillways are considered. In the case of inflatable weirs (Obermeyer style equipment) the forebay water level is maintained automatically by the station controller by establishing a defined water level setpoint. The operator does have access to override the automatic control if necessary from a remote location. The water level is controlled by instrumentation which monitors the elevation of the weir crest and forebay water levels with the relative difference maintained by the operator by adjusting the inflation of the bladders. This difference controls the flows over the spillway to maintain the forebay level.

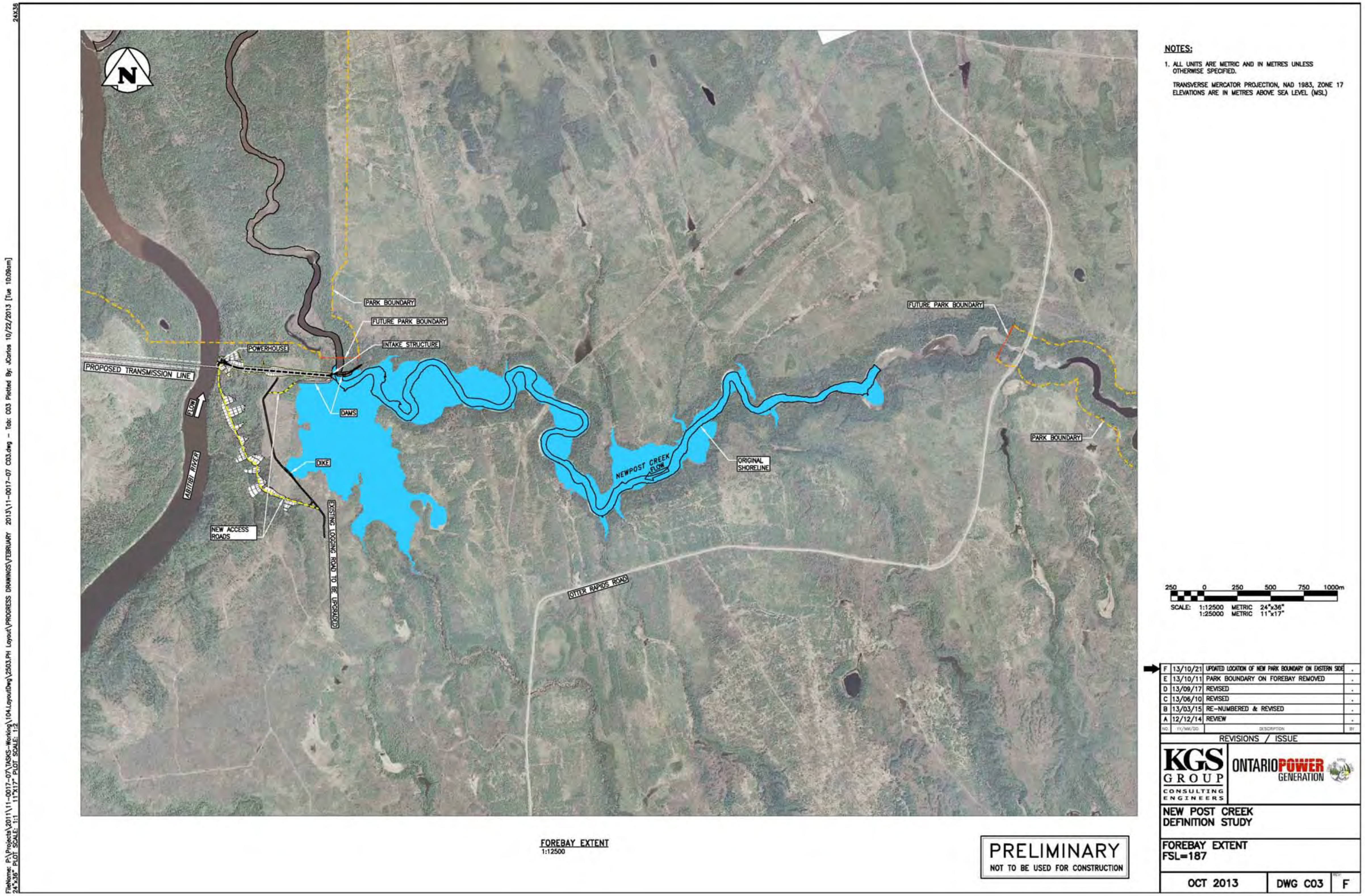
In case of stop logs the forebay level is maintained by the manual addition and removal of stop logs as required. In this approach the water levels are monitored remotely by the operator and instructions are issued when flows change sufficiently to warrant an adjustment in order to remain within the operating range of the forebay.

Normal operation of the proposed Project will increase the water level in New Post Creek at the intake to a Full Supply Level (FSL) of 187.00 metres above sea level (m.a.s.l.), resulting in a total inundated area of approximately 170 ha (KGS Group, 2012). The upstream extent of the inundated area (approximately 7,166 m from the proposed intake weir location) is limited by the rather steep gradient at the rapids (see Figure 1.9). Under normal operating conditions, most of the inundated area will occur within the deregulated park area of approximately 228 ha upstream of the proposed Project spillway (Figure 1.3). Most of the flooding outside of the deregulated park area will encompass the unnamed tributary that discharges to New Post Creek approximately 150 m upstream of the proposed Project intake location (Figure 1.9).

Considering the planned dimensions of the spillway the 1:100 year flood levels would be expected to rise by 0.5 m to 187.50 m.a.s.l. The corresponding discharge to the 1:100 year event is 296 $m^3$/s.

A low head earth dam will be constructed on the eastern shore adjacent to the fixed concrete weir to contain flow within the creek channel. The access road and parking areas at the intake and at a location approximately 800 m south of the penstock will also serve as water-retaining dykes under high flow flood conditions. The western edge of the excavation downstream of the spillway will be in rock and not susceptible to erosion.

**Figure 1.9 Forebay Extent for FSL = 187 m.a.s.l.**



Grouting of the bedrock may be required in areas where the tie-ins for the proposed low head earth dams and spillway structures are on bedrock to minimize the potential of groundwater seepage through the abutments.

The proposed spillway structure will include a gravel trap and a sluice consisting of either a set of stop logs or an Obermeyer style crest gate. In addition, another gate may be required as a sediment sluice and outlet for continued minimum flow requirements downstream to the waterfalls (see Section 1.3.2.2).

The intake structure to the two shallow buried penstocks will be protected by trash racks and set to submerge the intake to the penstocks to minimize potential vortex problems. A sediment trap and a low level sluice gate may be included in the design to reduce the potential for suspended sediment and bedload entrainment in the diverted flow to the powerhouse. The sluice gate will allow for flushing of any sediment deposits at the intake during high flows downstream into the existing creek channel with appropriate permits and approvals.

The operation of the sediment gate will consist of opening the gate, likely manually. The actual need to clear the sediment trap would be with a frequency in the order of years if not decades. However, CRP/OPG has considered this issue and is suggesting that a yearly flushing occur during near the start of the freshet. A yearly flushing would reduce the effect of a larger less frequent (e.g., every 10 years) flushing event and may also help in providing sediment bank stabilization for the by-pass reach that otherwise may be starved of sediment.

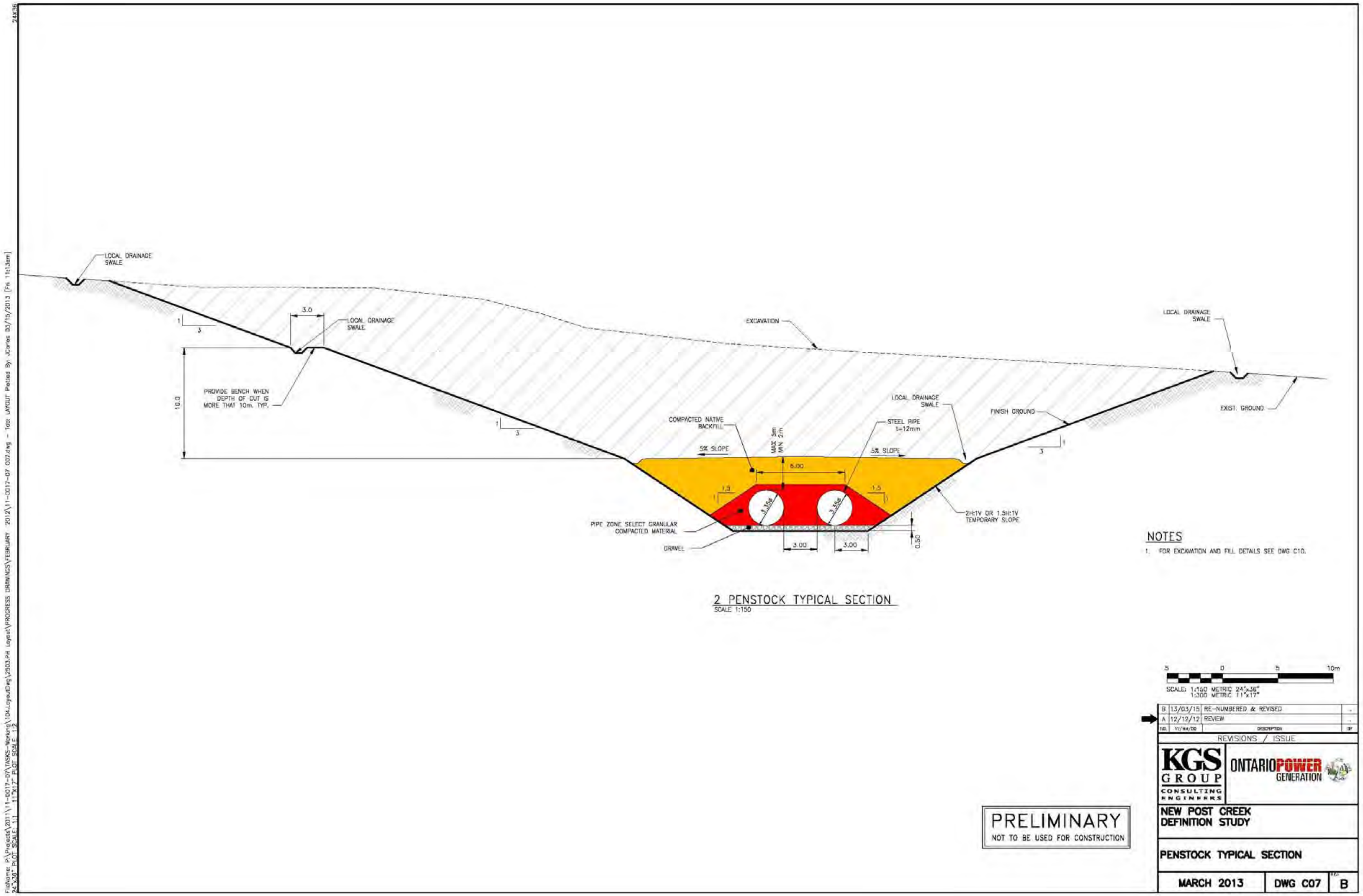
Water Conveyance System

The proposed water conveyance system includes two buried penstocks with the potential of a portion of open water canal. The two side by side buried steel penstocks, each 3.35 m in diameter, would extend approximately 820 m from the intake structure to the powerhouse. The twin penstock will extend from the intake area sloping very gently for about 650 m with minimal submergence below the forebay level and then drop approximately 61 m over 290 m down to the powerhouse at the Abitibi River shore. A head drop of just over 66 m occurs from the intake on New Post Creek to the Abitibi River. Figure 1.10 shows the penstock profile.

Due to shallow overburden, the penstock would be founded on competent bedrock along its first 150 m length from the intake structure with the remaining portion constructed within overburden. As the overburden sands and silts are erosion prone, the penstock system will be provided with granular drainage layers and drains that can be monitored for leak detection.

The proposed penstocks may be equipped with manhole access along the route near the end of the shallow sloping section and above the steeper portion. Impressed current or sacrificial anode cathodic protection will be provided along the penstock.

**Figure 1.10 Penstock Profile**

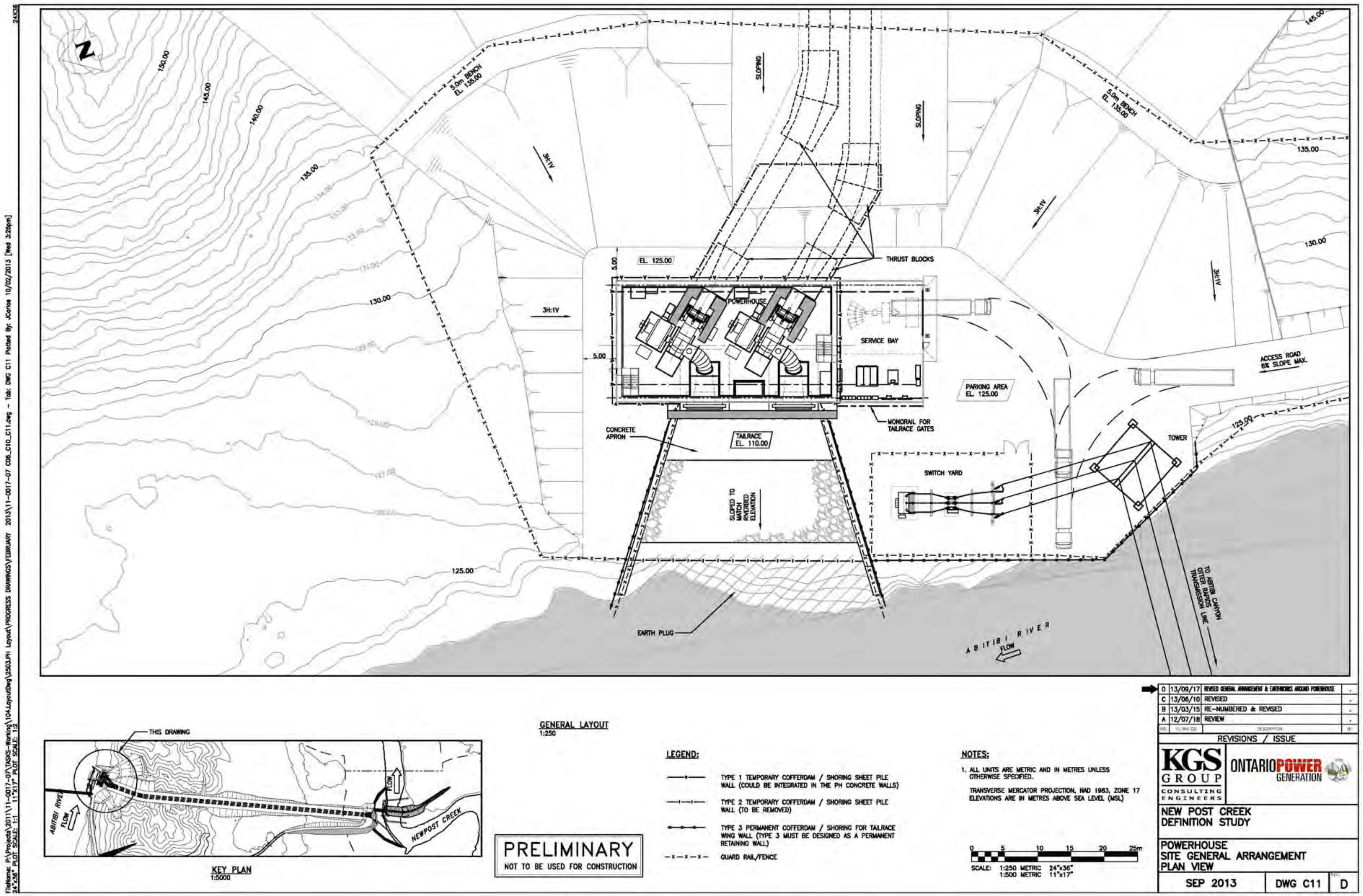


Powerhouse Structures

The proposed powerhouse will have a concrete substructure for the turbine draft tubes, with potentially the two identical horizontal Francis turbine/generator sets (approximately 12.5 MW each) and all required ancillary equipment mounted on the powerhouse floor. Each turbine is expected to have Francis type runners with 13 blades operating at nominal speeds between 277 to 360 rpm depending on the final runner dimensions. The turbine units may be mounted near or below the normal tailwater level. The turbine shutoff valves will have gravity trip counterweights located within the powerhouse. The layout and details of the powerhouse facility are presented in Figure 1.11.

The powerhouse foundation structure will be constructed on a dense sand deposit with sufficient load bearing capacity. The powerhouse and tailrace area will be excavated and founded on dense sands and gravels (Photograph 1.2), with bedrock located more than 15 m below the powerhouse draft tubes and tailrace. The surficial overburden material above the water table is relatively firm and can be excavated and temporarily sloped back at a 2H:1V slope angle, or 3H:1V for slope height higher than 10 m (KGS Group, 2013a). The firm sand deposit will be saturated below the water table reflecting the proximity to the Abitibi River. Therefore, it will be necessary to dewater the area prior to excavating below the water table. Temporary construction shoring will be required due to the depth of the required excavation and groundwater condition, and to minimize the footprint that would be disturbed. The sand deposit can be excavated using standard soil excavation equipment such as bucket excavators, bulldozers and similar equipment, in combination with an appropriate and effective dewatering procedure. A properly designed sheet pile wall, diaphragm wall and/or contiguous bored pile wall can be used to support and dewater the excavation. Groundwater depressurization/dewatering will be required for powerhouse foundation excavation below the river water level. In addition, long-term seepage control, if necessary, can be provided by the use of cut-off walls, low maintenance gravity drains and relief wells.

**Figure 1.11 Powerhouse General Arrangement**



**Photograph 1.2 View Along the Abitibi River Shoreline in the Vicinity of the Proposed Tailrace**

Cofferdams

A series of cofferdams will be required during construction at both the intake/spillway structure and at the powerhouse tailrace.

The cofferdams will generally be low structures (1.5 to 2 m) and will be constructed utilizing several methods. The tailrace and powerhouse excavation is expected to be done behind a cofferdam consisting of an earth plug or a section of unexcavated shoreline with sheet piling to improve the water barrier given the existing soil conditions.

At the intake the cofferdams will also be low structures consisting of either rock plugs of unexcavated shoreline on the west side of the creek or rock fill berms that may include some membranes or grouting to improve imperviousness.

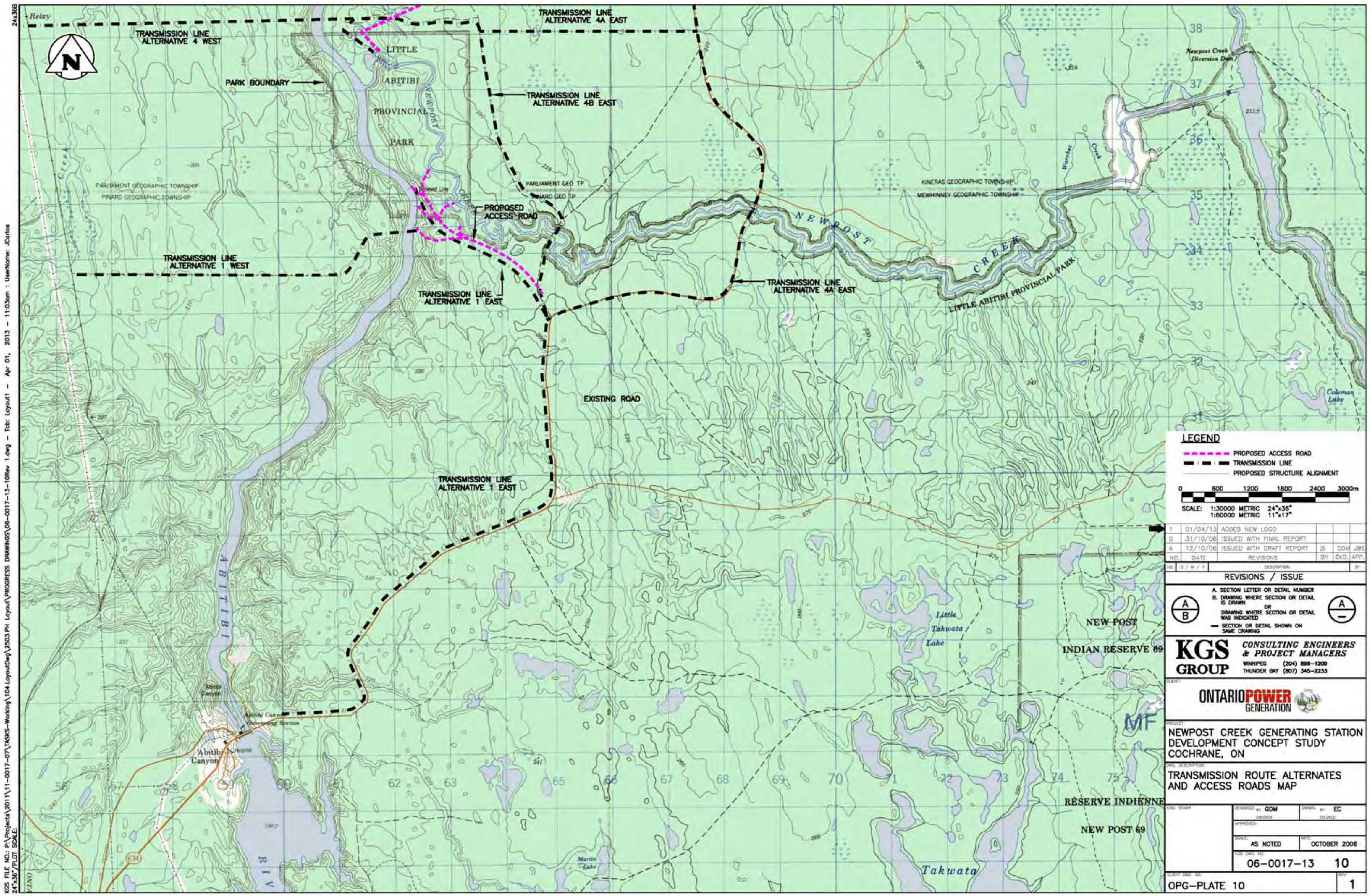
Transmission Line

A number of alternative transmission routes were assessed before selecting the preferred route (see Figure 1.12). The alternate routes shown correspond to the alternative powerhouse locations assessed in 2006 (see Section 1.2.1 and Figure 1.4). Both alternative “east” and “west” routes were considered. The “east” routes would follow access roads back to Abitibi Canyon GS, whereas the “west” routes would cross the Abitibi River and mainly recently harvested forest areas to the existing Hydro One 115 kV transmission line between Abitibi Canyon GS and Otter Rapids GS.

Once Alternative 1 had been selected for the powerhouse location (see Section 1.2.1), a “west” route was selected on the basis that it was the shortest route with fewer bends. The route of this alternative, designated as “Transmission Line Alternative 1 West” in Figure 1.12, was later modified to locate the point of interconnection with the existing Hydro One transmission line at an existing road (see Figure 1.13). The proposed transmission line right-of-way (ROW) is located outside of LAPP.

The proposed single-circuit 115 kV transmission line extending from the powerhouse switchyard directly west over a distance of approximately 7 km to the existing 115 kV Otter Rapids GS/Abitibi Canyon GS transmission line is the technically preferred connection option (see Figure 1.13). Based on available information, the preferred interconnection would involve a T-tap direct with protection provided by a circuit breaker at the new switchyard outside the powerhouse. Based on a System Impact Assessment (SIA) by the IESO (2010), the proposed connection to the existing 115 kV transmission line is acceptable conditional on a number of requirements that have been incorporated by KGS Group (2013c). Based on the Customer Impact Assessment, Hydro One (2010) concluded that the proposed New Post Creek Project can be incorporated with minor impact to Hydro One customers conditional on adherence to the requirements identified in the IESO (2010) SIA.

**Figure 1.12 Alternative Transmission Line Routes[1]**




[1] It should be noted that Figure 1.12 shows the previous LAPP boundary prior to land deregulation and replacement (see Section 1.1).

**Figure 1.13 Proposed Transmission Line Route**

The proposed transmission line begins at the substation located adjacent to the powerhouse on the east bank of the Abitibi River (see Figure 1.14). The proposed transmission line will cross the Abitibi River and extend in a direct route to a point near the intersection of the existing Hydro One transmission line and access road. The western shoreline of the Abitibi River has a fairly rapid rise in elevation with few changes in elevation to the interconnection point. The proposed transmission line will cross over land that has been subject to previous forest harvesting, some wet areas and the Ontario Northland Railway (ONR) rail line.

The proposed transmission line will be constructed within a minimum 30.5 m (100 feet) wide ROW (KGS Group, 2013d). Any non-compatible trees outside of the 30.5 m ROW will also be removed to prevent their fall over the transmission line conductors. The remaining vegetation (compatible trees, shrubs, understory) will remain intact. The transmission line will consist of untreated wood (likely cedar) poles, aluminum conductor steel reinforced cables, polymer insulators, and optical ground wire, as well as guy-wire and anchors, as necessary. The aerial cable crossing of the Abitibi River is approximately 150 m wide.

Access for transmission line construction is provided by an existing road network between the interconnection point and the west bank of the Abitibi River (see Figure 1.13) considered to be adequate for construction equipment use.

A small switchyard is to be constructed at the point of interconnection which will require the construction of a small access area from the existing road (see Figure 1.14). No permanent roads will be constructed to or along the remainder of the proposed transmission line route. It is expected that the DBC selected for this work will execute the construction of the transmission line in the same manner as other such work in this region with the work likely being done in the winter to minimize the impact on the natural environment, particularly wet areas.

A fibre optic cable will be installed by trenching directly west from the point of interconnection switchyard (see Figure 1.14) to the Ontera-owned fibre optic communications trunk, located within the existing Hydro One transmission line ROW.

The selected DBC will be responsible to secure the necessary licences and permits including those for timber removal along the ROW, watercourse crossing installations and overhead crossing of the ONR rail line. Amendments to the *Navigable Waters Protection Act* under Bill C-38 has resulted in the exemption of construction of any works in, on, over, through or across water bodies from the provisions of the new *Navigation Protection Act* with the exception of those listed in Schedule 2 of the new Act. The Abitibi River is not listed in Schedule 2.

Proposed New Post Creek Project Technical Summary

The technical details of the proposed New Post Creek Project are summarized in Tables 1.1 and 1.2.

**Figure 1.14 Transmission Line Plan and Profile/Interconnection General Arrangement**

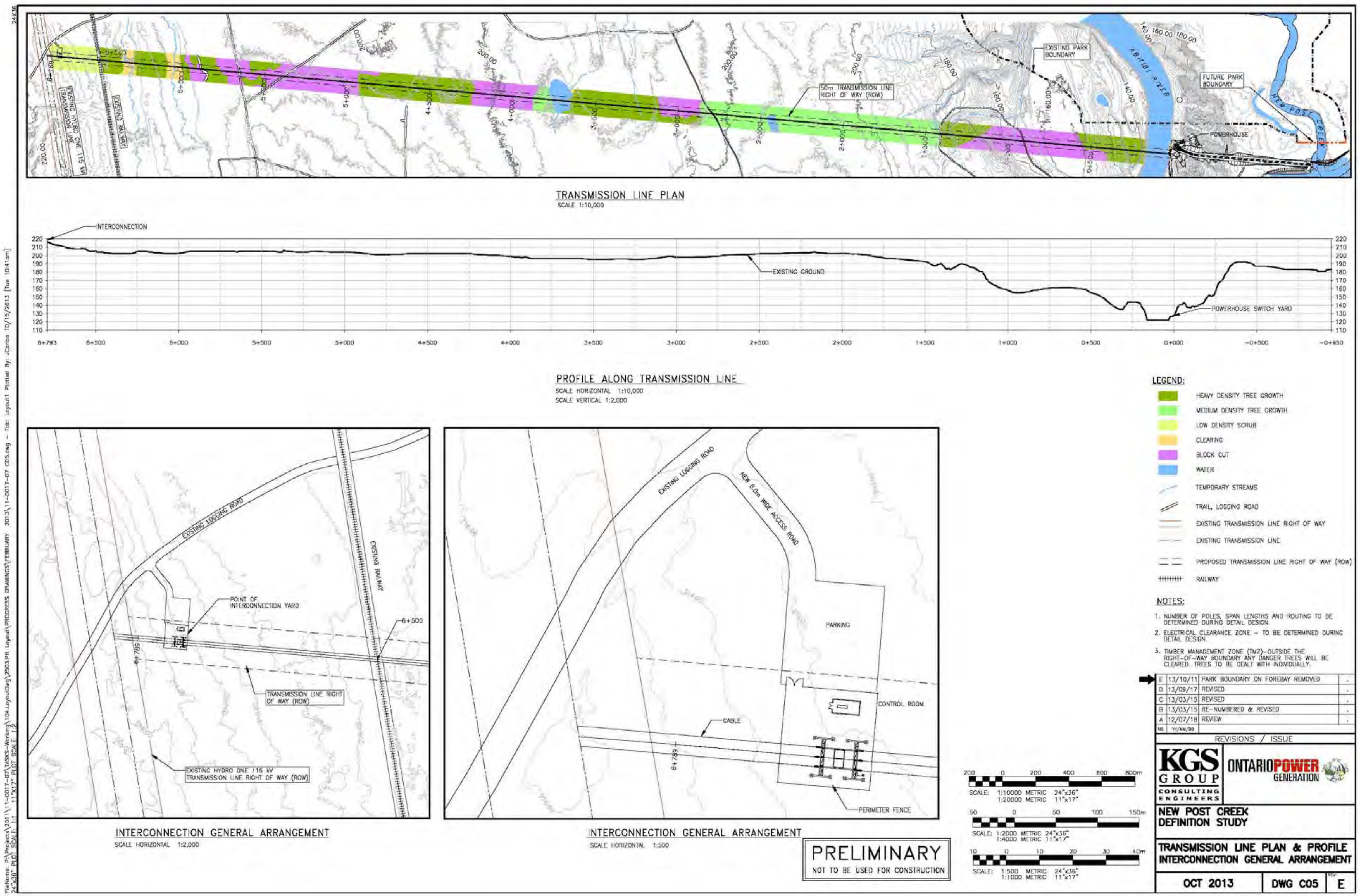


**Table 1.1 Proposed New Post Creek Project Hydraulic Characteristics**

| | | |
|---|---|---|
| Gross Head | | 66 m |
| Average Annual Flow | | ~42 $m^3$/s (based on 1975-2012 data) |
| Rated Plant Flow | | 50 $m^3$/s |
| Minimum Flow:[1] | *May 1 to mid-June* | 15 $m^3$/s |
| | *Mid-June to August 31* | 7.5 $m^3$/s |
| | *September 1 to 30* | 5 $m^3$/s |
| | *October 1 to April 30* | 2 $m^3$/s |
| Installed Capacity | | 25 MW |
| Average Annual Energy Output | | 125 GWh |
| Inundation | | 170 ha |

[1] See Section 1.3.2.2 for more details.

**Table 1.2 Proposed New Post Creek Project Components[1]**

| | |
|---|---|
| Earth Dam | |
| Type | Earthfill |
| Crest height | Approximately 7.1 m (varies) |
| Crest length | Approximately 500 m |
| Base width | Approximately 76 m |
| Crest width | 3.0 m |
| Core height | Approximately 6.8 m (varies) |
| Headpond | |
| New inundation area | 170 ha (extending 7,166 m upstream of dam) |
| Spillway Structure | |
| Type | Steel crest gate section with an uncontrolled (fixed) concrete weir or stop logs |
| Crest height | 3.7 m |
| Length | 32 m |
| Intake | |
| Number of intakes | Dual |
| Type | Concrete |
| Gates/intakes | 2 |
| Penstock | |
| Number of penstocks | 2 |
| Type | Steel |
| Diameter | 3.35 m |
| Length of each penstock | Approximately 820 m |
| Powerhouse | |
| Type | Surface |
| Turbine-generator units | 2 x 12.5 MW |
| Tailrace | |
| Type | Cut in overburden |
| Length | 30 m |

[1] Note: All dimensions provided are approximate and will be finalized during the detailed design of the proposed Project.

The spillway structure will facilitate year-round minimum flow requirements downstream of the spillway to the waterfalls (see Sections 1.3.2.2 and 3.2.1.3).

Safety devices, such as booms and buoys, will be placed in the water upstream and downstream of the spillway, and downstream of the tailrace. A risk assessment exercise will be undertaken to identify requirements and locations for signs, booms and buoys prior to operations. Figure 1.15 provides preliminary fencing, signage and safety boom locations, but is subject to change based on the risk assessment results.

## 1.3 Project Activities

### 1.3.1 Construction

It is assumed that a temporary construction camp will be needed to accommodate the workers for the approximate 2 to 3 year construction period. It is anticipated that this construction camp could house up to 100 workers depending on the particular phase of the proposed Project. Workers at the construction camp will not be permitted to fish, hunt or use ATVs while they are working at the camp. A concrete batch plant is also likely to be required in the vicinity of the proposed Project.

Work areas will be cleared of trees and the camp, construction, laydown and concrete batch plant areas would be grubbed and levelled. After construction, the temporary work areas would be re-planted with native tree species and allowed to re-vegetate naturally.

As indicated in Section 1.2.3, the proposed intake and spillway structures will be constructed adjacent to each other on competent bedrock. At the intake and spillway location, New Post Creek is currently 1 to 4 m deep and approximately 50 m wide.

An initial perspective on what might be the intake and spillway construction method that would be employed by the DBC is presented below. However, it should be noted that the final sequencing of excavations, cofferdams, construction and dewatering methods used would be defined by the successful DBC on the basis of environmental requirements and constraints outlined in the tender documents.

The intake and spillway are integrated, and consequently construction of the two works requires close coordination. The initial intake and west portion of the spillway could be excavated in “dry” conditions behind a rock plug serving as a cofferdam (Figure 1.16a). This rock plug may be topped with a low level berm to achieve the desired freeboard. The access road will form a permanent berm along the west creek edge when completed.

**Figure 1.15 Preliminary Fencing, Signage and Safety Boom Locations**

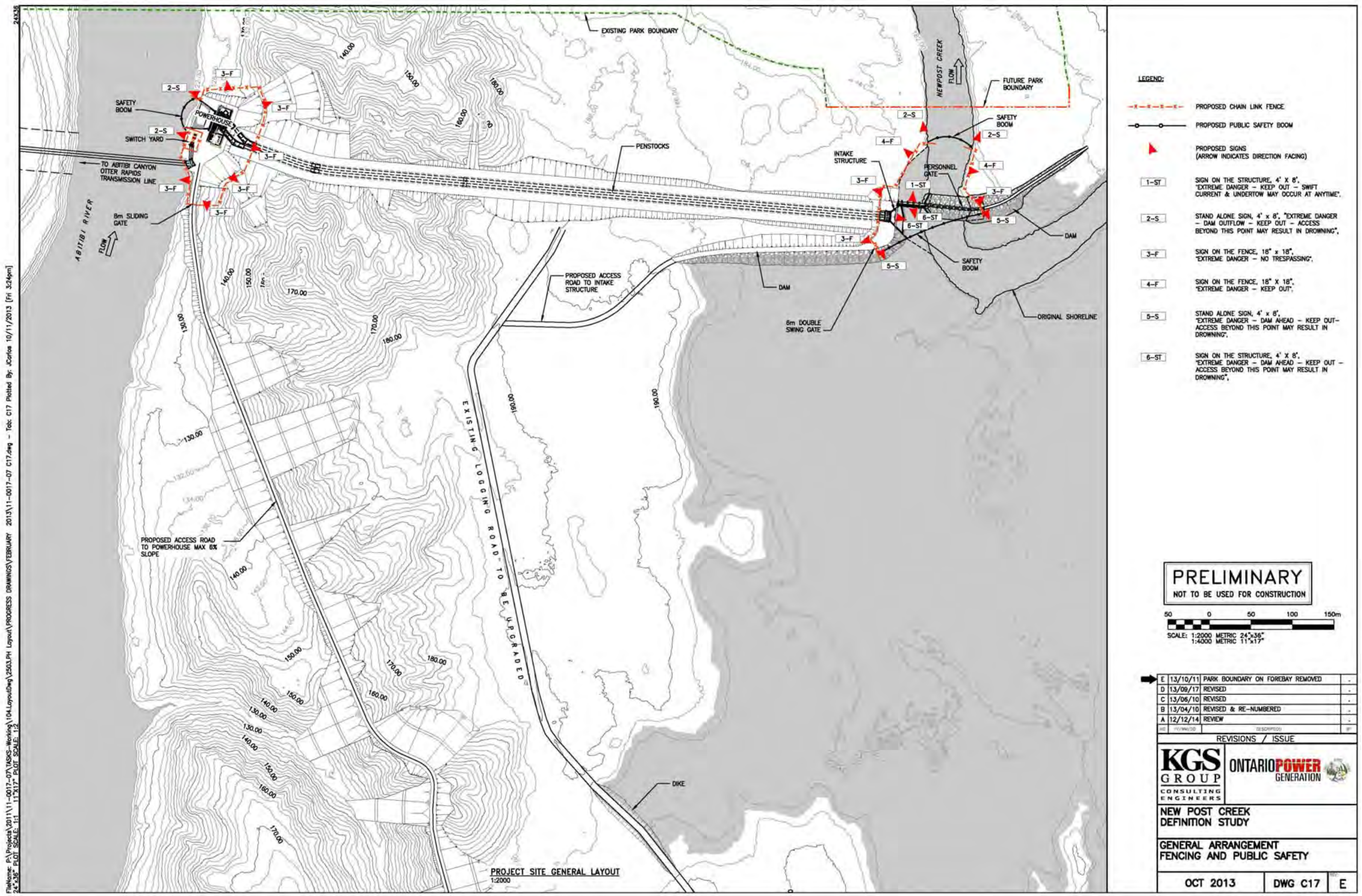
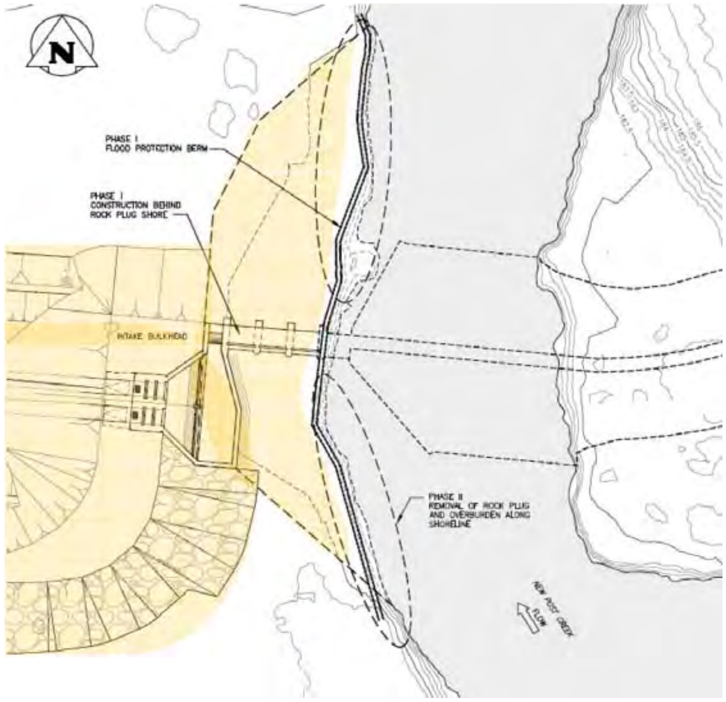
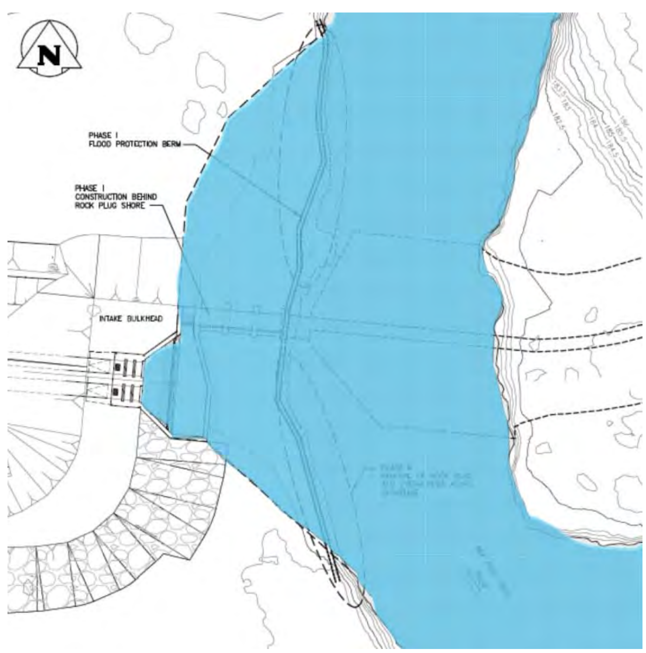


**Figure 1.16a Phase I - Excavations**



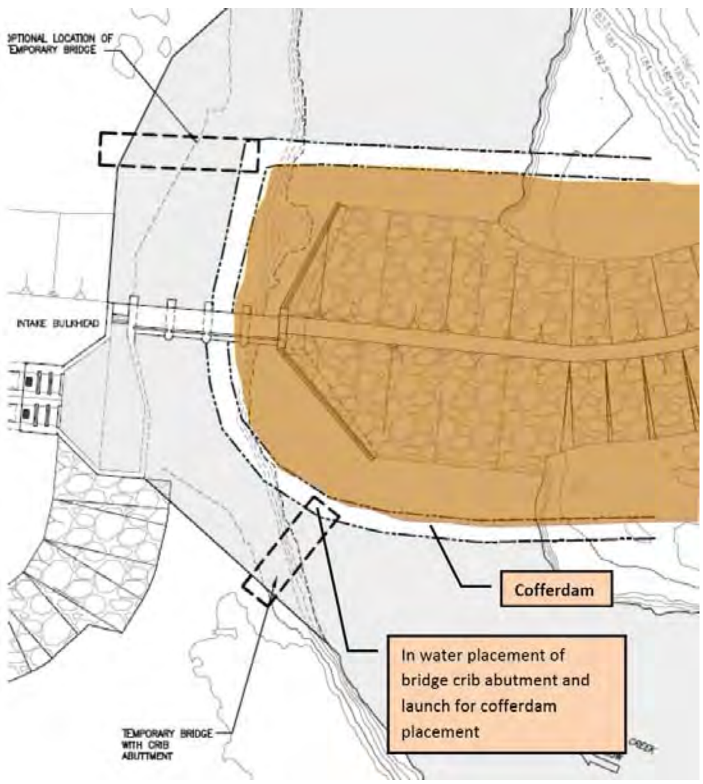

Upon completion of the intake and the concrete spillway work, the cofferdam and remaining rock plug would be removed and the new spillway bay on the west side will be used to pass creek flows downstream (Figure 1.16b).

**Figure 1.16b Phase II – Removal of Rock Plug**



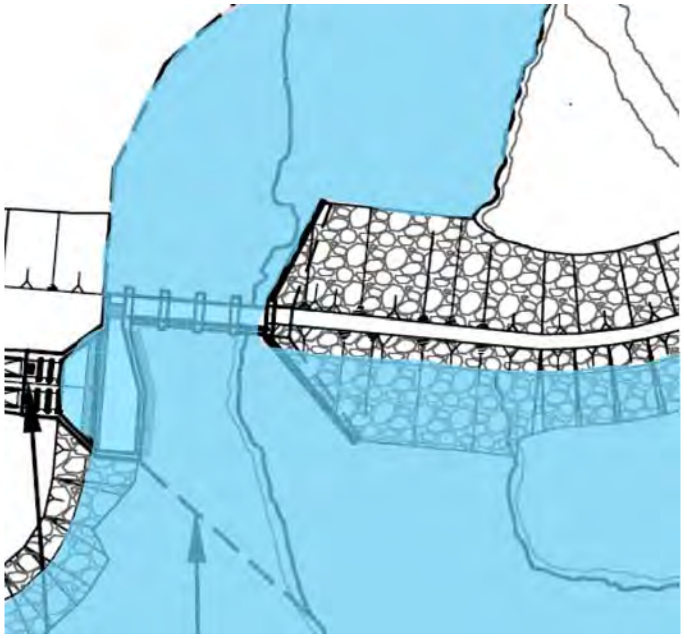
A small cofferdam for the construction of the earth dam could be constructed from the eastern shoreline (Figure 1.16c). It is anticipated that an access trail from Parliament Loop Road to the east abutment could be enhanced to facilitate construction (see Section 1.3.1.2). Alternatively, a temporary bridge could be used to cross the open portion of diverted flow, in combination with limited in-stream work for timber crib abutments. In either case the cofferdam would be quite small, with a dewatered river channel area in the order of 150 m by 50 m using a cofferdam in the order of 1.5 to 2 m high. The cofferdam selected by the DBC is anticipated to be either an in-stream water tight barrier (e.g., aquadam), or constructed of granular fill with a water retaining core (membrane or silty sand). In this phase of construction the spillway concrete components would be completed and the earth dam would be put in place.

**Figure 1.16c Phase III – Construction of Earth Dam**




In the final phase the cofferdam would be removed and the forebay eventually flooded as shown in Figure 1.16d. The material from the cofferdam may be used as part of the earth dam, or placed in designated spoil piles.

**Figure 1.16d Phase IV – Removal of Cofferdam**



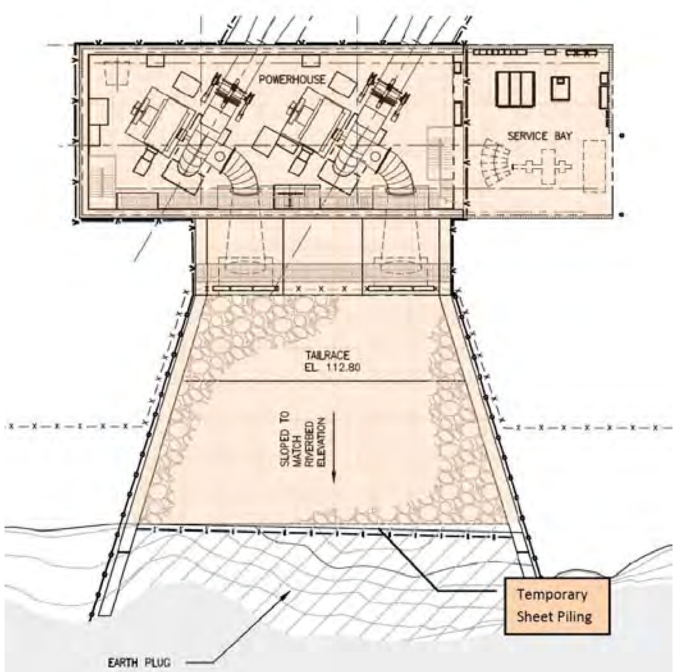
Existing slopes along the Abitibi River and inland at the proposed Project site are relatively steep. Some slope angles were near 1V:1H locally, with overall slopes of 1V:3H, reflecting fairly high strength materials in the *in-situ* sands, silts and tills and limited groundwater pressure influence. There was no evidence of deep-seated slumping or slides occurring at the proposed Project site. For preliminary design purposes, a slope angle of 1V:2H could be used for temporary construction excavations above the groundwater table. As the native soils are highly erodible, extensive stabilization works may be required to prevent vegetation removal, drainage pattern alteration and slope destabilization by heavy loads. Freshly exposed surfaces due to construction activities will require erosion control measures such as granular material placement over exposed surfaces, surface water diversion from slopes and French drain installation for water control in water-bearing granular areas.

The proposed penstocks will extend approximately 820 m from the intake to the powerhouse and will be buried with a minimum 2 m cover to provide thermal insulation during winter operation. Blasting of surface and near-surface bedrock along the initial 150 m distance from the intake will be required to facilitate penstock burial.

Groundwater depressurization/dewatering will be required for powerhouse foundation excavation. This may be achieved by installation of a pump well system or a low permeability seepage barrier such as sheet pile walls or slurry trench to reduce seepage gradients at the downstream face of the natural cofferdam (dyke) around the powerhouse foundation excavation.

Construction of the proposed powerhouse and a portion of the tailrace will be set back from the Abitibi River shoreline (see Figure 1.11). Due to the presence of sand, it is anticipated that a pumped dewatering system possibly combined with a trench cut-off and/or sheet pile cut-off will be required during excavation and construction (Figure 1.17).

**Figure 1.17 Powerhouse Excavation behind Earth Plug and Sheet Piling Cofferdam**




It is anticipated that tailrace construction in the channel involving overburden excavation would be undertaken after completion of the powerhouse substructure. Once the cofferdam is constructed, the area enclosed by the cofferdam will be pumped dry to facilitate nearshore sediment excavation and extension of the tailrace. The tailrace area will require rip-rap lining to protect against erosion and sloughing of the overburden. Portions of the Abitibi River bank in the immediate vicinity of the tailrace area may also require shoreline rip-rap protection to minimize toe erosion due to scouring and lower bank sloughing along the river bank. A retaining wall or a tied steel sheet pile wall will extend out from the powerhouse draft tube piers to assist in reducing the excavated quantities. After construction completion the final shoreline plug/sheet pile will be removed in the wet.

The final site grading and elevations will be designed to minimize erosion and manage stormwater in accordance with the Stormwater Management Plan prepared by the DBC based on the Ontario Ministry of the Environment (MOE, 2003) report “Stormwater Management Planning and Design Manual” and the conditions of the Environmental Compliance Approval under the *Ontario Water Resources Act (OWRA)*.

Upon construction completion, the site will be restored and re-vegetated based on the Site Rehabilitation Plan.

CRP/OPG currently envisions hiring a DBC that will be responsible for the detailed design and construction of the proposed New Post Creek Project. The DBC would also be responsible for obtaining construction-related permits and approvals that would be required for the proposed Project dependent on the final designs prepared by the DBC. The ER provides a list of anticipated permits and approvals required during construction and operation phases.

Construction is anticipated to last up to 30 months.

#### *1.3.1.1 Inundation and Total Cleared Areas*

As indicated in Table 1.2, the proposed Project is projected to result in an estimated inundated area of 170 ha. The inundation is limited to the portion of waterway and land upstream of the proposed spillway structures. The inundated areas associated with the proposed Project are a combination of riparian shoreline and moist forest-covered areas (see Figure 1.9). The total area affected by the proposed Project has been calculated from mapping and by adding up the areas of the various proposed Project components. The total area affected was apportioned into three categories:

1. Permanent Loss of Area – this is a permanent loss of existing habitat to facilities and structures such as a road, dam, powerhouse and transmission line ROW.
2. Temporary Loss of Area – this is a temporary loss of existing habitat associated with land required for the construction period of the proposed Project.
3. New Water Area – is the total loss of terrestrial habitat due to the reservoir inundation and creation of aquatic habitat.

The areas affected by the proposed Project components are presented in Table 1.3.

**Table 1.3 Quantification of Areas Affected by Proposed Project Components**

| Project Component | Permanent Loss of Area (ha)[1] | Temporary Loss of Terrestrial Area (ha)[1] | Creation of New Water Area (ha) |
|---|---|---|---|
| Camps (maximum) | NA[2] | 8 | NA |
| Borrow Areas (maximum) | NA | NA | NA |
| Access Roads | 15 | 9 | NA |
| Intake and Spillway Structures | <1 | <1 | |
| Power Canal, Penstocks, Powerhouse and Tailrace | 7 | 7 | NA |
| Switchyards and Substations | <1 | <1 | NA |
| Inundation | 170[3] | NA | 131 |
| Transmission Line ROW (maximum)[4] | 34 | NA | NA |
| **Total** | 226 | 24 | 131 |

[1] Includes New Post Creek, associated tributaries and land base.
[2] NA=not applicable.
[3] Including permanent conversion of riverine habitat to lacustrine habitat.
[4] Based on 50 m width.

The final total area to be cleared will be refined as detailed design of the proposed Project progresses. It is assumed that all temporary construction roads will be included in the footprint identified in Table 1.3. It also assumes that borrow areas would not be a permanent loss from the land base, since once the resources are depleted, site restoration will be undertaken by the borrow operators.

Vegetation clearing will involve a combination of manual and mechanical approaches. Based on commitments made to the Aboriginal communities, no chemical methods will be utilized for vegetation clearing.

#### *1.3.1.2 Requirements for Off-site Land Use and Other Ancillary Features*

A number of ancillary facilities will be required for the proposed Project, including roads, camps for construction workers, lay-down/construction areas and borrow areas for construction materials.

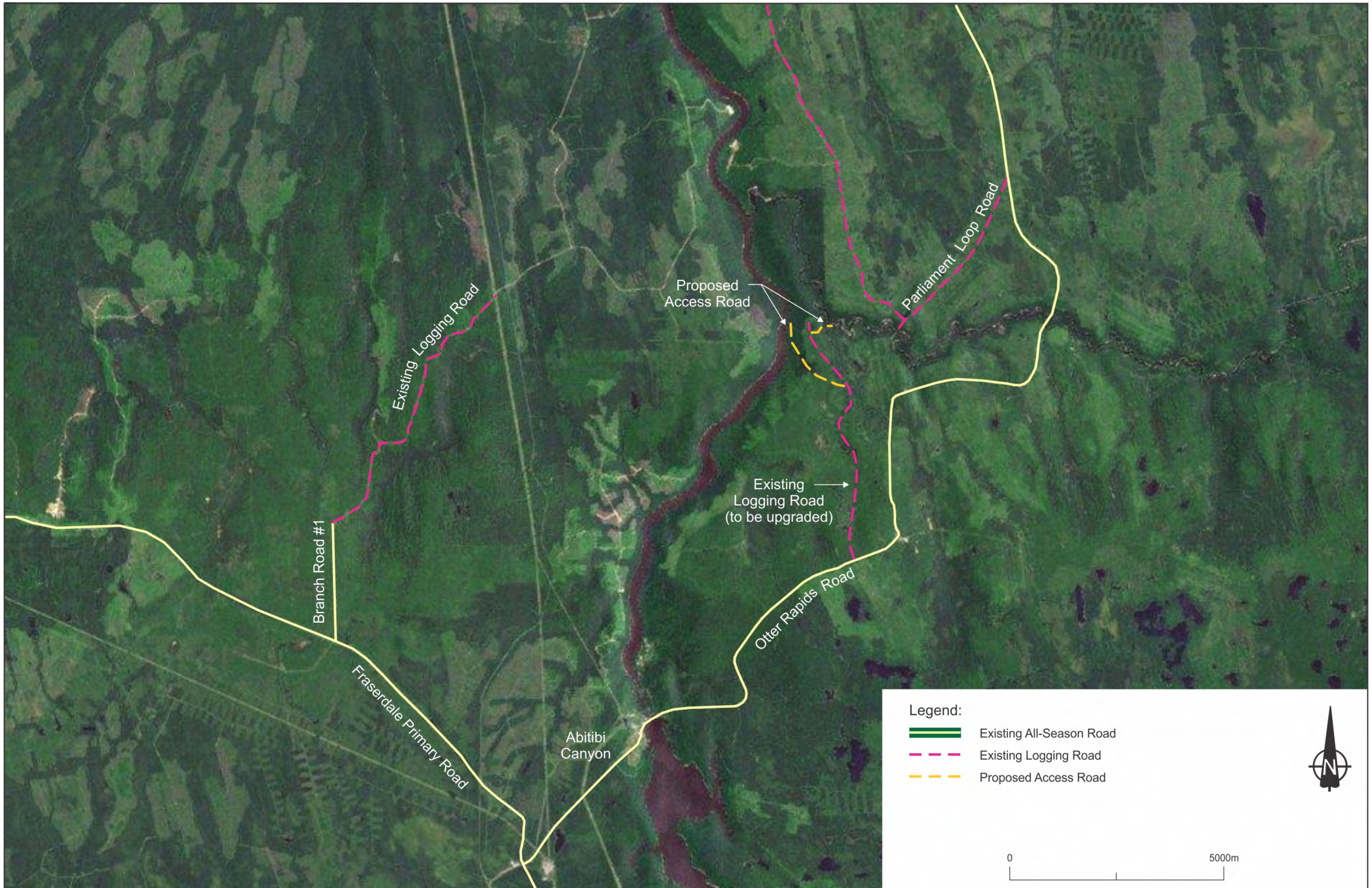
Existing road access leading to the proposed GS Site is provided by Provincial Highway 634 to the Abitibi Canyon GS and a short section of the Otter Rapids Road (private road) which ends at the Otter Rapids GS (see Figure 1.5).

Further access to the proposed GS Site would be via a disused clay-topped forestry road, approximately 6.1 km in length, that would have to be substantially expanded and reinforced (see Figures 1.5 and 1.18). This is a single-lane road that was constructed by grubbing and heaping the clay soil to create a sub-grade, with portions topped with sand and/or gravel. This road is assumed to have been constructed in 1980 to provide access for harvesting and has subsequently not received maintenance. The existing road would have to be upgraded and extended approximately 530 m and 1,450 m to the proposed intake and powerhouse locations, respectively. This road traverses two permanent unnamed watercourses. In addition, there are six cross-drainage culverts along the operational road to facilitate seasonal water flows and avoid pooling along the road. Culvert replacement will require a permit from the MNR.

CRP/OPG presumes that access to the east bank of the New Post Creek, as may be necessary for the construction of the dam structures, will be provided with a temporary bridge across the creek at the intake area. Other old forestry roads north of the Otter Rapids Road bridge over New Post Creek such as Parliament Loop Road may also provide access to the east bank of the creek. Figure 1.18 shows the potential access route along Parliament Loop Road. These roads would require construction and environmental mitigation measures by the DBC prior to use, and would be upgraded in accordance with permit approvals from MNR.

Access to the west bank of the Abitibi River for construction of the proposed transmission line is provided by an existing road network to the interconnection point with the existing Hydro One transmission line and is considered adequate for construction equipment traversal (see Figure 1.13). Proposed transmission line construction is expected to be carried out in winter with no additional access road creation. In any case, the DBC will have to secure permits and approvals regardless of the season of proposed transmission line construction.

**Figure 1.18 Proposed Project Access**



The proposed interconnection point will be accessed using the Fraserdale Primary Road (#634), Branch Road #1 and an unnamed operational (logging) road (see Figures 1.5 and 1.18) that bisects the Pinard Moraine Conservation Reserve which was regulated by the MNR in 2005. Upon regulation, this road continues to be used by the forestry industry as per agreement with the MNR. An Area of Concern (AoC) prescription for use of this road during proposed Project construction may be required from the MNR.

A construction camp will likely be required to accommodate up to approximately 100 workers for the three-year duration of proposed Project construction. The DBC will decide the camp location and have responsibility for acquisition of relevant permits. It is anticipated that the camp would be constructed in the Abitibi Canyon GS area where OPG currently has a Water Power Lease and a Licence of Occupation.

Construction staging or lay-down areas will be required and are expected to be close to the main construction sites, e.g., intake and spillway structures, penstocks and powerhouse. These areas will be used for vehicle and equipment parking, materials storage, construction facilities (e.g., site office, security buildings/cabins) and construction access provision. CRP/OPG has identified from a practical perspective a number of areas that will likely be used during construction (see Figure 1.6). In some cases, the DBC will use areas that will be permanently lost to infrastructure for temporary uses. These opportunities can occur during proposed Project staging. The DBC will be required to obtain any land use permits and licences for temporary construction activities.

Borrow areas will be required primarily for the earth fill dam and dykes and other aggregate use. CRP/OPG anticipates that aggregate from the excavations would be used and supplemented from several nearby existing borrow areas for which the DBC would have to secure permits or procurement from those already holding the permits. Figure 1.5 shows the locations of potential borrow areas.

CRP/OPG will provide as much information as possible regarding the locations of borrow areas which might be used during the construction phase. Confirmation of the specific borrow areas is not possible for CRP/OPG to provide at the EA stage, as the final selection and permitting for use of these areas will be the responsibility of the DBC.

Any waste generated by the proposed Project will be disposed of in accordance with federal and provincial requirements.

#### *1.3.1.3 Construction Schedule and Strategy*

The proposed New Post Creek Project is currently completing the Definition Phase, which includes:

- completion of the OWA Class EA process;
- selection of a DBC for construction; and
- procurement of a revenue agreement or contract with the Ontario government.

When all Definition Phase tasks are complete, CRP/OPG will complete a final review of the proposed Project and make a decision to proceed into the "Execution Phase". This phase includes CRP and OPG obtaining respective board approval to proceed.

The earliest time frame in which construction would start is 2014 and it is expected that construction phase will last approximately 30 months.

In the Execution Phase, CRP/OPG currently envisions hiring a third party contractor, i.e., DBC, who will be responsible for the detailed design and construction of the proposed Project. The DBC would be responsible for completing detailed final stamped designs and obtaining all construction-related permits and approvals, e.g., Permits-to-Take-Water (PTTWs) for cofferdams and construction-related activities, road use and watercrossing approvals, aggregate permits, etc.

CRP/OPG is committed to working with federal and provincial agencies to address information requirements related to construction and operation approvals or authorizations.

At this point, CRP/OPG does not know the specific equipment that will be required for the proposed Project; however, it is likely that it will include typical construction equipment associated with large-scale civil works.

CRP/OPG anticipates that explosives will be required during construction. All necessary permits will be obtained by the DBC, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canadian Explosives Act* and the *Transportation of Dangerous Goods Act* (see Section 3.1.2.3). Environmental monitoring during construction will also occur to ensure commitments in the ER and other permits are being followed as intended (see Section 3.2.13).

### 1.3.2 Operation

#### *1.3.2.1 Proposed New Post Creek Hydroelectric GS*

Operation of the New Post Creek Diversion Dam has been designed in a manner which requires minimal intervention by OPG personnel. Since 1974, the dam has been operated by leaving the stop logs set at elevation 218.80 m to maximize diversion flow while eliminating the need for ongoing log operations at the dam (OPG *et al*., 2006). When the headwater exceeds this elevation, water spills over the stop logs and flows downstream along the old channel of the Little Abitibi River.

Operation of the proposed New Post Creek Hydroelectric GS will be unmanned. No permanent staff will be stationed at the facility. Operating and maintenance personnel will visit the site only to perform specific periodic routine inspection and servicing tasks, or to deal with necessary investigations and repairs, when these are required.

Once placed into service, the proposed GS will be operated from the OPG North East Control Centre (NECC) in Timmins. The station will be monitored on a continuous basis by OPG operators from a control room where all North East Plant Group (NEPG) units are controlled. As well as monitoring the operation of the station, the NECC control room operators will initiate such operations as starting, synchronizing and stopping the turbine generators and adjusting their loads, opening and closing sluice gates as required to manage the forebay operations and downstream flows, and responding to malfunctions of the equipment brought to their attention.

Maintenance of the trash rack and intake, such as removal of timber debris, will be performed manually or with mobile equipment from the intake deck. There is an option to add automated equipment for this activity in the future.

The intake bay for each penstock will have self-closing vertical lift gates to ensure that the penstocks and powerhouse can be safely isolated and dewatered under all conditions.

Maintenance of the draft tubes or turbines will require the use of a draft tube bulkhead system. Consequently, the powerhouse will be equipped with one set of draft tube bulkhead gates (for one unit at a time), with the gates to be installed using a monorail hoist travelling across the tailrace deck. The gates will be stored in the gate slots above tailwater level.

The base case operating scheme, as outlined in the feasibility update report (KGS Group, 2010), involves the passage of minimum flows downstream to the New Post Creek waterfalls and the remaining flow diverted from the creek and passed through the turbine units to generate electricity. During high flow periods, flow diversion will meet the maximum flow capacity of the turbines. Plant capacity will be 50 $m^3$/s. During spring, significant flows will continue downstream of the intake weir to the waterfalls, as the estimated average New Post Creek flows for May and June are 131 $m^3$/s and 71 $m^3$/s, respectively. During the rest of the year, the minimum flow will be first released downstream of the weir with the remaining flow directed to the turbines to generate electricity.

When the diverted creek flow is less than the lowest plant operating flow of the smallest turbine unit (typically 40% of the unit capacity for a Francis turbine), pulsed operation would occur. It is expected to occur primarily during the low flow winter periods and would use the limited storage available in the forebay to provide additional generation. Using a FSL of 187.00 m.a.s.l., sufficient storage would be available to augment low creek inflow in order to operate one turbine unit for several hours. This operation could be repeated throughout the day as flow permits, thereby generating additional energy during a period when the plant would otherwise be shut down. The plant will release flow in any day equal to the volume of inflow. This pulsing operation provides additional technical (and cost) benefits such as ensuring continued flow through the penstocks and station heating in the winter months. For example, for two equal sized turbine units with a capacity of 25 $m^3$/s each, the plant would operate in pulsed mode at riparian flows between approximately 2 and 12 $m^3$/s during parts of February and March (based on a 2 $m^3$/s minimum flow for this period). Pulsing will be undertaken during other times of the year when there is not enough flow to provide the minimum flow and run the turbines.

Annual water levels in New Post Creek vary by approximately 3 m. With pulsing, water level fluctuations will be less, but occur more frequently over short periods of time. Water level fluctuations will be limited to 0.5 m below the usual full headpond water level. Pulsing will be permitted at any time during the year within this operating range of 0.5 m provided minimum flows are directed over the spillway and no negative effects due to pulsing, that can not be otherwise mitigated, are observed (G. Funnell, MNR, 2013, pers. comm.).

#### *1.3.2.2 Operating Regime*

The existing Abitibi River Water Management Plan (WMP) (OPG *et al*., 2006) will need to be amended through an Administrative Amendment. Flows and levels for the proposed New Post Creek Hydroelectric GS will comply with the amended Abitibi River WMP.

Operation will be constrained by the minimum flow required in the existing channel mandated as required for the waterfalls downstream. This minimum flow was agreed to with MNR, Ontario Parks and Department of Fisheries and Oceans (DFO) during the Definition Phase. All parties have been working towards the operating regime that:

a) continues to provide important ecological functions;
b) ensures that the proposed Project is economically viable;
c) respects TTN's historic and modern day interests;
d) ensures and enhances public safety; and
e) ensures continual flow down New Post Creek and over the waterfalls to maintain aesthetic value.

As a pre-condition, it was agreed that the proposed Project will not change the total volume of water flowing into the Abitibi River, or the operating considerations for OPG's Abitibi Canyon GS and Otter Rapids GS. Total flows from New Post Creek into the Abitibi River will remain unchanged (except that there will now be two discharge locations, i.e., at the proposed GS tailrace and the existing New Post Creek outlet). As a result, flow magnitude, frequency, timing, duration and rate of change will be different than current flow conditions at the New Post Creek outlet.

The minimum flows that must be maintained downstream of the spillway structure at all times are provided below:

| Period | Minimum Flow ($m^3/s$) |
|---|---|
| Approximately May 1 to mid-June[1]; timing dependent on spring spawning and egg incubation period[2] | 15 |
| Mid-June to August 31 | 7.5 |
| September 1 to 30 | 5 |
| October 1 to approximately April 30; timing dependent on Walleye (*Sander vitreus*) spawning initiation | 2 |

[1] To be expanded to include Lake Sturgeon spawning and egg incubation period if spawning occurrence is demonstrated.
[2] Brief transition of flows from 15 to 7.5 $m^3/s$ from the end of egg incubation (based on thermal units accumulated) with the rampdown rate ($m^3/s$ per day) to be determined in consultation with the MNR and DFO.

The proposed Project will have a relatively small headpond (approximately 170 ha) and will hold approximately 8,000,000 $m^3$ of water. However, all of the water within the headpond is not available to the proposed facility to use for generation since the facility is only permitted to vary the headpond water level by 0.5 m. Therefore, the headpond will have limited ability to store water and the intended operation of the facility is to utilize the water as it comes down New Post Creek, while maintaining a minimum flow through the downstream creek reach and over the waterfalls. For clarity, the proposed headpond will not be drained for generation and replenished.

The forebay fluctuations are intended to provide operation during low flow periods primarily in late winter and late summer. This pulsing will be an automatic process and will involve the following:

1. The turbines are expected to require a minimum of approximately 10 $m^3/s$ to operate. Any time the total flow in New Post Creek is less than 10 $m^3/s$ plus the minimum downstream flow requirement, the turbine units will not be able to operate.
2. In such situations, the proposed GS will be allowed to draw down the forebay within the prescribed range at a flow rate that will optimize efficiency.
3. When the water level reaches its lower limit, the units will shut down until the forebay returns to its high level. This will not be co-ordinated with the time of day for increasing revenue but will be an automatic process.
4. The fluctuation is expected to be lower in the winter to maintain an ice cover on the forebay.
5. This cycle will repeat most frequently in situations when flows are just below the required 10 $m^3/s$ plus the minimum downstream flow requirement. The situation that would cause the most frequent starts/stops would be during the winter. In such cases the cycle could be expected to repeat every 8 to 48 h, depending upon riparian flow.
6. In the prescribed period where a 50 cm band is achievable, the cycle would be expected to repeat every 48 to 150 h, depending upon riparian flow.
7. The flows downstream of the dam would not change during this process as they will remain as the defined minimum flow requirement.

The 7.5 $m^3$/s requirement between mid-June and August 31 is used as an example to better illustrate the minimum flow operation. Depending on the available inflow, there are basically three scenarios:

1. When there is not enough flow to provide the minimum flow of 7.5 $m^3$/s **and** run the turbines (requires approximately 10 $m^3$/s), the minimum flow of 7.5 $m^3$/s will continue to be provided down New Post Creek and over the waterfalls. Any remaining water will be held back within the headpond. The headpond has limited capacity to hold water within the 0.5 m band. Therefore, once enough water has collected in the headpond to run the station for a reasonable duration, it will restart and begin generation. When the lower limit of the band is reached, generation will stop. This cycle could happen a few times a day during a low flow period; however, the 7.5 $m^3$/s minimum flow will be maintained.

2. For the majority of the summer period, it is expected that there will be enough flow to provide the 7.5 $m^3$/s and operate the proposed GS continuously. The proposed GS will be designed in a manner to run in low flow situations so that operations can continue as frequently as practical in order to minimize any stop/start cycles for the equipment. In this scenario, a constant flow of 7.5 $m^3$/s is provided down New Post Creek.

3. In situations where the flow exceeds the amount required to provide the 7.5 $m^3$/s minimum flow and the maximum flow that the proposed GS can utilize (approximately 50 $m^3$/s), the additional water will be spilled through New Post Creek increasing the flow above 7.5 $m^3$/s.

In all cases (other than a natural drought condition in which all available flow will be released down the creek), a minimum flow of 7.5 $m^3$/s will be provided during the summer period downstream in New Post Creek and over the waterfalls.

With respect to water levels, it is proposed that the upper FSL of 187.00 m.a.s.l. be used as the normal maximum operating level with a minimum operating level of 182.00 m.a.s.l. The proposed headpond water levels are summarized below:

- Maximum Operating Level (flood conditions): 187.50 m.a.s.l.
- Normal Maximum Operating Level: 187.00 m.a.s.l.
- Normal Minimum Operating Level: 186.50 m.a.s.l.
- Absolute Minimum Level: 182.00 m.a.s.l.
- Minimum Level for Periodic Headpond Maintenance: 182.30 m.a.s.l.

#### *1.3.2.3 Transmission Facilities*

The proposed transmission facilities would be inspected on an annual basis using a combination of aerial and/or ground reconnaissance. Additional inspections may be required after the occurrence of any harsh weather conditions or upon occurrence of any line faults. Emergency repairs could occur at any point in the year.

Vegetation control on the ROW will be required, involving a combination of manual and mechanical approaches. Based on commitments made to the Aboriginal communities, no chemical treatment will be utilized for vegetation management.

### 1.3.3 Decommissioning

The history of hydroelectric generating stations in Ontario is that they are typically not decommissioned. Rather, as the structures near the end of their engineered life, they are either re-developed or refurbished. The societal benefit of these hydroelectric assets and their associated infrastructure, e.g., transmission and distribution lines, is such that these re-investments are usually considered economically, socially and environmentally preferable to developing new energy projects. As such, no specific decommissioning activities have been identified. Rather, transmission and distribution structures and lines would be maintained and/or replaced as part of ongoing operations.

## 1.4 DESCRIPTION OF THE STUDY AREAS

In the baseline description of the aquatic environment, reference will be made to regional, local and site-specific study areas. These study areas are defined as follows.

Regional Study Area

The regional setting is generally defined by the Abitibi River watershed (see Figure 1.19). The regional setting provides for the baseline description of the watershed and the associated general land and water uses affecting the aquatic environment.

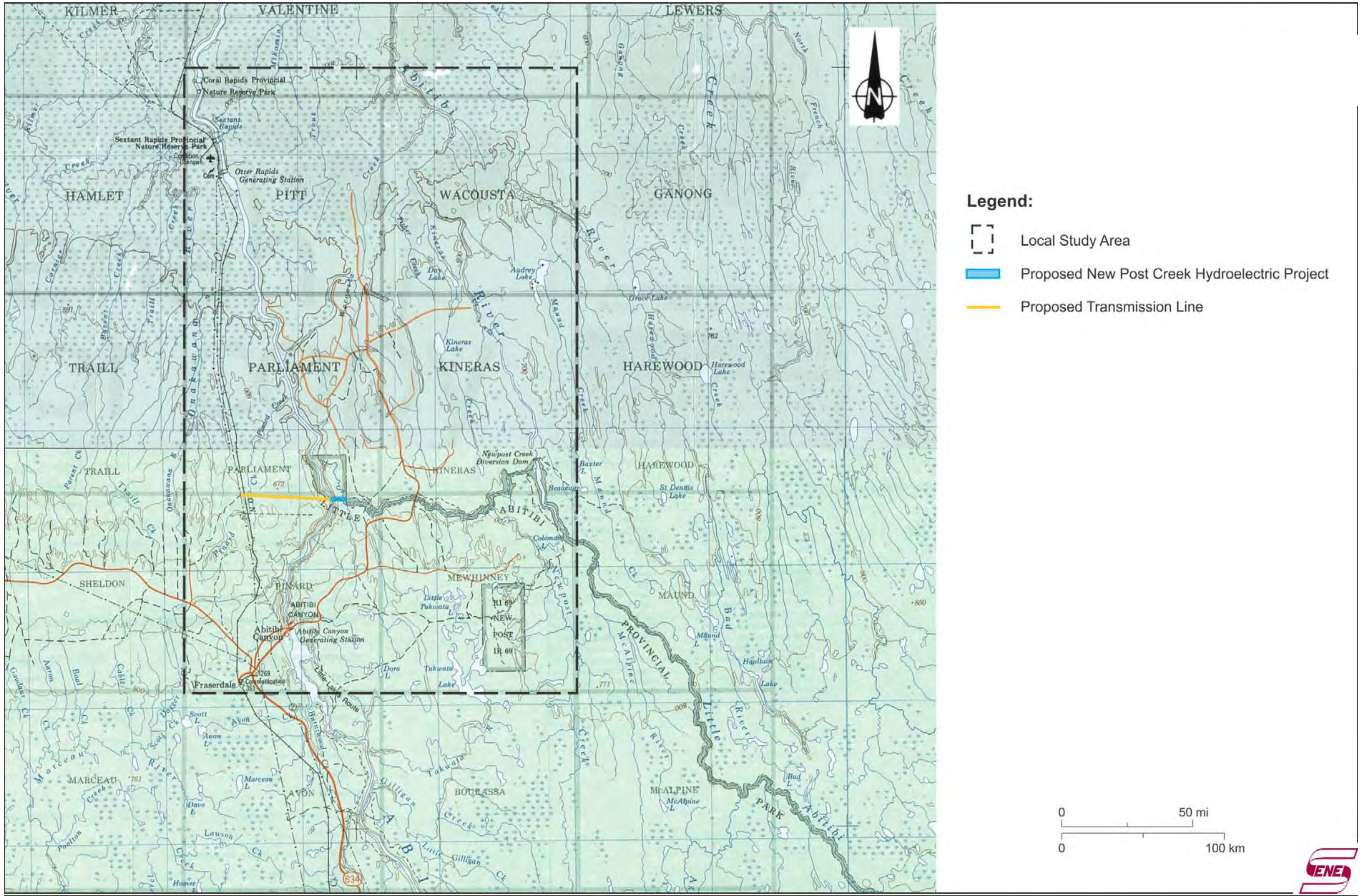
Local Study Area

The local study area for the aquatic environment encompasses New Post Creek and the Abitibi River extending from New Post Creek Diversion Dam and Abitibi Canyon GS, respectively, downstream of the confluence of New Post Creek with the Abitibi River to Otter Rapids GS (Figure 1.20). The local setting encompasses the area possibly affected by the construction and operation of the proposed undertaking, and provides for the environmental baseline description of hydrology, water quality, aquatic biota and specific water uses, e.g., recreational boating, sportfishing, power generation, etc.

**Figure 1.19 Abitibi River Watershed Generating Stations and Dams**


Source: OPG *et al*. (2006).

**Figure 1.20 Local Study Area**[1]




[1] It should be noted that Figure 1.20 shows the previous LAPP boundary prior to land deregulation and replacement (see Section 1.1).

Site-Specific Study Area

The site-specific study area (Figure 1.21) includes those areas that will be directly affected by the proposed Project including:

- the inundation or flooded area (170 ha in area) upstream of the proposed intake/weir location on New Post Creek (see Figure 1.9);
- New Post Creek extending downstream from the proposed intake/weir location to its confluence with the Abitibi River (see Figure 1.21);
- the Abitibi River from Abitibi Canyon to 1 km downstream of the New Post Creek outlet encompassing the proposed Project tailrace (see Figure 1.21);
- the proposed transmission line which traverses the Abitibi River, as well as a number of smaller water bodies (see Figures 1.14 and 1.21);
- proposed upgrades and extension of access roads which traverse a number of watercourses (see Figures 1.17 and 1.21); and
- proposed potential borrow areas proximate to or overlapping watercourses (see Figure 1.21).

The site-specific study area provides for the environmental baseline description of sediment, aquatic vegetation, benthic macroinvertebrate communities and fisheries resources.

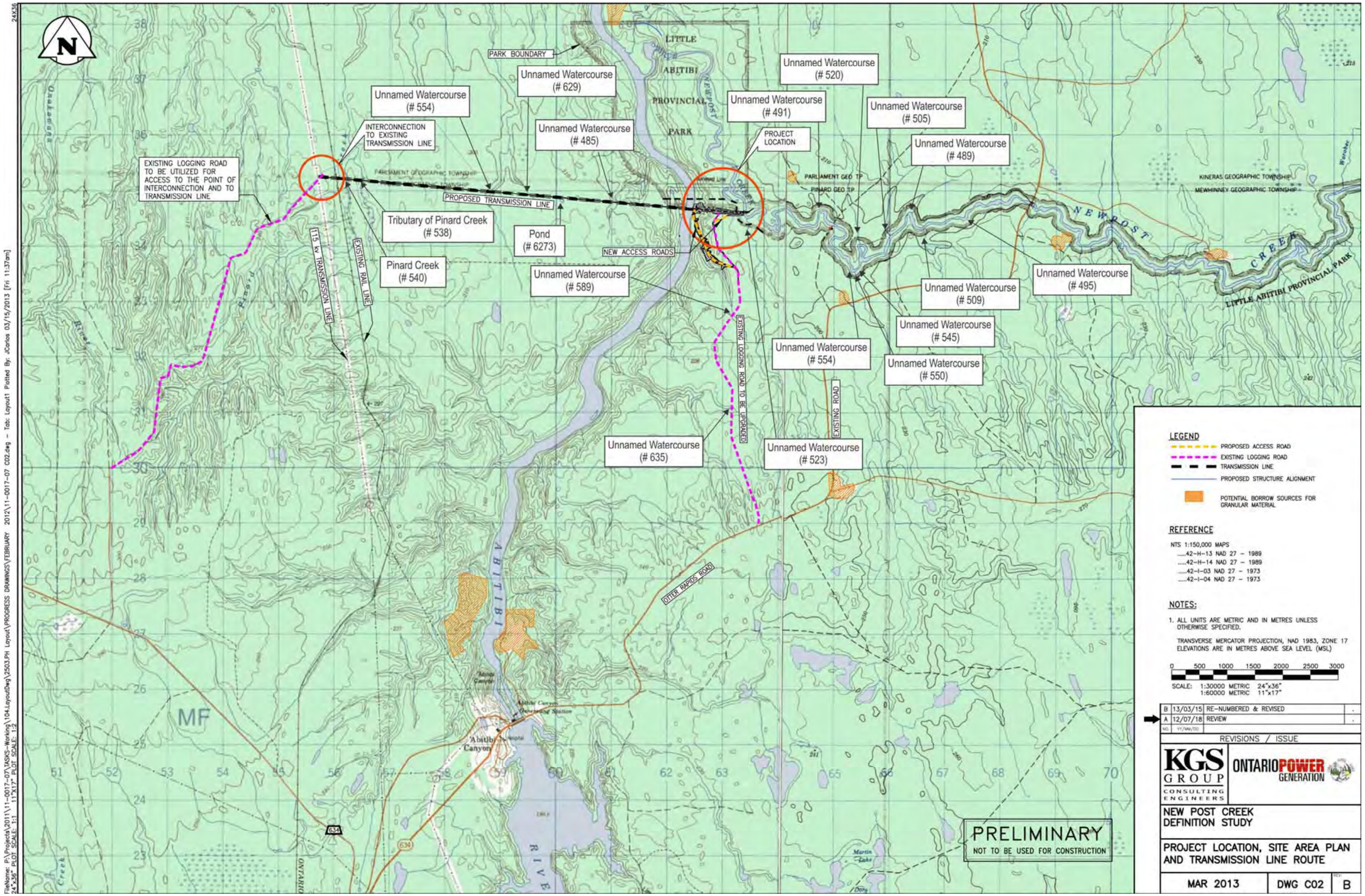
## 1.5 STUDY APPROACH

The baseline setting for the aquatic environment was prepared based on literature review and personal contacts. Relevant environmental baseline information was available in reports prepared by Seyler (1997), Hendry and Chang (2001), KGS Group (2006, 2013a, b, e), Ontario Parks (2006) and OPG *et al.* (2006). This information was augmented by information in other available reports and documents, and updated by data requested from the MNR. Traditional Knowledge was also obtained from the TTN. Finally, site-specific studies have been undertaken by C. Portt and Associates addressing fish communities and habitat (see Appendix A).

## 1.6 STRUCTURE OF REPORT

This document was prepared as a TSD to the ER (SENES, 2013) prepared pursuant to the OWA Class EA process. ER preparation has adhered to the OWA (2012a) Class EA under the *EA Act*. The ER provides a description of the proposed Project, summarizes the overall baseline environmental setting and anticipated environmental effects, recommends appropriate mitigation measures to minimize or obviate these effects, and describes agency, public, and First Nation and Métis consultation. Other TSDs address the terrestrial environment, cultural heritage, socio-economics and land use, public and agency consultation, and First Nations and Métis interests and consultation.

**Figure 1.21 Site-specific Study Area[1]**




[1] It should be noted that Figure 1.21 shows the previous LAPP boundary prior to land deregulation and replacement (see Section 1.1).

This Aquatic Environment TSD is organized into four main chapters:

- Chapter 1.0 **Introduction** – provides a description of the proposed Project, a delineation of the study areas and the study approach;
- Chapter 2.0 **Baseline Aquatic Environment Conditions** – describes the baseline aquatic environment conditions in the study areas;
- Chapter 3.0 **Effects Assessment and Mitigation Measures** – details the assessment of aquatic environment effects, presents mitigation measures to minimize or obviate these effects and summarizes the net effects; and
- Chapter 4.0 **Summary and Conclusions** – summarizes the potential effects and recommended mitigation/remedial measures.

Chapters 5.0, 6.0 and 7.0 provide the References, Acronyms/Abbreviations and Glossary, respectively.

# 2.0 BASELINE AQUATIC ENVIRONMENT CONDITIONS

## 2.1 WATER RESOURCES

### 2.1.1 Site Surface Hydrology

At the proposed New Post Creek site, surface water drainage is towards New Post Creek to the east and the Abitibi River to the west.

No defined watercourses are present within the proposed GS construction footprint (encompassing the intake, water conveyance system, powerhouse and laydown/ assembly areas). A permanent unnamed watercourse (MNR ID#523) discharges to New Post Creek approximately 150 m upstream of the proposed Project intake location, draining lands to the south and north of Otter Rapids Road. The lower reaches of this and nine other unnamed watercourses further upstream would be inundated by the proposed headpond (see Figure 1.21).

The existing operational access road from Otter Rapids Road to the proposed construction footprint traverses two permanent unnamed watercourses, i.e., MNR watercrossings #589 and #635 that drain into the Abitibi River (Figure 1.21). In addition, there are six cross-drainage culverts along the road to facilitate seasonal water flows and preclude pooling.

The proposed transmission line ROW traverses Pinard Creek (MNR ID#540) and its tributary (MNR ID#538), as well as two tributaries (MNR ID#554 and #629) of an unnamed watercourse and a second unnamed watercourse (MNR ID#485). All watercourses traversed discharge into the Abitibi River (Figure 1.21). Tributary #554 was ponded along the transmission corridor (see Figure 1.13); however, the beaver dam has subsequently failed and the pond is less than 10% of its former size (see Section 2.2.6.1). A small (0.4 ha) pond (MNR ID#6273) is also traversed.

### 2.1.2 Groundwater Hydrology

Groundwater is generally shallower in the Great Clay Belt area than in the Canadian Shield area due to greater permeability and water retention capability. Groundwater yields in the overburden are generally less than 1 L/s (MNR, 1984). These well yields are suitable for domestic purposes. In areas of organic deposits, the water table may come within 1 m of the surface.

Based on hydrogeological investigations near New Post Creek, there is a relatively shallow groundwater table, approximately 2 m below ground surface, within the upper silty soils and till zones. Somewhat deeper (approximately 3.7 m) perched groundwater regimes were also identified within the overburden due to the differing permeability characteristics of the stratigraphic units. Inland, the groundwater table was deeper ranging from approximately 21 to 25 m. Groundwater levels ranging from approximately 5 to 7 m in the sand and basal till layers of the overburden near the proposed powerhouse location closely reflect the water levels of the

Abitibi River. A slight upward seepage gradient was observed in the test holes along the east bank of the Abitibi River (KGS Group, 2013a).

### 2.1.3 Abitibi River

#### *2.1.3.1 Hydrology*

The Abitibi River occurs within the Moose River drainage basin of the Hudson Bay Drainage System (Figure 2.1). The Moose River drainage basin drains approximately 109,000 km$^2$ traversing two physiographic regions (see Figure 2.2): the Great Clay Belt and the Hudson Bay Lowlands (Brousseau and Goodchild, l989).

The Abitibi River extends approximately 285 km from its headwaters to its confluence with the Moose River draining two other major rivers, Frederick House River and Little Abitibi River (OPG *et al*., 2006). The Abitibi River and its tributaries drain approximately 33,987 km$^2$.

Based on historical hydrological data, greatest streamflow occurs during the spring freshet in May and June with the lowest flows occurring generally during the winter (see Table 2.1). Figures 2.3 and 2.4 present the annual daily flow hydrographs from 1973 to 2002 for the Abitibi River at Abitibi Canyon GS and Otter Rapids GS, respectively. Extreme maximum and minimum monthly flows at Abitibi Canyon GS were 1,620 m$^3$/s in May 1960 and 106 m$^3$/s in December, 1933, respectively. Extreme maximum and minimum daily flows at this location were 2,510 m$^3$/s on May 19, 1947 and 25.2 m$^3$/s on June 27, 1982, respectively.

**Figure 2.1 Moose River Drainage Basin**

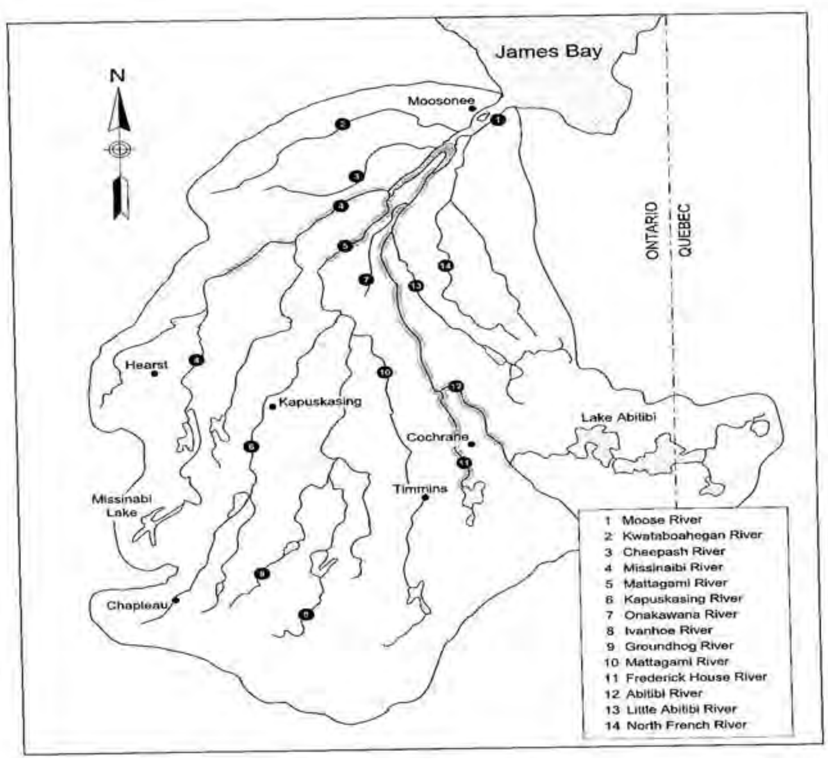


**Figure 2.2 Major Physiographic Regions of the Moose River Basin**

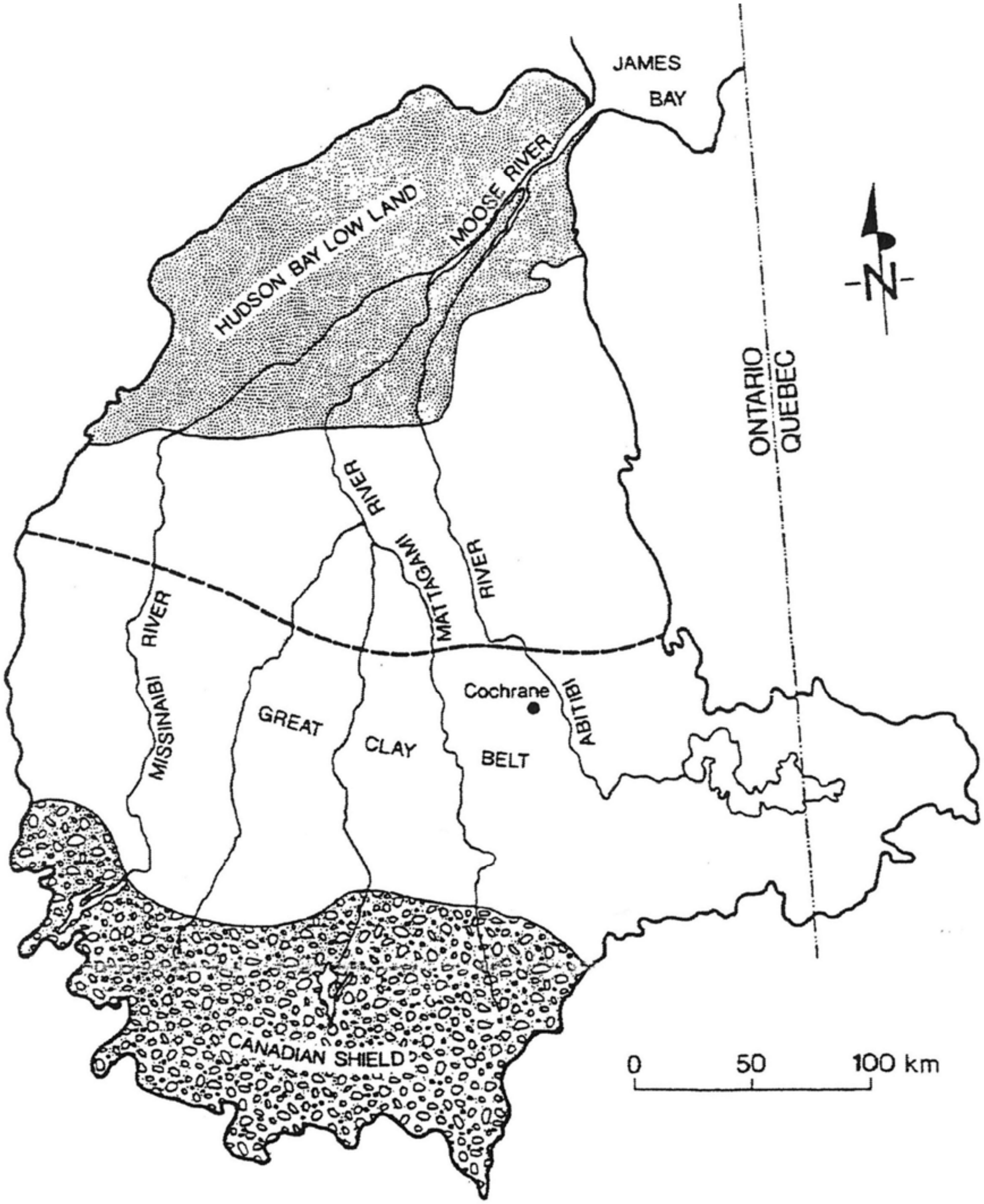
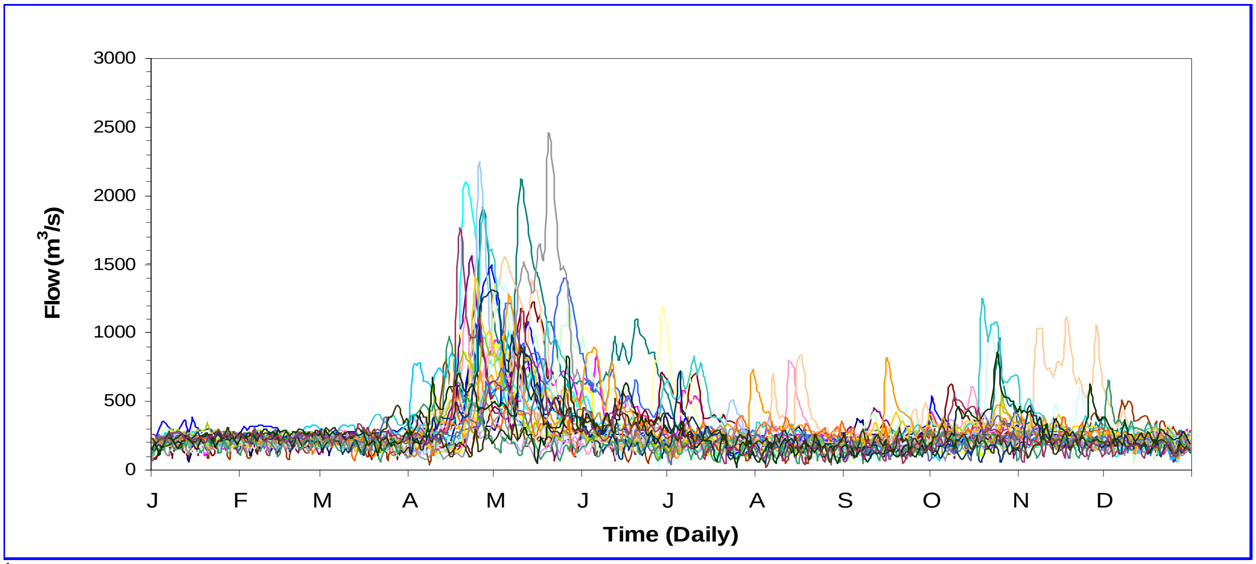


**Table 2.1 Minimum, Maximum, as well as Monthly and Annual Mean Discharges ($m^3/s$) of the Abitibi River[1]**

| Location | Period of Record | Metric | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abitibi Canyon GS[2] | 1929 – 1994 | Mean | 205 | 213 | 227 | 451 | 653 | 380 | 263 | 213 | 235 | 300 | 276 | 213 | 300 |
| | | Max | 309 | 392 | 394 | 898 | 1,620 | 1.040 | 688 | 407 | 591 | 710 | 713 | 368 | 424 |
| | | Min | 114 | 121 | 141 | 192 | 198 | 172 | 152 | 141 | 146 | 150 | 129 | 106 | 213 |
| Otter Rapids GS[3] | 1961 – 1994 | Mean | 226 | 232 | 233 | 472 | 722 | 418 | 290 | 250 | 268 | 347 | 310 | 242 | 334 |
| | | Max | 325 | 407 | 375 | 881 | 1,330 | 911 | 618 | 442 | 399 | 666 | 746 | 404 | 473 |
| | | Min | 136 | 138 | 158 | 201 | 249 | 224 | 178 | 161 | 160 | 168 | 186 | 163 | 220 |

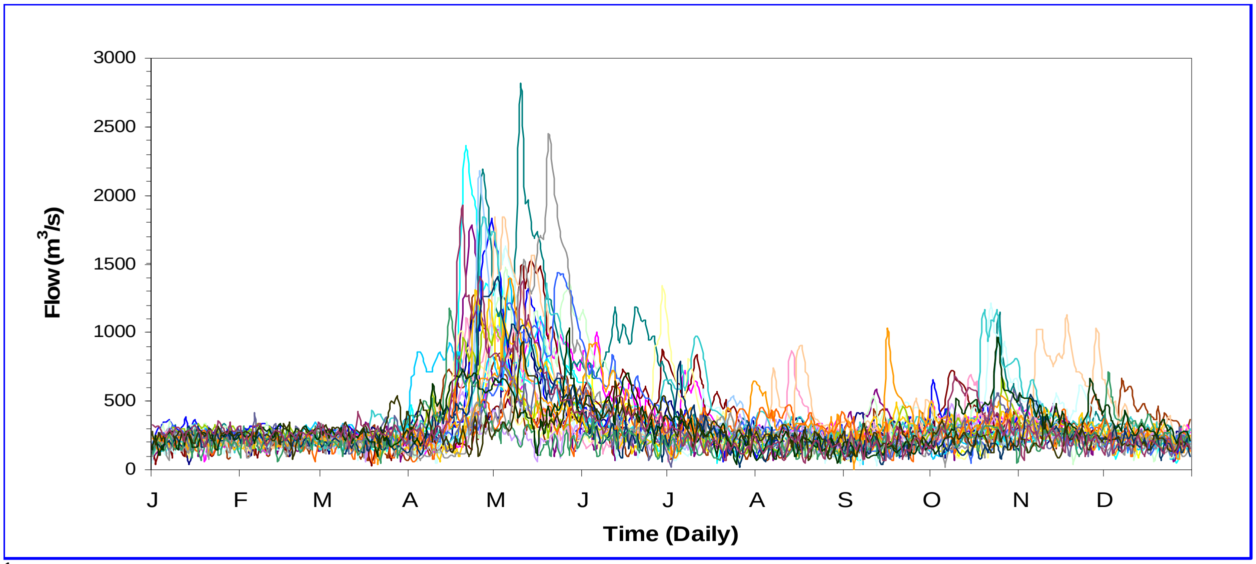
[1] Source: Water Survey of Canada (WSC): http://www.wsc.ec.gc.ca.
[2] Station ID: 04ME002; Location: 49°52’55”N; 81°34’0”W; drainage area of 22,900 $km^2$.
[3] Station ID: 04ME004; Location: 50°10’55”N; 81°38’12”W; drainage area of 23,400 $km^2$.

**Figure 2.3 Annual Daily Regulated Flow Hydrographs for the Abitibi River at Abitibi Canyon GS[1]**




[1] Source: OPG *et al*. (2006).

**Figure 2.4 Daily Regulated Flow Hydrographs for the Abitibi River at Otter Rapids GS[1]**




[1] Source: OPG *et al*. (2006).

Annual flow metrics based on the 30 years of data are presented in Table 2.2.

**Table 2.2 Annual Regulated Flow Metrics for the Abitibi River[1]**

| Descriptive Metric | Value | |
|---|---|---|
| | Abitibi Canyon GS[2] | Otter Rapids GS[3] |
| Drainage Area ($km^2$) | 22,900 | 23,400 |
| Mean Annual Flow ($m^3/s$) | 279.2 | 317.9 |
| 20% Time Exceeded Flow ($m^3/s$) | 311.5 | 371.3 |
| Median Flow ($m^3/s$) | 227.7 | 252.4 |
| 80% Time Exceeded Flow ($m^3/s$) | 175.9 | 188.1 |
| Month of Maximum Median Flow | May | May |
| Month of Minimum Median Flow | September | August |

[1] Source: OPG *et al.* (2006); based on 1973-2002 data.

The Abitibi River at the proposed Project tailrace location is affected by the backwater influence of the Otter Rapids Reservoir controlled by the Otter Rapids GS approximately 28 km downstream. The river at the tailrace location is relatively deep and velocities are low. The water level is essentially equivalent to the water level controlled at the Otter Rapids Dam, and typically ranges between 119.90 and 121.89 m.a.s.l. The water level can fluctuate rapidly, possibly varying over the full range within a few hours, or less.

River freeze-up generally occurs at the end of November, whereas ice break-up usually occurs in April (MNR, 1984). The freeze-up and break-up dates are approximate and will vary according to ambient temperature, channel width and orientation, and water flow.

#### *2.1.3.2 Morphology and Bathymetry*

The Abitibi River traverses two physiographic regions: the Great Clay Belt and the Hudson Bay Lowlands (see Figure 2.2).

Within the Great Clay Belt, gradients are more regular with bedrock outcrops tending to occur along significant faults (Brousseau and Goodchild, 1989). River channels are contained within well-defined, narrow flood plains. Long meandering runs occur between rapids and falls. Channel widths generally vary between 100 and 200 m.

An escarpment marks the beginning of the Hudson Bay Lowlands. This bedrock fault is manifested at Otter Rapids GS.

High steeply sloping soil banks predominantly occur along both banks of the Abitibi River with no exposed bedrock above the existing river level (Ontario Hydro, 1982). Subsequently, several small locations of exposed bedrock above the river level have been observed between Abitibi Canyon and the outlet of New Post Creek (G. Coker, C. Portt and Associates, 2013, pers. comm.). Vegetation frequently extends down to the shoreline, with intermittent areas of exposed steep overburden (sands, silts, tills) bluffs of low (1 to 3 m) to high (10 m) elevations (KGS Group, 2006).

A detailed description of the morphology and bathymetry of the Abitibi River at the proposed tailrace location is presented in Section 2.2.6.1.

### 2.1.4 New Post Creek

#### *2.1.4.1 Hydrology*

Pre-diversion

Historically, New Post Creek was a permanent lotic system and minor tributary of the Abitibi River, with an estimated average flow of less than 4 $m^3/s$, approximately nine times lower than the current average diverted flow (~35 $m^3/s$ based on 1975 to 2010 data) (KGS Group, 2010). Based on Traditional Knowledge, the creek was only navigable by canoe during the spring freshet and in the fall during extended periods of precipitation (P. Archibald Sr., TTN, 2011, pers. comm.). In contrast, most of New Post Creek can currently be travelled by canoe during the entire navigation season, requiring portages only at the Otter Rapids Road bridge and the New Post Creek waterfalls just upstream of its outlet to the Abitibi River (http://www.myccr.com).

Table 2.3 presents the estimated natural (pre-diversion) flows of New Post Creek. The mean monthly flow range from lows of 1.3 $m^3/s$ in February and March to highs of 13.8 and 7.5 $m^3/s$ in May and June, respectively, during the freshet. The highest monthly flows in May and June were 21.4 and 18.0 $m^3/s$, respectively. For the remainder of the year, the mean monthly flows ranged from 2.0 to 4.8 $m^3/s$ in January and October, respectively. For the ten non-freshet months, the overall mean monthly flow was approximately 3.2 $m^3/s$.

**Table 2.3 Estimated Natural (Pre-diversion) Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River[1]**

| Year | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1975** | 1.8 | 1.4 | 1.0 | 1.0 | 11.9 | 8.4 | 3.7 | 1.7 | 1.2 | 1.2 | 2.9 | 2.4 |
| **1976** | 1.8 | 1.2 | 1.0 | 4.3 | 16.0 | 6.4 | 2.4 | 2.9 | 2.3 | 4.2 | 2.7 | 1.9 |
| **1977** | 1.4 | 1.0 | 0.9 | 7.4 | 12.5 | 4.8 | 5.3 | 3.2 | 8.5 | 3.9 | 4.8 | 3.7 |
| **1978** | 2.6 | 1.3 | 0.9 | 0.8 | 17.0 | 18.0 | 11.4 | 3.8 | 5.4 | 11.3 | 5.1 | 2.8 |
| **1979** | 1.6 | 1.0 | 0.9 | 3.5 | 15.3 | 11.1 | 5.1 | 3.3 | 3.9 | 7.1 | 7.6 | 3.8 |
| **1980** | 2.3 | 1.5 | 1.2 | 3.9 | 16.9 | 8.2 | 3.2 | 3.2 | 3.4 | 4.8 | 4.4 | 3.0 |
| **1981** | 2.0 | 1.3 | 1.3 | 6.2 | 18.6 | 11.5 | 4.4 | 2.5 | 3.4 | 4.8 | 4.4 | 3.0 |
| **1982** | 2.3 | 1.4 | 0.6 | 1.2 | 17.2 | 5.3 | 4.7 | 4.1 | 5.4 | 8.8 | 10.4 | 5.5 |
| **1983** | 2.9 | 1.4 | 0.8 | 1.4 | 17.4 | 12.2 | 2.8 | 2.9 | 3.4 | 4.8 | 4.4 | 3.0 |
| **1984** | 1.7 | 1.1 | 1.0 | 5.3 | 9.3 | 7.9 | 9.7 | 2.0 | 0.4 | 4.5 | 4.4 | 3.0 |
| **1985** | 2.6 | 1.0 | 0.5 | 3.2 | 14.5 | 5.4 | 4.9 | 4.2 | 2.2 | 4.5 | 4.4 | 2.2 |
| **1986** | 2.0 | 1.3 | 1.3 | 3.9 | 14.8 | 4.9 | 4.5 | 6.3 | 4.9 | 6.6 | 4.0 | 2.1 |
| **1987** | 2.0 | 1.3 | 1.3 | 3.8 | 6.6 | 6.5 | 3.9 | 3.6 | 3.4 | 4.8 | 4.4 | 3.0 |
| **1988** | 2.0 | 1.3 | 1.1 | 3.4 | 21.3 | 6.5 | 3.6 | 7.8 | 4.4 | 4.7 | 4.3 | 3.0 |
| **1989** | 2.8 | 1.8 | 1.3 | 2.6 | 16.8 | 11.7 | 4.9 | 2.9 | 1.4 | 3.3 | 6.0 | 3.3 |
| **1990** | 2.0 | 1.3 | 1.1 | 4.1 | 16.8 | 10.5 | 6.3 | 6.0 | 4.3 | 5.4 | 4.4 | 3.0 |
| **1991** | 2.0 | 1.3 | 1.3 | 5.7 | 13.3 | 5.9 | 1.5 | 1.7 | 4.9 | 4.8 | 4.4 | 3.0 |

**Table 2.3 Estimated Natural (Pre-diversion) Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River[1] (Cont'd)**

| Year | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1992** | 2.0 | 1.3 | 1.3 | 4.2 | 20.2 | 5.2 | 2.7 | 1.6 | 3.1 | 4.5 | 4.0 | 2.7 |
| **1993** | 2.4 | 1.4 | 1.3 | 4.2 | 13.8 | 7.5 | 4.1 | 3.3 | 3.4 | 5.5 | 3.9 | 1.6 |
| **1994** | 2.0 | 1.3 | 1.3 | 3.4 | 10.2 | 8.6 | 4.9 | 7.7 | 4.7 | 4.1 | 4.1 | 2.9 |
| **1995** | 1.7 | 1.2 | 1.3 | 1.5 | 15.6 | 9.2 | 3.5 | 2.3 | 3.2 | 6.6 | 7.0 | 2.7 |
| **1996** | 1.6 | 1.3 | 1.3 | 4.2 | 13.8 | 7.5 | 4.1 | 3.3 | 3.4 | 4.8 | 4.4 | 3.0 |
| **1997** | 2.0 | 1.3 | 1.3 | 4.2 | 13.8 | 7.5 | 4.1 | 3.3 | 3.4 | 4.8 | 4.0 | 1.1 |
| **1998** | 1.0 | 1.3 | 1.3 | 6.5 | 4.1 | 1.9 | 2.2 | 3.3 | 3.1 | 1.7 | 1.2 | 1.5 |
| **1999** | 1.1 | 0.9 | 1.3 | 4.2 | 12.0 | 6.8 | 2.5 | 1.1 | 3.4 | 4.5 | 4.3 | 2.8 |
| **2000** | 3.0 | 1.9 | 1.1 | 4.1 | 8.3 | 9.5 | 4.8 | 1.6 | 0.6 | 0.9 | 1.0 | 1.0 |
| **2001** | 0.6 | 0.6 | 1.2 | 6.5 | 12.5 | 3.3 | 2.8 | 1.0 | 4.3 | 5.1 | 4.7 | 4.8 |
| **2002** | 2.9 | 2.2 | 1.7 | 7.6 | 17.2 | 6.9 | 1.8 | 1.5 | 1.6 | 6.9 | 4.4 | 3.0 |
| **2003** | 2.0 | 1.3 | 1.3 | 4.2 | 13.9 | 4.4 | 4.7 | 7.8 | 7.8 | 10.0 | 4.3 | 3.0 |
| **2004** | 2.0 | 1.3 | 1.3 | 4.2 | 13.9 | 7.3 | 4.1 | 2.9 | 3.6 | 3.2 | 5.2 | 3.0 |
| **2005** | 2.8 | 1.4 | 1.4 | 6.1 | 12.6 | 3.4 | 1.9 | 3.3 | 3.4 | 8.0 | 7.2 | 5.2 |
| **2006** | 1.3 | 0.8 | 1.3 | 4.2 | 9.1 | 1.8 | 0.9 | 3.1 | 3.4 | 4.8 | 4.4 | 3.0 |
| **2007** | 2.7 | 1.3 | 1.3 | 4.7 | 9.1 | 15.8 | 6.1 | 1.9 | 2.9 | 3.2 | 3.8 | 3.2 |
| **2008** | 2.5 | 1.3 | 1.3 | 6.8 | 21.4 | 8.6 | 5.3 | 3.7 | 3.5 | 4.4 | 4.5 | 3.0 |
| **2009** | 2.3 | 1.5 | 1.2 | 2.6 | 20.6 | 9.2 | 8.2 | 4.6 | 1.4 | 1.1 | 2.1 | 2.9 |
| **2010** | 0.9 | 0.7 | 0.6 | 3.7 | 3.8 | 2.3 | 2.2 | 2.1 | 5.2 | 5.0 | 3.1 | 3.1 |
| **2011** | 1.7 | 1.0 | 0.7 | 2.4 | 15.0 | 9.0 | 2.9 | 1.4 | 1.2 | 1.6 | 2.9 | 1.8 |
| **2012** | 1.2 | 0.9 | 6.8 | 9.8 | 8.4 | 3.4 | 1.0 | 1.7 | 1.2 | 1.8 | 4.8 | 6.3 |
| **Mean** | 2.0 | 1.3 | 1.3 | 4.2 | 13.8 | 7.5 | 4.1 | 3.3 | 3.4 | 4.8 | 4.4 | 3.0 |
| **Maximum** | 3.0 | 2.2 | 6.8 | 9.8 | 21.4 | 18.0 | 11.4 | 7.8 | 8.5 | 11.3 | 10.4 | 6.3 |
| **Minimum** | 0.6 | 0.6 | 0.5 | 0.8 | 3.8 | 1.8 | 0.9 | 1.0 | 0.4 | 0.9 | 1.0 | 1.0 |

[1] Discharge data for the period January 1975 to December 2012 based on Ontario Hydro/OPG New Post Diversion Dam gauge data and using the Regional Flood Frequency method based on the ratio of the delineated drainage basin of New Post Creek downstream of the diversion dam (319 $km^2$) and that of the known drainage area of the Little Abitibi River upstream of the diversion dam (2,706 $km^2$).

Post-diversion

The New Post Creek Diversion Dam was constructed in 1963 by Ontario Hydro on the Little Abitibi River to divert flows from the river into New Post Creek to discharge into the Abitibi River approximately 12 km downstream of Abitibi Canyon GS and 20 km upstream of Otter Rapids GS. The dam allows significant flows to be diverted along the constructed New Post Creek Diversion Channel and New Post Creek to the Abitibi River, increasing inflows to Otter Rapids GS by approximately 12%. Flow in New Post Creek increased approximately ten times, from an estimated mean flow of approximately 4.4 $m^3/s$ to the current mean diverted flow of approximately 42 $m^3/s$ (based on 1975 to 2012 data).

Since 1974, the New Post Creek Diversion Dam has been operated by leaving the stop logs set at elevation 218.80 m. This allows OPG to maximize diversion flow while eliminating stop log operations at the diversion dam. When the headwater exceeds the elevation of the stop logs, water spills into the old channel of the Little Abitibi River. As a result, significantly lower flows currently occur in the Little Abitibi River downstream of the diversion dam than were present historically. Access to the diversion dam is by helicopter and a MNR–authorized winter trail.

The drainage area of New Post Creek is 319 $km^2$, whereas the drainage area of the Little Abitibi River upstream of the dam is approximately 2,706 $km^2$. This entire area of approximately 3,025 $km^2$ would be drained through New Post Creek when flow is not being passed through the dam on the Little Abitibi River.

Based on hydrological data between 1975 and 2012, greatest streamflow occurs during the spring freshet in May and June with the lowest flows occurring generally in the winter (see Table 2.4). The highest mean maximum and minimum monthly flows were 202.8 $m^3/s$ in May 2008 and 3.4 $m^3/s$ in September 1984, respectively. A maximum instantaneous flow of 270.226 $m^3/s$ was recorded on May 9, 2013, probably the highest on record. It should be noted that the 2013 gauge data are preliminary, with finalized data not available until early 2014.

Annual daily regulated flow hydrographs from 1973 to 2002 for the Little Abitibi River at New Post Creek Diversion Dam are presented in Figure 2.5. Annual flow metrics for this location are presented in Table 2.5.

**Table 2.4 Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River (1975 to 2012)[1]**

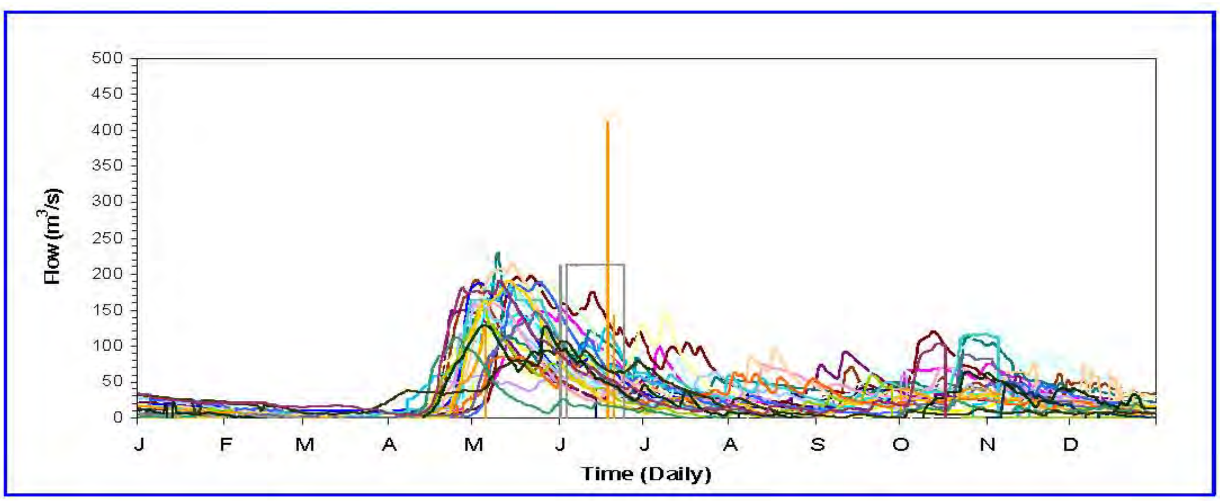
| Year | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1975** | 16.8 | 13.7 | 9.8 | 9.8 | 112.7 | 79.7 | 35.3 | 16.3 | 11.5 | 11.4 | 27.4 | 22.5 |
| **1976** | 17.2 | 11.6 | 9.1 | 40.7 | 151.4 | 60.8 | 22.6 | 27.7 | 22.1 | 39.7 | 25.3 | 18.0 |
| **1977** | 13.4 | 9.5 | 8.9 | 69.8 | 118.1 | 45.5 | 50.4 | 30.7 | 81.0 | 36.9 | 45.6 | 34.7 |
| **1978** | 24.8 | 12.1 | 8.2 | 8.0 | 161.3 | 171.0 | 108.1 | 36.4 | 50.7 | 107.5 | 48.0 | 27.0 |
| **1979** | 14.8 | 9.9 | 8.2 | 32.8 | 145.2 | 105.7 | 48.6 | 31.1 | 36.7 | 67.5 | 71.8 | 35.9 |
| **1980** | 22.0 | 14.4 | 11.4 | 37.4 | 160.3 | 77.6 | 30.7 | 30.2 | 32.7 | 45.4 | 42.1 | 28.2 |
| **1981** | 18.8 | 11.9 | 12.2 | 58.4 | 176.4 | 108.6 | 41.5 | 23.4 | 32.7 | 45.4 | 42.1 | 28.2 |
| **1982** | 22.1 | 13.6 | 5.9 | 11.1 | 163.4 | 50.5 | 44.7 | 39.2 | 51.0 | 83.5 | 98.6 | 52.5 |
| **1983** | 27.2 | 13.1 | 7.9 | 13.2 | 164.9 | 115.3 | 26.4 | 27.4 | 32.7 | 45.4 | 42.1 | 28.2 |
| **1984** | 16.3 | 10.5 | 9.6 | 50.0 | 88.1 | 75.3 | 92.2 | 18.5 | 3.4 | 42.8 | 42.1 | 28.2 |
| **1985** | 24.9 | 9.9 | 4.5 | 30.5 | 137.2 | 51.4 | 46.6 | 40.2 | 21.0 | 42.6 | 42.0 | 20.9 |
| **1986** | 18.8 | 11.9 | 12.2 | 37.4 | 140.0 | 46.3 | 42.7 | 60.0 | 46.2 | 62.2 | 38.3 | 20.3 |
| **1987** | 18.8 | 11.9 | 12.2 | 35.6 | 62.9 | 61.8 | 36.6 | 33.8 | 32.7 | 45.4 | 42.1 | 28.2 |
| **1988** | 18.9 | 12.5 | 10.6 | 31.9 | 202.2 | 61.3 | 34.3 | 73.7 | 41.8 | 45.0 | 40.5 | 28.2 |
| **1989** | 26.9 | 16.9 | 12.6 | 24.9 | 159.1 | 110.8 | 46.5 | 27.8 | 13.5 | 31.4 | 57.2 | 31.0 |
| **1990** | 18.7 | 12.2 | 10.8 | 38.5 | 159.1 | 99.7 | 59.7 | 56.9 | 40.8 | 51.1 | 42.1 | 28.2 |
| **1991** | 18.8 | 11.9 | 12.2 | 54.2 | 126.3 | 56.1 | 14.1 | 16.4 | 46.8 | 45.4 | 42.1 | 28.2 |
| **1992** | 18.8 | 11.9 | 12.2 | 39.8 | 191.3 | 49.6 | 25.7 | 15.2 | 29.0 | 42.6 | 37.9 | 25.2 |
| **1993** | 22.3 | 13.1 | 12.0 | 40.2 | 131.2 | 70.9 | 39.3 | 31.1 | 32.7 | 52.0 | 37.2 | 15.2 |
| **1994** | 18.8 | 11.9 | 12.2 | 32.0 | 97.0 | 81.3 | 46.4 | 73.3 | 44.7 | 39.2 | 38.6 | 27.9 |
| **1995** | 16.2 | 11.6 | 12.2 | 14.0 | 148.1 | 87.4 | 33.6 | 22.8 | 30.0 | 62.7 | 66.2 | 25.6 |
| **1996** | 14.9 | 12.5 | 12.2 | 40.2 | 131.2 | 70.9 | 39.3 | 31.1 | 32.7 | 45.4 | 42.1 | 28.2 |
| **1997** | 18.8 | 11.9 | 12.2 | 40.2 | 131.2 | 70.9 | 39.3 | 31.1 | 32.7 | 45.4 | 38.2 | 10.9 |
| **1998** | 9.5 | 11.9 | 12.2 | 61.9 | 38.9 | 17.9 | 20.9 | 31.1 | 29.5 | 15.8 | 11.0 | 13.8 |
| **1999** | 10.5 | 8.3 | 12.2 | 40.2 | 113.4 | 64.3 | 24.0 | 10.7 | 32.7 | 42.6 | 41.1 | 26.6 |
| **2000** | 28.6 | 18.0 | 10.8 | 38.6 | 78.9 | 89.7 | 45.3 | 15.0 | 5.5 | 8.7 | 9.6 | 9.1 |

**Table 2.4 Mean, Maximum and Minimum Monthly Flows ($m^3/s$) at New Post Creek Outlet to the Abitibi River (1975 to 2012)[1] (Cont'd)**

| Year | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | 5.9 | 5.5 | 11.1 | 61.9 | 118.6 | 30.9 | 26.2 | 9.7 | 41.2 | 48.4 | 44.6 | 45.9 |
| **2002** | 27.5 | 20.9 | 15.7 | 72.0 | 163.3 | 65.0 | 17.2 | 14.2 | 15.6 | 65.0 | 42.1 | 28.2 |
| **2003** | 18.8 | 11.9 | 12.2 | 40.2 | 132.0 | 41.6 | 44.5 | 73.6 | 73.6 | 94.5 | 41.0 | 28.2 |
| **2004** | 18.8 | 11.9 | 12.2 | 40.2 | 132.1 | 69.5 | 39.0 | 27.2 | 34.3 | 30.4 | 49.6 | 28.1 |
| **2005** | 26.3 | 13.3 | 13.2 | 57.9 | 119.0 | 31.8 | 18.4 | 31.1 | 32.2 | 76.0 | 68.0 | 49.4 |
| **2006** | 12.6 | 7.5 | 12.2 | 40.2 | 86.0 | 17.1 | 8.7 | 29.3 | 32.7 | 45.4 | 42.1 | 28.2 |
| **2007** | 25.4 | 11.9 | 12.2 | 44.4 | 86.5 | 149.7 | 57.5 | 17.7 | 27.4 | 30.6 | 35.9 | 30.7 |
| **2008** | 23.4 | 11.9 | 12.2 | 64.9 | 202.8 | 82.0 | 50.4 | 35.0 | 32.8 | 41.6 | 42.9 | 28.6 |
| **2009** | 21.9 | 14.5 | 11.6 | 25.0 | 195.7 | 87.2 | 78.2 | 44.0 | 13.5 | 10.3 | 20.2 | 27.4 |
| **2010** | 8.9 | 6.8 | 6.1 | 34.7 | 36.5 | 21.7 | 20.9 | 20.3 | 49.6 | 47.4 | 29.4 | 29.4 |
| **2011** | 16.4 | 9.1 | 6.2 | 22.8 | 142.5 | 85.4 | 27.7 | 13.6 | 10.9 | 15.3 | 27.7 | 17.5 |
| **2012** | 11.5 | 8.2 | 64.4 | 92.8 | 79.4 | 31.8 | 9.7 | 16.0 | 11.3 | 16.7 | 45.5 | 60.0 |
| **Mean** | 18.8 | 11.9 | 12.2 | 40.2 | 131.2 | 70.9 | 39.3 | 31.1 | 32.7 | 45.4 | 42.1 | 28.2 |
| **Maximum** | 28.6 | 20.9 | 64.4 | 92.8 | 202.8 | 171.0 | 108.1 | 73.7 | 81.0 | 107.5 | 98.6 | 60.0 |
| **Minimum** | 5.9 | 5.5 | 4.5 | 8.0 | 36.5 | 17.1 | 8.7 | 9.7 | 3.4 | 8.7 | 9.6 | 9.1 |

[1] Discharge data for the period January 1975 to October 2009 based on Ontario Hydro New Post Diversion Dam gauge data; November 2009 to December 2012 based on WSC gauge station 04ME005 provisional data (Location: 49°58'19"N; 81°30'43"W; approximately 1 km downstream of proposed intake weir location).

**Figure 2.5 Annual Daily Regulated Flow Hydrographs for the Little Abitibi River at New Post Creek Diversion Dam[1,2]**




[1] Source: OPG *et al*. (2006); based on 1973-2002 data.

[2] It should be noted that portions of two flow hydrographs are incorrect, i.e., the grey line shows a constant discharge for a period of time in June of one year which is not correct, and the peak flow of greater than 400 $m^3/s$ is very likely a false reading.

**Table 2.5 Annual Regulated Flow Metrics for the Little Abitibi River at New Post Creek Diversion Dam[1]**

| Descriptive Metric | Value |
|---|---|
| Drainage Area ($km^2$) | 2,702 |
| Mean Annual Flow ($m^3/s$) | 36.0 |
| 20% Time Exceeded Flow ($m^3/s$) | 54.4 |
| Median Flow ($m^3/s$) | 22.3 |
| 80% Time Exceeded Flow ($m^3/s$) | 7.8 |
| Month of Maximum Median Flow | May |
| Month of Minimum Median Flow | March |

[1] Source: OPG *et al.* (2006); based on 1973-2002 data.

#### *2.1.4.2 Morphology and Bathymetry*

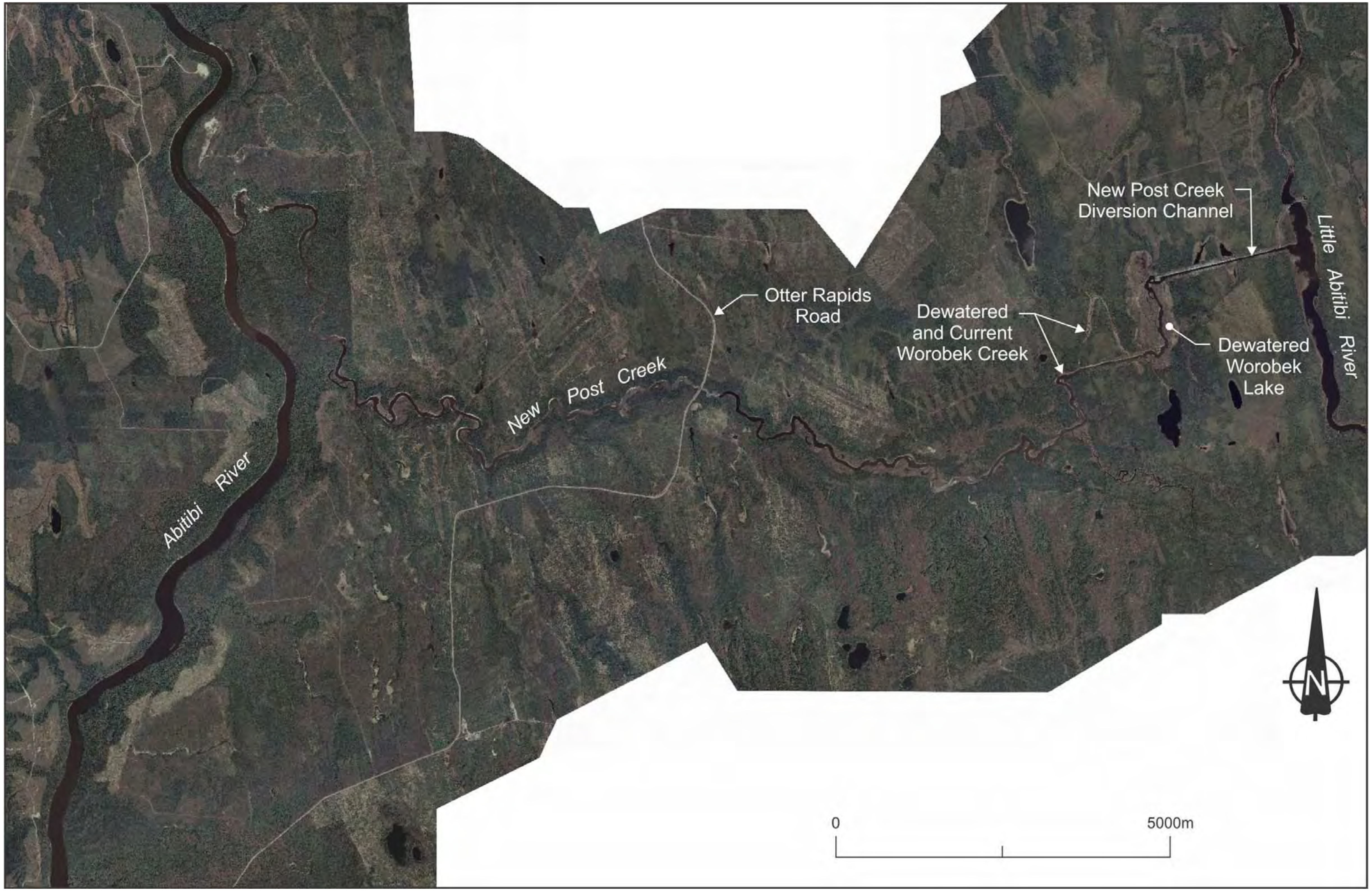
Pre-Diversion

Ontario Hydro (1961) undertook a pre-diversion reconnaissance of New Post Creek and its tributary Worobec Creek in late August 1961 to assess the potential effects of the proposed diversion. The upper section of Worobec Creek downstream of Worobec Lake flowed through a muskeg covered, undulating plain underlain by dense resistant glacial till. The stream valley was a broad shallow meander around glacial till ridges. The creek was approximately 2 m wide and up to 0.4 m deep with little flow. At low flows, it was confined to a narrow shallow channel eroded in alluvium but floored by the glacial till. During high flows the stream overflowed its banks and flooded the adjoining lower valley.

The New Post Creek Diversion Channel drained Worobek Lake and cut through the meander of Worobek Creek. The outline of Worobek Lake and the previous channel of Worobek Creek are visible on Figure 2.6.

Valley erosion in or along the north edge of the “so-called Takwata moraine”, composed predominantly of fine granular soils, was evident along the remainder of Worobec Creek and much of New Post Creek (Ontario Hydro, 1961). As these soils were more subject to erosion, the streams were eroding a deep narrow valley, with evidence of considerable erosion and/or deposition over some reaches.

**Figure 2.6 Post-diversion New Post Creek Morphological Characteristics**



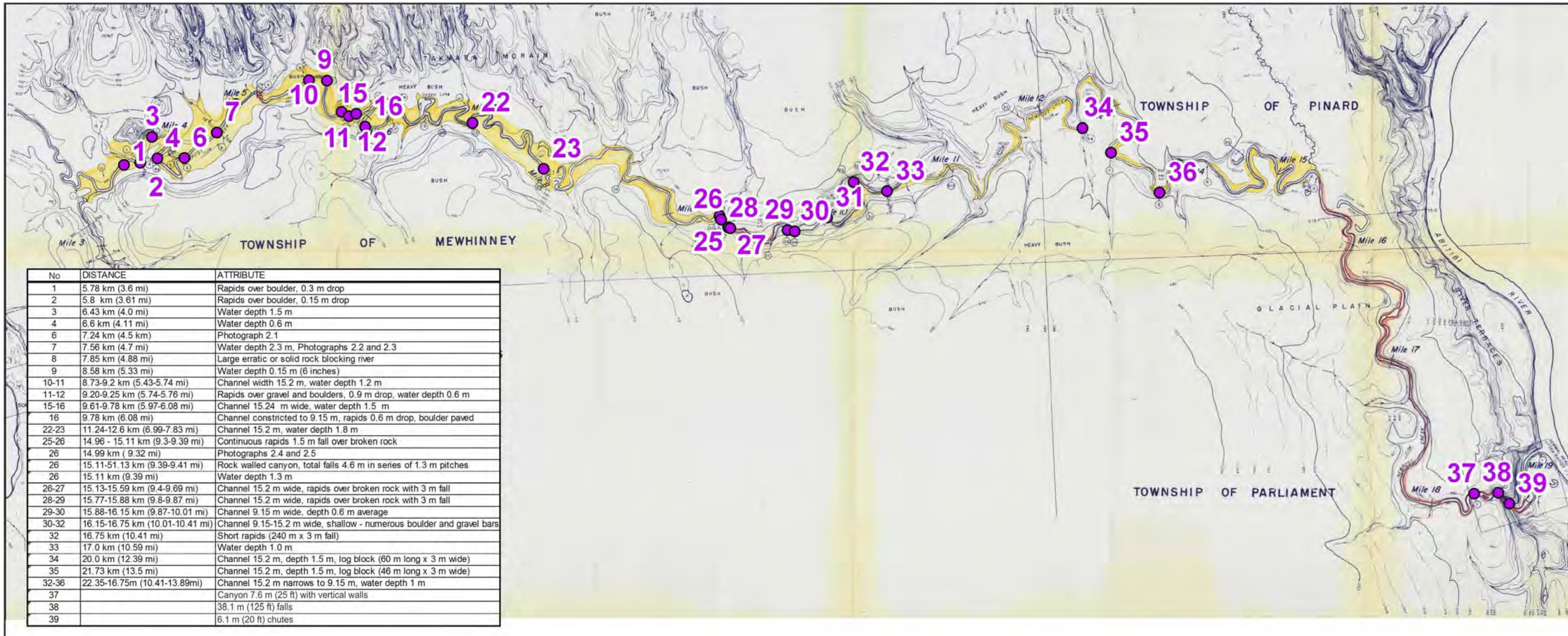
From the confluence of the two creeks to the rapids at Otter Rapids Road, the valley was broad, with extensive alluvial flats on either side of the channel. In this reach, the channel was generally approximately 15 m wide with water depths ranging from 1.2 to 1.8 m (see Figure 2.7). A number of rapids also occurred along this reach. Oxbow lakes and sharp “S”-shaped meanders, which were formative ox-bow lakes, were common. This reach was relatively stable with little evidence of severe erosion. Heavy forest cover generally extended to the channel edge with few woodfalls into the watercourse. Ontario Hydro (1961) opined that under conditions of increased flow and velocities due to the proposed diversion, “serious erosion may occur, “S”-shaped meanders may deepen and finally connect forming oxbows, and in this process many woodfalls would occur.” Water level elevation above the present stream would also result in extensive flooding into the dense forest on the adjacent broad alluvial flats.

From the rapids at Otter Rapids Road to approximately 7 km downstream, New Post Creek was eroding a deep narrow valley through generally unstable, easily eroded, fine granular soils. Along most of this reach, the watercourse was approximately 15 m wide with water depths of 1 to 1.5 m, frequently interrupted by shallow boulders and gravel swifts. Steep heavily wooded main valley slopes extended to the edge of the stream channel along most of this reach with narrow terraced alluvial flats occurring at some locations. The slopes were rendered unstable by undercutting at their toes resulting in slides and numerous woodfalls blocking the channel. Ontario Hydro (1961) indicated that under conditions of increased flow and velocities, these erosional processes would be accentuated.

Farther downstream to the waterfalls, New Post Creek flowed through a glacial till plain transected by easterly trending bedrock ridges. The main valley was broad and shallow. The stream channel was a series of swifts over bedrock with intervening channel widening to 12 to 15 m. Erosion effects were negligible with no woodfalls in the creek.

Figure 2.7 provides additional details on the morphology and bathymetry of New Post Creek prior to construction of the New Post Creek Diversion Channel.

**Figure 2.7 Morphology and Bathymetry of Pre-diversion New Post Creek[1]**




| No | DISTANCE | ATTRIBUTE |
|---|---|---|
| 1 | 5.78 km (3.6 mi) | Rapids over boulder, 0.3 m drop |
| 2 | 5.8 km (3.61 mi) | Rapids over boulder, 0.15 m drop |
| 3 | 6.43 km (4.0 mi) | Water depth 1.5 m |
| 4 | 6.6 km (4.11 mi) | Water depth 0.6 m |
| 6 | 7.24 km (4.5 km) | Photograph 2.1 |
| 7 | 7.56 km (4.7 mi) | Water depth 2.3 m, Photographs 2.2 and 2.3 |
| 8 | 7.85 km (4.88 mi) | Large erratic or solid rock blocking river |
| 9 | 8.58 km (5.33 mi) | Water depth 0.15 m (6 inches) |
| 10-11 | 8.73-9.2 km (5.43-5.74 mi) | Channel width 15.2 m, water depth 1.2 m |
| 11-12 | 9.20-9.25 km (5.74-5.76 mi) | Rapids over gravel and boulders, 0.9 m drop, water depth 0.6 m |
| 15-16 | 9.61-9.78 km (5.97-6.08 mi) | Channel 15.24 m wide, water depth 1.5 m |
| 16 | 9.78 km (6.08 mi) | Channel constricted to 9.15 m, rapids 0.6 m drop, boulder paved |
| 22-23 | 11.24-12.6 km (6.99-7.83 mi) | Channel 15.2 m, water depth 1.8 m |
| 25-26 | 14.96 - 15.11 km (9.3-9.39 mi) | Continuous rapids 1.5 m fall over broken rock |
| 26 | 14.99 km ( 9.32 mi) | Photographs 2.4 and 2.5 |
| 26 | 15.11-51.13 km (9.39-9.41 mi) | Rock walled canyon, total falls 4.6 m in series of 1.3 m pitches |
| 26 | 15.11 km (9.39 mi) | Water depth 1.3 m |
| 26-27 | 15.13-15.59 km (9.4-9.69 mi) | Channel 15.2 m wide, rapids over broken rock with 3 m fall |
| 28-29 | 15.77-15.88 km (9.8-9.87 mi) | Channel 15.2 m wide, rapids over broken rock with 3 m fall |
| 29-30 | 15.88-16.15 km (9.87-10.01 mi) | Channel 9.15 m wide, depth 0.6 m average |
| 30-32 | 16.15-16.75 km (10.01-10.41 mi) | Channel 9.15-15.2 m wide, shallow - numerous boulder and gravel bars |
| 32 | 16.75 km (10.41 mi) | Short rapids (240 m x 3 m fall) |
| 33 | 17.0 km (10.59 mi) | Water depth 1.0 m |
| 34 | 20.0 km (12.39 mi) | Channel 15.2 m, depth 1.5 m, log block (60 m long x 3 m wide) |
| 35 | 21.73 km (13.5 mi) | Channel 15.2 m, depth 1.5 m, log block (46 m long x 3 m wide) |
| 32-36 | 22.35-16.75m (10.41-13.89mi) | Channel 15.2 m narrows to 9.15 m, water depth 1 m |
| 37 | | Canyon 7.6 m (25 ft) with vertical walls |
| 38 | | 38.1 m (125 ft) falls |
| 39 | | 6.1 m (20 ft) chutes |

[1] Source: Ontario Hydro (1961).

**Photograph 2.1 Pre-diversion New Post Creek at KP 7.24 (see Figure 2.7) (looking downstream)**

**Photograph 2.2 Pre-diversion New Post Creek at KP 7.56 (see Figure 2.7) (looking upstream)**

**Photograph 2.3 Pre-diversion New Post Creek at KP 7.56 (see Figure 2.7) (looking downstream)**

**Photograph 2.4 Pre-diversion New Post Creek at KP 14.99 (see Figure 2.7) (looking upstream)**

**Photograph 2.5 Pre-diversion New Post Creek at KP 14.99 (see Figure 2.7) (looking downstream)**

<u>Post-diversion</u>

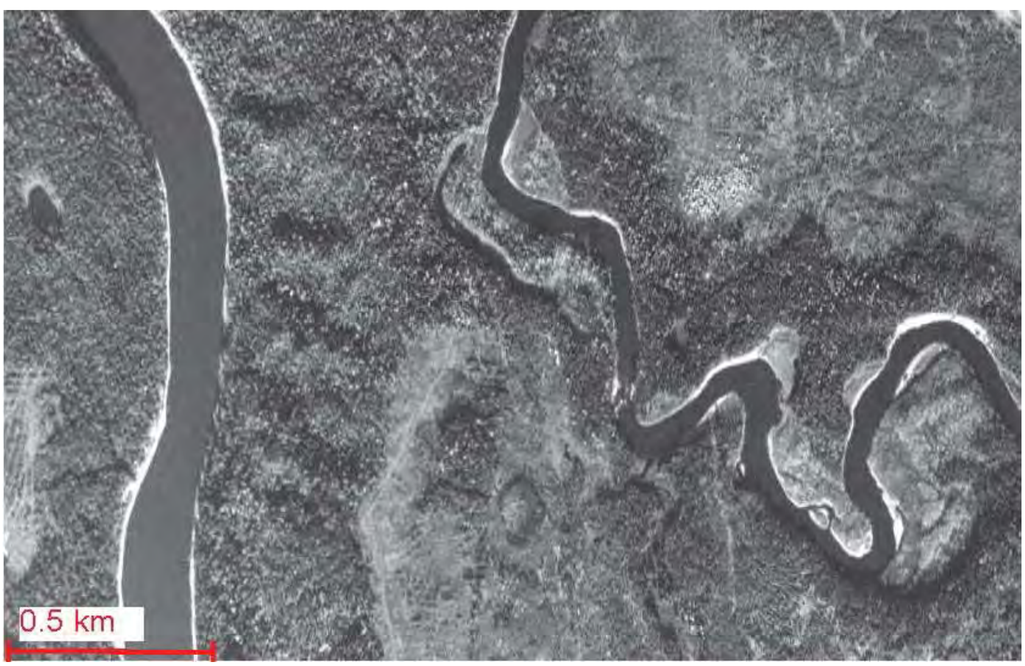
As indicated in Section 2.1.4.1, with the construction and operation of the New Post Creek Diversion Dam, flow in New Post Creek increased approximately nine times, from an estimated mean flow of less than 4 $m^3/s$ to the current mean diverted flow of approximately 35 $m^3/s$, based on 1975 to 2010 data (KGS Group, 2010). The majority of erosion of New Post Creek occurred in the 1960s upon initiation of the New Post Creek Diversion Dam operation with subsequent reduction of erosion rates. The increase in flow and associated erosion would have a dramatic impact on the channel morphology of the creek (Parish, 1998). The channel would have to adjust its cross-sectional form and planform pattern. The adjustments would create a wider and deeper channel. The spacing of pools and riffles would increase and channel sinuosity would decrease. These responses would occur over decades, and if the channel flows do not change further, a stable channel form would eventually be attained.

The magnitude of the impact of Little Abitibi River diversion on New Post Creek is clearly evident by comparing pre- and post-diversion aerial photographs presented as Photographs 2.6 and 2.7, respectively, indicating that much of the land adjacent to New Post Creek has been affected by inundation, flooding and erosion (Beacon, 2010).

Reaches of New Post Creek that are in bedrock have provided a natural base for maintenance of channel alignment and morphology.

**Photograph 2.6 Pre-diversion (1947) New Post Creek**


**Photograph 2.7 Post-diversion (2005) New Post Creek**



Based on review of air photos taken in 1971, 1978 and 1994, Parish (1998) reported that channel width has increased by 0.7 to 2.8 times along New Post Creek over the 23 years of coverage, which equates to an erosion rate of approximately 65 cm per year. In addition, channel length has decreased resulting in a lower sinuosity value (Table 2.6). This change was due to the increased flows and erosion of the sandy banks, which have cut-off meander bends, creating numerous oxbow lakes.

**Table 2.6 Summary of Changes to Channel Planform for a New Post Creek Reach[1]**

| Metric | 1971 | 1978 | 1994 |
|---|---|---|---|
| Channel Width (m) | 25 | 31 | 39 |
| Channel Length (m) | 2,265 | 2.186 | 1,980 |
| Sinuosity | 1.49 | 1.42 | 1.15 |

[1] Source: Parish (1998).

The alignment of present New Post Creek appears to follow closely the northern limit of the Pinard Moraine (see Terrestrial Environment TSD). The creek has cut down through the moraine material to form a broad floodplain with associated oxbows and braided channels at a number of locations. Because of the extensive downcutting and the nature of the creek valley, soils along much of the creek are described as being of Alluvial Plain origin.

New Post Creek has exposed shorelines with active toe erosion and scouring of the silt and sand slopes that range from a few metres in height, up to approximately 10 m (KGS Group, 2006).

A helicopter survey on May 5, 1998 of the shoreline conditions of the forebay upstream of the New Post Creek Diversion Dam, as well as the banks of a 0.5 km reach of the Little Abitibi River downstream of the dam, the diversion channel and New Post Creek downstream to its confluence with the Abitibi River. An estimated 67.050 km of lake shoreline and river bank were videotaped and evaluated within the study area (ERDE, 1998). Table 2.7 summarizes the composition of the shoreline surveyed. Within the study area, 61.265 km of the lake shoreline and watercourse bank are composed of mineral soils, whereas 3.680 km are composed of organic soils (upstream of the diversion dam). The remaining 2.705 km is bedrock outcrop and man-made structures. The shoreline and banks consist predominantly of mixed soils (71.0%) as a primary component and clay/silt (5.4%). The predominant vegetation types are trees (45.6%) and bush/shrub growth (24.5%), with bedrock occurring along 3.8% of the shoreline and banks (see Table 2.8). “Severe”, “active” (i.e., bank toe erosion or upper bank failure) and “moderate” erosion conditions were observed along 37.025 km (54.8%) and 12.915 (19.1%) of the shoreline and banks within the study area (see Table 2.9).

Much of the banks of New Post Creek are composed of highly erodible soils of mixed composition (ERDE, 1998). Mixed soils with a higher sand and/or cobble content tend to predominate in high and steep banks. Along those reaches where the banks are low and the creek channel is located towards the middle of the valley floor, the soils generally are of mixed composition with a high fines content. Bedrock outcrops are infrequent.

**Table 2.7 New Post Creek and Diversion Dam Shoreline Composition[1]**

| Shoreline Material Type | Shoreline Length (km) | % Shore |
|---|---|---|
| Boulders/Bedrock | 0.125 | 0.2 |
| Boulders/Gravel | 0.370 | 0.5 |
| Boulders/Mixed Soils | 0.245 | 0.4 |
| Clay/Silt | 3.675 | 5.4 |
| Concrete/Steel/Timber | 0.135 | 0.2 |
| Gravel | 0.165 | 0.2 |
| Landfill/Rip Rap/Boulders | 0.135 | 0.2 |
| Landfill/Mixed Soils | 0.070 | 0.1 |
| Mixed Soils/Bedrock | 0.140 | 0.2 |
| Mixed Soils/Cobbles | 16.075 | 23.8 |
| Mixed Soils/Fine Soils | 15.020 | 22.2 |
| Mixed Soils/Gravel | 1.865 | 2.8 |
| Mixed Soils/Sand | 4.130 | 6.1 |
| Mixed Soils/Till | 3.680 | 5.4 |
| Organics/Mixed Soils | 1.860 | 7.0 |
| Rock Outcrop/Bedrock | 2.579 | 3.8 |
| Sand | 0.695 | 1.0 |
| Sand/Boulders | 0.875 | 1.3 |
| Sand/Fine Soils | 1.030 | 1.5 |
| Sand/Gravel | 0.539 | 0.8 |
| Sand/Mixed Soils | 5.315 | 7.9 |
| TOTAL | 67.650 | 100.00 |

[1] Source: ERDE (1998).

**Table 2.8 New Post Creek and Diversion Dam Shoreline Vegetation Type[1]**

| Vegetation Type | Shoreline Length (km) | % Shore |
|---|---|---|
| Bush/Grass | 2.200 | 3.3 |
| Bush/Offshore Vegetation | 0.275 | 0.4 |
| Bush/Shrub Growth | 16.590 | 24.5 |
| Bush/Trees | 5.925 | 8.8 |
| Grass/Pasture/Farmland | 0.220 | 0.3 |
| No Vegetative Cover | 1.245 | 1.8 |
| Trees (moderate/dense) | 30.915 | 45.6 |
| Trees/Bush | 3.085 | 4.6 |
| Trees/Grass/Pasture | 0.055 | 0.1 |
| Trees/Offshore Vegetation | 1.130 | 1.7 |
| Trees/Wetland | 0.965 | 1.4 |
| Wetland | 2.475 | 3.7 |
| Unclassified (bedrock) | 2.570 | 3.8 |
| TOTAL | 67.650 | 100.0 |

[1] Source: ERDE (1998).

**Table 2.9 New Post Creek and Diversion Dam Shoreline Erosion Conditions[1]**

| Shoreline Erosion/Failure Condition | Shoreline Length (km) | % Shore |
|---|---|---|
| No Erosion (bedrock) | 0.500 | 0.7 |
| Very Minor (acceptable) | 13.850 | 20.5 |
| Very Minor/Old Scar | 0.790 | 1.1 |
| Moderate (active) | 10.760 | 15.9 |
| Moderate/Active Failure | 1.075 | 1.6 |
| Moderate/Old Scar | 1.080 | 1.6 |
| Severe (excessive) | 0.265 | 0.4 |
| Severe/Active Failure | 36.760 | 54.4 |
| Unclassified (bedrock) | 2.570 | 3.8 |
| TOTAL | 67.650 | 100.0 |

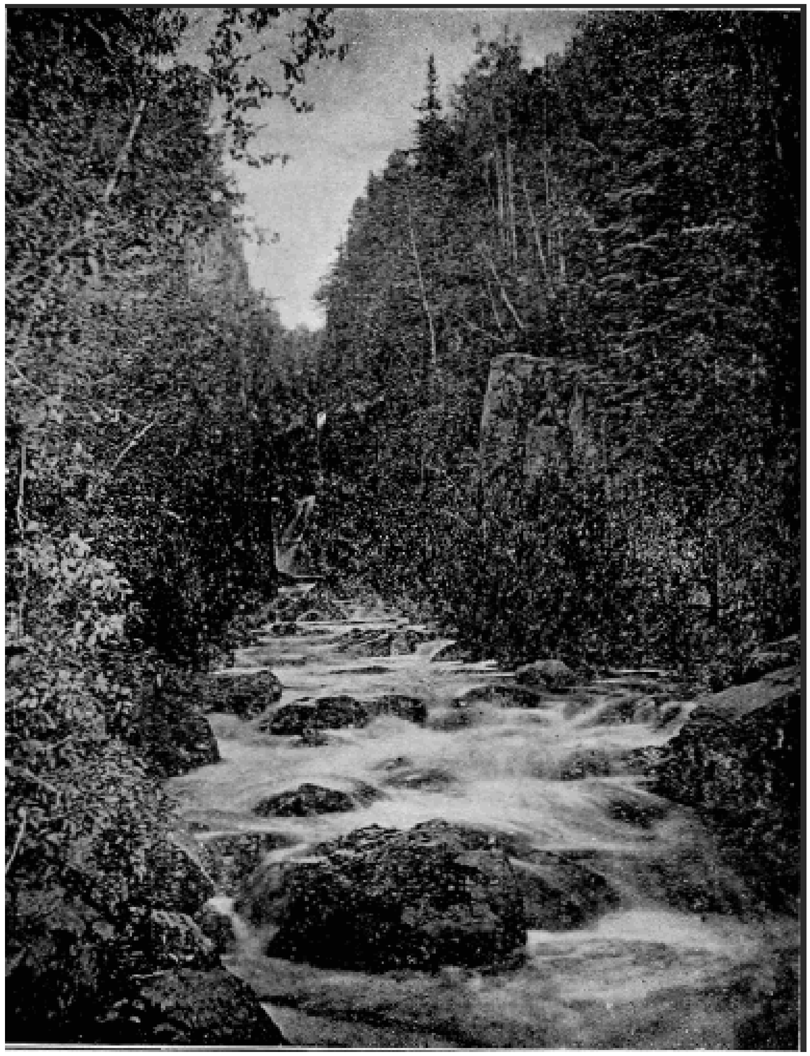
[1] Source: ERDE (1998).

New Post Creek waterfalls consists of a 170 m long stretch of steep rapids at its upstream end, a vertical falls that drops approximately 40 m, an 8 to 19 m wide narrow chute that is 210 m long with several smaller waterfalls, and some very shallow rapids about 140 m long at the downstream end (Coker and Portt, 2013a). Photograph 2.8 depicts the waterfalls on May 26, 2010 when water flow was 30.8 $m^3$/s.

**Photograph 2.8 New Post Creek Waterfalls, May 26, 2010, Discharge = 30.8 $m^3$/s**

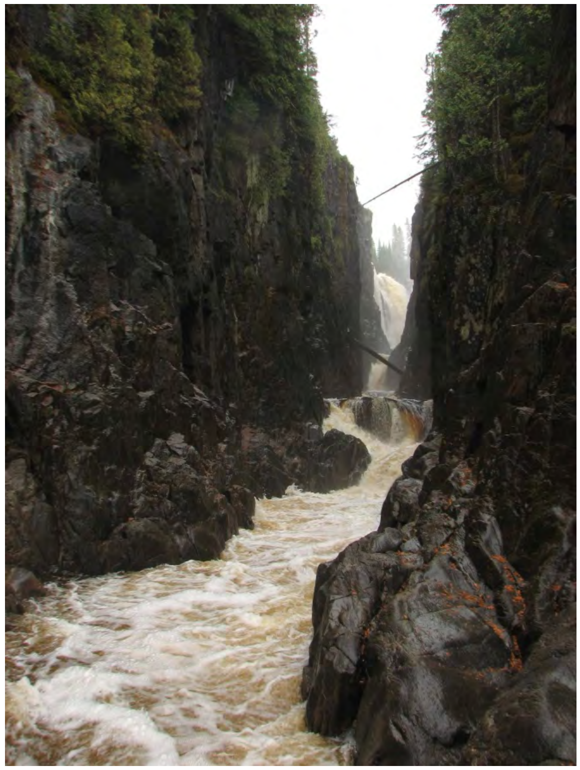
A reduction of water flowing over New Post Creek waterfalls due to the proposed New Post Creek Project would result in flows more typical of natural conditions as recalled by TTN Elders (P. Archibald Sr., TTN, 2011, pers. comm.). As described by Bell (1904), "an interesting fall is that on the Blue Water river or New Post brook just behind New Post. At this point the small stream enters the Abitibi with an almost vertical fall of ninety feet, flowing directly over the edge of the plateau in a veritable hanging valley". Photograph 2.9 taken in 1899 shows New Post Creek waterfalls and the rapids at its base prior to flow diversion.

**Photograph 2.9 New Post Creek Waterfalls, 1899 (Bell, 1904)**



Photograph 2.10 was taken on October 28, 2009 from approximately the same location as that taken in 1899 (Photograph 2.9) of New Post Creek at the mouth of the rock canyon. Based on comparison of the two photographs, it is evident that the boulders and cobble that can be seen in the streambed in the 1899 photograph foreground have been scoured down by at least 5 m. As indicated by Bell (1904), the vertical falls was approximately 90 feet (30 m) in 1899 compared to approximately 40 m in 2009 (Coker and Portt, 2013a). The shape of the waterfalls in the 1899 photograph suggests that the water level at its base was just below the log wedged on an angle within the canyon shown in the 2009 photograph. Downstream of the wedged log, the additional step falls and the deep channel in the foreground of the 2009 photograph are the result of scouring that has occurred since the diversion in 1963. As a result, the tops of the canyon sides and associated trees appear to be much higher in the 2009 photograph due to the scoured (lower) creek bed.

**Photograph 2.10 New Post Creek Waterfalls, October 28, 2009, Discharge = 11.26 $m^3/s$**



A detailed description of New Post Creek morphology and bathymetry from the upstream inundation limit to its confluence with the Abitibi River is provided in Section 2.2.6.1.

## 2.2 AQUATIC ENVIRONMENT RESOURCES

### 2.2.1 Water Quality

Water quality data are available for the Abitibi River near Onakawana approximately 75 km downstream of the proposed Project powerhouse location based on studies undertaken as part of the EA of the proposed lignite mine and power development (Lammers *et al*., 1972; MOE, 1972; EAG, 1981). Water quality surveys of the Moose River system, including the Abitibi River, have also been undertaken by the MNR (Brousseau and Goodchild, 1989).

Based on these studies, water quality in the Abitibi River and Little Abitibi River is relatively good (see Table 2.10), reflective of the lack of major contaminant sources in the drainage basin. However, untreated water was not suitable for drinking based on microbiological criteria. The pH was generally within the Provincial Water Quality Objective (PWQO) range of 6.5 to 8.5. The water was moderately soft and buffered, with alkalinity generally between 40 and 50 mg/L. Water colour values were somewhat elevated, with the natural yellow-brown colour reflecting high levels of humic acids. As the Abitibi River system originates in the Great Clay Belt (see Figure 2.2), turbidity levels were elevated. Cation and anion concentrations were low.

Concentrations of nutrients and chlorophyll were higher than those in the more oligotrophic waters of the Canadian Shield to the south. Total phosphorus (TP) concentrations in the Abitibi River exceeded the interim PWQO of 0.030 mg/L to avoid excessive aquatic plant growth, but were below the interim PWQO in the Little Abitibi River. Iron concentrations were consistently above and generally below the PWQO in the Abitibi River and Little Abitibi River, respectively. Total aluminum, cadmium and mercury concentrations also approached or exceeded their respective PWQOs.

**Table 2.10 Abitibi River and Little Abitibi River Water Quality Data**

| Parameter (mg/L unless otherwise indicated) | Abitibi River[1] | Abitibi River[2] | Little Abitibi River[1] | PWQO[3] |
|---|---|---|---|---|
| Dissolved Oxygen (D.O.) | n/a[4] | 7.0(2.2) (3.6-14.4)[5] | n/a | -[6] |
| pH (units) | 8.0 | 7.3 (6.9-8.7)[5] | n/a | 6.5-8.5 |
| Colour (Units)[1] (Hazen Units)[2] | 150 | 70 | 40-85 | - |
| Turbidity (JTU)[1] (FTU)[2] | 8-40 | 40(13) | 10-25 | -[7] |
| Conductivity (µmhos/cm)[1] (µS/cm)[2] | 128 | 121(16) | 90-121 | - |
| Alkalinity (as $CaCO_3$) | 12-71 | 48(5) | 44-49 | -[8] |
| Total Dissolved Solids (TDS) | 140 | 81[9] | n/a | - |
| Tannins | 0.5-3.5 | n/a | 0.5-1 | - |
| Total Unfiltered Carbon | n/a | 14.1(1.1) | n/a | - |
| Dissolved Organic Carbon | n/a | 15.7(2.9) | | - |
| Total Kjeldahl Nitrogen (as N) | 0.36-1.1 | 0.59(0.24) | 0.27-0.40 | - |
| Nitrate (as N) | <0.01-0.14 | n/a | <0.01-0.02 | - |
| Nitrite + Nitrate (as N) | n/a | 0.083(0.061) | n/a | - |
| Total Phosphorus | 0.034-0.13 | 0.079(0.102) | 0.012-0.022 | -[10] |
| Filtered Reactive Orthophosphate | n/a | 0.026(0.049) | n/a | - |
| Chloride | 1-8 | n/a | 1 | - |
| Sulphate | <5-25 | n/a | <5-14 | - |
| Calcium | 8-26 | n/a | 14-17 | - |
| Magnesium | 2-7 | n/a | 2-4 | - |
| Potassium | 0.5-0.6 | n/a | - | - |
| Sodium | 1-4 | n/a | 0.8-1 | - |
| Silica | 4.3-7.9 | n/a | <0.1-3.4 | - |
| Iron | 0.85-4.0 | n/a | 0.15-0.35 | 0.300 |

1 Lammers *et al*. (1972).
2 Brousseau and Goodchild (1989); geometric mean (standard deviation).
3 PWQO=Provincial Water Quality Objective (MOEE, 1994).
4 n/a = not analyzed.
5 Range.
6 For warmwater biota, D.O. concentrations of 4 mg/L, 5 mg/L, 6 mg/L and 7 mg/L at water temperatures of 20-25°C, 10-15°C, 5°C and 0°C, respectively.
7 Suspended matter should not be added to surface water in concentrations that would change the natural Secchi disc reading by more than 10%.
8 Alkalinity should not be decreased by more than 25% of the natural concentration.
9 Calculated from mean conductivity value using formula: TDS = 0.666 x conductivity (25°C).
10 Interim PWQO to avoid nuisance concentrations of algae in lakes, average TP concentrations for the ice-free period should not exceed 0.020 mg/L. Excessive plant growth in rivers and streams should be eliminated at a TP concentration below 0.030 mg/L.

In general, the concentrations of most parameters in the Little Abitibi River were lower than in the Abitibi River.

The MOE (1972) reported that high turbidity in the Abitibi River due to fine particulate sediment reduced visibility in the water to 15 to 20 cm. D.O. concentrations ranged from 7 to 10 mg/L with a Biological Oxygen Demand of 0.6 mg/L based on one sample.

EAG (1981) reported that water quality in the Abitibi River was moderately poor primarily due to fecal bacteria levels and elevated concentrations of dissolved and suspended matter rendering the water unfit for drinking, unless treated. The water was slightly alkaline, with lowest pH associated with high discharge. There was similar evidence of dilution of other parameters, e.g., hardness, alkalinity and conductivity, by precipitation or spring runoff, whereas the concentrations of other parameters increased, e.g., turbidity, total suspended solids (TSS) and apparent colour. As indicated in Table 2.11, TSS concentrations generally increase with greater discharge due to accelerated soil erosion, coupled with bed sediment resuspension. The TSS concentrations are generally too low to limit fish productivity. Nutrient concentrations, especially phosphorus and nitrogen, were well above levels necessary to promote nuisance algal blooms and aquatic plant growth. Anion/cation and nutrient concentrations were highest under the ice in April, and lowest during high runoff in June. Iron and manganese concentrations were high in unfiltered samples. The iron and aluminum concentrations exceeded their respective PWQOs.

**Table 2.11 TSS Concentrations in the Abitibi River near Onakawana[1]**

| Sampling Date | Discharge ($m^3/s$) | TSS (mg/L) |
|---|---|---|
| July 27, 1978 | 281 | 46 |
| May 16, 1983 | 1,360 | 120 |
| August 4, 1983 | 239 | 4 |
| October 30, 1983 | 303 | 6 |
| May 7, 1986 | 1,080 | 81 |
| July 9, 1986 | 129 | 49 |
| April 30 1987 | 219 | 129 |
| November 11, 1987 | 338 | 84 |
| May 15, 1988 | 1,640 | 139 |
| August 18, 1988 | 1,700 | 141 |
| May 13, 1989 | 951 | 141 |
| November 1, 1990 | 885 | 66 |
| May 22, 1992 | 765 | 43 |
| August 9,1992 | 269 | 59 |
| May 9, 1993 | 1,250 | 98 |
| May 14, 1994 | 278 | 54 |

[1] Source: www.wsc.ec.gc.ca/sedat/sedflo/WEBfrmInstReport_e.cfm

Table 2.12 presents TSS concentrations in New Post Creek based on sampling at the proposed intake location and the Otter Rapids Road bridge. The TSS concentrations were below the analytical detection limit of 5.0 mg/L at a low flow of 12.26 $m^3/s$. TSS concentrations were higher during higher flows but were variable with no apparent direct relationship.

**Table 2.12 TSS Concentrations in New Post Creek[1]**

| Sampling Date | No. of Samples | Average TSS Concentration (mg/L) | Flow ($m^3/s$) |
|---|---|---|---|
| May 26, 2011 | 2 | 28 (23-33)[2] | 124 |
| June 4, 2011 | 2 | 190 (151-229) | 125 |
| June 6, 2011 | 4 | 68.5 (46-87) | 146 |
| September 28, 2011 | 14 | <5 | 12 |
| April 4, 2012 | 15 | 32 (21-41) | 133 |
| May 7, 2013 | 9 | 225 (148-317) | 260 |

[1] Source: KGS Group (2013e).
[2] (Range).

Based on bed load sampling in November 2011, KGS Group (2013e) determined that sediment movement by bed load does not occur at the proposed intake location at flows of 13 $m^3$/s or less. Bed load sampling during the spring of 2012 and 2013 was aborted due to equipment malfunction and treacherous flow conditions, respectively.

The MOE requested CRP/OPG to undertake seasonal water quality monitoring in New Post Creek at the proposed Project intake location based on the MOE, Northern Region, “Guidance for Conducting Baseline and Post-Development Monitoring of Water Quality and Fish Tissue for Proposed Waterpower Projects”. Water samples were collected from New Post Creek near the proposed Project intake location on four occasions: November 2 and 17, 2011, May 24, 2012 and September 19, 2012. The concentrations of most parameters were below their respective PWQOs or within the range found in uncontaminated waters in northern Ontario (see Table 2.13).

**Table 2.13 New Post Creek Water Quality Data**

| Parameter (mg/L unless otherwise indicated) | Nov 2, 2011 | Nov 17, 2011 | May 24, 2012 | Sep 19, 2012 | PWQO[1] |
|---|---|---|---|---|---|
| pH (units) | 7.85 | 7.65 | 7.56 | 8.04 | 6.5-8.5 |
| Colour (TCU) | 153 | <5[2] | 137 | 92 | - |
| Turbidity (NTU) | 5.5 | 5.4 | 3.5 | 3.1 | -[3] |
| Conductivity (µS/cm) | 109 | 116 | 95 | 146 | - |
| Alkalinity (as $CaCO_3$) | 62 | 56 | 49 | 78 | -[4] |
| Bicarbonate (as $CaCO_3$) | 62 | 56 | 49 | 78 | - |
| Carbonate (as $CaCO_3$) | <5 | <5 | <5 | <5 | - |
| Hydroxide (as $CaCO_3$) | <5 | <5 | <5 | <5 | - |
| Hardness (as $CaCO_3$) | 60 | 67 | 52 | 82 | - |
| TDS | 108 | 100 | 186 | 100 | - |
| Total Organic Carbon | 19.2 | 20.4 | 15.3 | 11.8 | - |
| Dissolved Organic Carbon | 18.1 | n/a[5] | 12.6 | 11.8 | - |
| Ammonia (as N) | 0.08 | 0.07 | <0.02 | 0.08 | -[6] |
| Nitrite (as N) | <0.05 | <0.05 | <0.05 | <0.05 | - |
| Nitrate (as N) | <0.05 | <0.05 | <0.05 | <0.05 | - |
| Total Phosphorus | 0.07 | <0.05 | <0.05 | 0.08 | -[7] |
| Ortho Phosphate (as P) | <0.10 | <0.10 | <0.10 | <0.10 | - |
| Chloride | 0.49 | 0.46 | 0.39 | 0.49 | - |

**Table 2.13 New Post Creek Water Quality Data (Cont'd)**

| Parameter (mg/L unless otherwise indicated) | Nov 2, 2011 | Nov 17, 2011 | May 24, 2012 | Sep 19, 2012 | PWQO[1] |
|---|---|---|---|---|---|
| Fluoride | <0.05 | <0.05 | <0.05 | <0.05 | - |
| Bromide | <0.05 | <0.05 | <0.05 | <0.05 | - |
| Sulphate | 1.40 | 1.94 | 1.22 | 1.66 | - |
| Calcium | 17.4 | 19.5 | 15.4 | 23.7 | - |
| Magnesium | 3.93 | 4.52 | 3.38 | 5.51 | - |
| Potassium | 0.45 | 0.39 | 0.37 | 0.51 | - |
| Sodium | 1.08 | 1.10 | 0.89 | 1.42 | - |
| Reactive Silica | 3.49 | 4.86 | 2.91 | 3.74 | - |
| Aluminum | 0.088 | 0.101 | 0.189 | 0.221 | 0.075[8] |
| Antimony | <0.003 | <0.003 | <0.003 | <0.003 | 0.020[9] |
| Arsenic | <0.003 | <0.003 | <0.003 | <0.003 | 0.100 |
| Barium | 0.005 | 0.006 | 0.005 | 0.008 | - |
| Beryllium | <0.001 | <0.001 | <0.001 | <0.001 | 0.011 |
| Boron | <0.010 | <0.010 | <0.010 | <0.010 | 0.200[9] |
| Cadmium | <0.002 | <0.002 | <0.002 | <0.002 | 0.0002[9] |
| Chromium | <0.003 | <0.003 | <0.003 | <0.003 | 0.100 |
| Cobalt | <0.001 | <0.001 | <0.001 | <0.001 | 0.0006[9] |
| Copper | <0.003 | 0.006 | <0.003 | <0.003 | 0.005 |
| Iron | 0.168 | 0.206 | 0.189 | 0.181 | 0.300 |
| Lead | <0.002 | <0.002 | <0.002 | <0.002 | 0.020 |
| Manganese | 0.013 | 0.015 | 0.015 | 0.016 | - |
| Mercury (µg/L) | <0.1 | <0.1 | <0.1 | <0.1 | 0.2[10] |
| Molybdenum | <0.002 | <0.002 | <0.002 | <0.002 | 0.010[9] |
| Nickel | <0.003 | <0.003 | <0.003 | <0.003 | 0.025 |
| Selenium | <0.004 | <0.004 | <0.004 | <0.004 | 0.100 |
| Silver | <0.002 | <0.002 | <0.002 | <0.002 | 0.0001 |
| Strontium | 0.029 | 0.034 | 0.025 | 0.041 | - |
| Thallium | <0.006 | <0.006 | <0.006 | <0.006 | 0.0003[9] |
| Tin | <0.002 | <0.002 | <0.002 | <0.002 | - |
| Titanium | 0.004 | 0.004 | 0.005 | 0.007 | - |
| Tungsten | n/a | n/a | n/a | <0.010 | 0.030[9] |
| Uranium | <0.002 | <0.002 | <0.002 | <0.002 | 0.0005[9] |
| Vanadium | <0.002 | <0.002 | <0.002 | <0.002 | 0.0007[9] |
| Zinc | 0.025 | 0.038 | 0.027 | 0.025 | 0.030 |
| Zirconium | n/a | n/a | n/a | <0.004 | 0.004[9] |

1 PWQO=Provincial Water Quality Objective (MOEE, 1994).
2 Erroneous analytical result.
3 Suspended matter should not be added to surface water in concentrations that would change the natural Secchi disc reading by more than 10%.
4 Alkalinity should not be decreased by more than 25% of the natural concentration.
5 n/a = not analyzed.
6 Based on pH and temperature, the total ammonia concentration was below the PWQO of 0.020 mg/L for un-ionized ammonia.
7 Interim PWQO: to avoid nuisance concentrations of algae in lakes, average TP concentrations for the ice-free period should not exceed 0.020 mg/L. Excessive plant growth in rivers and streams should be eliminated at a TP concentration below 0.030 mg/L.
8 Based total aluminum measured in clay-free samples.
9 Interim PWQO.
10 In a filtered water sample.

The TP concentrations on November 2, 2011 and September 19, 2012 were above the interim PWQO of 0.030 mg/L to avoid excessive plant growth in watercourses. For the November 17, 2011 and May 24, 2012 samples, the analytical detection limit for TP was above the interim PWQO. The elevated TP concentrations are likely due to the decomposition of organic matter. Excessive plant growth is unlikely in New Post Creek due to the elevated turbidity levels. The U.S EPA (1976) reported a maximum desirable TP concentration of 0.10 mg/L in streams or other flowing waters not discharging directly to lakes or impoundments for the prevention of plant nuisances.

The aluminum concentrations were above the PWQO of 0.075 mg/L; however, this PWQO is based on clay-free samples. For cadmium, cobalt, silver, thallium, uranium and vanadium, the analytical detection limits were above the respective PWQO or interim PWQOs. The copper and zinc concentrations on November 17, 2011 were slightly above their respective PWQOs.

Turbidity levels are generally higher in the Great Clay Belt section compared to the upstream Canadian Shield section of the Abitibi River due to increased concentration of suspended clay particles, particularly during the spring freshet and rainfall events.

### 2.2.2 Sediments

Sediments in the Abitibi River within the Great Clay Belt can be expected to be predominantly silt and clay, particularly in the in-stream lakes and slower moving sections of the river.

Based on four samples, surficial sediment in New Post Creek is predominantly sand comprising 59.2 to 94.5% of the particle size distribution (Table 2.14). Clay is a minor component (range of 1.88 to 5.63%).

**Table 2.14 Particle Size Distribution in New Post Creek Surficial Sediment[1]**

| Sample Location | Particle Size Distribution | | | |
|---|---|---|---|---|
| | % Gravel (>2 mm) | % Sand (2.0 - 0.063 mm) | % Silt (0.063 mm - 4 μ) | % Clay (<4 μ) |
| Intake – Left Bank | <0.10 | 59.2 | 35.2 | 5.63 |
| Intake – Middle of Channel | <0.10 | 94.5 | 3.61 | 1.88 |
| Intake – Right Bank | 17.3 | 73.6 | 6.86 | 2.27 |
| ~ 5 km Upstream of Intake | <0.10 | 63.8 | 32.4 | 3.85 |

[1] Source: KGS Group (2013e).

A more detailed description of substrate type and distribution in New Post Creek and the Abitibi River in the area of the proposed tailrace location is provided in Section 2.2.6.1.

EAG (1981) reported that sediment quality in the Abitibi River near Onakawana was good. Nutrient and metal concentrations were typical for northern watercourses unaffected by anthropogenic activities, with the values varying according to the grain size distribution of the sample. Humic and fulvic acids were present in about equal concentrations in the sediments with the values for humic acids higher.

Based on the good water quality of New Post Creek (see Table 2.12), the sediments can be expected to have low concentrations of contaminants.

### 2.2.3 Aquatic Vegetation

Within the Great Clay Belt, aquatic vegetation in the main channel of the Abitibi River is sparse, often consisting of a narrow fringe less than 1 m wide (Seyler, 1997). This is due to the steep-sided channel morphology, turbidity and annual water-level fluctuations which range from 2 to 4 m.

Table 2.15 lists the 22 aquatic macrophyte species identified within the proposed New Post Creek Project study area. Of these, 20 are designated by the MNR Natural Heritage Information Centre (NHIC, 2010) as S5, i.e., secure – common, widespread and abundant in the Province; one is designated as S4?, i.e., apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors (? indicates rank uncertain); and one is designated as S4S5, i.e., apparently secure to secure.

**Table 2.15 Aquatic Macrophyte Species Observed within the Proposed Project Study Area**

| Scientific Name | Common Name | Provincial Status[1] |
|---|---|---|
| **Equisetaceae**<br>*Equisetum arvense* | **Horsetail Family**<br>Field Horsetail | S5 |
| *E. fluviatile* | Water Horsetail | S5 |
| **Typhaceae**<br>*Typha latifolia* | **Cattail Family**<br>Broad-leaf Cattail | S5 |
| **Sparganiaceae**<br>*Sparganium natans* | **Bur-reed Family**<br>Small Bur-reed | S5 |
| **Najadaceae**<br>*Potamogeton gramineus* | **Pondweed Family**<br>Grassy Pondweed | S5 |
| *P. richardsonii* | Redheadgrass | S5 |
| **Alismataceae**<br>*Sagittaria cuneata* | **Water-Plantain Family**<br>Wapatum Arrowhead | S4? |
| *S. latifolia* | Broadleaf Arrowhead | S5 |
| **Hydrocharitaceae**<br>*Elodea canadensis* | **Frogbit Family**<br>Broad Waterweed | S5 |
| *Vallisneria americana* | Eel-grass | S5 |
| **Cyperaceae**<br>*Carex lacustris* | **Sedge Family**<br>Lake-bank Sedge | S5 |
| *C. lasiocarpa* | Slender Sedge | S5 |
| *C. stipata* | Stalk-grain Sedge | S5 |
| *C. stricta* | Tussock Sedge | S5 |

**Table 2.15 Aquatic Macrophyte Species Observed within the Proposed Project Study Area (Cont'd)**

| Scientific Name | Common Name | Provincial Status[1] |
|---|---|---|
| *Eleocharis* sp. | Spikerush species | -[2] |
| *Scirpus cyperinus* | Cottongrass Bulrush | S5 |
| **Juncaceae** | **Rush Family** | |
| *Juncus dudleyi* | Dudley's Rush | S5 |
| *J. nodosus* | Knotted Rush | S5 |
| **Polygonaceae** | **Smartweed Family** | |
| *Polygonum amphibium* | Water Smartweed | S5 |
| *Rumex orbiculatus* | Water Dock | S4S5 |
| **Nymphaeaceae** | **Pond-lily Family** | |
| *Nuphar lutea* ssp. *variegata* | Yellow Cowlily | S5 |
| **Apiaceae** | **Carrot Family** | |
| *Cicuta bulbifera* | Bulb-bearing Water-hemlock | S5 |
| *Sium suave* | Hemlock Water-parsnip | S5 |

[1] NHIC (2010): S5 = secure; S4S5 = apparently secure to secure; S4? = apparently secure, rank uncertain.
[2] Status not available as taxonomy only at genus level.

The two horsetail, water-plantain and pondweed species, Yellow Cowlily, Small Bur-reed, Broad Waterweed and the sedge species occur within the New Post Creek floodplain. Eel-grass was present in the unnamed tributary which discharges in New Post Creek approximately 150 m upstream of the proposed intake weir location. No aquatic macrophytes were observed in New Post Creek at the proposed intake weir location (see Photograph 1.1), or in the Abitibi River at the proposed tailrace location (see Photograph 1.2).

#### *2.2.3.1 Significant Plant Species*

Undisturbed areas of native vegetation within the proposed New Post Creek Project area have the potential to support plant species which are at risk, i.e., species which are designated with significant status under federal and/or provincial legislation. Federally, species at risk (SAR) are recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2012) and are protected under the *Species at Risk Act* (*SARA*). Provincially these are recognized by the Committee on the Status of Species at Risk in Ontario (COSSARO) under the *Endangered Species Act* (*ESA*), in conjunction with the Species at Risk in Ontario (SARO) List (MNR, 2013). Species listed as provincially Endangered or Threatened and their habitat are afforded protection under the *ESA*.

An updated *ESA* came into effect on June 30, 2008, providing broader protection of SAR and their habitat and a stronger commitment to recovery and effective enforcement. Once a species is designated to be at risk, it is included on the SARO List. All species that are considered Endangered or Threatened and their critical habitats are now legally protected.

None of the aquatic macrophyte species identified during the field surveys are designated as SAR by COSEWIC (2012) or COSSARO (MNR, 2013) (see Table 2.15).

Similarly, based on examination of the MNR Natural Heritage Information Centre (NHIC, 2012) and *SARA* Schedule 1 Species at Risk Web Mapping Application (Environment Canada, CWS, 2010/2011) databases, no plant SAR have been documented within the proposed Project local study area.

Three aquatic plant species considered to be significant by the MNR were listed in the Abitibi River WMP (see Table 2.16). Slender Bulrush and Northern Mudwort are designated by the NHIC (2010) as S3, i.e., vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors, whereas Roundleaf Monkey-flower is designated as S1, i.e., critically imperiled – due to extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the Province. None of these species are considered to be Endangered, Threatened or of Special Concern federally by COSEWIC (2012) or provincially by COSSARO (MNR, 2013). Based on examination of the NHIC (2012) database, these three species have not been recorded within a 5-km radius of the proposed Project site.

### 2.2.4 Plankton

There are two algal communities in most lotic (fast river) systems: the potamoplankton, or drift plankton, and the periphyton (Aufwuchs), or benthic algae.

Lakes on lotic systems are the major source of potamoplankton, with diatoms almost universally the most important constituents (Williams and Scott, 1962).

However, the periphyton is by far the more important algal community in terms of the ecology and productivity of rivers. This community can be divided into three types (Round, 1973). The epilithic type consists of benthic algae attached to rocks. The epiphytic type is attached larger filamentous algae, bryophytes (mosses) and aquatic macrophytes. The epipelic type is a rich algal flora, mainly composed of diatoms, associated with the bed sediments.

Similarly, lakes are the major source of zooplankton with rotifers the dominant taxon in rivers (Williams, 1966).

**Table 2.16 Significant Aquatic Plant Species Recorded in the Abitibi River Watershed[1]**

| Common Name | Scientific Name | Habitat Requirements | Provincial Rank[2] |
|---|---|---|---|
| Slender Bulrush | *Schoenoplectus heterochaetus* | Marshes, shores and pond margins | S3 |
| Roundleaf Monkey-flower | *Mimulus glabratus* | Swamps, shores and shallow water along streams adjacent to open, meadow-like areas | S1 |
| Northern Mudwort | *Limosella aquatica* | Swampy places, shores and shallow water | S3 |

1 Source: OPG *et al.* (2006).
2 NHIC (2010): S1 = critically imperiled; S3 = vulnerable.

### 2.2.5 Benthic Macroinvertebrates

The composition of the benthic fauna has been the most widely used indicator of water quality. This is because the macroinvertebrates form relatively sedentary communities in the sediments, thereby reflecting the character of both the water and the sediment. Alteration of benthic community structure is used to assess the trophic or general pollutional status of a waterbody. This assessment is usually based on interpretation of indicator species, changes in the relative numbers of individuals and species, and/or the derivation of a species diversity or community comparison index.

Appendix B provides a list of the benthic macroinvertebrate taxa recorded in the Abitibi River. The occurrence of numerous species of the relatively more sensitive benthic macroinvertebrate groups, Ephemeroptera (mayfly nymphs), Plecoptera (stonefly nymphs) and Trichoptera (caddisfly larvae), attests to the good water quality of the Abitibi River (see Section 2.2.1). The MOE (1972) observed the crayfish, *Orconectes propinquus*, in the Abitibi River near Onakawana.

EAG (1981) reported that the benthic macroinvertebrate communities in the Abitibi River near Onakawana were simple and of low diversity. Community structure suggested good water quality for relatively unproductive northern waters unaffected by anthropogenic activities. Riffle area communities were composed entirely of insect larvae, which exhibited marked seasonal differences in numbers and biomass. Many of the species present are sensitive to water quality deterioration.

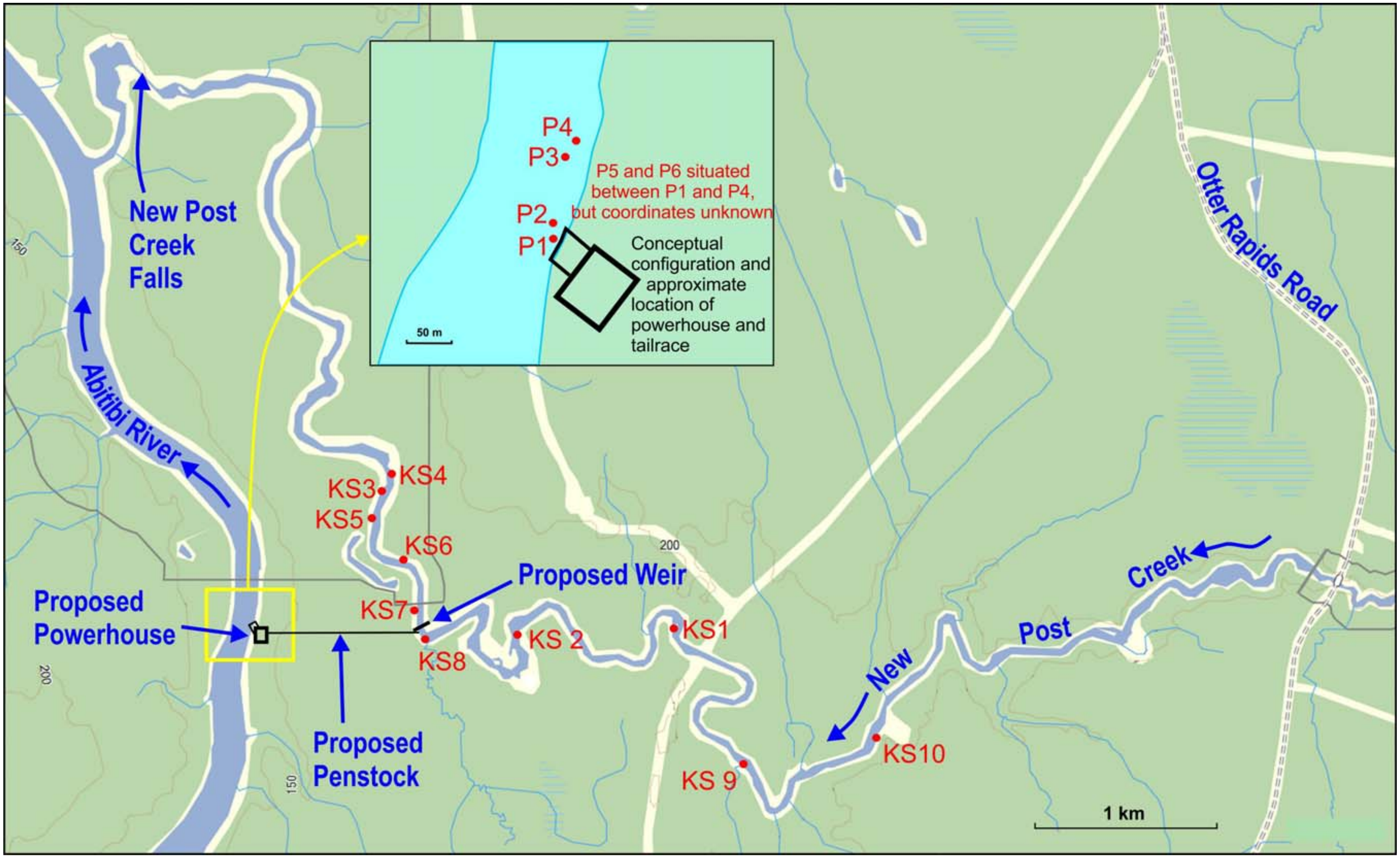
Table 2.17 presents the benthic macroinvertebrate community composition at six sampling locations in the Abitibi River based on Ponar grab sampling in water depths from 1.8 to 6 m undertaken on September 13 and 18, 2011. The low benthic macroinvertebrate densities (43 to 516/$m^2$), number of taxa (1 to 6) and species diversities (0 to 2.6) reflect the homogeneous, unproductive habitat afforded by the smooth, predominantly sand/clay substrate (see Figure 2.10 in Section 2.2.6.1).

**Table 2.17 Benthic Macroinvertebrate Community Composition in the Abitibi River**

| Taxon | Sampling Location[1] | | | | | |
|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | P4 | P5 | P6 |
| **P. Arthropoda** | | | | | | |
| **Cl. Arachnida** | | | | | | |
| **O. Acarina** | | | | | | |
| **F. Unionicolidae** | | | | | | |
| *Unionicola* | - | - | - | - | - | 43 |
| **Cl. Insecta** | | | | | | |
| **O. Ephemeroptera** | | | | | | |
| **F. Ephemeridae** | | | | | | |
| *Ephemera simulans* | 258 | 43 | 43 | - | - | - |
| *Hexagenia rigida* | - | - | - | - | - | 43 |
| **F. Heptageniidae** | | | | | | |
| *Stenacron interpunctatum* | - | 43 | 43 | 43 | - | - |
| **O. Trichoptera** | | | | | | |
| **F. Limnephilidae** | | | | | | |
| *Hydatophylax* | - | 43 | - | - | - | - |
| **F. Polycentropodidae** | | | | | | |
| *Polycentropus* | - | - | - | 43 | 43 | - |
| **O. Diptera** | | | | | | |
| **F. Chironomidae** | | | | | | |
| **S.F. Chironominae** | | | | | | |
| *Axarus* | - | 43 | - | - | - | - |
| *Cryptochironomus* | 43 | - | - | - | - | - |
| *Demicryptochironomus* | - | - | - | - | - | 43 |
| *Harnischia curtelamellata* | - | - | - | - | - | 43 |
| *Microtendipes* | 43 | 43 | - | - | - | - |
| *Polypedilum* | 43 | - | - | - | - | - |
| *Stictochironomus* | - | 43 | - | - | - | - |
| **P. Mollusca** | | | | | | |
| **Cl. Gastropoda** | | | | | | |
| **F. Hydrobiidae** | | | | | | |
| *Amnicola limosa* | 43 | - | - | - | - | - |
| *Probythinella lacustris* | 86 | - | - | - | - | - |
| *Physella* | | | | | | |
| **Total Number of Organisms/m$^2$** | 516 | 258 | 86 | 86 | 43 | 172 |
| **Total Number of Taxa** | 6 | 6 | 2 | 2 | 1 | 4 |
| **Shannon-Wiener Diversity Index** | 2.1 | 2.6 | 1.0 | 1.0 | 0.0 | 2.0 |
| **EPT Index** | 1 | 3 | 2 | 2 | 1 | 1 |

[1] See Figure 2.8 for sampling locations.

**Figure 2.8 Benthic Macroinvertebrate Sampling Locations**



Benthic macroinvertebrate communities in New Post Creek were sampled at 10 locations on September 19 and 20, 2011, using the “kick and sweep” method (with distance sampled ranging from 1.5 to 20 m). The benthic macroinvertebrate community composition data are presented in Table 2.18 (data standardized to the approximately average sampling distance of 10 m and subsampled proportions standardized to 100%).

Quantitative comparison of the benthic macroinvertebrate communities in the Abitibi River and New Post Creek could not be undertaken due to the different sampling methodologies used. However, it is obvious qualitatively that the benthic macroinvertebrate communities in New Post Creek have higher densities, number of taxa and species diversities, reflecting the more diverse habitat conditions. Benthic macroinvertebrate community metrics generally reflect the substrate and flow conditions. For example, densities (128/10 m) and number of taxa (13) were lowest at Station KS4 which was characterized by a sand/clay substrate and minimal flow velocity. Density was highest at Station KS9 with a cobble substrate and fast flow velocity, that was located near the outlet of an unnamed tributary, which is likely a source of organic matter. In contrast, density and diversity were low near the outlet of the other unnamed tributary (Station KS8) presumably due to the sandy substrate and minimal flow velocity.

The Shannon-Wiener diversity index is a measure of the number of species and individuals present at a given location as well as the distribution of these individuals among the various species. Wilhm and Dorris (1968) proposed that benthic macroinvertebrate communities with diversity index values greater than 3 are generally found in unpolluted conditions. The Shannon-Wiener diversity index values at the 10 sampling locations in New Post Creek ranged from 3.1 to 4.8 (Table 2.18).

The EPT index is a measure of the diversity of the relatively more sensitive benthic macroinvertebrate groups, Ephemeroptera, (mayfly nymphs), Plecoptera (stonefly nymphs) and Trichoptera (caddisfly larvae). This index is the sum of all taxa within these three orders, which generally are the most sensitive to anthropogenic stressors. The EPT index is low to zero when the aquatic environment is moderately to severely impacted, whether due to organic enrichment or other pollutants. An EPT index of 5 to 8 is indicative of acceptable water quality, whereas a higher value reflects good water quality. Although some sites may lack EPT taxa, it should be noted that this may be the result of habitat type rather than anthropogenic stress.

The EPT index values for the Abitibi River ranged from 1 to 3 (see Table 2.17), reflecting the uniform habitat conditions. The EPT index values for New Post Creek ranged from 5 to 20 (see Table 2.18), reflecting the diverse habitat conditions and good water quality (see Section 2.2).

The mayfly nymph *Siphloplecton basale* and the caddisfly larva *Arctopsyche ladogensis* are fairly rare and are only present in watercourses with excellent water quality (W.B. Morton, 2012, pers. comm.).

The greater diversities and densities of the benthic macroinvertebrate communities in New Post Creek are likely important to fish productivity below the waterfalls due to downstream drift. As indicated in Section 3.3, a benthic macroinvertebrate community and drift sampling program will be undertaken in New Post Creek below the waterfalls prior to proposed Project construction initiation to provide a baseline for a subsequent identical program to be undertaken during operation of the proposed GS.

**Table 2.18 Benthic Macroinvertebrate Community Composition in New Post Creek[1]**

| Taxon | Sampling Location (KS)[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **P. Nematoda** | - | - | - | - | - | - | 1 | - | - | - |
| **P. Annelida** | | | | | | | | | | |
| **Cl. Oligochaeta** | | | | | | | | | | |
| **F. Naididae** | | | | | | | | | | |
| *Nais* | 17 | 6 | 13 | - | 13 | 13 | 14 | 2 | - | 20 |
| *Stylaria lacustris* | - | 13 | 1 | - | 7 | 13 | 1 | 2 | - | - |
| *Uncinais uncinata* | - | 8 | 3 | 20 | 7 | - | - | 10 | 10 | - |
| **F. Tubificidae** | | | | | | | | | | |
| immature without chaetae | - | - | - | 3 | - | 7 | 1 | 2 | - | - |
| immature with chaetae | - | - | - | - | - | - | - | 1 | - | - |
| **P. Arthropoda** | | | | | | | | | | |
| **Cl. Arachnida** | | | | | | | | | | |
| **O. Acarina** | | | | | | | | | | |
| **F. Krendowskijidae** | | | | | | | | | | |
| *Krendowskia similis* | - | - | - | - | - | - | 4 | - | - | - |
| **F. Lebertiidae** | | | | | | | | | | |
| *Lebertia* | - | - | - | - | - | - | - | - | 10 | - |
| **F. Sperchonidae** | | | | | | | | | | |
| *Sperchon* | 4 | - | - | - | - | - | - | - | - | - |
| **Cl. Crustacea** | | | | | | | | | | |
| **O. Amphipoda** | | | | | | | | | | |
| **F. Hyalellidae** | | | | | | | | | | |
| *Hyalella azteca* | - | - | 1 | - | - | - | - | - | - | - |
| **Cl. Insecta** | | | | | | | | | | |
| **O. Coleoptera** | | | | | | | | | | |
| **F. Dryopidae** | | | | | | | | | | |
| *Helichus lithophilus* | - | - | - | - | - | - | - | 1 | - | - |
| **F. Dytiscidae** | | | | | | | | | | |
| *Neoporus dimidiatus* | - | - | - | - | 2 | - | - | - | - | - |
| **F. Elmidae** | | | | | | | | | | |
| *Dubiraphia quadrinotata* | - | 5 | 1 | - | 2 | - | 1 | 3 | - | - |
| *Optioservus* | - | 11 | - | - | - | - | - | 1 | 31 | - |
| **O. Ephemeroptera** | | | | | | | | | | |
| **F. Baetidae** | | | | | | | | | | |
| *Acentrella* | 13 | - | - | - | - | - | 6 | - | - | 3 |
| *Acerpenna pygmaeus* | 4 | 2 | 3 | - | 2 | - | 21 | 1 | 10 | 3 |
| *Baetis flavistriga* | 42 | - | - | - | - | - | - | - | - | 6 |
| *Centroptilum* | - | 10 | 8 | 7 | 7 | 47 | 8 | - | - | - |
| *Procloeon* | - | 5 | 4 | - | - | - | 1 | - | - | - |
| **F. Baetiscidae** | | | | | | | | | | |
| *Baetisca* | - | 19 | - | - | 2 | 7 | 4 | 2 | - | - |
| **F. Caenidae** | | | | | | | | | | |
| *Caenis puncata* | - | 2 | 1 | - | 2 | 7 | 2 | 2 | - | - |
| **F. Ephemerellidae** | | | | | | | | | | |
| *Ephemerella* | 33 | - | - | - | - | - | - | - | 406 | 20 |
| *Eurylophella* | - | 3 | - | - | 2 | - | 2 | - | - | - |

| Taxon | Sampling Location (KS)[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Serratella* | 63 | - | - | - | - | - | - | - | 125 | 20 |
| **F. Ephemeridae** | | | | | | | | | | |
| *Ephemera simulans* | - | 2 | - | - | - | - | 2 | - | - | - |
| *Hexagenia rigida* | - | - | 1 | - | 2 | 20 | 3 | 2 | - | - |
| **F. Heptageniidae** | | | | | | | | | | |
| *Heptagenia* | - | 2 | 7 | - | 2 | - | 23 | 1 | - | - |
| *Rhithrogenia* | 567 | - | - | - | - | - | - | - | - | 316 |
| *Stenacron interpuncatum* | - | - | 4 | - | 7 | 13 | 8 | - | - | - |
| *Stenonema terminatum* | 50 | 37 | 6 | 7 | 3 | 7 | 3 | - | 31 | 3 |
| *S. vicarium* | - | - | - | - | - | - | 1 | - | 10 | - |
| **F. Isonychiidae** | | | | | | | | | | |
| *Isonychia bicolor* | 104 | - | - | - | - | - | - | - | 52 | 59 |
| **F. Leptohyphidae** | | | | | | | | | | |
| *Tricorythodes* | - | 2 | - | - | - | - | - | - | - | - |
| **F. Leptophlebiidae** | | | | | | | | | | |
| *Leptophlebia* | - | 14 | 60 | 7 | 12 | 20 | - | - | 21 | - |
| *Paraleptophlebia* | 117 | 22 | - | - | 33 | 53 | 6 | - | - | 148 |
| **F. Metretopodidae** | | | | | | | | | | |
| *Siphloplecton basale* | - | 3 | 17 | - | 20 | 20 | - | 3 | - | - |
| **O. Hemiptera** | | | | | | | | | | |
| **F. Corixidae** | | | | | | | | | | |
| *Sigara* | - | 5 | 4 | 7 | 30 | 20 | 8 | 107 | 21 | - |
| **O. Megaloptera** | | | | | | | | | | |
| **F. Sialidae** | | | | | | | | | | |
| *Sialis* | - | - | - | - | - | - | - | 1 | - | - |
| **O. Odonata** | | | | | | | | | | |
| **F. Gomphidae** | | | | | | | | | | |
| *Ophiogomphus rupinsulensis* | - | 11 | - | - | - | - | 1 | - | 10 | - |
| **F. Macromiidae** | | - | - | - | - | 7 | 1 | - | - | - |
| **O. Plecoptera** | | | | | | | | | | |
| **F. Capniidae** | | | | | | | | | | |
| *Paracapnia angulata* | - | - | - | - | - | - | 1 | 1 | - | - |
| **F. Chloroperlidae** | 13 | - | - | - | - | - | - | - | - | 8 |
| **F. Leuctridae** | | | | | | | | | | |
| *Leuctra* | - | - | - | - | 2 | - | - | - | - | - |
| **F. Nemouridae** | | | | | | | | | | |
| *Nemoura* | 17 | - | - | - | - | 7 | - | - | - | - |
| **F. Perlidae** | | | | | | | | | | |
| *Acroneuria lycorias* | 46 | 2 | - | - | 2 | - | 2 | - | 31 | 31 |
| **F. Perlodidae** | | | | | | | | | | |
| *Isoperla* | - | 2 | - | - | - | - | - | - | 125 | 36 |
| **F. Ptaronarcyidae** | | | | | | | | | | |
| *Ptaronarcys dorsata* | - | - | - | - | - | 7 | - | - | - | 8 |
| **O. Trichoptera** | | | | | | | | | | |
| **F. Glossosomatidae** | | | | | | | | | | |
| *Glossosoma* | - | - | - | - | - | - | - | - | 10 | - |
| **F. Helicopsychidae** | | | | | | | | | | |
| *Helicopsyche borealis* | - | 2 | - | - | 5 | - | 10 | - | - | - |

| Taxon | Sampling Location (KS)[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **F. Hydropsychidae** | | | | | | | | | | |
| *Arctopsyche ladogensis* | - | - | - | - | - | - | - | - | 10 | - |
| *Hydropsyche* | 29 | - | - | - | - | - | 1 | - | 688 | 78 |
| **F. Hydroptilidae** | | | | | | | | | | |
| *Hydroptila* | 13 | 46 | 3 | - | - | 7 | 12 | - | 271 | 14 |
| *Leucrotrichia pictipes* | - | - | - | - | - | - | - | - | 21 | - |
| *Oxyethira* | - | 1 | - | - | - | - | - | - | - | - |
| **F. Lepidostomatidae** | | | | | | | | | | |
| *Lepidostoma* | - | - | - | - | - | - | 1 | - | - | - |
| **F. Leptoceridae** | | | | | | | | | | |
| *Ceraclea* | - | - | - | - | 2 | - | - | - | - | - |
| **F. Limnephilidae** | | | | | | | | | | |
| *Hydatophylax* | - | - | - | - | 3 | - | - | - | - | - |
| **F. Molannidae** | | | | | | | | | | |
| *Molanna* | - | - | - | - | - | - | - | 1 | - | - |
| **F. Philopotamidae** | | | | | | | | | | |
| *Chimarra* | 29 | - | - | - | - | - | - | - | 542 | 25 |
| **F. Polycentropodidae** | | | | | | | | | | |
| *Polycentropus* | - | - | - | 3 | 3 | - | 3 | - | - | - |
| **F. Psychomyiidae** | | | | | | | | | | |
| *Psychomyia flavida* | - | - | - | - | - | - | - | - | 10 | - |
| **O. Diptera** | | | | | | | | | | |
| **F. Athericidae** | | | | | | | | | | |
| *Atherix variegatus* | 54 | 5 | - | - | - | - | - | - | 188 | 6 |
| **F. Ceratopogonidae** | 4 | 48 | 6 | 7 | 8 | 33 | 10 | 37 | 10 | - |
| **F. Chironomidae** | | | | | | | | | | |
| **S.F. Chironominae** | | | | | | | | | | |
| *Cryptochironomus* | - | 10 | - | - | 2 | 33 | 3 | - | - | - |
| *Dicrotendipes* | 4 | 2 | - | - | - | - | - | - | - | - |
| *Micropsectra* | - | - | - | - | - | - | - | 3 | - | - |
| *Microtendipes* | 8 | - | - | - | 2 | - | - | - | 21 | 14 |
| *Nilothauma babiyi* | - | 3 | - | - | - | - | - | - | - | - |
| *Paralauterbourniella* | - | 10 | - | - | - | - | 1 | 9 | - | - |
| *Pagastiella astansa* | - | - | 3 | - | 2 | 7 | 1 | - | - | - |
| *Polypedilum* | 8 | 5 | - | - | - | 13 | - | - | 10 | - |
| *Pseudochironomus* | - | - | - | - | - | - | - | - | - | 3 |
| *Robackia* | 4 | - | - | - | - | - | - | - | - | - |
| *Stempellina* | - | - | - | - | - | - | - | - | 31 | 6 |
| *Stempellinella* | - | 2 | - | - | - | - | 1 | - | - | 3 |
| *Stenochironomus* | - | 2 | - | - | - | - | - | - | - | - |
| *Stictochironomus* | - | - | - | - | - | - | - | 2 | - | - |
| *Tanytarsus* | - | 2 | - | - | - | - | - | 1 | - | - |
| **S.F. Orthocladiinae** | | | | | | | | | | |
| *Cardiocladius* | - | - | - | - | - | - | - | - | 21 | - |
| *Corynoneura* | - | - | - | - | - | - | - | - | - | 3 |
| *Cricotopus* | 4 | 18 | 1 | 7 | - | 7 | 2 | - | 94 | 59 |
| *Epoicocladius* | - | - | - | - | - | - | 1 | - | - | - |
| *Nanocladius* | - | 2 | - | - | - | - | - | - | - | - |

| Taxon | Sampling Location (KS)[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Parakiefferiella* | - | - | - | - | - | - | - | 1 | - | - |
| *Psectrocladius* | - | - | 4 | - | 3 | - | - | - | - | - |
| *Tvetenia* | 25 | - | - | - | - | - | - | - | 83 | 34 |
| **S.F. Tanypodinae** | | | | | | | | | | |
| *Ablabesmyia* | - | 72 | - | - | 5 | 13 | 2 | - | - | - |
| *Helopelopia* | - | 38 | 6 | - | 3 | 7 | 4 | - | 52 | - |
| *Procladius* | - | - | - | - | - | - | - | 105 | - | - |
| **F. Empididae** | | | | | | | | | | |
| *Hemerodromia* | - | 3 | - | - | - | - | - | - | 10 | 3 |
| **F. Simuliidae** | | | | | | | | | | |
| *Simulium* | 8 | - | - | - | - | - | - | - | - | - |
| **F. Tabanidae** | | | | | | | | | | |
| *Chrysops* | - | - | 3 | 23 | - | 13 | - | 17 | - | - |
| **F. Tipulidae** | | | | | | | | | | |
| *Hexatoma* | - | 14 | - | - | - | - | - | - | 21 | - |
| **P. Mollusca** | | | | | | | | | | |
| **Cl. Gastropoda** | | | | | | | | | | |
| **F. Ancylidae** | | | | | | | | | | |
| *Ferrissia parallella* | - | - | - | - | - | - | 1 | - | - | - |
| **F. Hydrobiidae** | | | | | | | | | | |
| *Amnicola limosa* | - | 5 | 1 | - | - | - | - | 1 | - | - |
| *Probythinella lacustris* | - | 2 | 60 | 7 | 8 | 93 | 6 | 4 | - | - |
| **F. Lymnaeidae** | | | | | | | | | | |
| *Fossaria* | - | - | - | - | - | - | - | 1 | - | - |
| **F. Physidae** | | | | | | | | | | |
| *Physella gyrina* | - | 2 | 8 | - | 17 | 100 | 8 | 2 | - | - |
| **F. Planorbidae** | | | | | | | | | | |
| *Helisoma anceps* | - | - | 1 | - | - | - | - | - | - | - |
| **F. Valvatidae** | | | | | | | | | | |
| *Valvata tricarinata* | - | - | 162 | 10 | 8 | 7 | 1 | 14 | - | - |
| **Cl. Bivalvia (Pelecypoda)** | | | | | | | | | | |
| **F. Sphaeriidae** | | | | | | | | | | |
| *Pisidium* | - | 2 | 25 | 20 | 27 | 20 | 7 | 14 | 125 | - |
| *Sphaerium striatinum* | - | - | 10 | - | 7 | - | 2 | - | - | - |
| **Total Number of Organisms/10 m** | 1,280 | 482 | 427 | 128 | 264 | 621 | 202 | 354 | 3,111 | 929 |
| **Total Number of Taxa** | 26 | 45 | 30 | 13 | 36 | 29 | 45 | 32 | 33 | 26 |
| **Shannon-Wiener Diversity Index** | 3.2 | 4.5 | 3.3 | 3.4 | 4.5 | 4.2 | 4.8 | 3.1 | 3.8 | 3.4 |
| **EPT Index** | 14 | 18 | 11 | 5 | 18 | 12 | 20 | 8 | 16 | 16 |
| **Habitat[2]** | Co/G | SR | Co | S/Cl | Bc/S | Cl/Bo | Be/C | S | Co | G |
| **Water Velocity[3]** | F | S | S | N | N | M | M | N | F | F |

[1] See Figure 2.8 for sampling locations.
[2] Be = bedrock; Bo = boulder; Cl = clay; Co= cobble; G = gravel; S = sand; Sr = small rock.
[3] F = fast; M = moderate; S = slow; N = nil.

### 2.2.6 Fisheries Resources

The Abitibi River provides coolwater fish habitat, with Walleye the most important fish species common throughout the river (Seyler, 1997). Northern Pike (*Esox lucius*) and White Sucker (*Catostomus commersonii*) are also common throughout the river. Lake Sturgeon (*Acipenser fulvescens*) has also been documented throughout the Abitibi River, whereas Lake Whitefish (*Coregonus clupeaformis*) has been reported in the upper reaches of the Abitibi River. Other relatively common fish species include Goldeye (*Hiodon alosoides*), Mooneye (*H. tergisus*), Longnose Sucker (*Catostomus catostomus*), Shorthead Redhorse (*Moxostoma macrolepidotum*), Yellow Perch (*Perca flavescens*), Burbot (*Lota lota*), Mottled Sculpin (*Cottus bairdii*) and various minnows (Cyprinidae).

Seyler (1997) reported the presence of 24 resident fish species in the Abitibi River proper. Based on more recent information (e.g., Hendry and Chang, 2001), OPG *et al*. (2006) identified 26 resident fish species and three species that occur in tributaries and are occasional residents (see Table 2.19). Brook Trout are present in those smaller tributaries that provide coldwater habitat. Brook Trout are also reported to occur in the Little Abitibi River likely originating from its feeder tributaries (Ontario Parks, 2006). Brook Stickleback and Ninespine Stickleback also occur in tributaries and are occasional residents.

**Table 2.19 Fish Species Recorded in the Abitibi River[1]**

| Common Name | Scientific Name | Resident Status | Provincial Status[2] |
|---|---|---|---|
| Lake Sturgeon[3] | *Acipenser fulvescens* | River resident | S3 |
| Goldeye | *Hiodon alosiodes* | River resident | S3 |
| Mooneye | *H. tergisus* | River resident | S4 |
| Lake Chub | *Couesius plumbeus* | River resident | S5 |
| Golden Shiner | *Notemigonus crysoleucas* | River resident | S5 |
| Emerald Shiner | *Notropis atherinoides* | River resident | S5 |
| Spottail Shiner | *N. hudsonius* | River resident | S5 |
| Longnose Dace | *Rhinichthys cataractae* | River resident | S5 |
| Fallfish | *Semotilus corporalis* | River resident, lower reaches only | S4 |
| Pearl Dace | *Margariscus margarita* | River resident | S5 |
| Longnose Sucker | *Catostomus catostomus* | River resident | S5 |
| White Sucker | *C. commersonii* | River resident | S5 |
| Shorthead Redhorse | *Moxostoma macrolepidotum* | River resident | S5 |
| Brown Bullhead | *Ameiurus nebulosis* | River resident | S5 |
| Northern Pike | *Esox lucius* | River resident | S5 |
| Cisco (Lake Herring) | *Coregonus artedii* | River resident | S5 |

| Common Name | Scientific Name | Resident Status | Provincial Status[2] |
|---|---|---|---|
| Lake Whitefish | *C. clupeaformis* | River resident | S5 |
| Brook Trout | *Salvelinus fontinalis* | Present in tributaries, occasional residents | S5 |
| Burbot (Ling) | *Lota lota* | River resident | S5 |
| Trout-perch | *Percopsis omiscomaycus* | River resident | S5 |
| Brook Stickleback | *Culaea inconstans* | Present in tributaries, occasional residents | S5 |
| Ninespine Stickleback | *Pungitius pungitius* | Present in tributaries, occasional residents | S5 |
| Mottled Sculpin | *Cottus bairdii* | River resident | S5 |
| Rock Bass | *Ambloplites rupestris* | River resident | S5 |
| Yellow Perch | *Perca flavescens* | River resident | S5 |
| Sauger | *Sander canadensis* | River resident | S4 |
| Walleye | *S. vitreus* | River resident | S5 |
| Johnny Darter | *Etheostoma nigrum* | River resident | S5 |
| Logperch | *Percina caprodes* | River resident | S5 |

[1] Source: Seyler (1997); OPG *et al*. (2006).
[2] NHIC (2010): S5 = secure; S4 = apparently secure; S3 = vulnerable.
[3] Designated as Special Concern federally (COSEWIC, 2012) and provincially (MNR, 2013).

Of the 29 species recorded in the Abitibi River, 24 are designated by the NHIC (2010) as S5, (secure); three are designated as S4, i.e., apparently secure - uncommon but not rare with some cause for long-term concern due to declines or other factors; and two are designated as S3 (vulnerable).

Lake Sturgeon is designated as Special Concern federally (COSEWIC, 2012) and provincially (MNR, 2013). Payne (1987) reported that the Lake Sturgeon population in the Abitibi River between Island Falls and the Abitibi Canyon Dam was robust. The Lake Sturgeon population between Abitibi Canyon Dam and Otter Rapids Dam is isolated and not large, and its available critical habitats are not well understood (C. Chenier, MNR, 2013, pers. comm.).

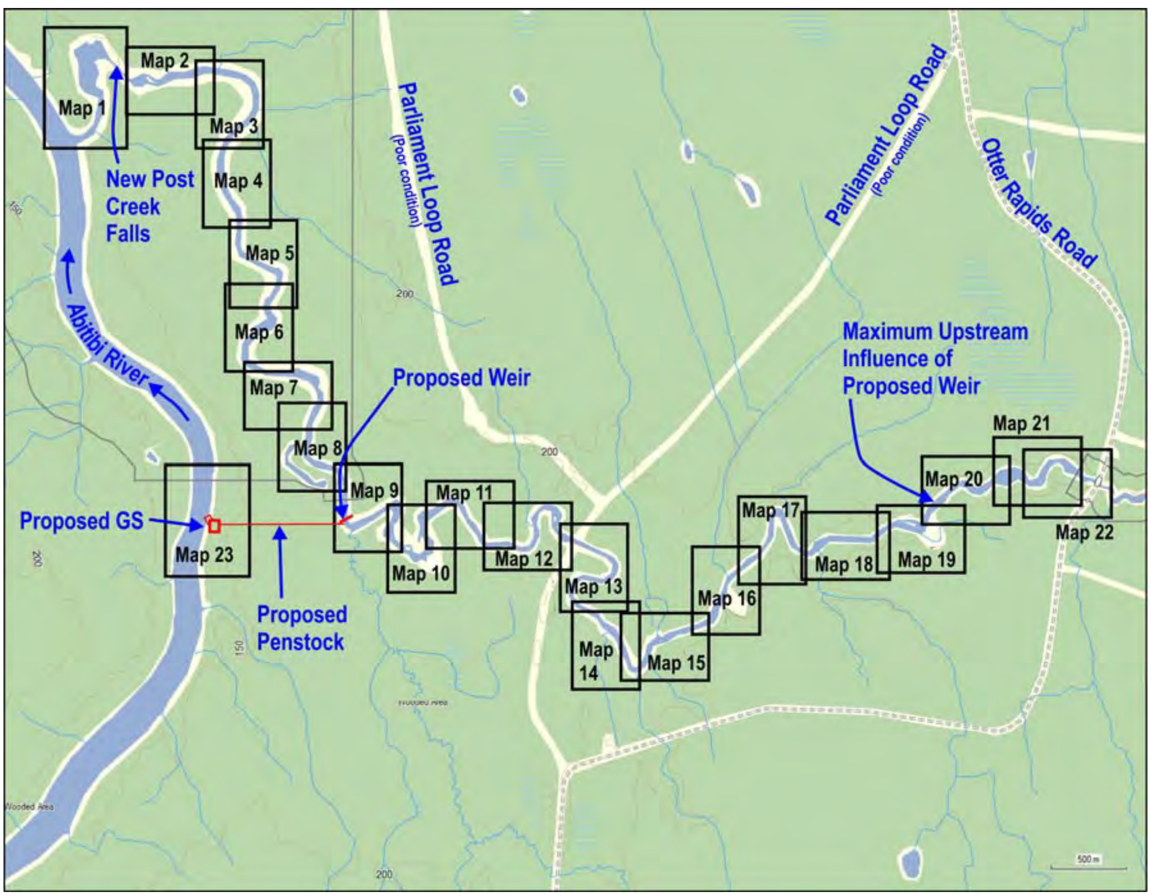
Some small “grass pike”, i.e., Northern Pike, were present in pre-diversion New Post Creek upstream of the waterfalls, but generally the creek was not a reliable source of fish (P. Archibald Sr., TTN, 2011, pers. comm.).

The TTN did harvest fish below the New Post Creek waterfalls using nets during the spawning period, including Walleye, Lake Sturgeon and suckers (P. Archibald Sr., TTN, 2011, pers. comm.). There were also “a lot of Mooneye and the odd Lake Whitefish”. The TTN would sometimes string a line with 1-inch hooks baited with Walleye or sucker across the mouth of the creek to catch Lake Sturgeon.

### *2.2.6.1 Existing Aquatic Habitat*

Aquatic habitat mapping and assessment of the Abitibi River in the vicinity of the proposed Project tailrace location and of New Post Creek downstream of the waterfalls were undertaken on August 25 and 26, 2009, with supplemental substrate mapping on November 1, 2011 (Coker and Portt, 2013a; see Appendix A). Aquatic habitat mapping and assessment were also undertaken of New Post Creek in the vicinity of the proposed Project intake weir location on October 27, 2009, and over approximately 10 km of the creek from the brink of the waterfalls upstream to as far as safely possible by boat on September 27 and 28, 2010, September 19 and 20, and November 3, 2011. The aquatic habitat mapping and assessment of New Post Creek was extended an additional 2,300 m upstream to the Otter Rapids Road bridge on September 17, 2012 to account for the increase in the upstream extent of anticipated water level and flow alterations due to design modifications resulting in increased height of the proposed intake weir. Aquatic habitat mapping and assessment were also undertaken of the lower reaches of accessible New Post Creek tributaries upstream of the proposed intake weir location in 2011 and 2012. Figure 2.9 shows the areas characterized for depth (Maps 1-17 and 23) and substrate (Maps 1-23).

**Figure 2.9 Locations of Habitat Mapping and Assessment in New Post Creek and the Abitibi River[1]**




[1] Habitat maps are provided in Appendix A of Coker and Portt (2013a) (see Appendix A).

Aquatic habitat assessments were also undertaken of the waterbodies to be traversed by the proposed access roads and transmission line ROW.

**Abitibi River**

The Abitibi River at the proposed tailrace location is approximately 140 m wide with a maximum depth of about 10.4 m (see Map 23 in Coker and Portt, (2013a) provided in Appendix A). The cross-section profile of the Abitibi River at this location is U-shaped. Substrate is dominated by sand and clay with occasional patches of rocks or wood debris.

The Abitibi River at the mouth of New Post Creek is approximately 170 m wide with a maximum depth of about 10 m (see Map 1 in Coker and Portt (2013a) provided in Appendix A). The bathymetric map of the Abitibi River indicates that the centre of the channel, accounting for approximately 50% of the river width, is relatively flat and deep, and the river bottom then slopes up to each shore in a fairly uniform manner.

**Tributaries of the Abitibi River**

Two tributaries are traversed by the access road to the proposed GS site (Coker and Portt, 2013b), whereas five tributaries and a small pond are traversed by the proposed transmission line ROW (Coker and Portt, 2013c). The Coker and Portt (2013b, c) reports are provided in Appendix A. Figure 1.21 shows the locations of the Abitibi River tributaries.

Unnamed Tributary (MNR ID#635)

Flow in this watercourse was less than 1 L/s at the time of the September 17, 2011 site visit with a small plunge pool at the downstream end of the perched culvert. Substrate within the poorly defined channel is soil or silt. Upstream and downstream of the access road crossing, the watercourse passes through a series of beaver ponds. It discharges into the Abitibi River, approximately 3 km downstream of the crossing. Brook Stickleback and Fathead Minnow were captured by electrofishing at the road crossing.

Unnamed Tributary (MNR ID#589)

This watercourse has a poorly defined channel with a substrate of soil and silt, and some gravel, sand and cobble. Flow was approximately 1 L/s during the site visit. The watercourse passes through a series of beaver ponds upstream of the road crossing and discharges to the Abitibi River approximately 1,600 m downstream. No fish were captured by electrofishing, although some small, resilient fish species may be present in the upstream beaver ponds.

Unnamed Tributary (MNR ID#485)

The proposed transmission line ROW traverses the headwaters of this small tributary involving three crossings. Based on aerial photograph examination, one of the three crossings appears as a lighter colouration of vegetation indicating damp conditions. However, during the field survey on September 15, 2011, the watercourse could not be discerned from the surrounding landscape and is considered to be ephemeral.

The watercourse at the second crossing is poorly defined with a soil and sand substrate. The watercourse was dry during the site visit and is likely ephemeral being only wet during rain storms and the spring freshet.

The watercourse at the third crossing was also dry but with a better defined channel with 1.5 m high banks. Substrate consisted of gravel, cobble and sand. Several on-line beaver ponds were present upstream. Unlike the other two watercourses which do not provide direct fish habitat, this watercourse may support simple fish communities upstream and downstream of the crossing and provide fish habitat on a seasonal basis at the ROW crossing.

Pond (MNR ID#6273)

This pond with an area of 3,900 $m^2$ is isolated, with no apparent inlet or outlet. Its floating bog shoreline prevented close approach and fish sampling. No fish were observed. If fish are present, they likely comprise a simple community with one or two species of small bodied fish.

Unnamed Tributary (MNR ID#629)

At the proposed transmission line ROW, this watercourse consists of an undefined wet depression. Based on aerial photograph examination, a defined channel becomes apparent approximately 300 m downstream of the north limit of the proposed ROW. No water was observed in the watercourse at a forest access road crossing approximately 408 m downstream of the ROW. This watercourse is not considered fish habitat at the ROW crossing.

Unnamed Tributary (MNR ID#554)

As indicated in Figure 1.14, a large (2 ha) beaver pond had been created at the proposed transmission line ROW. However, the September 18, 2011 field survey determined that the beaver dam had subsequently failed and the pond was less than 10% of its former size. The dewatered area has formed a boggy meadow with *Sphagnum* and sedges dominating. Substrate in the pond and the meadow shoreline was clay, with peat in the remaining meadow area. Flow was approximately 2 to 3 L/s in the channel downstream of the beaver dam. Brook Stickleback was captured in the pond, as well as in a small pool approximately 470 m downstream of the pond.

Tributary of Pinard Creek (MNR ID#538)

This tributary of Pinard Creek joins the main creek approximately 413 m north of the proposed transmission line ROW. Two drained on-line beaver ponds and associated meadows are present in the ROW. The substrate is soft peat. Dense growths of Pondweed (*Potamogeton* spp.) occur within the watercourse. Iron staining in the channel indicated groundwater inputs. Based on electrofishing, Brook Stickleback was abundant and Northern Redbelly Dace was common. One Finescale Dace was also captured.

Pinard Creek (MNR ID#540)

Pinard Creek discharges to the Abitibi River approximately 10 km downstream of the proposed transmission line ROW. At the proposed ROW, the watercourse is a cold, clear flowing stream with a wide range of flow velocities due to the shallow nature of the channel, and the pockets of aquatic vegetation and woody debris along the channel edge. The channel ranged in width from 3.5 to 6 m, and had a gravel and silt substrate. Bur-reed (*Sparganium* sp.) dominated the aquatic plant community. Brook Trout was the only fish species captured by electrofishing.

**New Post Creek**

New Post Creek, at its mouth, is approximately 45 m wide and 3 to 4 m deep, and is similar for approximately 330 m upstream from the Abitibi River (see Map 1 in Coker and Portt (2013a) provided in Appendix A). This section of channel is relatively uniform with mainly sand or sand/clay substrates, dropping to depth close to the left shore facing downstream, with a more gentle slope to depth along the right shore. Approximately 330 m upstream of the Abitibi River, the channel widens significantly to a maximum of approximately 230 m near the bottom of the rapids that are situated below the waterfalls (Photograph 2.11). The irregularly wide section of channel downstream of the rapids is approximately 330 m long. The majority of this reach is between 1 and 2.5 m deep, with a maximum depth of about 3.6 m. Substrate is a patchy mixture of clay/sand, sand, gravel, cobble and boulder, with one area of exposed bedrock. Water depth in this reach of New Post Creek is highly dependent upon the water level in the nearby Abitibi River, which varies with the operations of the Abitibi Canyon GS and Otter Rapids GS.

The New Post Creek waterfalls consists of a 170 m long stretch of steep rapids at its upstream end, a vertical falls that drops approximately 40 m, an 8 to 19 m wide narrow chute that is 210 m long with several smaller waterfalls, and some very shallow rapids about 140 m long with mainly cobble/boulder substrate at the downstream end (Photograph 2.11). The total difference in elevation between the upstream and downstream ends of these waterfalls, determined by GPS, is approximately 56 m.

**Photograph 2.11 View of Rapids below New Post Creek Waterfalls**

Upstream of the waterfalls for approximately 1,390 m, New Post Creek is gently sloped (slope = 0.759 m/km and meandering with high eroding banks throughout much of the reach, with its width ranging between 44 and 63 m (see Maps 2 and 3 in Coker and Portt (2013a) provided in Appendix A). The substrate is mainly a mixture of sand, clay, gravel and cobble. The next 2,036 m upstream has more diverse habitat due to a number of bedrock outcrops that create variation in depth and velocity (Maps 4 to 7), with some outcrops creating short sets of rapids and others constricting the channel width, resulting in deeper habitats (see Map 5). While there are a couple of short riffle sections, the creek is otherwise relatively flat having an overall slope of 0.572 m/km. Along this section, stream width ranges from 32 m to 92 m, and substrates are mainly some combination of cobble, gravel and boulder, with occasional patches of bedrock. The next 1,076 m of stream (Maps 8 and 9), up to the proposed intake weir location, is relatively steep with a slope of 0.677 m/km. As a result, there is less variation in flow velocity and stream width ranges from 32 to 56 m. A bedrock outcrop occurs at the proposed intake weir location, approximately 4,502 m upstream of the top of the waterfalls (Photograph 1.1).

Upstream of the proposed intake weir location, for approximately 2,380 m (Maps 9 to 12), the creek is low gradient (slope = 0.390 m/km) and meandering, and is dominated by fine-grained substrates. A sizable area where woody debris is abundant on the bottom occurs a short distance upstream from the weir location (Map 9). A couple of low gradient riffles, dominated by gravel and sand and some cobble, are apparent in this area during low flow, e.g., on September 19, 2011, when flow was 9.07 $m^3$/s. On September 27, 2010, no riffles were apparent at these two locations when flow was 102 $m^3$/s. Water depth was approximately 3 m deeper in this section of the creek on September 27, 2010, than it was on September 19, 2011. In this section, stream width ranges from 30 to 91 m. At the upstream end of this reach, approximately 2,380 m upstream of the proposed intake, and 6,882 m upstream of the waterfalls, is the first main rapids upstream of the proposed intake. This set of rapids was apparent under all flows observed, and is approximately 135 m long with a broad range of patchy substrates (Map 12).

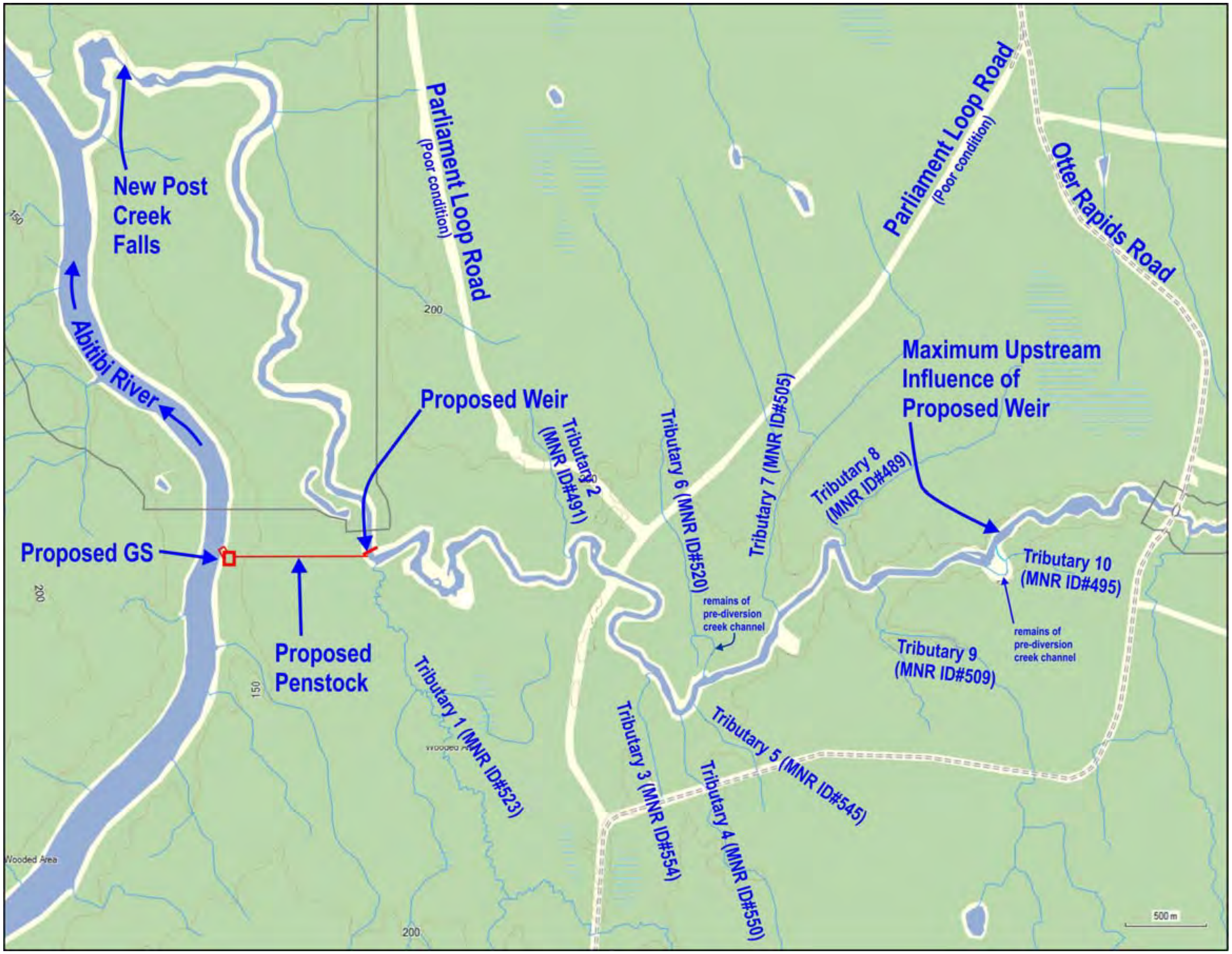
For the next 3,100 m upstream (Maps 13 to 17), the creek has a slightly greater gradient (slope = 0.476 m/km) and generally coarser-grained substrates. Riffle sections are slightly more numerous than in the previously described downstream reach, but they remain relatively short and gentle. Width of this reach ranged from 31 to 90 m. Approximately 5,600 m upstream of the proposed intake location, two steep, rocky sets of rapids, separated by a short section of calmer water, was the upstream limit of boat access due to safety concerns at high water, and being too shallow to navigate during low water. Therefore, no depth information was mapped within or upstream of this 448 m long set of rapids. Immediately upstream of these rapids, a flatwater section (371 m in length) has substrates dominated by sand, clay, gravel, and some cobble (Map 18).

At 6,419 m upstream of the proposed intake weir location, and continuing 2,055 m upstream to the Otter Rapids Road bridge, New Post Creek was more than 50% riffle over its length on September 17, 2012, when streamflow was 7.81 $m^3/s$ (Maps 18 to 22). The watercourse slope through this section is 3.407 m/km. Cobble, boulder, and gravel dominated the substrates through the main channel of this reach, although there were significant deposits of finer materials in backwater areas along the shore. The only significant area of aquatic plants observed in New Post Creek occurs in one of these nearshore deposits of fine material that is protected from the main force of stream flow. Moderate densities of Redheadgrass, Grassy Pondweed, Eel-grass, Arrowhead and Broad Waterweed were observed in a narrow shoreline band, approximately 270 m long, on the south side of the creek (Maps 20 and 21). The estimated upstream extent of influence upon flow velocity and water depth, due to the proposed intake weir and operation of the GS, is expected to extend 7,166 m upstream (Map 20). An oxbow wetland occurs on the south side of New Post Creek, near the upstream extent of influence from the proposed GS and intake weir (Map 19).

**Tributaries of New Post Creek**

There are ten tributaries to New Post Creek between the proposed intake weir location and the upstream extent of backwater effect caused by the weir and the operation of the proposed GS (Figure 2.10). Detailed descriptions of these tributaries are presented in Coker and Portt (2013a). Descriptions of tributary crossings by Parliament Loop Road, potentially used to access the proposed Project from the east side of New Post Creek, are presented in Coker and Portt (2013d). The Coker and Portt (2013a, d) reports are provided in Appendix A.

**Figure 2.10 New Post Creek Tributaries Upstream of the Proposed Project Weir**



Tributary 1 (MNR ID#523)

This is the largest tributary entering New Post Creek within the study area (Figure 2.10). Flow in this tributary was approximately 0.3 $m^3/s$ on September 20, 2011. Channel width varies from 3 to 6 m. Water temperature in this watercourse was 9.4°C, compared to 12.7°C in New Post Creek. Substrate is patchy. Gravel and sand with some cobble appears to occur most commonly, but areas of sand and silt or soil are also present. Eel-grass was observed in places. The stream banks are generally approximately 1 m high, but can be significantly higher or lower in places. The surrounding overbank area floodplain has mainly thick alder (*Alnus* sp.) stands, with grass and herbaceous plants in isolated areas. Aerial photograph examination indicates that this watercourse form occurs along most of the 4,542 m length of channel from New Post Creek to Otter Rapids Road. Immediately upstream of Otter Rapids Road there is a backwater effect that seems to have reduced the amount of alder overhanging the channel for approximately 650 m; however, the alders reassert themselves upstream of this point. The broad floodplain with alder gradually narrows in an upstream direction, and is apparent in the aerial photograph until approximately 9 km upstream from New Post Creek.

Numerous Slimy Sculpin, which prefers cold water temperatures, and one young-of-the-year (YOY) White Sucker, were collected by electrofishing upstream of New Post Creek. Slimy Sculpin and Brook Stickleback were also captured near Otter Rapids Road.

Tributary 2 (MNR ID#491)

This tributary is very small and has a small watershed (Figure 2.10). Consequently, it has little flow, as evidenced by the shallow channel that drops steeply into New Post Creek from the surrounding table lands. It was not flowing but did have some standing water at a small culvert crossing of Parliament Loop Road, approximately 516 m upstream from New Post Creek, after a couple of rainy days when examined on September 18, 2012. Based on aerial photograph examination, the tributary does not have a well defined channel, and is likely often dry. No electrofishing was attempted, but this watercourse is unlikely to support fish, due to the lack of water and the steep drop into New Post Creek that would likely be a barrier to upstream fish movement.

Tributary 3 (MNR ID#554)

This tributary is very small and has a small watershed (Figure 2.10). No outfall to New Post Creek was apparent when this area was examined on September 20, 2011. Aerial photograph examination indicates that it is essentially a swale that appears to begin approximately 1,100 m upstream from New Post Creek. It likely does not provide habitat for fish.

Tributary 4 (MNR ID#550)

Tributary 4 is a relatively long watercourse with numerous beaver dams that occur at a point approximately 1,200 m upstream from New Post Creek. Flows were estimated at 0.05 and

0.02 $m^3$/s on September 20, 2011 and September 18, 2012, respectively. Substrate near its mouth at New Post Creek is mainly gravel and cobble with wood debris accumulation a short distance upstream. The banks near its mouth are fairly high, and composed of clay and gravel. Approximately 212 m upstream from New Post Creek, the channel substrate was mainly hard clay with some gravel and cobble, with a greater amount of coarse material in riffles. Approximately 510 m upstream from New Post Creek at Otter Rapids Road, the terrain is relatively flat and this tributary is more like a wetland immediately upstream of the road culvert.

Slimy Sculpin and Pearl Dace were captured by electrofishing upstream of its outlet to New Post Creek, whereas Northern Redbelly Dace and Brook Stickleback were collected upstream of Otter Rapids Road.

Tributary 5 (MNR ID#545)

Tributary 5 is very small with a small watershed (Figure 2.10). No outfall to New Post Creek was apparent on September 20, 2011. Examination of aerial photographs and another site approximately 150 m upstream from New Post Creek on September 18, 2012 indicates that it has a poorly defined channel. There was no water present at the Otter Rapids Road culvert or downstream on September 18, 2012, despite the previous 36 hours of rain. Because of the lack of water this watercourse likely does not provide habitat for fish.

Tributary 6 (MNR ID#520)

Tributary 6 originates in a large wetland approximately 2.8 km upstream from New Post Creek, and flows through a number of beaver ponds between the wetland and its crossing of Parliament Loop Road, approximately 760 m upstream from New Post Creek (Figure 2.10). The last 350 m of this watercourse is a meander loop of the pre-diversion New Post Creek channel, that became isolated when the flows diverted from the Little Abitibi River in 1963 eroded a new course for the creek that bypassed this loop (Figure 2.10). When examined near its mouth on September 20, 2011, there was some standing water in the pre-diversion New Post Creek channel with very little flow despite the heavy sustained rainfall the previous day. Substrate is clay, and the riparian vegetation is alder. Aerial photograph examination indicates that farther upstream in the pre-diversion loop there are larger areas of ponding, that likely retain some water during extended dry periods. At the Parliament Loop Road crossing, there is a large beaver pond with clay substrate and rooted aquatic plants upstream of the road. The beaver dam is perched on the top of the roadbed, and the culvert is blocked, forcing the water to flow over the road. Immediately downstream of the beaver dam, the small channel has substrate of clay mixed with sand, gravel and cobble.

No fish were captured by electrofishing upstream of its outlet to New Post Creek, likely because this portion of channel is dry at times. Northern Redbelly Dace and Brook Stickleback were collected below the beaver dam at Parliament Loop Road.

Tributary 7 (MNR ID#505)

Tributary 7 begins in a large wetland approximately 3 km upstream from New Post Creek, and flows through a number of beaver ponds and marshy areas up to a point approximately 850 m upstream from New Post Creek (Figure 2.10). There is a fairly steep drop into New Post Creek at its mouth. The substrate was hard clay or soil wherever examined. Between the two beaver ponds, approximately 1,500 m upstream from New Post Creek, the tributary had a meandering entrenched channel, whereas farther downstream it was a flooded alder swamp.

Parliament Loop Road is traversed by the main channel of Tributary 7, approximately 1,700 m upstream of New Post Creek, as well as two smaller tributary branches to the west and east (see Figure 2.10). At the main channel crossing, a large beaver dam is perched on the upstream (north) side of the road. The culvert is blocked, with a flow of approximately 4 L/s over the roadbed. A small alder swamp is present immediately downstream of the road.

The western branch of Tributary 7 consists of a broad swale upstream of the Parliament Loop Road crossing, with a narrow defined channel downstream that joins the main channel approximately 400 m further downstream. During two site visits, flow was less than 1 L/s after one or two days of sustained rainfall.

The eastern branch of Tributary 7 has no defined channel and consists of a broad swale with a small culvert beneath Parliament Loop Road. During the two site visits, wet boggy soil was present within the swale upstream of the road, whereas a limited area of standing water was present downstream.

No fish were captured in this tributary by electrofishing. Based on its size, Tributary 7 likely supports a simple and sparse fish community in some locations.

Tributary 8 (MNR ID#489)

Tributary 8 originates in a large wetland approximately 1.7 km upstream from New Post Creek, and flows through a series of beaver ponds until a point approximately 470 m upstream, where it descends within a wooded slope in a ravine before leveling off for the last 100 m before its confluence with New Post Creek (Figure 2.10). Northern Redbelly Dace was collected by electrofishing.

Parliament Loop Road is traversed by an additional tributary just south of its intersection of Otter Rapids Road. This watercourse has a poorly defined channel with flows of less than and approximately 1 L/s during the two site visits. This watercourse likely discharges into Tributary 8, but may be a tributary of Wacousta Creek, which discharges into the Little Abitibi River. A small marsh with a 1 m deep pool of water was present upstream of the road crossing, with a diffuse channel with soil substrate downstream. No fish were captured by electrofishing.

Tributary 9 (MNR ID#509)

Tributary 9 is a relatively long watercourse that begins in a network of beaver ponds and a bog lake, at least 5 km upstream from New Post Creek. A series of active and inactive beaver ponds occur along the main channel closer to New Post Creek. The flow was estimated at 0.01 $m^3$/s on September 17, 2012. Near its mouth at New Post Creek and for 100 m upstream, the channel consists of clay with a small amount of coarse material on the bottom, whereas the adjacent flat overbank area is vegetated with alder. Further upstream, the watercourse descends the slope from the higher lands, and has cobble, sand and gravel substrate. Approximately 1,850 m upstream from New Post Creek at Otter Rapids Road, the terrain is relatively flat and the tributary is more like a wetland immediately upstream of the perched road culvert. Flow through the culvert on September 18, 2012 estimated at 0.005 $m^3$/s.

No fish were captured by electrofishing. However, because this watercourse has a diversity of pond habitats at various locations along its length, and habitats observed near New Post Creek are of reasonable quality, a simple fish community is probably present.

Tributary 10 (MNR ID#495)

This tributary is very small and has a small watershed (Figure 2.10). Based on this and the absence of water observed during a day of steady rain on September 17, 2012, it is typically dry. The shallow soil channel that drops steeply into a pre-diversion channel of New Post Creek from the surrounding lands without creating a gully also suggests that significant flow in this watercourse is rare. Aerial photograph examination indicates that there is no defined channel. Due to the lack of water this watercourse is unlikely to support fish. The section of pre-diversion New Post Creek channel that this tributary discharges to is now an oxbow pond and wetland.

#### *2.2.6.2 Fish Migration Barriers*

The New Post Creek waterfalls located approximately 800 m upstream of the creek's outlet to the Abitibi River provides a complete barrier to upstream fish migration.

Watercourses affected by diversions such as New Post Creek generally support a low diversity of fish (C. Jorgensen, DFO, 2011, pers. comm.). It is anticipated that when flows were abruptly increased by approximately 10 times due to the diversion, a substantial number of resident fish were initially swept over the waterfalls. As indicated in Section 2.2.6, Northern Pike were present in pre-diversion New Post Creek upstream of the waterfalls, whereas none were captured during the proposed Project fisheries surveys (see Section 2.2.6.4) except for a single YOY captured by drift net at the Otter Rapids Road bridge. With little recruitment from tributaries and severed from downstream habitats and fish communities by New Post Creek waterfalls, the post-diversion fish community in New Post Creek is characterized by low diversity and small populations. In addition, there is likely some migration of fish from this creek section downstream over the waterfalls.

### *2.2.6.3 Fish Community and Spawning Studies*

A number of fisheries resources studies have been undertaken as part of the EA for the proposed New Post Creek Project (see Appendix A):

- Walleye spawning assessments in New Post Creek downstream of the waterfalls and at the proposed Project tailrace location on May 19 to 22, 2009 (Coker and Portt, 2012a); as no potential Walleye spawning habitat was observed at the proposed Project tailrace location, no further investigations at the tailrace were undertaken in subsequent years;
- Walleye spawning assessments in New Post Creek downstream of the waterfalls only on May 3, 2010 (Coker and Portt, 2012a) and May 14, 2011 (Coker and Portt, 2012b);
- Lake Whitefish spawning assessments in New Post Creek downstream of the waterfalls and at the proposed Project tailrace location on October 26 to 28, 2009 (Coker and Portt, 2012c); as no potential Lake Whitefish spawning habitat was observed at the proposed Project tailrace location, no further investigations at the tailrace were undertaken in subsequent years;
- Lake Whitefish spawning assessments in New Post Creek downstream of the waterfalls only on October 19 and 20, 2010 and October 31 to November 3, 2011 (Coker and Portt, 2012c);
- Lake Sturgeon spawning assessment based on spawning observations on May 20, 2010 and gillnetting in New Post Creek downstream of the waterfalls and in the Abitibi River near the mouth of New Post Creek on May 25 to 27, 2010 (Coker and Portt, 2012d);
- Lake Sturgeon spawning assessments based on gillnetting and egg mat deployment in New Post Creek downstream of the waterfalls and gillnetting below the Abitibi Canyon GS tailrace from May 20 to June 6, 2011, as well as from May 11 to 23, 2012 (Coker and Portt, 2013e);
- drift netting for YOY Lake Sturgeon between May 30 and June 14, 2012, with 126 overnight driftnet sets conducted in New Post Creek downstream of the waterfalls and 20 in the Abitibi River below Abitibi Canyon (as well as four in upper New Post Creek to confirm that dead coregonid YOY captured in the drift nets below New Post Creek waterfalls were originating from upstream areas) (Coker and Portt, 2013e);
- small fish community assessments in New Post Creek by backpack electrofishing downstream of the waterfalls on August 24, 2009, May 25 and 27, 2010, September 17, 2011 and May 22, 2012, as well as upstream of the waterfalls on August 25, 2009, May 27, 2010, and September 20 and November 2, 2011 (Coker and Portt, 2013a);
- gillnetting in New Post Creek downstream of the waterfalls on September 13 to 18 and October 31 to November 3, 2011, as well as upstream of the waterfalls on October 28, 2009, May 27, 2010 and September 19 and 20, 2011 (Coker and Portt, 2013a); and
- gillnetting in the Abitibi River at the proposed tailrace location on October 18 to 20, 2010, near the mouth of New Post Creek on September 13 to 16, 2011, and below the rapids at Abitibi Canyon on September 14 to 20, 2011 (Coker and Portt, 2013a).

#### *2.2.6.4 Fish Community Composition*

Abitibi River

In October 2010, Goldeye, Longnose Sucker, Shorthead Redhorse and Walleye were captured by gillnetting in the Abitibi River at the proposed tailrace location (Coker and Portt, 2012c), whereas Lake Sturgeon were netted in the vicinity of the New Post Creek outlet in May 2010 (Coker and Portt, 2012d). In September 2011, Lake Sturgeon, Goldeye, Mooneye, Longnose Sucker and Shorthead Redhorse were captured by gillnetting near the mouth of New Post Creek and adjacent to the boat ramp downstream of the Abitibi Canyon rapids (Coker and Portt, 2013a). White Sucker, Brown Bullhead, Northern Pike, Lake Whitefish, Burbot, Rock Bass, Sauger and Walleye were also captured at the boat ramp location.

Based on river index netting between Abitibi Canyon GS and Otter Rapids GS between September 22 and 26, 2010, the MNR collected seven fish species: Lake Sturgeon, Goldeye, Fallfish, Longnose Sucker, Shorthead Redhorse, Sauger and Walleye (Coker and Portt, 2013a).

Larval drift netting in the Abitibi River below Abitibi Canyon during June 2012 captured embryo and YOY Lake Sturgeon, YOY sucker (Catostomidae), YOY Walleye or Sauger (*Sander* spp.) and YOY Northern Pike (Coker and Portt, 2013e). Juvenile or adult Mooneye, Trout-perch and Emerald Shiner were also captured.

Abitibi River Tributaries

Electrofishing of the Abitibi River tributaries traversed by the access road resulted in the collection of Fathead Minnow and Brook Stickleback in one of the watercourses (Coker and Portt, 2013b).

Electrofishing and/or dipnetting of the Abitibi River tributaries traversed by the proposed transmission line ROW resulted in the collection Northern Redbelly Dace, Finescale Dace and/or Brook Stickleback in two of the watercourses. Brook Trout was the only fish species captured in Pinard Creek (Coker and Portt, 2013c).

New Post Creek

Fourteen fish species were collected by electrofishing in New Post Creek downstream of the waterfalls in August 2009, May 2010, September 2011 and/or May 2012: Lake Chub, Longnose Dace, Longnose Sucker (juvenile), White Sucker (YOY), Shorthead Redhorse, Burbot (juvenile), Trout-perch, Mottled Sculpin, Slimy Sculpin, Spoonhead Sculpin, Yellow Perch (YOY), Walleye (juvenile), Johnny Darter and Logperch (Coker and Portt, 2013a). In addition, Lake Sturgeon, Mooneye, Longnose Sucker, White Sucker, Shorthead Redhorse, Northern Pike, Lake Whitefish, Burbot, Yellow Perch, Sauger and Walleye were captured during gillnetting and/or hoopnetting surveys in 2009, and gillnetting surveys in 2010, 2011 and 2012 in New Post Creek below the waterfalls (Coker and Portt, 2012a, b, c, d, 2013a, e).

In June 2012, drift net catches below the New Post Creek waterfalls were dominated by YOY coregonids (*Coregonus* spp.), YOY sucker (Catostomidae) and YOY Sculpin (Cottidae), with small numbers of YOY Burbot, YOY Walleye or Sauger (*Sander* spp.), YOY Yellow Perch and YOY Northern Pike (Coker and Portt, 2013e). Based on their deteriorated condition, the YOY coregonids likely originated from the Little Abitibi River upstream of New Post Creek Diversion Dam (see Section 2.2.6.7). A small number of juvenile or adult Trout-perch, Northern Redbelly Dace, Spottail Shiner, Logperch, Johnny Darter, Brook Stickleback and Brown Bullhead were also captured.

No fish were captured by electrofishing or gillnetting near the proposed intake weir location in August and October 2009, respectively, although some Sculpin (*Cottus* sp.) were observed in August 2009 (Coker and Portt, 2013a). In 2010, low numbers of Mottled or Slimy Sculpin and Burbot (juvenile) were collected by electrofishing near the proposed intake weir location, whereas a decomposed Longnose Sucker was collected by gillnetting.

Despite intensive gillnetting and electroshocking in 2011, low numbers of Longnose Dace, Pearl Dace, Longnose Sucker (juvenile and adult), White Sucker (YOY and adult), Burbot and Sculpin (Mottled or Slimy) and Johnny Darter were captured (Coker and Portt, 2013a).

In June 2012, drift net catches in New Post Creek at the Otter Rapids Road bridge included coregonid YOY in deteriorated condition (see Section 2.2.6.7), YOY sucker (Catostomidae), YOY Sculpin (Cottidae), YOY Burbot and YOY Northern Pike, suggesting that some portion of the drift net catch below the waterfalls may be fish that had been transported from upstream in New Post Creek (Coker and Portt, 2013e). A few juvenile and adult fish were also captured including Northern Redbelly Dace, Lake Chub, Longnose Dace, Spottail Shiner, Blacknose Shiner and Fallfish.

<u>New Post Creek Tributaries</u>

Electrofishing in the lower reaches of tributaries to New Post Creek between the proposed intake weir location and the anticipated upstream extent of inundation resulted in the capture of five fish species: Northern Redbelly Dace, Pearl Dace, White Sucker (YOY), Brook Stickleback and/or Slimy Sculpin in four of the ten tributaries (Coker and Portt, 2013a).

Electrofishing of the New Post Creek tributaries that are traversed by Parliament Loop Road resulted in the collection of Northern Redbelly Dace and Brook Stickleback in one of the watercourses (Coker and Portt, 2013d).

Overall, electrofishing, gillnetting and hoopnetting catches in the Abitibi River and New Post Creek were low. Table 2.20 presents the fish species collected in the Abitibi River, New Post Creek and their tributaries during the course of the proposed Project fisheries studies.

**Table 2.20 Fish Species Collected in the Abitibi River, New Post Creek and their Tributaries[1]**

| Common Name | Scientific Name | Abitibi River[2] | New Post Creek | |
|---|---|---|---|---|
| | | | Downstream of Falls | Upstream of Falls[3] |
| Lake Sturgeon[3] | *Acipenser fulvescens* | X | X | |
| Goldeye | *Hiodon alosiodes* | X | | |
| Mooneye | *H. tergisus* | X | X | |
| Northern Redbelly Dace | *Chrosomus eos* | X | X | X |
| Finescale Dace | *C. neogaeus* | X | | |
| Lake Chub | *Couesius plumbeus* | | X | X |
| Pearl Dace | *Margariscus margarita* | | | X |
| Emerald Shiner | *Notropis atherinoides* | X | | |
| Blacknose Shiner | *N. heterolepis* | | | X |
| Spottail Shiner | *N. hudsonius* | | X | X |
| Fathead Minnow | *Pimephales promelas* | X | | |
| Longnose Dace | *Rhinichthys cataractae* | | X | X |
| Fallfish | *Semotilus corporalis* | X | | X |
| Longnose Sucker | *Catostomus catostomus* | X | X | X |
| White Sucker | *C. commersonii* | X | X | X |
| Shorthead Redhorse | *Moxostoma macrolepidotum* | X | X | |
| Brown Bullhead | *Ameiurus nebulosis* | X | X | |
| Northern Pike | *Esox lucius* | X | X | X |
| Cisco (Lake Herring) | *Coregonus artedii* | | X[4] | X[4] |
| Lake Whitefish | *C. clupeaformis* | X | X | |
| Brook Trout | *Salvelinus fontinalis* | X | | |
| Burbot (Ling) | *Lota lota* | X | X | X |
| Trout-perch | *Percopsis omiscomaycus* | X | X | |
| Brook Stickleback | *Culaea inconstans* | X | X | X |
| Mottled/Slimy Sculpin | *Cottus bairdii/cognatus* | | X | X |
| Spoonhead Sculpin | *C. rice* | | X | |
| Rock Bass | *Ambloplites rupestris* | X | | |
| Yellow Perch | *Perca flavescens* | | X | |
| Sauger | *Sander canadensis* | X | X | |
| Walleye | *S. vitreus* | X | X | |
| Johnny Darter | *Etheostoma nigrum* | | X | X |
| Logperch | *Percina caprodes* | | X | |

1 Coker and Portt (2012a, b, c, d, 2013a, b, c, d, e).
2 Based on gillnetting and larval drift netting in the river and electrofishing and/or dipnetting of its tributaries potentially affected by the proposed Project within the local study area.
3 Based on gillnetting, larval drift netting and electrofishing in New Post Creek and electrofishing of its tributaries potentially affected by the proposed Project within the local study area.
4 Based on deterioration condition, YOY likely originated from the Little Abitibi River upstream of the New Post Creek Diversion Dam.

#### *2.2.6.5 Walleye Spawning*

Based on field observations in May 2009, 2010 and 2011, Walleye spawning does occur in the lower section of New Post Creek, downstream of the waterfalls (Coker and Portt, 2012a, b).

In May 2009 and 2011, Walleye was not observed during night observations using a 1.5 million candlepower spotlight; however, the water was very turbid which limited the potential to observe Walleye (Coker and Portt, 2012a, b). Two male Walleye in spawning condition and a nearly spent female Walleye were captured by hoopnet and gillnets in May 2009, whereas two male and one female Walleye in spawning condition were captured by gillnets in May 2011.

Walleye were observed along the shoreline during the night observations in 2010 when the flow was unusually low and the water was marginally clear (Coker and Portt, 2012a). Six male Walleye in spawning condition were captured by gillnet. Coker and Portt (2012a) opined that the lower flows (19.5 $m^3/s$) within New Post Creek in 2010 likely resulted in better habitat conditions for spawning Walleye than the higher flows (174.5 $m^3/s$) observed in 2009.

Walleye spawning is likely not a concern in the Abitibi River in the vicinity of the proposed Project tailrace (Coker and Portt, 2012a). There does not appear to be suitable spawning habitat at the proposed tailrace location, and habitat that occurs there is common and widespread in this watercourse section.

#### *2.2.6.6 Lake Sturgeon Spawning*

The James Bay Lake Sturgeon population is designated as Special Concern federally (COSEWIC, 2012) and provincially (MNR, 2013). The identification of critical Lake Sturgeon habitat, i.e., spawning, migration and nursery areas, through aquatic habitat surveys on the Abitibi River was a priority objective identified in the 1989-2000 MNR Cochrane District Fisheries Management Plan (MNR, 1988a).

Coker and Portt (2012d) undertook a Lake Sturgeon spawning assessment of New Post Creek between the waterfalls and its confluence with the Abitibi River in May 2010. One or more Lake Sturgeon was observed repeatedly surfacing at the base of shallow rapids downstream of the waterfalls. Nine Lake Sturgeon were captured by gillnet in New Post Creek, whereas two were captured in the Abitibi River near the mouth of New Post Creek. No other fish species were captured. Most of the adult Lake Sturgeon appeared as if they had been spawning, as they were flattened on their ventral surface and one had a small amount of blood coming from its vent. However, no gametes were expressed by any of the fish during handling. The presence of spent Lake Sturgeon in New Post Creek and the Abitibi River did not explicitly delineate their actual spawning location.

The rapids below Abitibi Canyon GS on the Abitibi River and the rapids downstream of the New Post Creek waterfalls are the only likely spawning locations for Lake Sturgeon. As a result, an additional assessment involving gillnetting and egg collection mat deployment (20 mats) in New Post Creek downstream of the waterfalls, as well as gillnetting in the Abitibi River near Abitibi Canyon, was undertaken in May and June 2011 (Coker and Portt, 2013e). A total of 13 Lake Sturgeon were captured in New Post Creek with only one being a recaptured fish and none were ripe. Below Abitibi Canyon, 30 Lake Sturgeon were captured with 12 being recaptured fish and eight were ripe males. None of the Lake Sturgeon captured and marked in either of these two areas were recaptured in the other area during the gillnetting period (May 21 to June 6, 2011).

Very few Lake Sturgeon were captured in gillnets over the first eight days of field work. On the ninth day (May 31), the number of Lake Sturgeon below Abitibi Canyon suddenly spiked to nine individuals, with seven being ripe males, indicating that the spawning run had begun. No corresponding increase in Lake Sturgeon catch, or appearance of ripe fish, occurred in New Post Creek. The spawning run below Abitibi Canyon appeared to be brief, with ripe fish captured for only two days, and the number of Lake Sturgeon captured declining after the initial spike. Although water temperatures were suitable for spawning in New Post Creek, only after the spawning period appeared to end below Abitibi Canyon did Lake Sturgeon begin to occur in greater numbers in New Post Creek. None of these fish in New Post Creek were ripe and most were in post-spawning condition (flaccid), suggesting that spawning did not occur in the creek in 2011.

No Lake Sturgeon eggs were collected in the 20 egg mats deployed in New Post Creek from May 22 to June 5, 2011, also suggesting that Lake Sturgeon spawning did not occur in the creek in 2011. A number of amber coloured eggs, approximately 3 mm in diameter, were recovered from the egg mats when they were initially set, but the number declined over the deployment period. Based on their colour and size, and the season and habitat, these eggs were probably from suckers (Catostomidae). Lake Sturgeon eggs are also approximately 3 mm in diameter, but are black in colour (Becker, 1983).

To further confirm that Lake Sturgeon spawn in the Abitibi River near Abitibi Canyon but not in New Post Creek downstream of the waterfalls, an additional assessment involving gillnetting and egg collection mat deployment were undertaken from May 11 to 23, 2012, as well as larval drift netting between May 30 and June 14, 2012.

A total of 15 Lake Sturgeon were captured in New Post Creek, of which five had been previously captured in 2011, and three of these previously captured below Abitibi Canyon. Below Abitibi Canyon, 32 Lake Sturgeon were captured, with five being recaptured fish marked in 2012 and two being recaptured fish marked in 2011 below Abitibi Canyon. None of the Lake Sturgeon captured and marked in either of these two areas in 2012, were recaptured in the other area during the gillnetting period (May 11 to 23, 2012).

All 15 Lake Sturgeon were caught in New Post Creek during the first five days of gillnetting, with none captured over the remaining seven days. None were ripe or in post-spawning condition, again suggesting that spawning did not occur in New Post Creek in 2012.

As in 2011, relatively few Lake Sturgeon were initially caught in the Abitibi River below Abitibi Canyon. Catches increased on May 19, 2012, coincident with the capture of six ripe males and one in post-spawning condition. Ripe males and females were also captured on May 20, 21 and 22, with catches declining over this period and none captured on May 23.

No Lake Sturgeon eggs were collected in the 40 egg mats deployed in New Post Creek from May 11 to 22, 2012, also suggesting that Lake Sturgeon spawning did not occur in the creek in 2012. As in 2011, a number of eggs were recovered from the egg mats and based on their amber colour, 3 mm size and the collection timing, these were likely catostomid (sucker) eggs.

No YOY Lake Sturgeon were captured in the eight to ten drift nets set in New Post Creek from May 31 to June 14 (Coker and Portt, 2013e). As indicated in Section 2.2.6.4, numerous YOY of other spring spawning fish species were collected.

In contrast, three pre-emergent Lake Sturgeon embryos were collected in the two drift nets set in the Abitibi River below Abitibi Canyon during the June 4 and 5, 2012 lifts (Coker and Portt, 2012b). These embryos were kept alive in jars of river water until they were sufficiently developed to be positively identified as Lake Sturgeon. On June 13 and 14, 2012, one and nine YOY Lake Sturgeon, respectively, were captured in the two drift nets below Abitibi Canyon, indicating that normal emergence from the substrate and drift had commenced. A few other YOY fishes were also captured (see Section 2.2.6.4).

Coker and Portt (2013e) concluded that the 2010, 2011 and 2012 studies have demonstrated that Lake Sturgeon spawn in the Abitibi River below Abitibi Canyon. The study findings also support the conclusion that Lake Sturgeon do not spawn in New Post Creek. Despite the lack of evidence based on the study findings, MNR and DFO have opined that New Post Creek may still be a possible spawning area used occasionally by Lake Sturgeon.

However, Lake Sturgeon were caught in New Post Creek prior to and after the Abitibi Canyon spawning period, suggesting that the watercourse does provide an important habitat function, e.g., availability of higher benthic macroinvertebrate densities for foraging (see Section 2.2.5).

As in the case of Walleye, Lake Sturgeon spawning is likely not a concern in the Abitibi River in the vicinity of the proposed Project tailrace (Coker and Portt, 2012d). There does not appear to be suitable spawning habitat at the proposed tailrace location, and habitat that occurs there is common and widespread in this section of river.

#### *2.2.6.7 Lake Whitefish Spawning*

The Lake Whitefish population in the Abitibi River between Abitibi Canyon and Otter Rapids is apparently small. Low numbers (total of four) of Lake Whitefish were captured by gillnetting in the tailrace of the Abitibi Canyon GS in May and June 1997 (Hendry and Chang, 2001). No Lake Whitefish were captured in 60 overnight gillnet sets during MNR River Index Netting undertaken between September 13 and 17, 2010 between Abitibi Canyon and the Otter Rapids GS. During the proposed Project EA field work, one Lake Whitefish was captured by gillnetting adjacent to the boat ramp below the Abitibi Canyon rapids between September 14 and 20, 2011, and one was captured in New Post Creek downstream of the waterfalls between September 13 and 18, 2011 (Coker and Portt, 2013a).

Lake Whitefish were not captured or observed by underwater video in New Post Creek below the waterfalls during field surveys in October 2009 and 2010 and October - November 2011 (underwater video was not used in 2011), although the habitat appeared suitable for spawning and was accessible from the Abitibi River, with water temperatures within the usual range for Lake Whitefish spawning (Coker and Portt, 2012c).

As indicated in Section 2.2.6.4, drift net catches in New Post Creek from May 31 to June 14, 2012, were dominated by YOY coregonids (*Coregonus* spp.) (Coker and Portt, 2013e). The majority were identified as Cisco, while the remaining could not be identified to species because of their smaller size or poor condition. All coregonids captured were dead and in various states of decomposition. As coregonid spawning had not been observed and was not considered to occur below New Post Creek waterfalls (Coker and Portt, 2012c), and given the late timing of the coregonid drift, as well as the deteriorated condition of these specimens, it was suspected that they originated from farther upstream (Coker and Portt, 2013b). Drift nets set in New Post Creek at the Otter Rapids Road bridge on June 7-8 and 11-12 captured coregonid YOY in a similar deteriorated condition, confirming the suspicion of upstream origin, likely the Little Abitibi River upstream of New Post Creek Diversion Dam.

As in the case of Walleye and Lake Sturgeon, Lake Whitefish spawning is likely not a concern in the Abitibi River in the vicinity of the proposed Project tailrace (Coker and Portt, 2012c). There does not appear to be suitable spawning habitat at the proposed tailrace location, and the habitat that occurs there is common and widespread in this watercourse section.

#### *2.2.6.8 Other Fish Species Spawning*

Based on field observations in May 2009, 2010 and 2011, White Sucker and Longnose Sucker spawning also occurs in the lower section of New Post Creek, downstream of the waterfalls.

Two male White Sucker in spawning condition were captured by gillnet in May 2009, whereas nine Longnose Sucker and three White Sucker, with some of the males in spawning condition, were captured in May 2010 (Coker and Portt, 2012a). The one male Longnose Sucker and four male White Sucker captured in May 2011 were also in spawning condition (Coker and Portt, 2012b).

As indicated in Section 2.2.6.4, in addition to YOY coregonids, June 2012 drift net catches in New Post Creek downstream of the waterfalls were also dominated by YOY sucker and YOY sculpin, with smaller numbers of YOY Burbot, YOY Walleye or Sauger, YOY Yellow Perch and YOY Northern Pike (Coker and Portt, 2013e), suggesting that the area below the New Post Creek waterfalls provides spawning habitat for a number of species. However, YOY sucker, YOY sculpin, YOY Burbot and YOY Northern Pike were also captured in drift nets set in New Post Creek at the Otter Rapids Road bridge, suggesting that some portion of the drift net catch below the waterfalls had originated from upstream sources.

#### *2.2.6.9 Fish Mercury Body Burden*

Relatively high total mercury (THg) concentrations in sportfish have been reported throughout the Moose River watershed (Headon and Pope, 1990; Seyler, 1998; Seyler and Kristmanson, 1999). Mean THg concentrations are higher in piscivores (Walleye, Northern Pike), generally exceeding the Health Canada (2007) fish consumption standard of 0.5 µg/g. Fish consumption advisories for Walleye, Northern Pike, Goldeye and White Sucker have been established by the MOE (see below). Mean THg concentrations are lower in benthivores and planktivores (Lake Whitefish, White Sucker), generally below the standard. THg concentrations generally increase with the length (age) of fish due to longer exposure.

Headon and Pope (1990) reported a mean THg concentration of 0.95 µg/g in Walleye with a mean length of 44.6 cm, collected from Lake Abitibi, upstream of the Twin Falls GS, the Iroquois Falls GS tailrace and Moose Lake, which is the headwater of the Frederick House River (a tributary of the Abitibi River). Only 8% of Walleye sampled had THg concentrations less than the 0.5 µg/g consumption standard, whereas 89% had THg concentrations below the 1.5 µg/g MOE advisory guideline for no consumption. THg concentrations of 40 cm Walleye from Lake Abitibi were 0.86, 0.71 and 0.92 µg/g in 1980, 1984 and 1985, respectively. In 1977, a sample of 15 Walleye with an average length of 47 cm collected from the Iroquois Falls GS tailrace downstream of Lake Abitibi had a mean THg concentration of 1.60 µg/g, which was the highest mean THg concentration reported for any dataset in the Moose River system.

Seyler (1998) reported that THg concentrations exceeding 1.0 µg/g were found in Walleye from 22 of 26 sampling locations within the Abitibi River watershed. THg concentrations exceeding 1.5 µg/g were found at 19 locations including eight natural lakes. Mercury concentrations in 50 cm Walleye, as predicted by regression modelling, in undeveloped portions of the Abitibi River were significantly higher (1.14 µg/g) than in 50 cm Walleye in the Groundhog River (0.64 µg/g) and Missinaibi River (0.74 µg/g).

Seyler and Kristmanson (1999) reported that THg concentrations in 40 cm Walleye from Moose Lake were 0.94 and 0.74 µg/g in 1977 and 1996, respectively, a decline of 0.2 µg/g. Moreover, THg concentrations in Walleye increased at locations where watercourses in the Moose River watershed have been impounded, but decreased immediately downstream.

The historic fish THg body burden data for the Abitibi River between Island Falls and Abitibi Canyon, Abitibi Canyon and Otter Rapids, and Otter Rapids and Onakawana were obtained from the MOE Environmental Monitoring and Reporting Branch (C. Mahon, MOE, 2013, pers. comm.) and are summarized in Table 2.21. The mean THg concentrations in Longnose Sucker, a benthivore, are lower than those in such piscivores as Walleye and Northern Pike. The elevated mean THg concentrations in Lake Sturgeon are due to their greater longevity and therefore their longer exposure to mercury sources.

**Table 2.21 Historic Fish THg Body Burden Data for the Abitibi River (Island Falls to Onakawana)[1]**

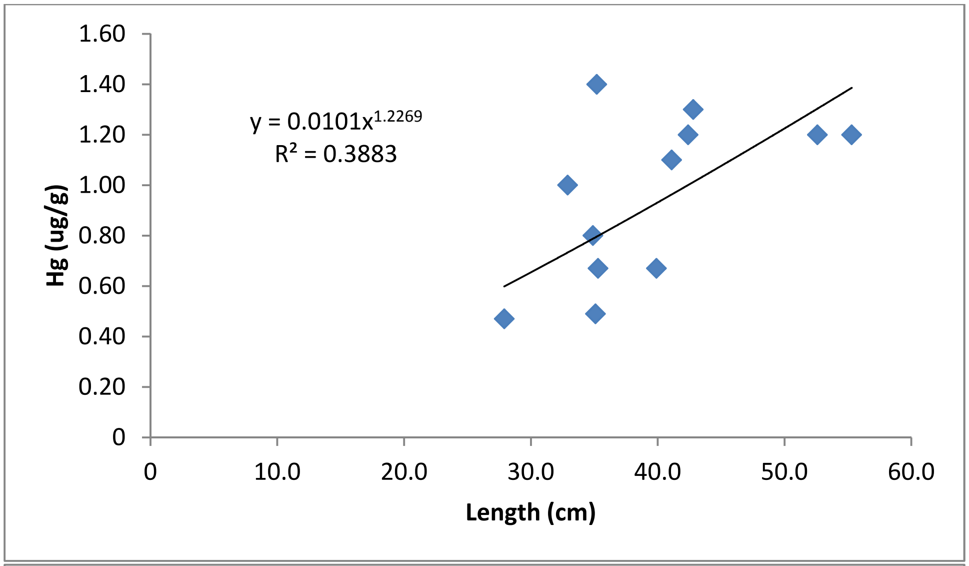
| Species/Location | Number of Fish | Mean Length (cm) (Range) | Mean Weight (g) (Range) | Mean Concentration (µg/g) (Range) |
|---|---|---|---|---|
| **Walleye** | | | | |
| Island Falls to Abitibi Canyon (1996) | 12 | 39.6 (27.9 – 55.3) | 881 (350 – 2,150) | 0.96 (0.47 – 1.40) |
| Island Falls to Abitibi Canyon (1977) | 16 | 42.7 (29.8 – 60.8) | 888 (225 – 2,719) | 1.54 (0.18 – 3.60) |
| Abitibi Canyon to Otter Rapids (1996) | 20 | 38.2 (25.0 – 47.9) | 655 (150 – 1,250) | 0.51 (0.20 – 1.20) |
| Otter Rapids to Onakawana (1996) | 13 | 50.1 (39.3 – 72.6) | 1,613 (675 – 5,000) | 0.90 (0.36 – 1.50) |
| **Northern Pike** | | | | |
| Island Falls to Abitibi Canyon (1977) | 15 | 57.6 (34.7 – 90.6) | 1,599 (278 – 5,075 | 1.14 (0.38 -2.40) |
| Abitibi Canyon to Otter Rapids (1996) | 11 | 53.2 (34.9 – 60.5) | 1,255 (500 - 1,800) | 0.57 (0.18 – 0.89) |
| **Sauger** | | | | |
| Island Falls to Abitibi Canyon (2010) | 12 | 30.3 (25.2 – 36.5) | 238 (120 – 468) | 0.48 (0.30 – 0.80) |
| **Lake Sturgeon** | | | | |
| Island Falls to Abitibi Canyon (1984) | 10 | 103.8 (87.5 – 120.0) | 7,185 (3,250 – 13,500) | 0.95 (0.40 -1.70) |
| **Goldeye** | | | | |
| Island Falls to Abitibi Canyon (1977) | 15 | 34.8 (30.0 – 41.0) | 433 (255 – 757) | 0.47 (0.20 – 0.71) |
| **Longnose Sucker** | | | | |
| Island Falls to Abitibi Canyon (1976) | 15 | 34.2 (28.7 – 37.2) | 592 (450 – 750) | 0.26 (0.12 – 0.50) |
| Otter Rapids to Onakawana (1996) | 14 | 37.0 (24.3 – 45.1) | 680 (175 – 1,225) | 0.09 (0.03 – 0.22) |

[1] Source: C. Mahon, MOE, 2013, pers. comm.

There were no statistically significant relationships between THg concentrations and the length or weight for each of the four Walleye data sets (see Figure 2.11). In contrast, statistically significant relationships were determined between THg concentrations and length and weight for both Northern Pike data sets (see Figure 2.12). For the remaining species, there were no statistically significant relationships between THg concentrations and length or weight, with the exception of THg concentrations and weight of Longnose Sucker from the Otter Rapids to Onakawana section of the Abitibi River (see Figure 2.13).

**Figure 2.11 Relationships between Walleye THg Concentrations and Length and Weight**

Island Falls to Abitibi Canyon (1996)



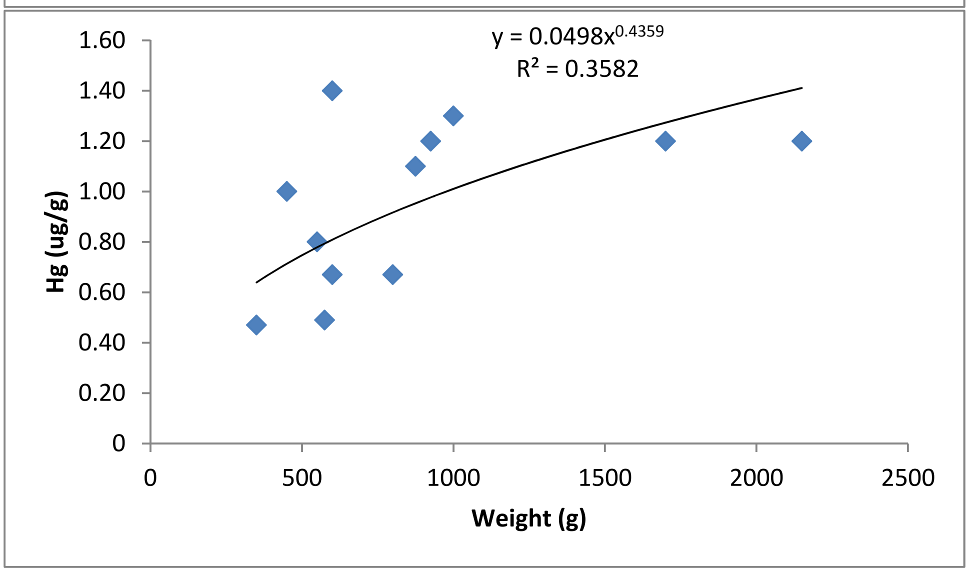
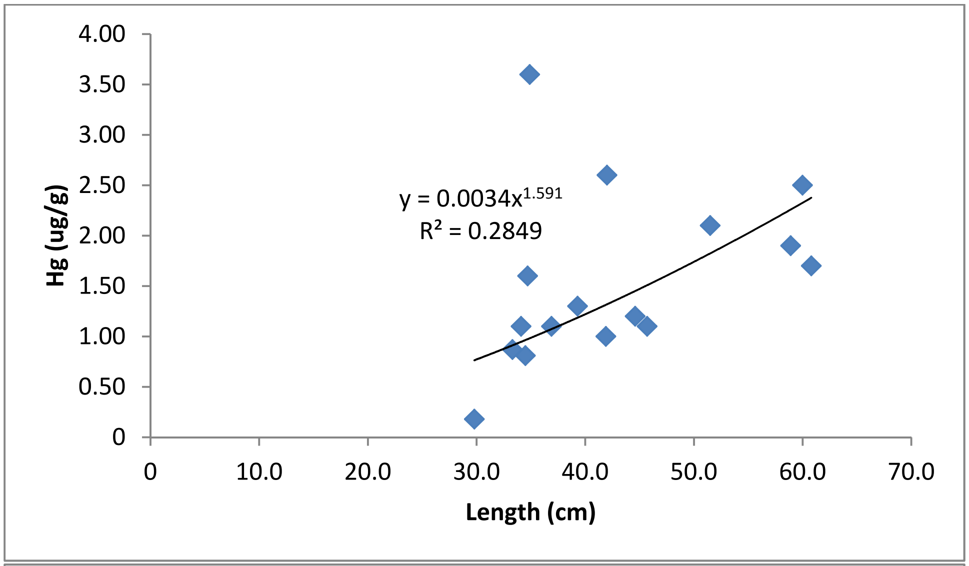



**Figure 2.11 Relationships between Walleye THg Concentrations and Length and Weight (Cont'd)**

Island Falls to Abitibi Canyon (1977)



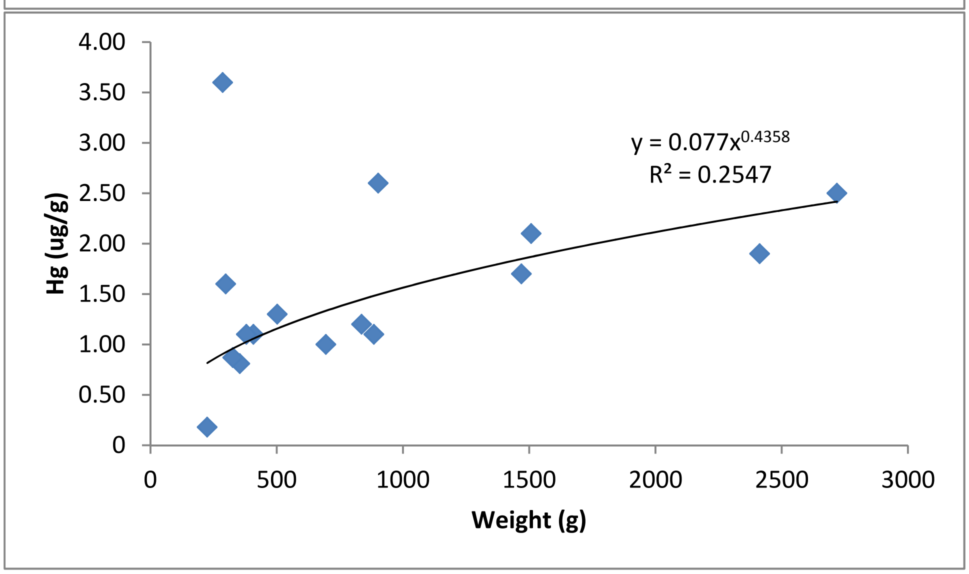
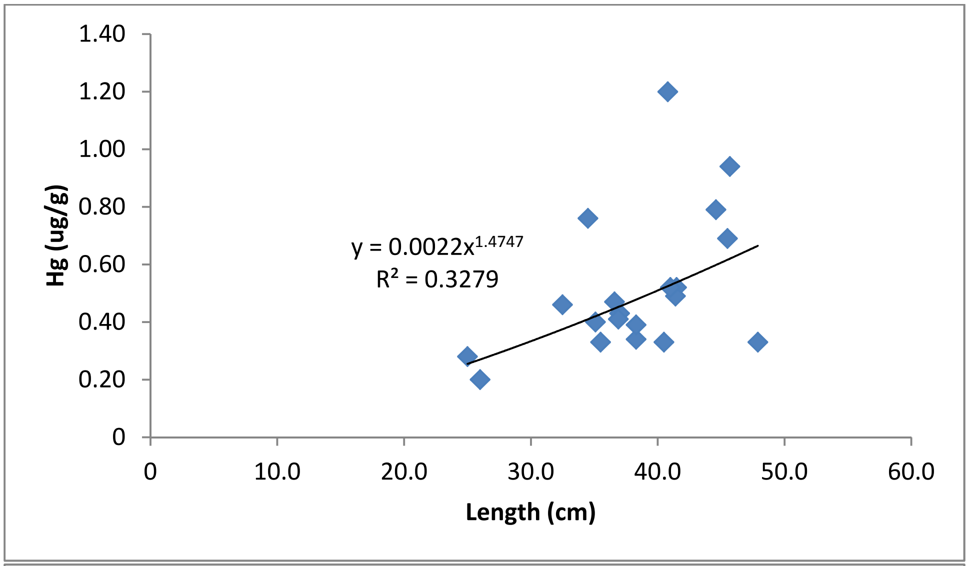



**Figure 2.11 Relationships between Walleye THg Concentrations and Length and Weight (Cont'd)**

Abitibi Canyon to Otter Rapids (1996)



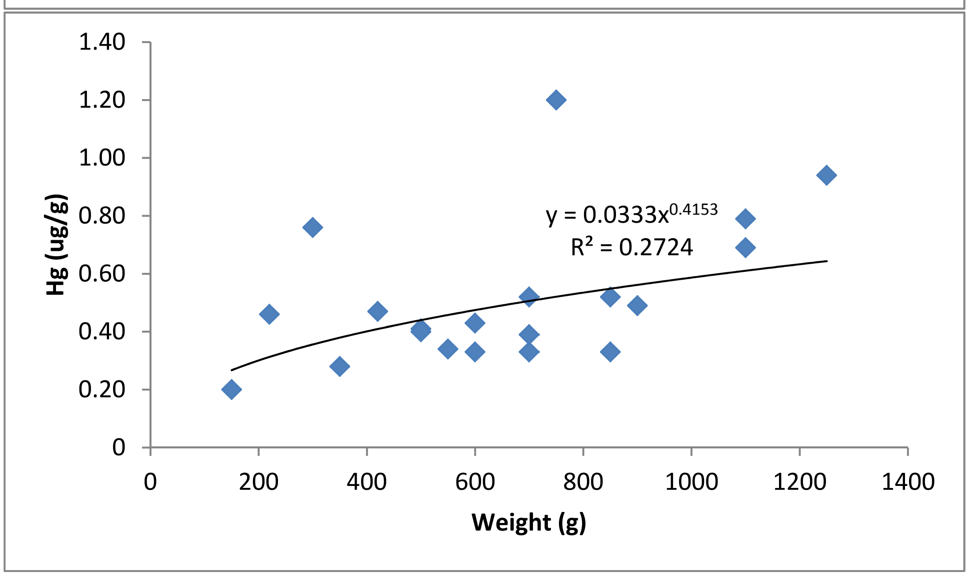



**Figure 2.11 Relationships between Walleye THg Concentrations and Length and Weight (Cont'd)**

<u>Otter Rapids to Onakawana (1996)</u>

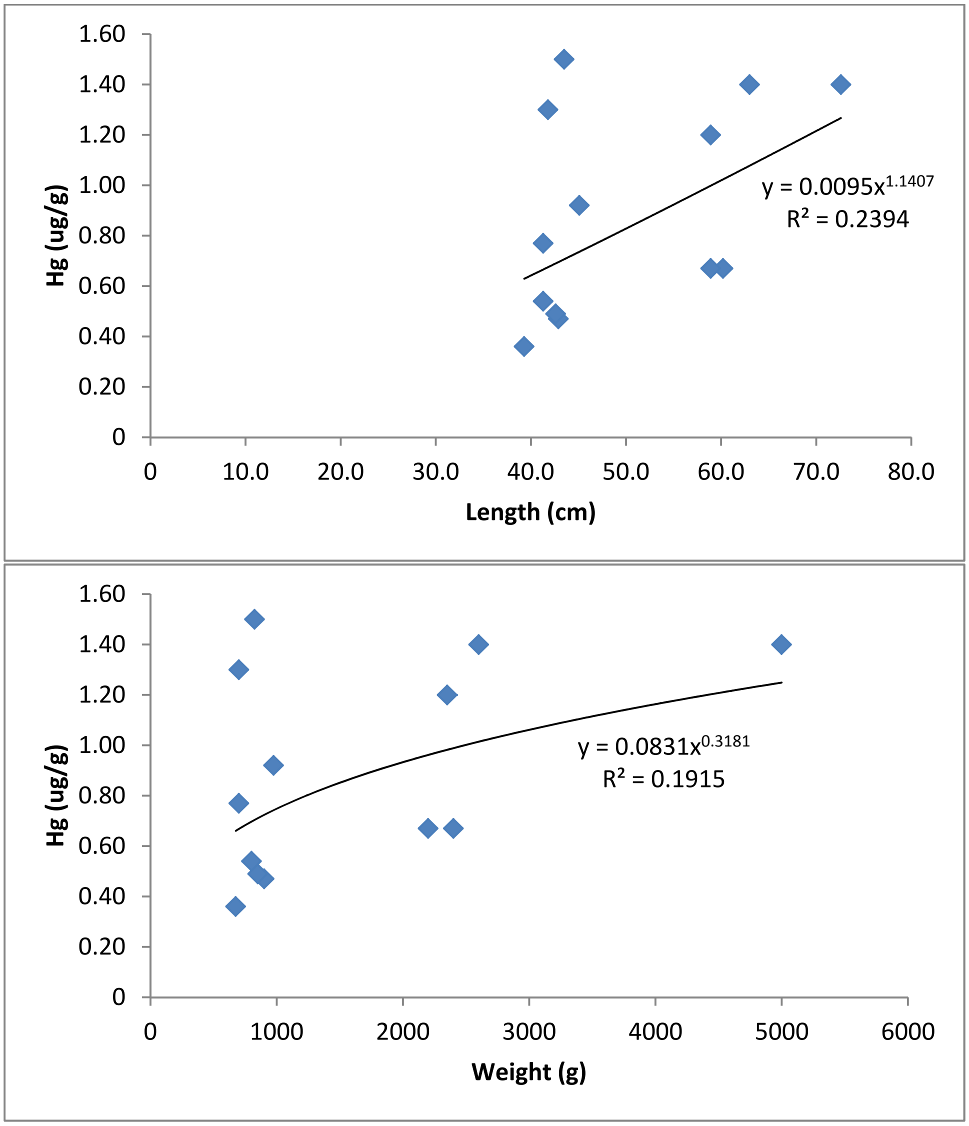
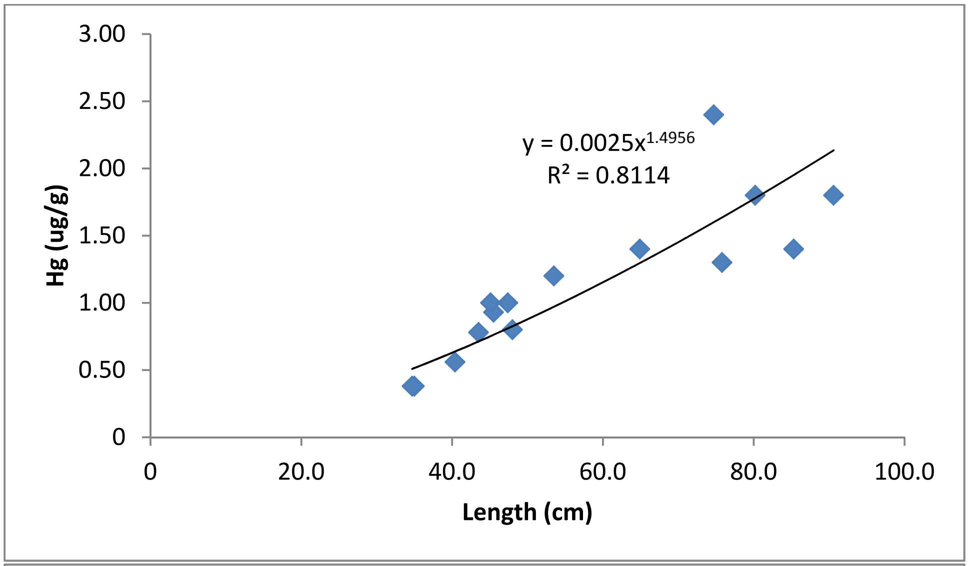


**Figure 2.12 Relationships between Northern Pike THg Concentrations and Length and Weight**

Island Falls to Abitibi Canyon (1977)



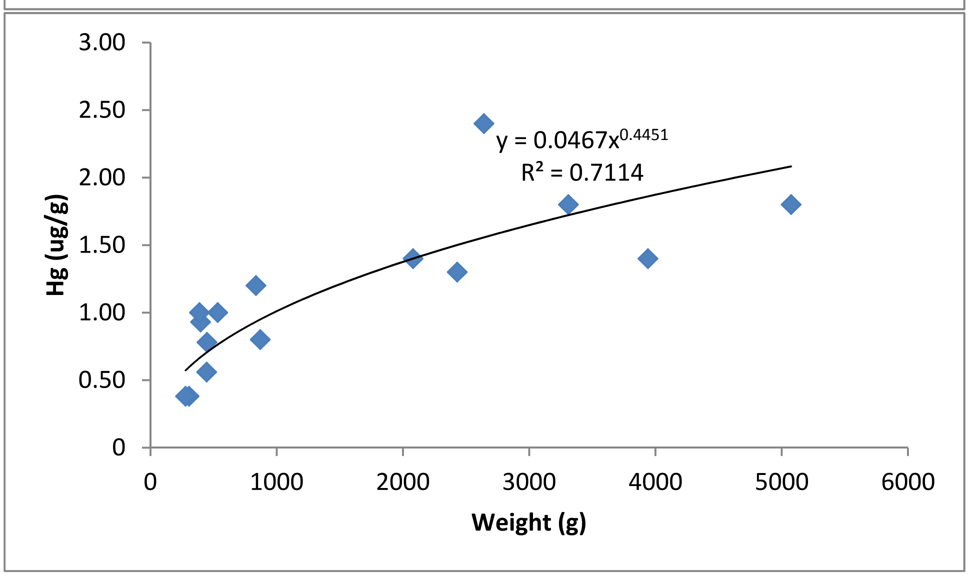
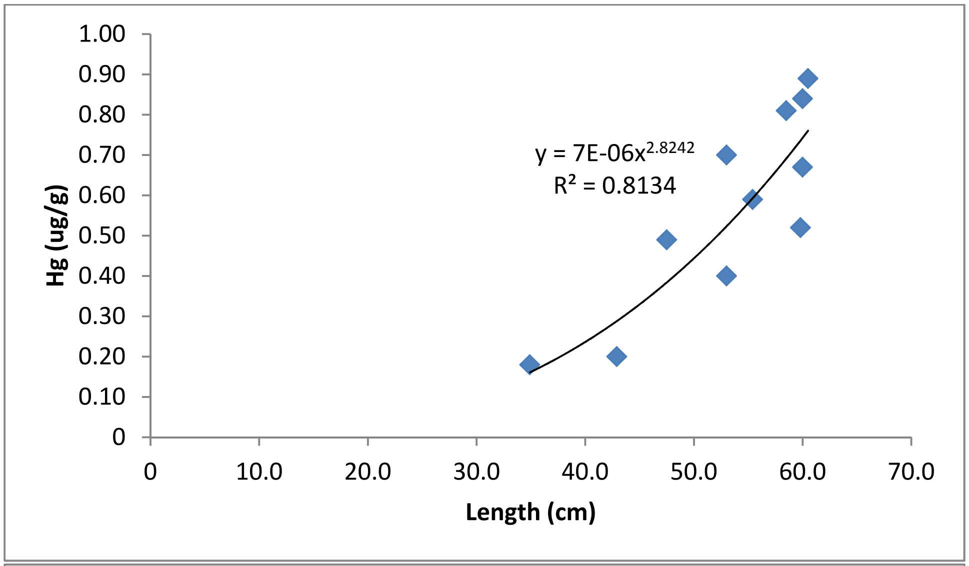



**Figure 2.12 Relationships between Northern Pike THg Concentrations and Length and Weight (Cont'd)**

Abitibi Canyon to Otter Rapids (1996)



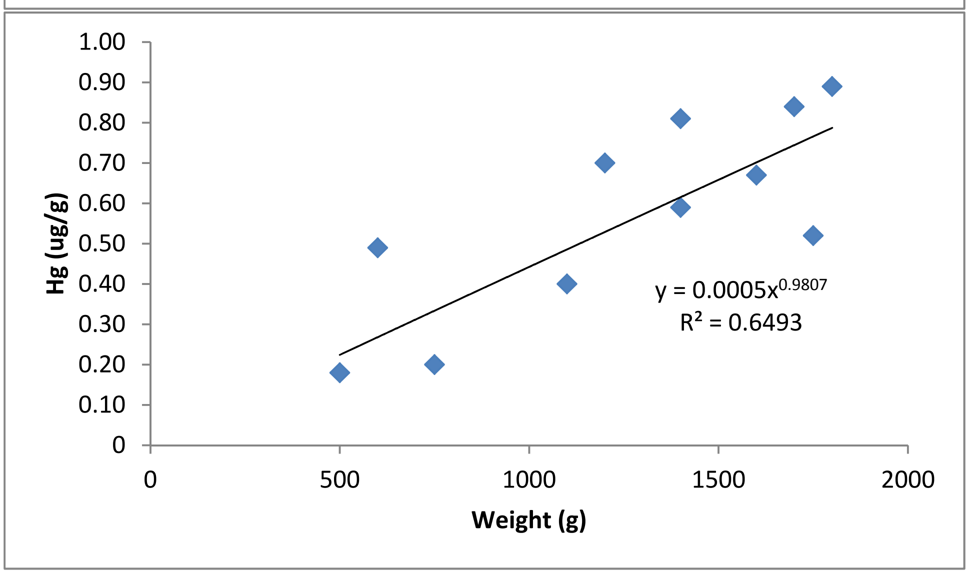
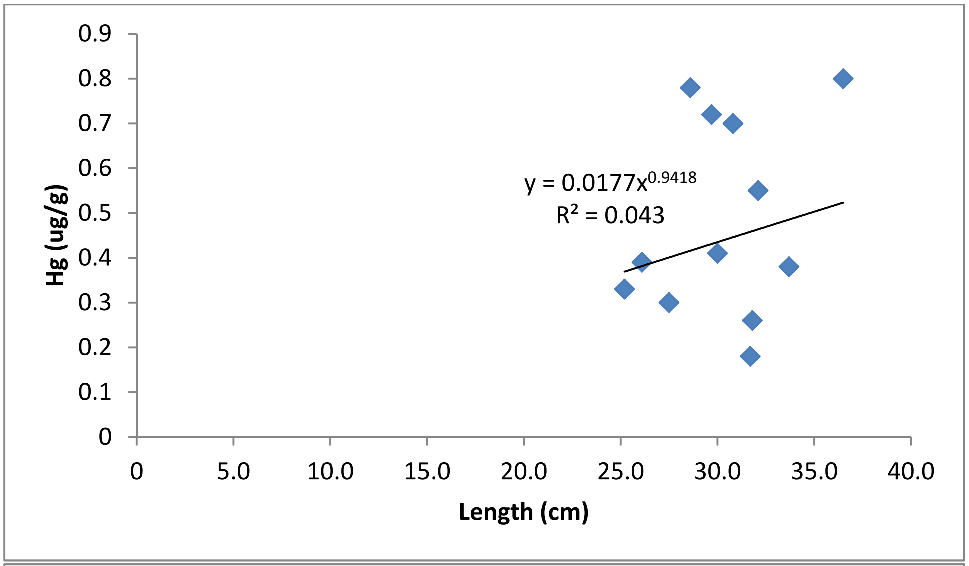



**Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight**

Sauger – Island Falls to Abitibi Canyon (2010)



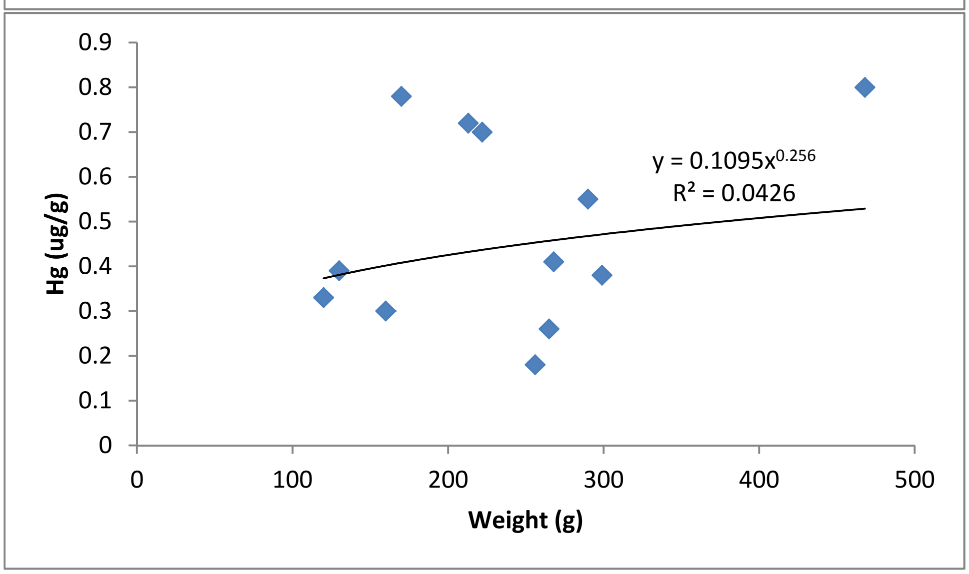



**Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight (Cont'd)**

Lake Sturgeon – Island Falls to Abitibi Canyon (1984)

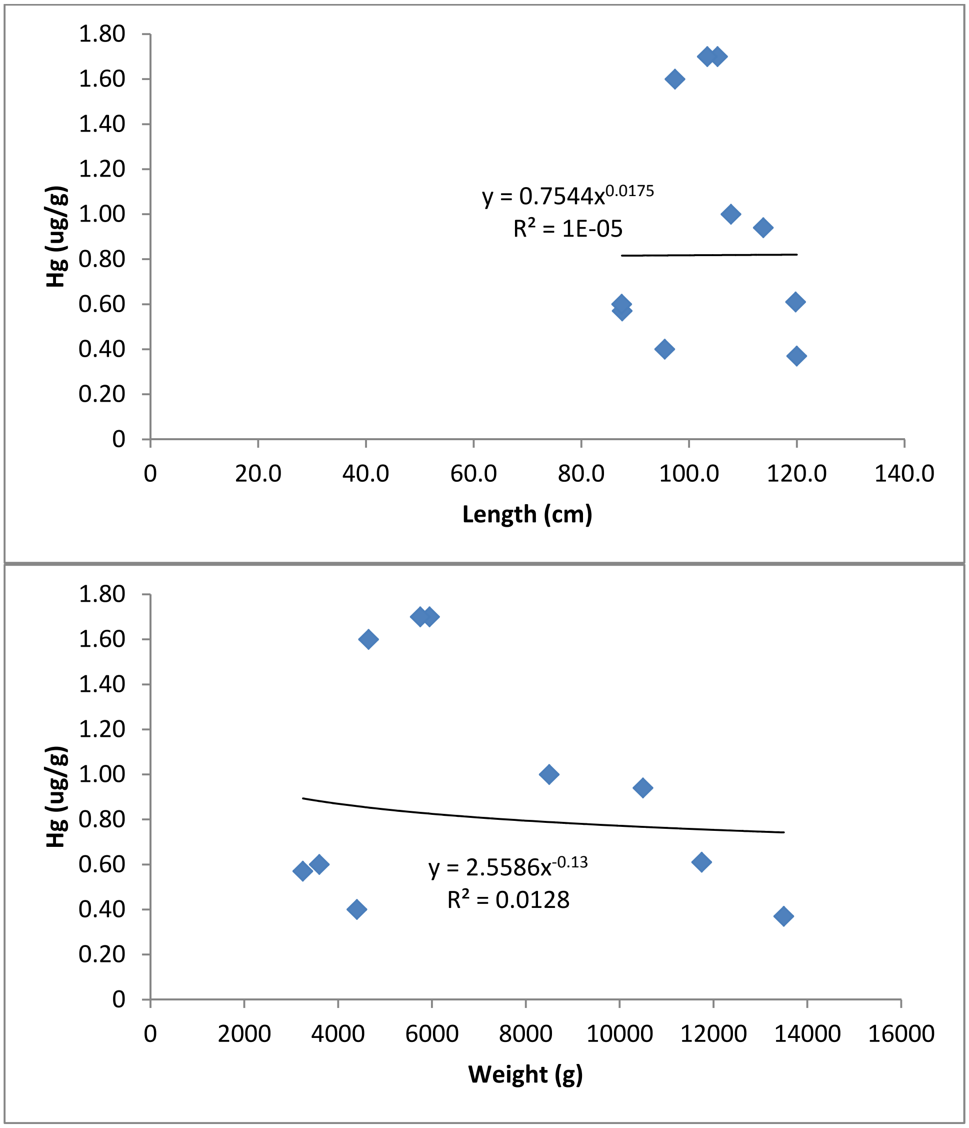
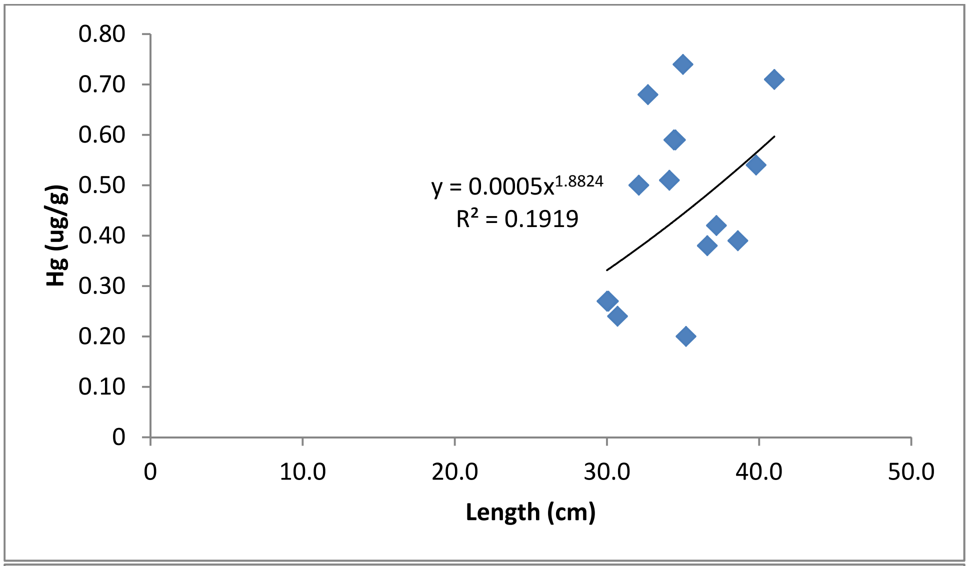


**Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight (Cont'd)**

Goldeye – Island Falls to Abitibi Canyon (1977)



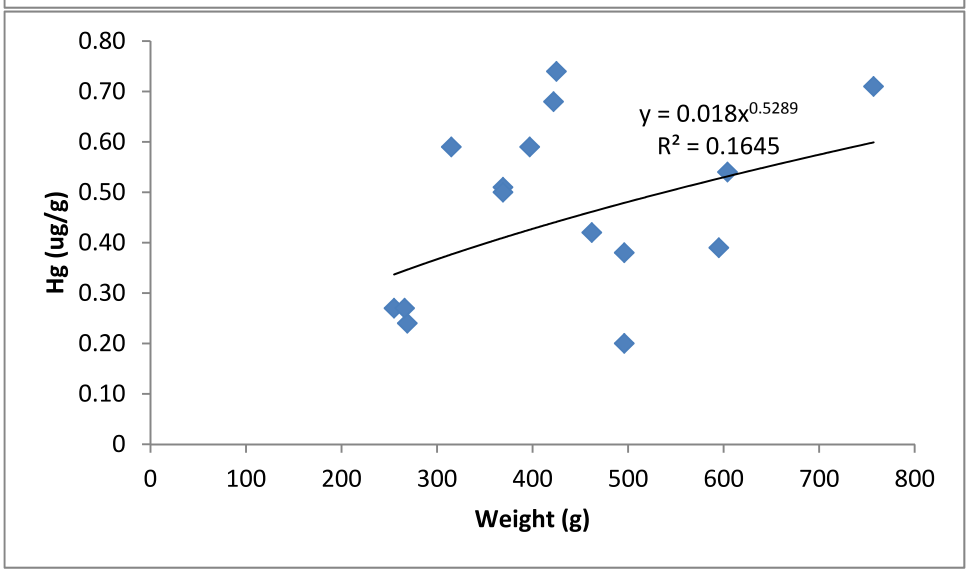
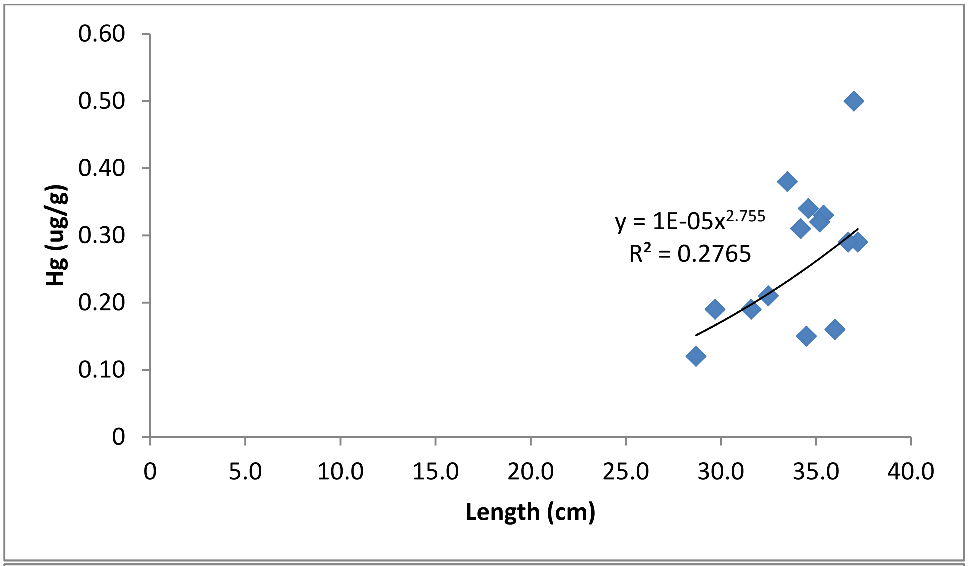



**Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight (Cont'd)**

Longnose Sucker – Island Falls to Abitibi Canyon (1996)



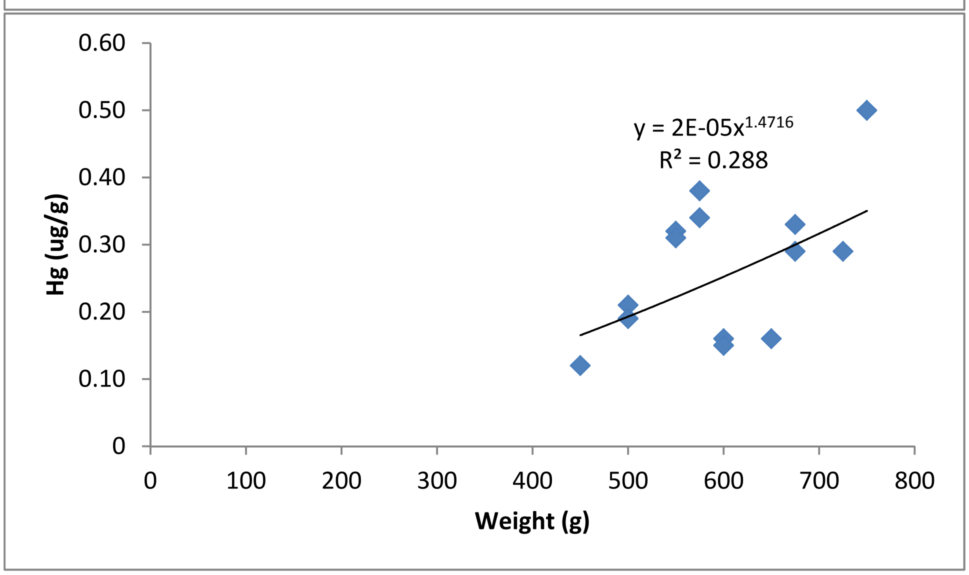
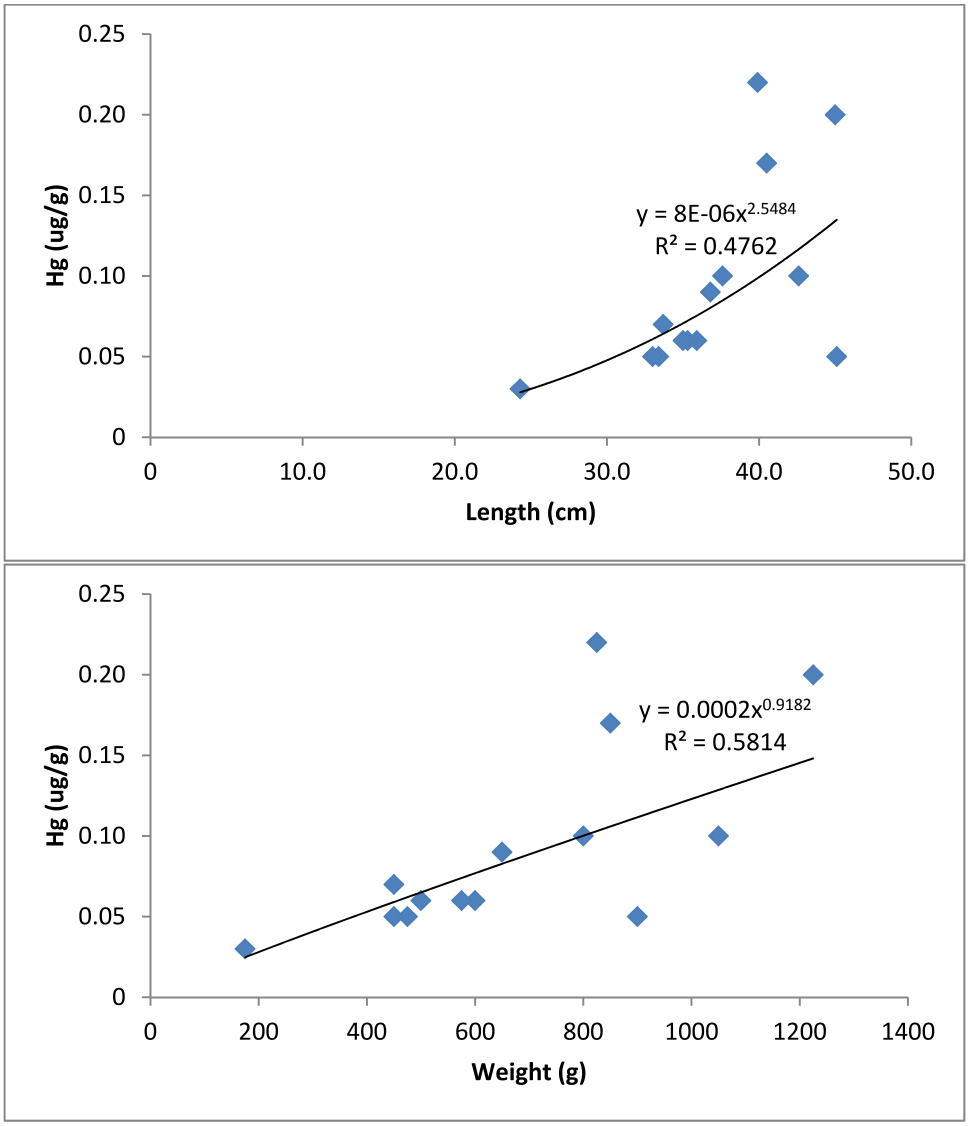



**Figure 2.13 Relationships between Other Fish Species THg Concentrations and Length and Weight (Cont'd)**

Longnose Sucker – Otter Rapids to Onakawana (1996)




There has been a decrease in THg concentrations in 40 cm length Walleye from the Island Falls to Abitibi Canyon section from 1.20 µg/g in 1977 to 0.93 µg/g in 1996. In 1996, the THg concentrations in 40 cm length Walleye in the Abitibi Canyon to Otter Rapids and Otter Rapids to Onakawana sections were 0.51 and 0.64 µg/g, respectively.

The THg concentration in 55 cm length Northern Pike from the Island Falls to Abitibi Canyon section was 1.00 µg/g in 1977. In 1996, the Hg concentration in 55 cm length Northern Pike from the Abitibi Canyon to Otter Rapids section was 0.58 µg/g.

The MOE requested CRP/OPG to analyze THg in Walleye in New Post Creek downstream of the waterfalls, as well as a forage fish at the proposed Project intake location based on the MOE, Northern Region, "Guidance for Conducting Baseline and Post-Development Monitoring of Water Quality and Fish Tissue for Proposed Waterpower Projects". As sufficient Walleye could not be captured in the lower portion of New Post Creek, additional specimens were obtained from the Abitibi River between Abitibi Canyon and the mouth of New Post Creek. Walleye likely move freely between the lower portion of New Post Creek and the Abitibi River.

Table 2.22 presents the THg concentrations in 20 Walleye (muscle tissue) collected below the New Post Creek waterfalls and in the adjacent section of the Abitibi River.

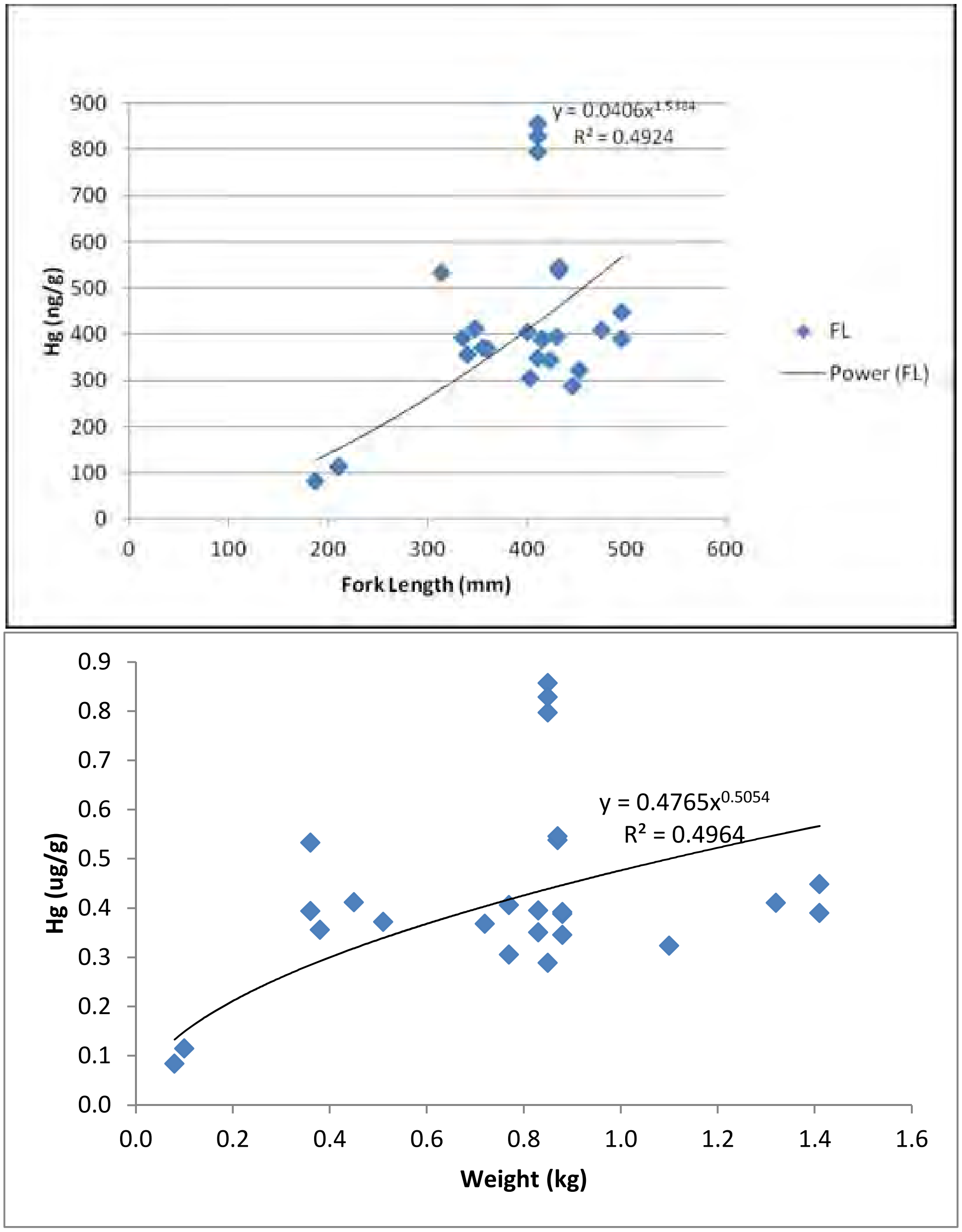
**Table 2.22 THg Concentrations in Walleye (Muscle Tissue)**

| Walleye No.[1] | Length (mm) | Weight (kg) | Sex[2] | THg (µg/g) |
|---|---|---|---|---|
| 1 | 432 | 0.87 | M | **0.537[3] (0.545)[4]** |
| 2 | 410 | 1.32 | F | 0.475 |
| 3 | 350 | 0.83 | F | 0.410 |
| 4 | 410 | 0.85 | M | **0.796 (0.856, 0.828)[5]** |
| 5 | 314 | 0.36 | M | **0.532** |
| 6 | 340 | 0.38 | F | 0.355 |
| 7 | 335 | 0.36 | F | 0.393 |
| 8 | 187 | 0.08 | I | 0.083 |
| 9 | 403 | 0.77 | M | 0.305 |
| 10 | 430 | 0.83 | F | 0.394 |
| 11 | 355 | 0.51 | M | 0.371 |
| 12 | 360 | 0.72 | F | 0.367 |
| 13 | 415 | 0.88 | M | 0.387 (0.391)[4] |
| 14 | 400 | 0.77 | F | 0.405 |
| 15 | 348 | 0.45 | F | 0.411 |
| 16 | 445 | 0.85 | F | 0.288 |
| 17 | 495 | 1.41 | F | 0.389 (0.448)[5] |
| 18 | 452 | 1.1 | F | 0.323 |
| 19 | 423 | 0.88 | F | 0.345 |
| 20 | 210 | 0.1 | I | 0.114 |

[1] Walleye 1 to 19 were collected between September 15 and 20, 2011, whereas Walleye 20 was collected on November 1, 2011.
[2] M = male; F = female; I = immature.
[3] Bold and shaded values exceed the Health Canada (2007) fish consumption standard of 0.5 µg/g.
[4] Duplicate sample.
[5] Sample analysis redone.

As indicated above, THg concentrations generally increase with the length (age) of fish due to greater exposure. Figure 2.14 shows good (but not statistically significant) relationships between fish length and weight and THg concentration for the 20 Walleye, possibly reflecting variable exposure to mercury sources in the Abitibi River between Abitibi Canyon GS and Otter Rapids GS.

**Figure 2.14 Relationships Between THg Concentrations and Length and Weight for Walleye from New Post Creek and the Abitibi River (2011)**



The predicted THg value of 0.58 µg/g in a standard 50 cm sized Walleye from New Post Creek is significantly lower than the 1.14 µg/g concentration reported by Seyler (1998) for underdeveloped portions of the Abitibi River.

The predicted THg values in a standard 40 cm sized Walleye based on the 2011 collection from New Post Creek and the Abitibi River (0.41 µg/g) and from the Abitibi Canyon to Otter Rapids section of the Abitibi River in 1996 (0.51 µg/g) are compared to 11 other locations in Québec, Manitoba and Ontario in Figure 2.15. The 2011 THg concentration for Walleye in New Post Creek and the Abitibi River (2011) is intermediate compared to the other locations and is lower than that for the earlier (1996) collection between Abitibi Canyon and Otter Rapids.

Table 2.23 presents the THg concentrations in five composite samples of Slimy Sculpin (total of 41 whole fish) collected on November 2, 2011 from the unnamed tributary (Tributary 1; MNR ID#523) discharging into New Post Creek approximately 150 m upstream of the proposed Project intake location (see Figures 1.21 and 2.10). Tributary 1 is the largest watercourse flowing into New Post Creek in the proposed headpond area, and will be affected the most from headpond development due to its proximity to the proposed weir and its low gradient channel, and being subjected to the highest water level increase (see Figure 1.9).

The standard forage fish species used for THg monitoring by the MOE are Spottail Shiner and YOY Yellow Perch. As indicated in Table 2.20, Spottail Shiner was captured in New Post Creek upstream of the waterfalls, but in small numbers insufficient to constitute the requisite composite samples. Yellow Perch were not captured in New Post Creek above the waterfalls.

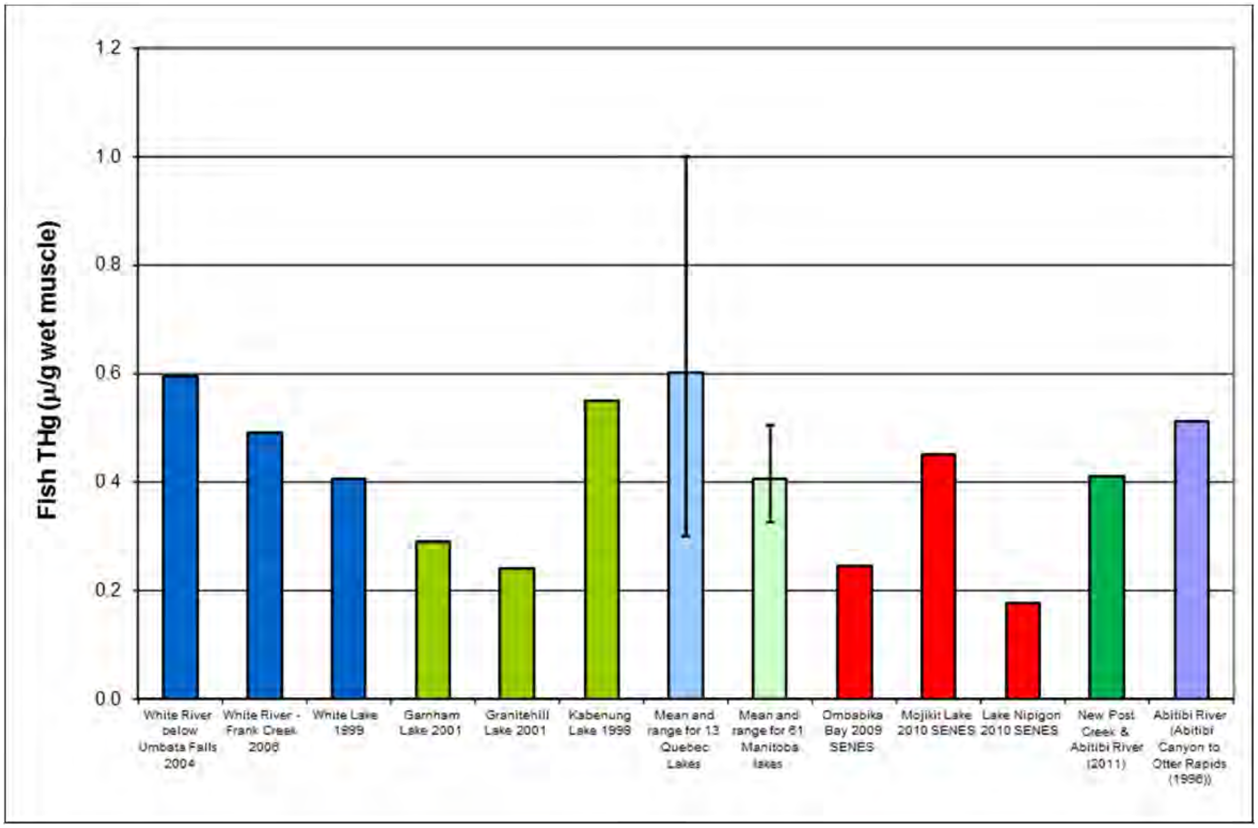
**Table 2.23 THg Concentrations in Slimy Sculpin (Whole Fish)**

| Composite No. | Number of Fish | Mean Length (Range) (mm) | THg (µg/g) |
|---|---|---|---|
| 1 | 9 | 46.67 (41-52) | 0.0212 |
| 2 | 8 | 49.0 (39-57) | 0.0242 (0.0240)[1] |
| 3 | 8 | 47.0 (40-54) | 0.0239 |
| 4 | 8 | 47.38 (33-54) | 0.0219 |
| 5 | 8 | 46.13 (40-51) | 0.0205 |

[1] Duplicate sample.

THg concentrations in Slimy Sculpin (whole fish) are an order of magnitude lower than those in Walleye (muscle tissue), reflecting their benthivorous feeding habits. It should be noted that the fish were all very small and of similar size, suggesting that they were YOY.

**Figure 2.15 Comparison of THg Concentrations in Standard Length of Walleye (40 cm) for Different Locations in Canada[1]**




1 Data for the first eight histogram bars provided by R. Harris, Reed Harris Environmental Ltd., 2009, pers. comm.; data for Ombabika Bay, Mojikit Lake and Lake Nipigon provided in SENES (2011b); data for Abitibi Canyon to Otter Rapids section provided by C. Mahon, MOE, 2013, pers. comm.

### *2.2.6.10 Fish Consumption Advisories*

As indicated in Section 2.2.6.9, Health Canada (2007) has established a fish consumption standard of 0.5 µg/g for THg in fish. The THg concentrations in three of the 20 Walleye collected from New Post Creek and the Abitibi River in 2011 exceeded the 0.5 µg/g standard.

Provincial fish consumption restrictions have also been developed by the MOE (2011a). For women of child-bearing age and children under 15, partial consumption restrictions for sport fish containing mercury begin at concentrations of 0.26 µg/g with complete restriction advised for concentrations above 0.52 µg/g. For the general population, partial consumption restrictions begin at concentrations above 0.61 µg/g with complete restriction advised for concentrations above 1.84 µg/g. The THg concentrations in 18, three, one and none of the 20 Walleye collected from New Post Creek and the Abitibi River in 2011 exceeded the 0.26 µg/g, 0.52 µg/g, 0.61 µg/g and 1.84 µg/g consumption restrictions, respectively.

Provincial consumption restrictions for standard 40 cm length Walleye and 55 cm length Northern Pike based on the 2011 and historic data (see Tables 2.22 and 2.21, respectively) are presented in Table 2.24.

**Table 2.24 Provincial Consumption Restrictions for 40 cm Walleye and 55 cm Northern Pike**

| Species/Location | THg Conc. (µg/g) | Sensitive Population | General Population |
|---|---|---|---|
| **40 cm Walleye** | | | |
| New Post Creek and Abitibi River (2011) | 0.41 | Partial | None |
| Abitibi Canyon to Otter Rapids (1996) | 0.51 | Partial | None |
| Otter Rapids to Onakawana (1996) | 0.64 | Complete | Partial |
| Island Falls to Abitibi Canyon (1996) | 0.93 | Complete | Partial |
| Island Falls to Abitibi Canyon (1977) | 1.20 | Complete | Partial |
| **55 cm Northern Pike** | | | |
| Abitibi Canyon to Otter Rapids (1996) | 0.58 | Complete | None |
| Island Falls to Abitibi Canyon (1977) | 1.00 | Complete | Partial |

Fish consumption advice based on a combination of species, fish size and contaminant concentrations has been provided by the MOE for waterbodies throughout Ontario since 1979. A summary of the most recent advisories for the Abitibi River between Abitibi Canyon and Otter Rapids is provided in Table 2.25.

**Table 2.25 Summary of Fish Consumption Advisories[1,2]**

| Fish Species | Fish Length (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 |
| Northern Pike[3] | | | 8[4] (8)[5] | 8(4) | 8(4) | 8(4) | 8(0) | 4(0) | 4(0) |
| Walleye[3] | 8(4) | 8(4) | 8(4) | 8(0) | 4(0) | 4(0) | 2(0) | 0(0) | 0(0) |
| Goldeye[3] | | 8(4) | 8(4) | 8(0) | 4(0) | | | | |
| White Sucker[6] | | | 8(4) | 8(0) | 4(0) | 4(0) | 4(0) | | |

[1] Source: MOE (2011a).
[2] Abitibi River below Abitibi Canyon to Otter Rapids.
[3] Based on mercury, other metals, PCBs, mirex/photomirex and pesticides.
[4] Number of meals of that size fish that can be consumed each month by the general population.
[5] Bracketed number of meals of that size that is advised for consumption by women of child-bearing age and children under 15.
[6] Based on mercury, PCBs, mirex/photomirex and pesticides.

For Walleye, the maximum recommended number of meals for the general public is eight per month in the fish size range of 20 to 40 cm, four per month in the range of 40 to 50 cm and two per month in the range of 50 to 55 cm. It is recommended that no Walleye of length greater than 55 cm should be consumed. Since young children and developing fetuses are affected by mercury and other contaminants at lower concentrations than the general population, children under 15 and women of child-bearing age are advised to consume only four meals per month in the size range of 20 to 35 cm and no meals of larger Walleye.

### 2.2.7 Aquatic Avifauna

The proposed New Post Creek Project area does not have much importance for breeding or migrating waterfowl due to a lack of suitable breeding habitat or notable flyway (MOE, 1972). During migration, flocks settle into the area only because of adverse weather conditions. Wallis (1998) observed long wavering flocks of Canada Goose, “white and blue waveys”, i.e., white and blue phases of Snow Goose (*Anser caerulescens*), and Brant (*Branta bernicla*) at the antecedent HBC trading post (New Post), located approximately 1 km downstream of the proposed Project tailrace, during fall migration and a huge flock of “white waveys” following the Abitibi River for direction during a spring snowstorm.

Waterfowl recorded in the Onakawana area, approximately 75 km downstream of the proposed Project, included Canada Goose (*Branta americana*), Black Duck (*Anas rubripes*), Redhead (*Aythya americana*), Canvasback (*Aythya valisineria*), Scaup (*Aythya* spp.), Common Goldeneye (*Bucephala clangula*) and Common Merganser (*Mergus merganser*) (MOE, 1972). Most waterfowl were concentrated along the Abitibi River utilizing the area principally during migration.

Canada Land Inventory (CLI, 1974) mapping for waterfowl production indicates that the Abitibi River between Abitibi Canyon and downstream of the New Post Creek outlet, as well as pre-diversion New Post Creek, are categorized as Class 6 with severe limitations due to adverse topography and free-flowing water conditions. Although the Abitibi River may not be useful for waterfowl production, the watercourse is categorized as Class 3M, i.e., important as a migration or wintering area. Worobec Lake prior to the diversion was categorized as Class 5 with moderately severe limitations due to adverse topography and water depth that limits the development of optimum wildlife habitat. Most of the pre-diversion Little Abitibi River was categorized as 50% Class 6, 40% Class 5 and 10% Class 4 with severe, moderately severe and moderate limitations, respectively, due to adverse topography and water depth.

The CLI mapping confirms TTN Traditional Knowledge of low geese and duck nesting activity in the proposed Project local study area (W. Ross, TTN, 2012, pers. comm.).

Table 2.26 lists the aquatic avifauna species recorded in the Ontario Breeding Bird Atlas as breeding or likely breeding within two 10-km by 10-km square grids (17MR53 and 17MR63) overlapping the proposed Project area (Bird Studies Canada, 2006). Of the six species listed, four are designated by the NHIC (2010) as S5, (secure) and two are S4, (apparently secure).

Solitary Sandpiper (*Tringa solitaria*), designated as S4 (apparently secure), was observed during the 2012 site-specific field survey.

**Table 2.26 Aquatic Breeding Bird Species Recorded within 10-km by 10-km Square Grids Overlapping the Proposed Project Area[1]**

| Common Name | *Scientific* Name | Breeding Status | Provincial Status[2] |
|---|---|---|---|
| **Herons and Bitterns** | **Ardeidae** | | |
| Great Blue Heron | *Ardea herodias* | Possible | S5 |
| **Swans, Geese and Ducks** | **Anatidae** | | |
| Canada Goose | *Branta canadensis* | Possible | S5 |
| American Wigeon (Baldpate) | *Aythya americana* | Possible | S4 |
| Common Goldeneye | *Bucephala clangula* | Confirmed | S5 |
| **Cranes** | **Gruidae** | | |
| Sandhill Crane | *Grus Canadensis* | Possible | S4 |

[1] Source: Bird Studies Canada (2006); Cadman *et al*. (2007), based on grids 17MR53 and 17MR63.
[2] Source: NHIC (2010); S5 = secure; S4 = apparently secure.

### 2.2.8 Significant Species

As indicated in Section 2.2.6, Lake Sturgeon is designated as Special Concern federally (COSEWIC, 2012) and provincially (MNR, 2013). None of the other aquatic species documented in the proposed Project site-specific study area are considered at risk. Goldeye is designated by the NHIC (2010) as S3, i.e., vulnerable.

Based on the *SARA* Schedule 1 Species at Risk Web Mapping Application (Environment Canada, CWS, 2010/2011), no aquatic SAR have documented occurrences overlapping the proposed New Post Creek Project. Similarly, examination of the NHIC (2012) database indicated that there were no records of significant aquatic species.

## 2.3 WATERCOURSE USES

### 2.3.1 Traditional Uses

New Post Creek, or Cheepilloya Sebee as it is known in Cree (English translation: Great Partridge River), played an important role in the lives of the TTN people, as well as people from other Native groups (P. Archibald Sr., TTN, 2011, pers. comm.). Fed from muskeg and unaffected by clay soil erosion, New Post Creek was the only source of fresh, clear water in the area. The watercourse was also referred to as “Blue Water river” reflecting its potable nature and “New Post brook” reflecting its relatively small size (Bell, 1904). The lands near the confluence of New Post Creek and the Abitibi River were a popular camping location during the summer for TTN families and other Native families from Kesagami Lake and Lawagamau (Kattawagami) Lake further east and the Mattice area to the southwest. These families would disperse in the fall to richer hunting and trapping grounds in the winter and return in the spring to live near the fresh waters of New Post Creek.

The TTN travelled to and from their traditional winter hunting and trapping lands in the Bad River system, a tributary of the Little Abitibi River. As indicated in Section 2.1.4.1, New Post Creek was used as a navigation route during the fall and spring to reach the traditional winter lands. A short portage route was used to bypass the New Post Creek waterfalls and another portage was made from upper New Post Creek to access the Little Abitibi River.

The New Post Creek and surrounding areas have a long history of use by First Nations. These lands have always been integral to the TTN way of life. During the spring, summer and fall, TTN and other First Nation families historically occupied land (New Post site) on the east bank of the Abitibi River, approximately 2 km south of the outlet of New Post Creek and 1 km downstream of the proposed powerhouse tailrace. New Post Creek, fed from muskeg, provided the only source of fresh, clear water in the area. The TTN harvested fish below the New Post Creek waterfalls using nets during the spawning period, including Lake Sturgeon, Walleye and suckers (P. Archibald Sr., TTN, 2011, pers. comm.). There were also a lot of Mooneye and the odd Lake Whitefish. The TTN would sometimes string a line with 1-inch hooks baited with Walleye or sucker across the creek to catch Lake Sturgeon. The surrounding lands provided opportunities for traditional harvesting (fishing, hunting, trapping).

In the fall, the families would disperse to their traditional winter trapline areas within the Bad River and Little Abitibi River drainage basins to the east and south, respectively, returning to the New Post site in the spring.

An HBC trading post was established on the site in 1867 to facilitate fur trading with the First Nations. TTN families continued to occupy the site seasonally throughout the operation of the trading post. Occupation of the site by TTN families decreased upon the closure of the post in 1925 and the establishment of the nearby railway providing access to the south.

As indicated in Section 2.1.4.1, average flow in New Post Creek prior to diversion is estimated to have been less than 4 $m^3/s$, approximately nine times lower than the current average diverted flow (~35 $m^3/s$ based on 1975 to 2010 data) (KGS Group, 2010). During spring freshet, the maximum width and depth of New Post Creek were approximately 10 m and 0.6 m, respectively (P. Archibald Sr., TTN, 2011, pers. comm.). At other times of the year, New Post Creek was shallow enough to cross by foot when travelling between the Little Abitibi River and New Post IR 69.

Currently, Walleye is the predominant fish species harvested by the TTN throughout the year within their Traditional Territory, followed by Northern Pike and Lake Sturgeon (W. Ross, TTN, 2012, pers. comm.). Lake Whitefish, particularly in the spring, and Brook Trout are also harvested. There is medium fish harvesting activity in the proposed Project site-specific study area.

Geese and ducks are predominantly harvested by the TTN within their Traditional Territory in the spring with the fall also an important harvesting season (W. Ross, TTN, 2012, pers. comm.). Geese and duck hunting use is low in the proposed Project site-specific study area.

### 2.3.2 General Recreation

The CLI (1972) has categorized the most of the shorelands along New Post Creek as primarily Class 5 with moderately low capability for outdoor recreation. These shorelands provide access to a waterway with significant capability for canoe tripping, water affording opportunity for angling or viewing of sportfish and to viewing rapids. These shorelands also exhibit variety, in topography or land and water relationships, which enhances opportunities for general outdoor recreation such as hiking and nature study or for aesthetic appreciation of the area. At and upstream of the waterfalls, the shorelands are categorized as Class 4 with moderate capability for outdoor recreation with similar opportunities to the Class 5 shorelands. The shorelands from the waterfalls to the confluence with the Abitibi River are categorized as Class 3 with moderately high capability for outdoor recreation capable of supporting organized camping and family beach activities, as well as affording opportunity for angling or viewing of sportfish.

The shorelands on the east and west sides of the Abitibi River are categorized as Class 4 and 3 with moderate and moderately high capabilities for outdoor recreation, respectively, providing access to water affording opportunity for angling or viewing of sportfish and a waterway with significant capability for canoe tripping. The east shorelands also exhibit variety, in topography or land and water relationships, which enhances opportunities for general outdoor recreation such as hiking and nature study or for aesthetic appreciation of the area. The west shorelands are also suited to family or other recreation lodging use.

### 2.3.3 Recreational Boating

Prior to construction of the diversion dam in 1963, New Post Creek was used extensively by the TTN for navigation to facilitate access to traditional trapline areas to the east. However, flows were sufficient for canoeing only during the spring freshet and generally after significant rainfall events in the fall (P. Archibald Sr., TTN, 2011, pers. comm.). The diversion dam substantially altered the flow regime of New Post Creek resulting in the damage to its riparian lands (see Section 2.1.4.2).

During a pre-diversion geological reconnaissance of New Post Creek by canoe, it was reported that it was necessary to traverse much of the creek by wading and/or portaging due to many shallow rapids and in some sections log jams (Ontario Hydro, 1961). As a result, the reconnaissance from Worobec Creek to the outlet of New Post Creek and up the Abitibi River to Abitibi Canyon GS required four days (August 29 to September 1, 1961) to be completed.

LAPP was established by regulation (O. Reg. 279/85) in February 1985. It is classified as waterway and natural environment. The waterway classification covers the Little Abitibi River from the outlet at Harris Lake for approximately 70 km to the New Post Creek Diversion Dam, the 4 km diversion channel to New Post Creek and 16 km of New Post Creek to the confluence with the Abitibi River. At this point, the park boundary expands to include a portion of the Abitibi River and adjacent land base to protect a significant historic site (HBC New Post).

Based on the MNR (2006) Crown Land Use Policy Atlas Policy Report for LAPP, canoeing/ kayaking may be permitted with long-term management direction to be determined through planning. Existing uses may continue in the interim, unless park values are threatened.

A canoe route has been established in LAPP which follows the Little Abitibi River to New Post Creek Diversion Channel, and then west on New Post Creek to the Abitibi River (Ontario Parks, 2006).

The diversion channel and most of New Post Creek from the New Post Creek Diversion Dam to the waterfalls are navigable by canoe (http://www.myccr.com). A portage is required at the Otter Rapids Road bridge, approximately 7.5 km upstream of the proposed intake location to avoid dangerous hydraulic conditions which set up a large (almost geyser-like) standing wave and rapids. A portage is also required at the waterfalls approximately 4.5 km downstream of the proposed Project intake location.

The Abitibi River is designated as a canoe route (MNR, 1991). However, many of the rapids previously present have been replaced by long stretches of flat water created by the hydroelectric dams at Island Falls, Abitibi Canyon and Otter Rapids. Moreover, from Otter Rapids to approximately the mouth of the Onakawana River (a distance of 60 km), the Abitibi River is unnavigable because of shallow water and dangerous rapids. Portage trails or roads are available to traverse canoes and gear around the generating stations.

### 2.3.4 Outfitter Excursions

The New Post Creek waterfalls has been identified as a tourism destination by the www.northernontario.travel website under Wilderness Heritage Canoe Tours. Two tourism operators located in Smooth Rock Falls (Howling Wolf Expeditions, Northern Spirit Adventures) provide half, full and/or two-day trips to "New Post Falls" and New Post.

Three outfitters, including the two mentioned above, in Cochrane service canoe trippers within LAPP: Northern Spirit Adventures, Howling Wolf Expeditions and Polar Bear Outfitters outfit approximately three, two and one canoe trips, respectively, on the Little Abitibi River each year.

### 2.3.5 Fishing

Commercial baitfishing activities are common in the Cochrane area. The MNR Cochrane District office controls and issues baitfishing licences. Baitfish include shiners, chubs, suckers and dace and are usually caught during the summer months.

MNR (1988a) indicated that there were 15 baitfish dealers in MNR Cochrane District with a reported 1986 harvest of 63,000 dozen. It was anticipated that both participation in the baitfish industry and baitfish harvest will increase by the year 2000 with no harm to the resource.

Sportfishing provides recreation, food and tourist dollars for the residents of northern Ontario and is mainly centred on the larger lakes and rivers. Fishing is conducted by local and other Ontario residents, as well as out-of-province visitors.

Walleye has been consistently the most sought after species by anglers on the Abitibi River.

The proposed New Post Creek Project occurs within MNR Fisheries Management Zone 8, with specific fishing seasons (Table 2.27) and catch limits.

**Table 2.27 Fishing Seasons in Fisheries Management Zone 8[1]**

| Species | Open Season |
|---|---|
| Lake Sturgeon | 01 January to 30 April and<br>01 July to 31 December |
| Northern Pike | Open all year |
| Lake Whitefish | Open all year |
| Brook Trout | 01 January to 15 September |
| Yellow Perch | Open all year |
| Walleye/Sauger | 01 January to 14 April and<br>third Saturday in May to 31 December |

[1] Source: MNR (2011); for sportfish species present in the Abitibi River (see Table 2.20).

### 2.3.6 Hydropower Facilities

As indicated in Figure 1.17, there are six hydroelectric generating stations and five dams in the Abitibi River watershed (OPG *et al*., 2006). Table 2.28 provides a summary description of these hydroelectric facilities and dam structures.

**Table 2.28 Summary of Hydroelectric Facilities and Dam Structures in the Abitibi River Watershed[1]**

| Facility/Dam[2] | Owner/ Operator | Comments |
|---|---|---|
| Twin Falls GS | H20 Power Limited Partnership (LP) | Constructed in 1921, this 22.5 MW facility is the most upstream generating station on the Abitibi River system and controls the water level of Lake Abitibi (the largest storage reservoir on the Abitibi River). The station is operated as a peaking facility with water levels controlled within established maximum and minimum levels of 265.39 m and 263.25 m, respectively. Minimum water level from Victoria Day weekend to Thanksgiving Day weekend is 264.20 m for navigational and recreational purposes. During a typical year, the level of Lake Abitibi is drawn down an average of 1.1 m from mid-November to early April to minimize spring flooding on the lake. |
| Iroquois Falls GS | H20 Power LP | Constructed in 1914, this 29.5 MW facility is located on the Abitibi River at the ACCC mill site in the Town of Iroquois Falls, approximately 17 km downstream of Twin Falls GS. The station is operated as a run-of-the-river facility with water levels controlled within established maximum and minimum levels of 249.11 m and 247.35 m, respectively. A minimum flow of 56 $m^3/s$ is maintained downstream of the Iroquois Falls GS. |
| Monteith Dam | MNR | Constructed circa 1917 and reconstructed in 1953, this control dam, located in the village of Monteith, controls water levels on the Driftwood River up to Moose Lake approximately 22 km upstream. The dam does not provide appreciable flood control on the Driftwood River. The regulated water level upstream of the dam is targeted at 260.36 m at all times of the year which maintains the water level of Moose Lake at 260.66 m. These historical levels have been shown to provide adequate upstream water supply for recreational uses and ecological functions. There is no established minimum flow constraint; however, minimum flows are discharged from the dam as a result of stop log leakage. |
| Watabeag Lake Dam | OPG | This control dam, located at the outlet of Watabeag Lake, controls flow from the lake into the Watabeag River and Black River which flow into the Abitibi River upstream of Iroquois Falls GS. The operating range of the dam is between 319.00 m and 321.70 m. Water levels are maintained below 321.70 m to minimize erosion in Watabeag Lake. Water level is maintained between 320.57 m and 320.82 m from Victoria Day weekend to Thanksgiving weekend for recreational and navigational purposes. Maximum discharge of 17 $m^3/s$ is maintained to avoid washing out a bridge located immediately downstream. Winter drawdown target limit is 319.62 m minimum elevation with an absolute minimum of 319.00 m from October to mid-February for Lake Trout spawning. Storage between 321.70 and 322.31 m is used strictly for flood mitigation with MNR permission. |
| Long Sault GS | Algonquin Power Income Fund | This run-of-the-river generating station, located 19 km north of Cochrane and downstream of the Iroquois Falls GS, has a total generating capacity of 18,000 kW. The headpond water level is maintained between 231.75 m and 232.05 m and is not utilized for storage and peaking purposes. An agreed upon minimum flow of 56.6 $m^3/s$ is maintained to conserve ecological functions. |

**Table 2.28 Summary of Hydroelectric Facilities and Dam Structures in the Abitibi River Watershed[1] (Cont'd)**

| Facility/Dam[2] | Owner/ Operator | Comments |
|---|---|---|
| Lillabelle Lake Dam | MNR | This control dam, located at the outlet of Lillabelle Lake, was originally constructed in 1948 to raise and maintain lake water levels to allow floatplane dock access. It was reconstructed in 1958 as a concrete weir structure with one operating gate. In 1997, a 16-inch stop log was added to the top of the concrete weir portion of the dam to increase and maintain the lake water level to 245.00 m to allow floatplane access during low water level periods. The gate has not been operated since the early 1990s. |
| Island Falls GS | H20 Power LP | Constructed in 1925, this 40 MW peaking facility is located on the Abitibi River approximately 133 km downstream of the Iroquois Falls GS. Water levels are controlled within established maximum and minimum levels of 215.54 m and 214.20 m, respectively. During operation of the ferry at Gardiner (i.e., ice-free period), the station is operated to ensure that the upstream water level does not decrease below 214.70 m to maintain navigation. Minimum water level from Victoria Day weekend to Thanksgiving Day weekend is 214.70 m for navigational and recreational purposes. The minimum daily average discharge is 10 $m^3/s$ to protect fisheries. |
| Frederick House Lake Dam | OPG | Constructed in 1938, this control dam, located on the Frederick House River, stores water in Nighthawk Lake and Frederick House Lake for the benefit of developments on the Abitibi River. The operating range is between 269.60 m and 274.40 m with a flood allowance maximum of 274.65 m. After drawdown, when freshet begins, the lake is allowed to fill with zero discharge to elevation 274.20 m as soon as possible as agreed with Ducks Unlimited to maximize duck nesting habitat. The water level is maintained between 274.10 m and 274.40 m from Victoria Day to Thanksgiving Day Weekend for recreational and navigational purposes. |
| Abitibi Canyon GS | OPG | Constructed in 1933, this 335 MW peaking facility is located approximately 74 km north of Smooth Rock Falls. The operating range is between 191.50 m and 195.49 m with an absolute minimum of 190.85 m. The winter drawdown elevation is 191.50 m prior to freshet. |
| Otter Rapids GS | OPG | Constructed in 1961, this 180 MW peaking facility is located approximately 37 km downstream of the Abitibi Canyon GS. The operating range is between 118,80 m and 122.10 m with absolute minimum and maximum of 118.46 m and 122.27 m, respectively. The winter drawdown elevation is 118.80 m prior to freshet. |
| New Post Creek Diversion Dam | OPG | Constructed in 1963, this diversion dam across the Little Abitibi River facilitates river water diversion by constructed canals from the headpond via Worobec Lake to New Post Creek, which flows into the Abitibi River upstream of Otter Rapids GS. This increases the inflows to Otter Creek GS by approximately 12%. Since 1974, the diversion dam has been operated by leaving the stop logs set at elevation 218.80 m. This allows OPG to maximize the diversion flow while eliminating stop log operations at the dam. When the headwater exceeds the elevation of the stop logs, water spills into the old channel of the Little Abitibi River. |

[1] Source: OPG *et al.* (2006).

[2] See Figure 1.19 for facility/dam location.

# 3.0 EFFECTS ASSESSMENT AND MITIGATION MEASURES

The available environmental baseline information and site-specific fisheries resources and benthic macroinvertebrate survey findings provided the basis for an assessment of potential construction and operational effects on the aquatic environment, e.g., due to cofferdam installation/removal, dewatering, blasting, soil erosion and turbidity generation, fish habitat loss/gain, fish entrainment, increased fish mercury body burden, etc.

Recommended mitigation measures for the effects on the aquatic environment considered best industry practices and various sources such as OWA (2012b) “Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction”, relevant government guidelines for proposed hydroelectric power plant development, e.g., MOE “Guidelines for Evaluating Construction Activities Impacting on Water Resources” (Persaud and Jaagumagi, 1995), DFO “Guidelines for Use of Explosives in or near Canadian Fisheries Waters” (Wright and Hopky, 1998) and DFO Ontario Operational Statements, as well as government agency and other organization consultation.

The selection and application of measures to mitigate potential effects of proposed transmission line construction and operation are based on the following six principles:

1. Avoidance of sensitive areas, where practicable, through siting of towers, e.g., towers will not be located within watercourses or associated riparian vegetation.
2. Avoidance of temporary watercourse crossings, wherever practicable, e.g., by use of an existing nearby crossing, or access to the tower location obtained from either side of the watercourse, or use of off-corridor access.
3. Appropriate timing of construction activities, whenever practicable, to avoid sensitive time periods, e.g., watercourse crossing installation outside of fish spawning and egg incubation periods (DFO, 2010a).
4. Implementation of conventional, proven mitigation measures during construction, e.g., (DFO, 2010b,c,d,e,f,g,h) Ontario Operational Statements for temporary stream crossings, culvert maintenance, clear span bridges, bridge maintenance, isolated or dry open-cut stream crossings, maintenance of riparian vegetation in existing ROWs and overhead line construction; MOE “Guidelines for Evaluating Construction Activities Impacting on Water Resources” (Persaud and Jaagumagi, 1995); MNR (1988b) “Environmental Guidelines for Access Roads and Water Crossings”; EPRI (2002) “Best Management Practices (BMPs) Manual for Access Road Crossings of Wetlands and Waterbodies”, OWA (2012b) “Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction” and Hydro One (2008) “Environmental Guidelines for the Construction and Maintenance of Transmission Facilities”.
5. Implementation of conventional proven mitigation measures during operation, e.g., EPRI (1999) “Vegetation Dynamics Along Utility Rights-of-Way” and Cieslewicz and Novembri (2004) “Utility Vegetation Management. Trends, Issues, and Practices”.
6. Development of environmental enhancement/compensation measures to offset the unavoidable effects of construction and operation.

The significance of potential effects was assessed based on their magnitude, duration and extent after the implementation of recommended mitigation measures.

## 3.1 POTENTIAL CONSTRUCTION EFFECTS AND ASSOCIATED MITIGATION

### 3.1.1 Surface and Groundwater Hydrology

As indicated in Section 2.1.1, no defined watercourses are present within the GS infrastructure footprint of the proposed Project. The existing operational access road to the proposed GS site and the proposed transmission line ROW traverse two and five watercourses, respectively (Coker and Portt, 2013b, c). The transmission line ROW also traverses a small pond. Parliament Loop Road, which may also be used to access the east side of New Post Creek at the proposed weir location, traverses seven small watercourses (Coker and Portt, 2013d). These creeks, pond and other drainage ditches may be affected by sediment loadings due to accelerated soil erosion during construction (see Section 3.1.2.1). These creeks, pond and any drainage ditches present in the general area of the construction site should be avoided with generally a 15 m buffer to mitigate potential soil erosion and sedimentation.

For any temporary or permanent crossings of creeks and drainage ditches, standard construction procedures will be followed, including crossing design (ramping, ford or culvert), installation and maintenance. Ontario Operational Statements have been developed by the DFO for:

- construction of temporary stream crossings (DFO, 2010b);
- culvert maintenance (DFO, 2010c);
- construction of clear span bridges (DFO, 2010d);
- bridge maintenance (DFO, 2010e); and
- construction of isolated or dry open-cut stream crossings (DFO, 2010f).

For new permanent crossings or repair/replacement of existing crossings, approvals must be obtained from the MNR.

Upgrading of Parliament Loop Road for access to the eastern side of New Post Creek will also likely necessitate beaver dam removal (see Section 1.3.1). An Operational Statement for beaver dam removal has been prepared by DFO (2010i).

Due to its relatively shallow nature (see Section 2.1.2), groundwater inflows due to any excavation can be expected, including excavation and dewatering in areas of high water table for transmission pole placement. The volume of water would be further enhanced during precipitation/runoff events. Higher inflows may occur if high permeability features are encountered, or if blasting and rock excavation techniques significantly modify the intrinsic hydraulic conductivity of the rock mass. Based on anticipated good water quality, the water may be discharged indirectly to New Post Creek. An energy absorption diffuser should be used to minimize the impact of water on the discharge location. A PTTW will be required under the *OWRA* from the MOE for water discharges that are greater 50,000 L/day. Temporary watercourse diversion to facilitate in-water work at water crossings are also considered to be water takings and may require a PTTW.

The implementation of these standard procedures during construction and rehabilitation will obviate or minimize potential effects on surface and groundwater hydrology.

### 3.1.2 Water Quality

During construction, water quality in the Abitibi River, New Post Creek and the watercourses identified in Section 2.1.1 and groundwater may be affected by soil erosion and turbidity generation, in-water construction activities, blasting, acid rock drainage, incidental spills and/or waste material dispersion, and stormwater.

Overall, based on the mitigation measures described below, the effects of the construction of the proposed Project on water quality are expected to be localized, temporary and negligible.

#### *3.1.2.1 Erosion and Sediment Control*

As indicated in Section 3.1.1, the watercourses and drainage ditches on the proposed Project site may be affected by sediment loadings due to accelerated soil erosion during construction. These sediment loads would be discharged to the Abitibi River and New Post Creek. Till and gully erosion caused by channelized overland flow can also be a major source of soil erosion to the watercourses. Sheet erosion can be an additional source of sediment.

Erosion and sediment control will be an integral component of the construction planning process. All personnel involved with the proposed works will be briefed on erosion and sediment control including engineers, contractors, inspectors and environmental staff.

Sediment and erosion control measures should be implemented as required prior to work and maintained during the work phase, to prevent entry of sediment into the water. This should include sediment removal from water pumped from within the work areas such as the powerhouse foundation area, draft pit and tailrace excavation. It should also include the use of silt curtains or cofferdams, if appropriate, during any in-water work to prevent deleterious substances from entering fish habitat.

Dredged material should be disposed of on land above the high water level and suitably contained/stabilized to prevent the dredged material from re-entering the water. Potential spoil pile areas are shown on Figure 1.6. Management of dredged material and control of runoff will be addressed by the site-specific Sediment and Erosion Control Plan and Stormwater Management Plan to be prepared by the DBC. The management of dredged material will take into consideration the guidelines and requirements provided in the MOE Handbooks for Dredging and Dredged Material Disposal in Ontario (MOE, 2011b, c, d).

During construction, the removal of natural shoreline vegetation should be minimized, and consideration made to armour potentially affected shoreline proximate to the proposed GS.

In general, the following guidelines will be applied in the development of the Erosion and Sediment Control Plan:

- fitting of proposed works to the terrain (i.e., using the natural topography of the land in the placement and organization of the construction site);
- timing of grading and construction activities to minimize soil exposure;
- retention of existing vegetation where feasible;
- restriction of the use of heavy construction equipment to within the approved work areas to minimize soil disturbance and vegetation destruction;
- storage of stripped soil at upland locations with a minimum of 5 m from the edge of the Abitibi River and New Post Creek and beyond the inundation area;
- implementation of erosion control measures, e.g., rip-rap berms underlain by filter geotextile, straw bales used as filters, silt fencing along the shoreline and/or mulching for interim stabilization;
- diversion of runoff away from exposed areas;
- minimization of the length and steepness of slopes;
- maintenance of low runoff velocities;
- design of drainage works, such as ditches and outfalls, to handle concentrated runoff;
- retention of sediment on site;
- routine inspection and maintenance of erosion and sediment control measures; and
- re-vegetation of disturbed areas by seeding and/or planting following construction as soon as seasonal conditions permit.

Figure 1.6 shows potential areas for settling ponds. The use of settling ponds will require Environmental Compliance Approvals under the *OWRA*. The DBC will be responsible for the final design of the settling ponds, including locations of such works, treatment options, volumes, discharges to the environment, proposed monitoring plans and effluent criteria for parameters of concern (e.g., pH, TSS, turbidity, hydrocarbons, total ammonia).

As indicated in the Terrestrial Environment TSD, site-specific Erosion and Sediment Control Plans, addressing the areas around the proposed Project intake weir, powerhouse and their ancillary infrastructures, the construction laydown and assembly areas, as well as the access roads and transmission line ROW, will be prepared and implemented during construction. The site-specific Erosion and Sediment Control Plans will be part of a broader Environmental Management Plan.

With the implementation of the site-specific Erosion and Sediment Control Plans, the potential effects of soil erosion and turbidity generation will be minimized or obviated.

#### *3.1.2.2 In-water Construction Activities*

As indicated in Section 1.3.1, CRP/OPG intends to minimize all in-water works through the construction of cofferdams at the proposed intake weir and powerhouse locations (see Figures 1.16 and 1.17) and use of natural rock plugs at the intake weir location to hold back water and allow construction to take place in the "dry". Cofferdam and other in-water work installation will be undertaken outside the designated in-water construction timing restrictions to protect fish spawning areas and egg incubation periods (see Section 3.1.3.1).

The cofferdams will be composed of clean rock fill. Temporary cofferdam construction will require the use of heavy equipment along the shoreline and on the rockfill wall as it is built up around the sites. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. The work will also involve dewatering to the area downstream of the cofferdam and as necessary the placement of erosion control structures. Fish within the area to be dewatered will be collected by electrofishing/netting during drawdown and released to New Post Creek and the Abitibi River under a Fish Scientific Collectors Permit obtained from MNR under the *Fish and Wildlife Conservation Act*.

The use of clean rock fill, the placement of rock fill over similar coarse substrate at the intake weir location and judicious selection of the discharge location and water pressure during dewatering will minimize potential effects of in-water construction activities on water quality in the Abitibi River and New Post Creek. The placement of rockfill over finer substrate in the Abitibi River will result in resuspension of bottom sediments resulting in temporary and localized increased turbidity prior to redeposition. Similarly, the removal of the cofferdam in the Abitibi River will result in temporary and localized increased turbidity.

Cofferdam installation and removal will comply with the conditions of the Work Permit issued by the MNR. An application for a PTTW will be submitted to the MOE if dewatering is expected to be greater than 50,000 L/day.

Water taking requirements for dewatering activities (e.g., types, location, water taking rates and volumes) will be defined in the detailed engineering design prepared by the DBC.

#### *3.1.2.3 Use of Explosives*

Blasting will likely be required to facilitate construction of the proposed spillway, intake and upper section of the penstock. Blasting may also be required for grading of any rock outcrops in the proposed material laydown and assembly areas.

Explosives used in construction will be closely controlled, with their use restricted to authorized personnel who have been trained in the use of explosives in a manner so as to minimize impacts on the environment. Appropriate government agencies and local residents will be informed of the blasting schedule in advance of construction, as well as just prior to the detonation program. All necessary permits will be obtained by the DBC, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canada Explosives Act* and the *Transportation of Dangerous Goods Act*. The DBC will be required to retain a consulting engineer with technical expertise in blasting to provide advice on maximum loading of explosives for all blasting, as well as an engineering report indicating recommended charges and blasting methods to be used at specific locations. All blasting will occur in such a way as to be in compliance with federal regulations and directions.

Blasting could have a potential effect on groundwater quality and flow in the immediate vicinity of the blasting operations. It has been estimated that peak particle velocities produced from blasting operations in excess of 600 mm/s will cause cracks and discontinuities in sedimentary rock up to a 5 m radial distance from the blast using the sophisticated techniques and control measures employed in modern blasting practice (L. McAnuff, VME/Explotech Associates Ltd., 1991, pers. comm.). Damage (seam creation) will be less and more localized in Precambrian rocks. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer.

Blasting of bedrock will be required within the dewatered zone at the proposed intake and upper (150 m) penstock locations with the rock fragments removed by backhoe. The DFO has developed a number of Operational Statements on methods and practices which are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives (Wright and Hopky, 1998). The use of temporary cofferdams to permit blasting within the dewatered areas and adherence to the DFO Guidelines and blasting engineer recommendations will avoid the death of fish and/or any permanent alteration to, or destruction of, fish habitat (see Section 3.1.3.2).

#### *3.1.2.4 Acid Rock Drainage Potential*

As indicated in Section 3.1.2.3, blasting of bedrock will be required within the dewatered zone at the proposed intake and the upper (150 m) penstock locations.

Acid Base Accounting (ABA) analyses were undertaken on 17 rock samples: 15 from boreholes at depths ranging from 2.0 to 15.0 m and two from bedrock exposed on surface (Table 3.1). The Neutralization Potential to Acid Potential (NP/AP) ratio is commonly used to assess the potential for Acid Rock Drainage (ARD). For rock, a ratio above 3.0, suggests that acid drainage is unlikely.

The (NP/AP) ratios are based on two Neutralization Potential (NP) methodologies:

1. Laboratory NP/AP involving the acidification of the sample using hydrochloric acid followed by titration with sodium hydroxide to determine available neutralization.

2. Carbonate NP/AP based on measured carbon dioxide ($CO_2$) concentrations, assuming $CO_2$ can be used to calculate the amount of calcium carbonate (calcite) present (this measure is more conservative, only indicating NP available from the most reactive minerals, i.e., carbonates.

Based on the standard laboratory NP/AP ratio, most of the samples have low to nil potential to generate ARD (J. Martin, SENES, 2012, pers. comm.). Sulphide sulphur concentrations in the two samples classified as uncertain were 0.14% and 0.26%, less than 0.3% used as a draft guideline by Price (1997) as having low potential for ARD, unless the rock has elevated metal concentrations and/or the NP levels are low.

Based on the more conservative NP/AP ratio, additional samples are classified as uncertain, whereas two are classified as having the potential to generate ARD (Table 3.1). All of these samples have low sulphide sulphur concentrations, i.e., at or below 0.3%, indicating that if ARD is generated it would be minor. Moreover, any ARD from blasted rock exposed to New Post Creek may be tempered by the moderately buffered water, with pH ranging from 7.56 to 8.04, alkalinity from 49 to 78 mg/L and hardness from 52 to 82 mg/L (see Table 2.13).

In conclusion, based on the ABA analyses, the potential for ARD is minimal. However, although the acid base accounting analysis revealed that ARD at the proposed Project site is unlikely, care should be taken during the placement of waste rock on land to avoid runoff into watercourses. In addition, a plan should be developed by the DBC for placement and monitoring of any waste rock stockpiles, including mitigation measures should ARD be evident.

**Table 3.1 Acid Base Accounting Results[1]**

| Sample ID | Location | Approx. Depth (m) | $CO_2$ (%) | Total Sulphur (%) | Sulphate Sulphur (%) | Sulphide Sulphur (%) | AP (kg $CaCO_3$/t) | Measured NP (kg $CaCO_3$/t) | Carbonate NP Calculated from $CO_2$ (kg $CaCO_3$/t) | NP/AP[2] | Carbonate[2] NP/AP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L845855-1 | K09-BH01 | 8.0 | 0.6 | 0.1 | <0.01 | 0.1 | 3.1 | 26 | 14 | 8.4 | 4.4 |
| L845855-2 | K09-BH01 | 15.0 | 0.6 | 0.19 | 0.02 | 0.19 | 5.9 | 23 | 14 | 3.9 | 2.3 |
| L845855-3 | Outcrop | surface | 0.3 | <0.01 | 0.02 | <0.01 | <0.3 | 12 | 7 | >40.0 | >22.7 |
| L845855-4 | Outcrop | surface | <0.2 | 0.14 | <0.01 | 0.14 | 4.4 | 8 | <5 | 1.8 | <1.0 |
| L845855-5 | K09-BH02 | 10.0 | 0.2 | 0.27 | 0.01 | 0.26 | 8.4 | 12 | 5 | 1.4 | 0.5 |
| TH-Ba | K11-BH13 | 2.0 | 0.8 | 0.25 | 0.02 | 0.23 | 7.8 | 39 | 18 | 5.0 | 2.3 |
| TH-Bb | K11-BH13 | 4.0 | 1.5 | 0.2 | 0.01 | 0.19 | 6.6 | 55 | 34 | 8.3 | 5.2 |
| TH-Bc | K11-BH13 | 6.5 | 1.3 | 0.04 | 0.01 | 0.03 | 1.3 | 51 | 30 | 39.2 | 22.7 |
| TH-Bd | K11-BH13 | 9.0 | 1.6 | 0.17 | 0.01 | 0.16 | 5.3 | 58 | 36 | 10.9 | 6.9 |
| TH-Ca | K11-BH14 | 3.0 | 0.7 | 0.28 | 0.02 | 0.26 | 8.8 | 36 | 16 | 4.1 | 1.8 |
| TH-Cb | K11-BH14 | 4.0 | 4.8 | 0.16 | 0.02 | 0.14 | 5.0 | 175 | 109 | 35.0 | 21.8 |
| TH-Cc | K11-BH14 | 6.0 | 0.4 | 0.17 | 0.02 | 0.15 | 5.3 | 26 | 9 | 4.9 | 1.7 |
| TH-Cd | K11-BH14 | 7.6 | 0.5 | 0.39 | 0.1 | 0.29 | 12.2 | 29 | 11 | 2.4 | 0.9 |
| TH-Da | K11-BH15 | 2.7 | 0.5 | 0.3 | 0.03 | 0.27 | 9.4 | 28 | 11 | 3.0 | 1.2 |
| TH-Db | K11-BH15 | 4.0 | 0.3 | 0.21 | 0.02 | 0.19 | 6.6 | 20 | 7 | 3.0 | 1.0 |
| TH-Dc | K11-BH15 | 5.8 | 0.6 | 0.33 | 0.03 | 0.3 | 10.3 | 37 | 14 | 3.6 | 1.3 |
| TH-Dd | K11-BH15 | 7.5 | 0.5 | 0.19 | 0.03 | 0.16 | 5.9 | 28 | 11 | 4.7 | 1.9 |

[1] Source: KGS Group (2012b).
[2] Legend

| | |
|---|---|
| (red) | Potentially Acid Generating |
| (yellow) | Uncertain potential to generate Acid Rock Drainage |
| (green) | Low to nil potential to generate Acid Rock Drainage |
| NP/AP classification based on Price (2009) | |

#### *3.1.2.5 Management and Control of Hazardous Materials, Construction Wastes and Incidental Spills*

Management and control of hazardous materials, construction wastes and incidental spills is described in detail in the Terrestrial Environment TSD and takes into account best industry practices listed at the beginning of Chapter 3.0.

In summary, all materials and equipment used for the purpose of site preparation and proposed Project completion should be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, debris, etc.) from entering the water. Incidental spills of oil, gas, diesel fuel and other liquids to the environment could occur during construction. Fuelling and lubrication of construction equipment should be carried out in a manner that minimizes the possibility of releases to the environment. Measures for containment and cleanup of contaminant releases should be followed to minimize contamination of the natural environment, e.g., placement of fuel tanks and generators on an appropriate form of containment where possible, monitoring and other measures documented in the Environmental Management Plan. At all times where spills are a risk, appropriate materials for cleanup and approved disposal locations should be available. Spills or other discharges should be reported to the MOE as required by provincial legislation. Interim sanitary waste collection and availability of treatment facilities should be arranged for the duration of the construction period. All construction waste, washwater and wastewater should be disposed of in accordance with regulatory requirements.

During dam construction, there is a potential for accidental loss of cement during surface application. Any dripped cement should be recovered from the river bottom for suitable disposal. All trash and other solid debris should also be collected for appropriate disposal.

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed as part of the broader Environmental Management Plan. The implementation of these pollution prevention plans will obviate or minimize the environmental effects of accidental releases to the natural environment that have the potential to affect surface water and groundwater quality in the proposed Project area.

#### *3.1.2.6 Stormwater Management*

As indicated in Section 1.3.1, the final site grading and elevations will be designed to minimize erosion and manage stormwater in accordance with the Stormwater Management Plan prepared by the DBC based on the MOE (2003) report “Stormwater Management Planning and Design Manual” and the conditions of the Environmental Compliance Approval under the *OWRA*.

### 3.1.3 Aquatic Habitat

As indicated in subsection 2.1.5 of the Provincial Policy Statement (OMMAH, 2005), development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements. The following sections present the recommended mitigation measures to be implemented for the proposed New Post Creek Project to meet regulatory requirements.

#### *3.1.3.1 Timing of In-Water Construction*

In-water construction activities should be timed to avoid the spawning and egg incubation period of spring spawning fishes, such as Walleye and Lake Sturgeon, which typically excludes in-water work from April 1 to June 30 (DFO, 2010a).

The area within the temporary cofferdam will be dewatered to facilitate proposed intake weir and powerhouse construction. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. As indicated in Section 3.1.2.2, fish within the area to be dewatered will be collected by electrofishing/netting during drawdown and released to New Post Creek and the Abitibi River. The temporary unavailability of this habitat during the construction period will have negligible effect on the local fish populations.

#### *3.1.3.2 Use of Explosives*

Blasting of bedrock will be required in the nearshore areas to be excavated. Numerous studies have been undertaken to assess fish mortality due to in-water blasting (e.g., Hubbs and Rechnitzer, 1952; Fry and Cox, 1953; Ferguson, 1962; Foye and Scott, 1965; Chamberlain, 1976, 1979; Teleki and Chamberlain, 1978; McAnuff and Booren, 1989; Keevin *et al.,* 1997). The degree of blasting impact on fish will depend on the type of explosive, type of substrate blasted, blasting technique, fish physiology and timing. Injury to fish from in-water blasting will result from physical abrasion from ejected debris and from pressure changes associated with the blast shock waves.

Common blast-induced injuries to fish include haemorrhage in the coelomic or pericardial cavity and rupture of the swim bladder. Differences in species-specific susceptibility to blast injuries are a function of the fish's shape and swim bladder formation (Teleki and Chamberlain, 1978). Physoclistic (with swim bladder isolated from oesophagus) and laterally compressed fish such as the centrarchids, e.g., Smallmouth Bass, are the most sensitive to pressure changes. Mortality within this group varies with orientation of the laterally-compressed body to the pressure front at the time of a blast. Physostomic (with swim bladder connected to the oesophagus by an open duct, which provides pressure release) fish with fusiform shape, such as the White Sucker, are most resistant to pressure changes.

To obviate injury to fish, blasting will be undertaken in the "dry", i.e., after dewatering and removal of fish, and will adhere to the DFO guidelines for use of explosives in or near fish habitat (Wright and Hopky, 1998). The shockwaves (peak particle velocities) produced from blasting using the sophisticated techniques and control measures employed in modern blasting practice will be attenuated rapidly within the bedrock. With the width of the cofferdam and its sufficient distance from the limit of blasting, no injury to fish from pressure changes associated with the blast shockwaves is expected. Moreover, blasting mats will be used to minimize the occurrence of fly-rock.

#### *3.1.3.3 Sediments*

Bottom substrate in New Post Creek at the proposed intake weir and spillway locations is predominantly bedrock. As indicated in Section 3.1.2.3, blasting will be required. The potential use of fragmented rock generated by blasting activities for fish habitat enhancement and/or nearshore/shoreline erosion protection will be discussed with DFO. Otherwise, the excess rock will be removed from the dewatered areas behind the temporary cofferdams for suitable upland disposal.

Sediment in the Abitibi River at the proposed tailrace location generally consists of fine material, e.g., sand/clay. As indicated in Section 1.3.1, construction of much of the in-water portion of the tailrace will be undertaken in the "dry" using a cofferdam (see Figure 1.17). The tailrace area will require rip-rap lining to protect against erosion and sloughing of the overburden. Upon completion of tailrace construction, the temporary cofferdam material will be re-used as rip rap. Portions of the Abitibi River bank in the immediate vicinity of the tailrace area may also require shoreline rip-rap protection to minimize toe erosion due to scouring and lower bank sloughing along the river bank. A concrete stackwall, retaining wall or a tied steel sheet pile wall will extend out from the powerhouse draft tube piers to assist in reducing the excavated quantities.

#### *3.1.3.4 Plankton*

Plankton populations will not be affected by construction of the proposed Project. Any plankton confined behind the cofferdams will be returned to the Abitibi River and New Post Creek during dewatering.

#### *3.1.3.5 Aquatic Vegetation*

No aquatic vegetation will be affected by construction activities.

#### *3.1.3.6 Benthic Macroinvertebrates*

The placement of rock fill may have a localized adverse effect on benthic macroinvertebrate communities on the surface and within the substrate. The extent of disruption depends on the type of bottom substrate, the extent of the disturbed area, any resultant turbidity and sedimentation, and the timing of construction. Substrate in New Post Creek at the proposed cofferdam location is predominantly bedrock. The placement of rock fill on bedrock substrate will have minimal detrimental effect on the benthic macroinvertebrate communities. With the use of the larger-size rockfill, sufficient interstitial spaces will be available for the survival and migration of mobile benthic fauna.

Recovery after cofferdam removal is expected to be rapid. Recovery is defined as the return of aquatic biotypes after disturbance to an abundance and diversity comparable to that in an adjacent undisturbed control area (Rosenberg and Snow, 1977). The principal mechanism of recolonization by invertebrates is drift (Luedtke and Brusven, 1976; Williams and Hynes, 1977), but other mechanisms, such as lateral migration, vertical migration from within the hyporheic zone (i.e., after burial) and larval recruitment from aerial sources are also important (Luedtke and Brusven, 1976; Williams and Hynes, 1977; Griffiths and Walton, 1978; Hirsch *et al*., 1978). The rate of recovery is dependent on ambient environmental conditions, the type of organisms present and the size of the disturbed area. In general, there will be less impact upon benthic communities associated with a naturally variable, high energy environment. The benthic organisms are adapted to the high-energy, unstable conditions, and have life cycles that allow them to better withstand these stresses (Hirsch *et al*., 1978).

In the case of proposed tailrace location in the Abitibi River, the placement of rockfill will occur on top of finer sediments with benthic communities adapted to a low energy environment. In this case, recovery may be somewhat longer. Although no specific data are available on negative effects of finer substrate coverage by rockfill or other material, recovery rates from dredging activities range from six days (McCabe *et al*., 1998), 14 days (Rosenberg and Snow, 1977), three weeks (Diaz, 1994), 38 days (Griffith and Andrews, 1981) and up to one year (Griffiths and Walton, 1978).

Blasting in the dewatered nearshore areas may result in localized destruction of benthic communities. Benthic mortality will be a function of distance from and intensity of the blast (Schwartz, 1961). However, recovery from blasting is expected to be rapid (see above).

#### *3.1.3.7 Site-Specific Fish Habitat Considerations*

Coker and Portt (2013a) presents a detailed assessment of the effects of the proposed Project on fish habitat (see Appendix A). The following provides a summary of the potential construction effects on fish habitat.

**Proposed Intake Weir at New Post Creek**

The footprint of the diversion weir covers 1,832 $m^2$ of New Post Creek stream bottom that is typically covered by water during bankfull flow conditions. Almost all of the impacted area is rough bedrock with a small amount of coarser material along the banks and in bedrock pockets. Flow velocity is generally fast through this bedrock chute, but varies in speed and extent with water depth. Electrofishing found a sparse fish community with few species, i.e., White Sucker

(YOY), Mottled or Slimy Sculpin, Pearl Dace and Burbot (juvenile), as indicated in Table 5 (sampling location Ef-2) in Coker and Portt (2013a). These were all collected along the shore in the coarser substrate material. No fish were captured on the offshore bedrock. Due to the bedrock substrate, this chute would not provide a significant amount of spawning habitat for any of the fishes found in New Post Creek (Coker and Portt, 2013a). Therefore, the weir footprint is considered to be a loss of 1,832 $m^2$ of general (feeding or residence) habitat.

**Proposed Tailrace at the Abitibi River**

The proposed GS tailrace will discharge to the Abitibi River, approximately 2.7 km upstream from the mouth of New Post Creek. Similar to much of the Abitibi River shoreline, the tailrace location appears to be primarily clay and sand, with some rocks of various sizes. The water depth increases rapidly with distance offshore, minimizing the need for alteration to the bed of the Abitibi River and ensuring that the nearshore modifications required will not significantly change the habitat character. Based upon the assumption of a typical 3 m deep tailrace for a GS of this size, approximately 604 $m^2$ of Abitibi River bottom will require excavation. No unique or critical habitats occur at this location, and it is not used as spawning habitat. The proposed tailrace channel will have an area of approximately 1,832 $m^2$, and will be lined with rip rap to stabilize its shape. The tailrace channel and rip-rap lining will provide additional aquatic habitat, and add some habitat diversity to this area of the Abitibi River.

Portions of the Abitibi River bank in the immediate vicinity of the tailrace area may also require shoreline rip-rap protection to minimize toe erosion due to scouring and lower bank sloughing along the river bank.

The potential use of fragmented rock generated by blasting activities for additional fish habitat enhancement (likely with a cobble cover) and/or use for nearshore/shoreline erosion protection will be discussed with DFO.

**Watercourse Crossings**

As indicated in Section 2.1.1, the existing operational access road to the proposed GS site traverses two small watercourses, whereas the proposed transmission line ROW traverses five watercourses and a small pond. Parliament Loop Road, which may be used to access the east side of New Post Creek, traverses seven small watercourses. DFO (2010a, b, c, d, e, f, g, h, i) Ontario Operational Statements and all conditions of MNR water crossing permits will be adhered to for construction of new temporary or permanent crossings and/or repair/replacement of existing crossings to ensure no adverse effect on fish habitat.

As transmission line construction will adhere to the appropriate mitigation measures identified at the beginning of Chapter 3.0 and in Sections 3.1.1, 3.1.2 and 3.1.3.1, e.g., buffer establishment, erosion and sediment control, and management and control of incidental spills, no adverse effects on fisheries resources or habitat are anticipated. A potential adverse effect on fish habitat and fisheries could be the maintenance of riparian vegetation in a more open state due to vegetation management in the proposed ROW. These effects would be negligible for those watercourses where the riparian habitat is currently dominated by wetlands, thicket swamps and thickets. Riparian vegetation of the watercourses to be traversed by the proposed transmission ROW, including Pinard Creek which supports a brook trout fishery, are dominated by these low plant communities. These communities are expected to remain similar even with vegetation management.

Additional fish habitat loss and gain/enhancement due to the operation of the proposed New Post Creek Project are discussed in Section 3.2.8. Overall fish habitat loss and gain/enhancement due to construction and operation of the proposed Project are presented in Section 3.2.13.

#### *3.1.3.8 Aquatic Avifauna*

As indicated in Section 2.2.7, the proposed New Post Creek Project area does not have much importance for breeding or migrating waterfowl due to a lack of suitable breeding habitat or notable flyway (MOE, 1972). The construction disturbance will be sufficiently local that little displacement of aquatic avifauna will occur. Any resident birds can relocate temporarily to avoid human activity associated with construction activities. Some bird species will habituate to noise and vehicular traffic.

Noise from blasting could have an initial effect on avian startle flight; however, it is anticipated that over time birds will become habituated to the impulse noise. For instance, during the St. Lawrence River crossing by a natural gas pipeline, blasting had no effect on waterfowl in the area (Silver and Fitchko, 1992). Noise effects due to other construction activities can be acceptably mitigated by conventional construction practices and are predicted to be localized, minor and transient. Additional information on noise effects and mitigation measures is provided in the Terrestrial Environment TSD.

#### *3.1.3.9 Watercourse Uses*

To ensure no adverse effect on sportfish populations, construction workers will not be permitted to sportfish while in camp as a condition of employment.

## 3.2 POTENTIAL OPERATIONAL EFFECTS AND ASSOCIATED MITIGATION, ENHANCEMENT AND MONITORING MEASURES

### 3.2.1 Surface Hydrology

The proposed New Post Creek Project would alter the current flow patterns of New Post Creek due to inundation upstream of the proposed intake weir location and diversion of water to the Abitibi River through the proposed GS. Inundation effects on New Post Creek tributaries are presented in Section 3.2.8.

The operation of the proposed transmission line involves only limited monitoring and maintenance activities. The potential effect of these activities on hydrology is expected to be negligible.

#### *3.2.1.1 Minimum Flow Considerations*

Optimization of power production is necessary to ensure the economic feasibility of the proposed New Post Creek Project. However, operation of the Project will be constrained by the mandated minimum flows required in New Post Creek downstream of the intake, particularly during low flow periods, to ensure that the watercourse continues to function as a lotic system.

A number of contending interests have been identified that need to be considered in the establishment of minimum flows in New Post Creek downstream of the proposed Project spillway. A summary discussion of these contending interests based on historic and current flow regimes in New Post Creek is provided below.

Power Production

A balance between power and other interests was considered by CRP/OPG to ensure the economic feasibility of the proposed New Post Creek Project. The base case operating scheme, as outlined in the feasibility update report (KGS Group, 2010), involves the passage of established minimum flows over the spillway and the remaining flow diverted from New Post Creek and passed through the turbine units to generate electricity.

During high flow periods, flow diversion is expected to meet the maximum flow capacity of the turbines most of the time. Plant capacity was estimated to be in the order of 50 $m^3/s$ by KGS Group (2010). During the spring, significant flows will continue downstream of the proposed Project intake, as the average New Post Creek flows for May and June are 131.2 $m^3/s$ and 70.9 $m^3/s$, respectively. It should be noted that in May and June of 2010, the measured flows were 36.5 and 21.7 $m^3/s$, respectively, the lowest and second lowest during these two months over the period of record (1975 to 2012) used in flow estimation (January 1975 to October 2009) and measured at the WSC gauge (November 2009 to December 2012) (see Table 2.4).

When the diverted creek flows are less than the lowest plant operating flow of the smallest turbine unit (typically 40% of the unit capacity for a Francis turbine), diversion through the intake would have to be shut down and all of the creek flow would continue downstream over the waterfalls. For two equal sized turbine units with a capacity of 25 $m^3$/s each, the plant would have to cease generation at diverted flows of approximately 10 $m^3$/s, typically in February and March (KGS Group, 2010). Under these circumstances, plant shutdown would occur on average about 17% of the year (G. McPhail, KGS Group, 2011, pers. comm.), occurring primarily during the low flow months of February and March, but also during the summer.

However, as indicated in Section 1.3.2.1, pulsed operation will be undertaken, using the limited storage available in the forebay to operate one turbine unit for several hours as flows permit during a day thereby generating additional energy during a period when the proposed GS would normally be shut down.

Fish Spawning and Egg Incubation below the Waterfalls

As indicated in Sections 2.2.6.5 and 2.2.6.8, field studies have confirmed that the rapids below the waterfalls provide spawning habitat for at least three fish species. Walleye, White Sucker and Longnose Sucker spawn in early to mid-May, with egg incubation taking approximately two weeks and fry dispersal two weeks after hatching. Walleye and catostomid eggs are demersal and adhesive, falling into crevices in the substrate and adhering to the substrate.

Based on the available flow dataset, the averages of the mean monthly flows in New Post Creek between 1975 and 2012 were 131.2 and 70.9 $m^3$/s in May and June, respectively (Table 2.4). Walleye, Longnose Sucker and White Sucker were found to be in spawning condition in early May 2010 (Coker and Portt, 2012a), when the flow was approximately 32 $m^3$/s. The average flow for May 2010 was 36.5 $m^3$/s, the lowest on record. Coker and Portt (2012a) opined that the lower flows in New Post Creek in 2010 likely resulted in better habitat conditions for spawning Walleye than the higher flows (195.7 $m^3$/s) observed in 2009.

Maintenance of Fish Habitat in New Post Creek

As indicated in Section 2.1.4.1, New Post Creek was historically a minor tributary of the Abitibi River, with an estimated average flow of less than 4 $m^3$/s, approximately nine times lower than the current average diverted flow (~35 $m^3$/s based on 1975 to 2010 data) (KGS Group, 2010).

It is the position of MNR, Cochrane District, that since New Post Creek has always been a lotic system, it should continue to function as such. As indicated in Section 2.1.4.1, for the ten non-freshet months, the overall average monthly pre-diversion flow in New Post Creek was approximately 3.1 $m^3$/s. This flow was sufficient to maintain fish habitat upstream and downstream of the waterfalls. It could be proposed that a minimum flow of 3 $m^3$/s be used as a minimum flow during the operation of the proposed Project in the non-freshet period (July to April).

Restoration of Historic Flow Regime

Restoration of historic flow regime in New Post Creek is of interest to the TTN. This interest would apply to the watercourse downstream of the proposed Project intake weir location including the waterfalls.

Restoration of historic flow regime would affect navigable waters downstream of the proposed Project intake location and possibly waterfalls aesthetics.

As indicated in Section 2.1.4.2, there has been a dramatic reconfiguration of the New Post Creek waterfalls and the channel downstream of the waterfalls due to the increased flows since the diversion. As a result, the original fish habitat has also been significantly altered to its current characteristics. Restoration of the historic flow regimes may also affect current fish habitat and therefore was not acceptable by the MNR.

Navigable Waters and Public Safety

As indicated in Section 2.3.3, LAPP is designated as a waterway/natural environment class park. Maintenance of navigable waters within LAPP downstream of the proposed Project intake location is of interest to Ontario Parks.

Based on the MNR (2006) Crown Land Use Policy Atlas – Policy Report for LAPP, canoeing/kayaking may be permitted with long-term management direction to be determined through planning. Existing uses may continue in the interim, unless park values are threatened.

As indicated in Section 2.3.3, the diversion channel and most of New Post Creek are navigable by canoe from the New Post Creek Diversion Dam to the waterfalls (http://www.myccr.com). A portage is currently required at the Otter Rapids Road bridge, approximately 7.5 km upstream of the proposed intake location. A portage is also currently required at the waterfalls approximately 4.5 km downstream of the proposed intake weir location.

Although New Post Creek was not navigable during the summer prior to flow diversion, sufficient flows may be available during proposed Project operation to facilitate canoeing during this period within LAPP downstream of the proposed intake weir location. This would necessitate the establishment of a portage around the proposed Project intake weir in order to continue downstream to the portage around the waterfalls. This portage at the waterfalls occurs along a poorly marked upper trail with significant blowdown obstructions and a very steep and slippery trail down to the base of the waterfalls. This portage has been designated as difficult (http://www.myccr.com).

Alternatively, a portage trail approximately 1 km long could be provided to the south of the proposed Project site from New Post Creek to the Abitibi River to facilitate further access for canoeists to LAPP. This alternative would enhance public safety by precluding the need to portage around the proposed Project intake weir on the east side of New Post Creek, and to locate and access the difficult portage around the waterfalls.

Prior to initiation of proposed Project construction, the DBC will identify disembark/launch locations for canoeists to access the new portage trail between New Post Creek and the Abitibi River. A map showing the proposed location of the new portage trail will be provided to Ontario Parks and MNR for review and approval.

Waterfalls Aesthetics

As indicated in Section 2.3.4, the New Post Creek waterfalls has been identified as a tourism destination by the www.northernontario.travel website under Wilderness Heritage Canoe Tours. Two tourism operators located in Cochrane (Howling Wolf Expeditions, Northern Spirit Adventures) provide half, full and/or two-day trips to "New Post Falls" and New Post. Reduction of flows over the waterfalls to historic levels may diminish visitor experience appreciation value.

#### *3.2.1.2 Minimum Flow Establishment Process*

During the EA process, discussions on the proposed Project operating regime and in particular minimum flow requirements have been ongoing between OPG, CRP, MNR, Ontario Parks and DFO. All parties have been working towards an operating regime that:

- continues to provide important ecological functions;
- ensures that the proposed Project is economically viable;
- respects TTN's historic and modern day interests;
- ensures and enhances public safety; and
- ensures continual flow in New Post Creek and over the waterfalls to maintain aesthetic value.

As a pre-condition, it was agreed that the proposed Project will not change the total volume of water flowing into the Abitibi River, or the operating considerations for Abitibi Canyon GS and Otter Rapids GS. Moreover, to simplify proposed New Post Creek Project operation, the OPG NEPG requested that the number of minimum flow requirements throughout the year be limited, e.g., if possible, a minimum flow to sustain fish spawning in the spring and a minimum flow for the remainder of the year.

As indicated above, the rapids below the waterfalls provide spawning habitat for at least three fish species during the spring freshet: Walleye, White Sucker and Longnose Sucker. Field studies have determined that Lake Sturgeon and Lake Whitefish do not utilize this habitat for spawning in the spring and fall, respectively (see Sections 2.2.6.6 and 2.2.6.7). As indicated in Section 2.2.6.5, Coker and Portt (2012a) opined that the lower flows (32 $m^3$/s) within New Post Creek in 2010 likely resulted in better habitat conditions for spawning Walleye than the higher flows (195.7 $m^3$/s) observed in 2009. This was confirmed by hydraulic/habitat modelling (see below).

A meeting of the five parties was held on October 20, 2011 to initiate formal discussions on minimum flow requirements for the proposed New Post Creek Project. During the meeting, MNR indicated that application of the $Q_{80}$ approach to minimal flow for the proposed Project would be acceptable. However, it was noted by CRP/OPG that this approach would effectively terminate the proposed Project since the $Q_{80}$ approach uses the flow that is exceeded 80% of the time as a target In-stream Flow Need (IFN). Some agencies apply this approach over the entire year, whereas others apply it only for defined periods, e.g., low flow periods. If used on a monthly basis for the proposed Project, the $Q_{80}$ would exceed the minimum flows typically observed in New Post Creek in the winter (see Table 2.4).

At the meeting, it was agreed that a 2D hydraulic/Habitat Suitability (HSI) model would be used to assess habitat at various flow conditions in New Post Creek in order to define minimum flow requirements.

To provide data necessary to develop the River2D hydraulic model used, a field survey was conducted by KGS Group to obtain bathymetric, substrate and flow/velocity/water level information for New Post Creek from the base of the waterfalls to its confluence with the Abitibi River (Coker and Portt, 2012e; see Appendix C). The hydraulic model results were used with the HSI model to simulate a range of potential in-stream flows, including Spring IFNs and Summer/Fall/Winter IFNs, and quantify fish habitat over this range of flows. The spawning period for Walleye was selected as the key life stage and target fish species for this study. Potential IFNs were assessed with the model for the period of May and June (spawning and egg incubation period) and from July to April.

As indicated in Section 2.2.6.6, there was still uncertainty with respect to Lake Sturgeon spawning in New Post Creek based on the 2010 findings. As a result, potential IFNs of Lake Sturgeon during the spawning period were also assessed with the model. Subsequent more comprehensive field studies undertaken in 2011 and 2012 have indicated that there is no evidence of Lake Sturgeon spawning in New Post Creek.

Minimum Flows Proposed by CRP/OPG for the Spring Spawning Period (May – June)

A large number of model runs were executed, using stream flows ranging from 1 to 144 $m^3/s$. The model results for Walleye spawning suitability at 10 and 30 $m^3/s$ are presented in Figures 3.1, 3.2, 3.3, 3.4 and 3.5. The small red ellipse at the top end of the Walleye spawning suitability mapping in Figure 3.5 indicates the location of Walleye observed at night during the 2010 spawning run (Coker and Portt, 2012a).

**Figure 3.1 Principal Walleye Spawning Habitat Parameters of Water Depth, Water Velocity at 10 m$^3$/s and Substrate**

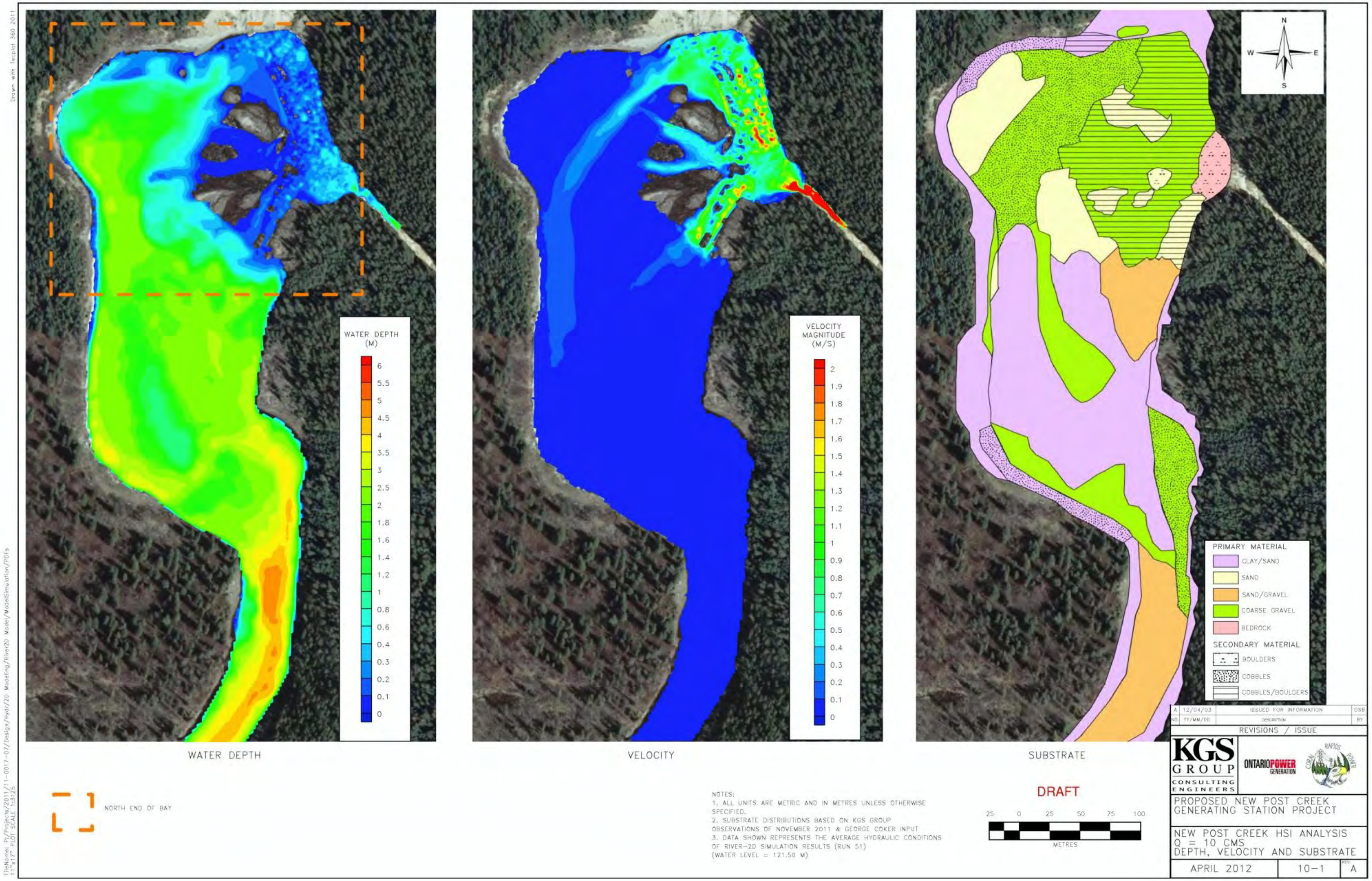


**Figure 3.2 The Spatial Extent of Suitable Water Depth, Water Velocity and Substrate Type Required by Walleye for Spawning at Flow of 10 $m^3/s$**

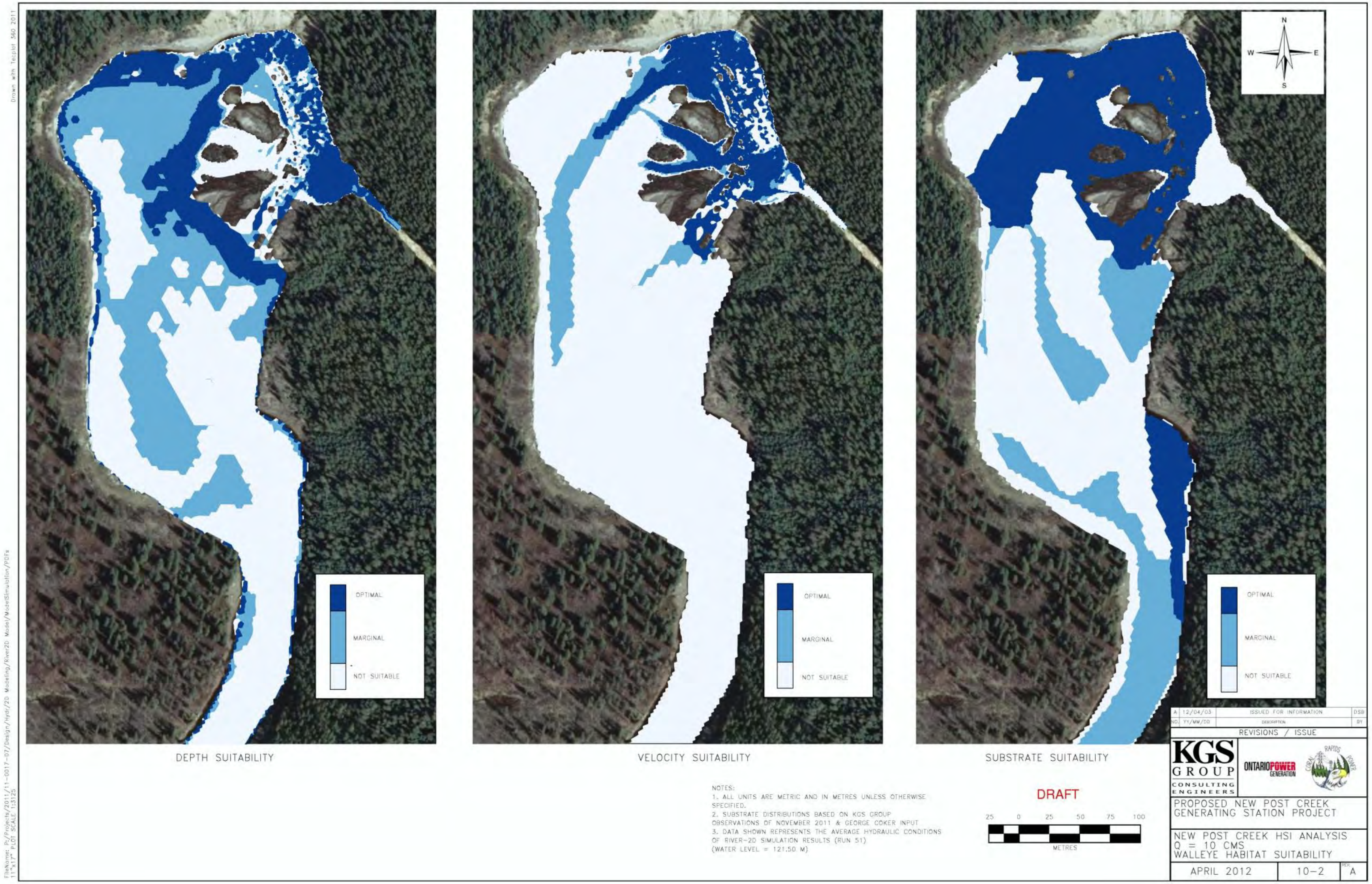


**Figure 3.3 Principal Walleye Spawning Habitat Parameters of Water Depth, Water Velocity at 30 $m^3$/s and Substrate**

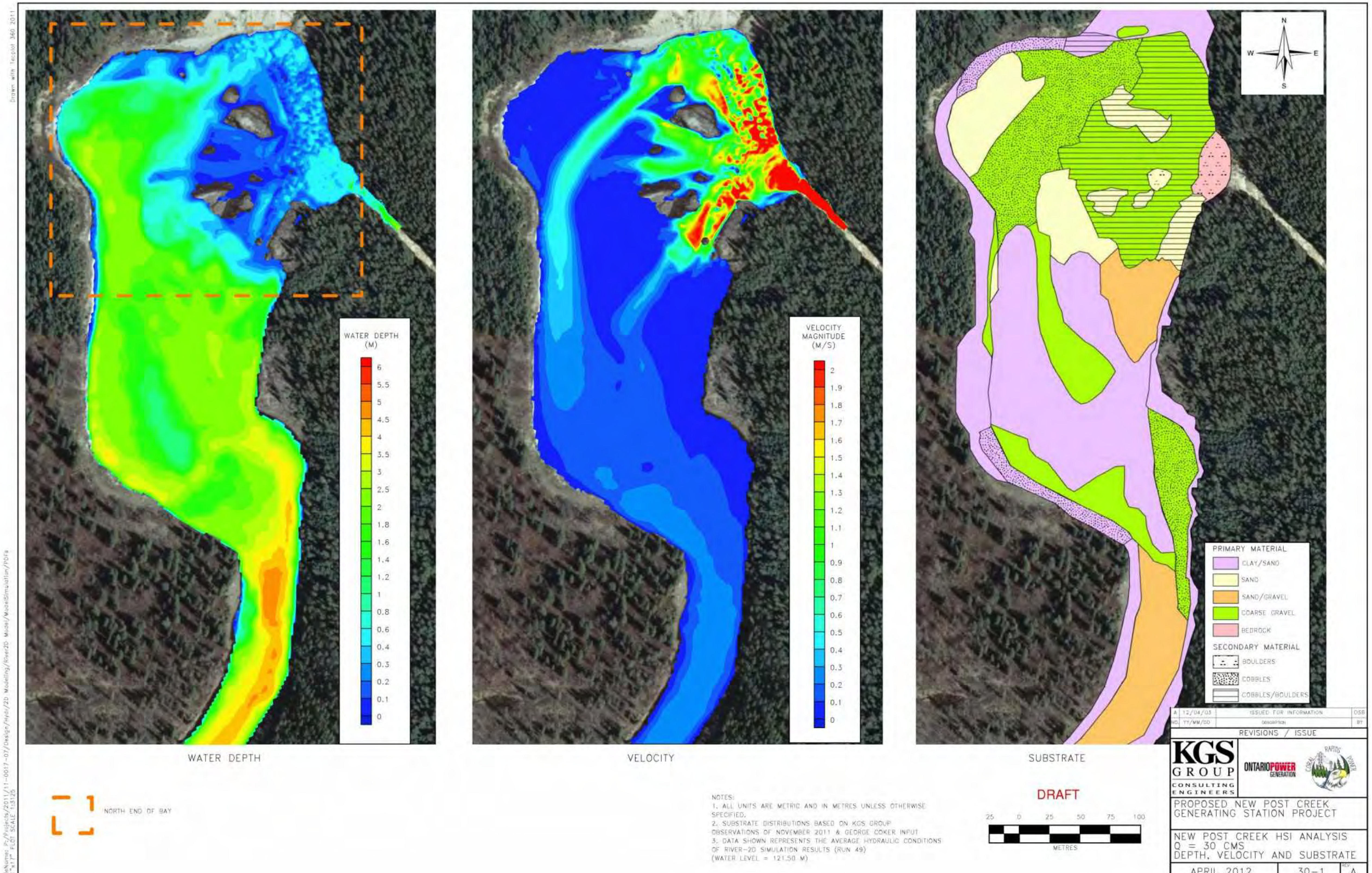


**Figure 3.4 The Spatial Extent of Suitable Water Depth, Water Velocity and Substrate Type Required by Walleye for Spawning at Flow of 30 $m^3/s$**

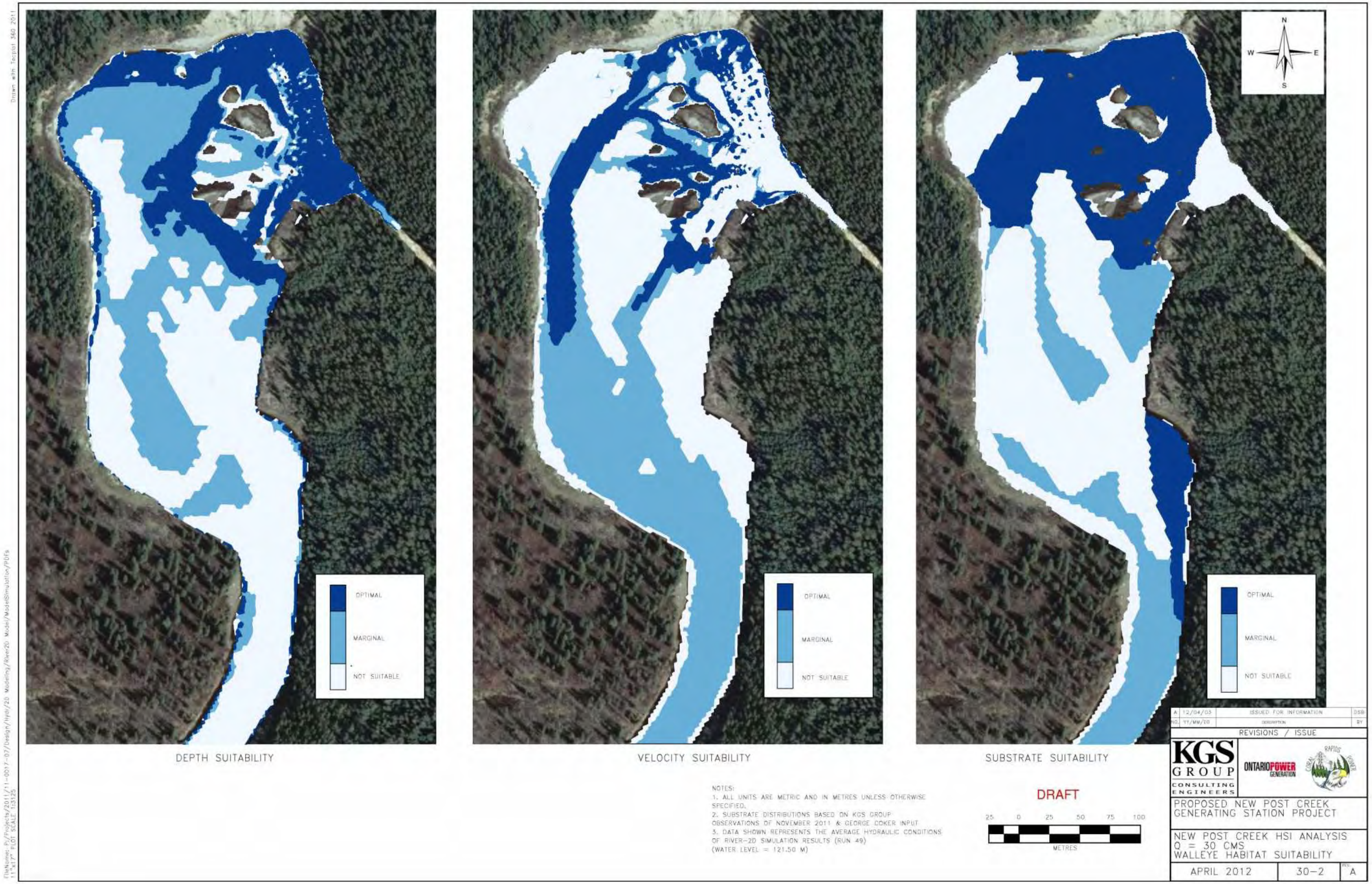
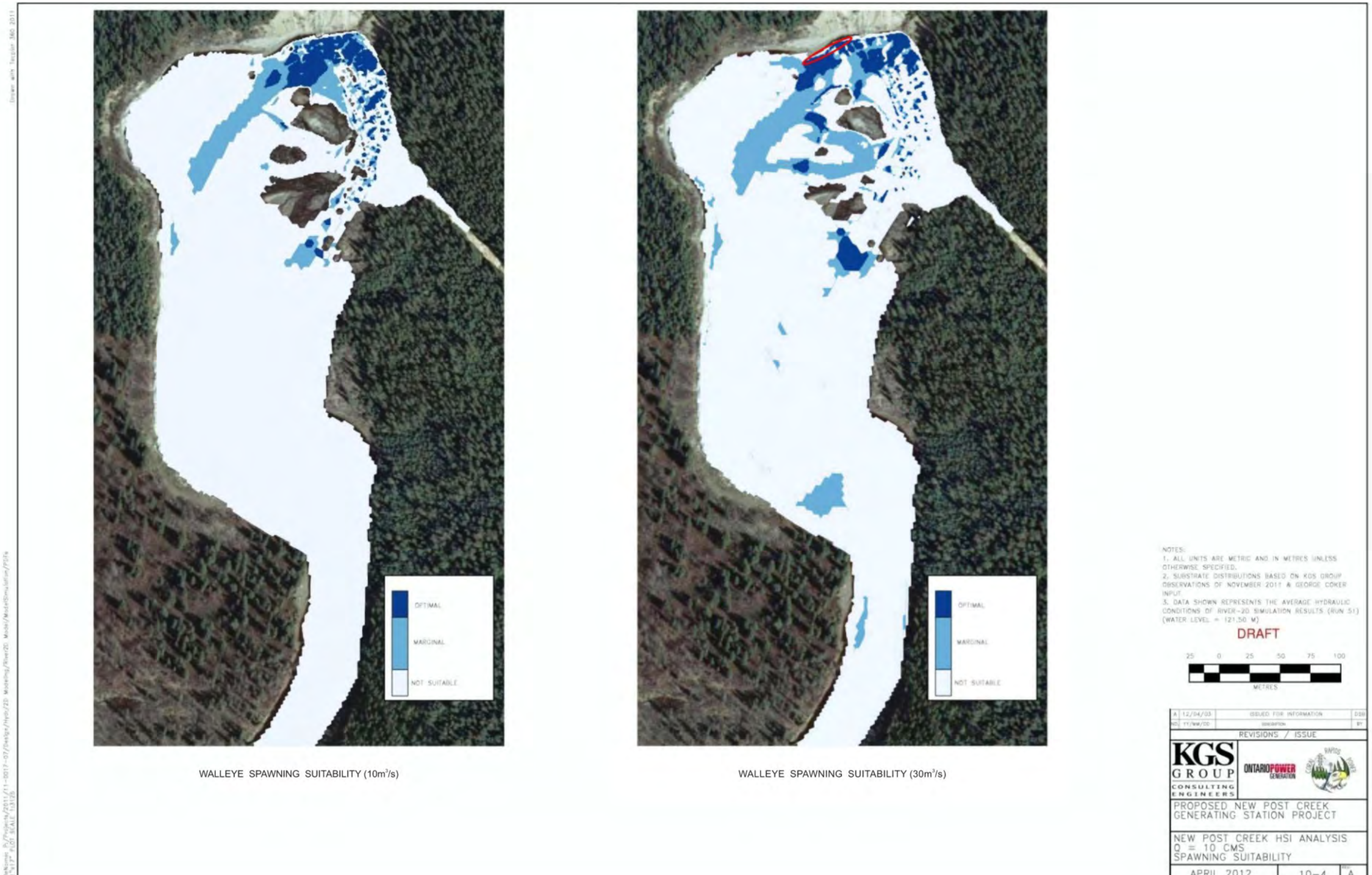
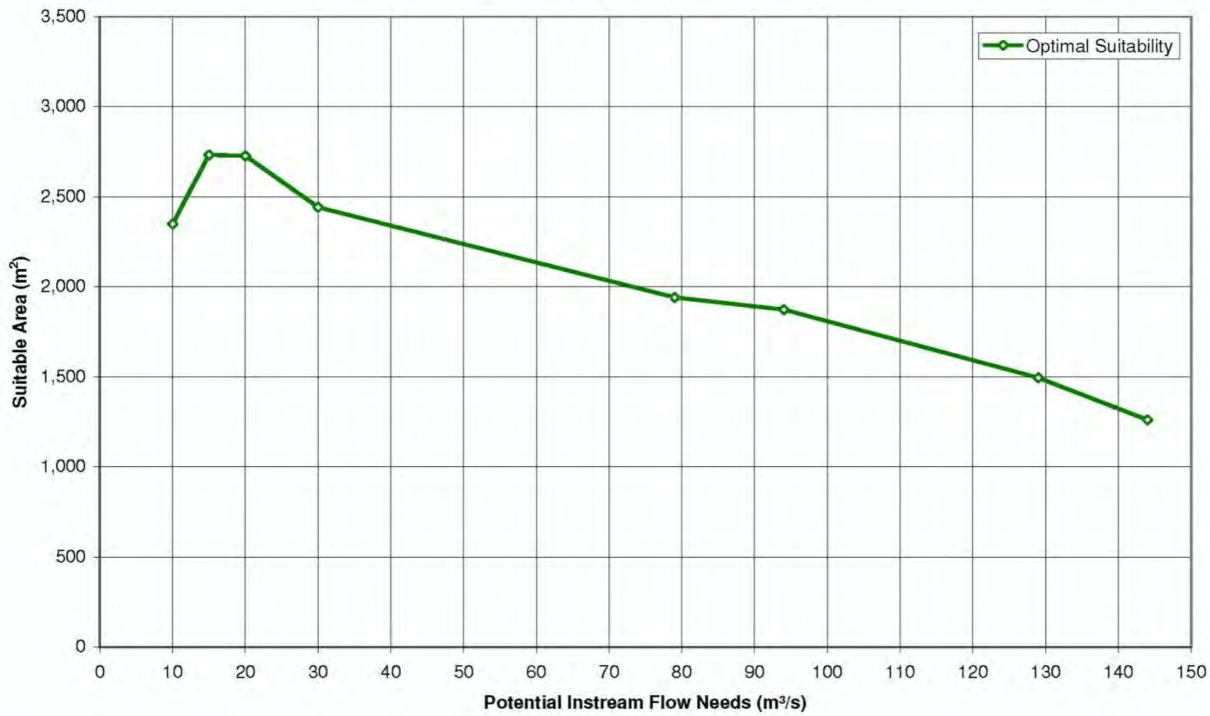


**Figure 3.5 The Spatial Extent at 10 and 30 $m^3$/s of Potential Walleye Spawning Habitat, where Suitable Flow Velocities, Water Depths and Substrate Types Overlap**



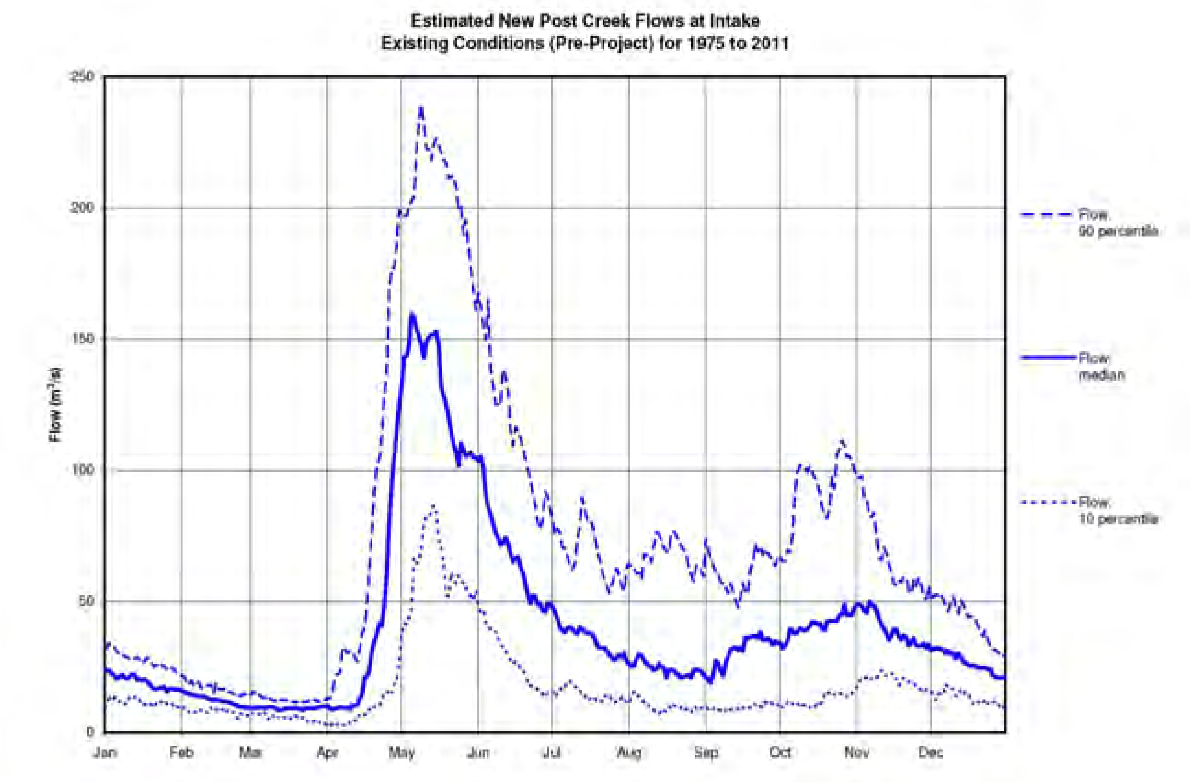
Besides the two example habitat runs provided above, the results of additional optimal Walleye spawning habitat model runs at a range of flows are presented in Figure 3.6.

**Figure 3.6 Graph of Potential Optimal Walleye Spawning Habitat Area versus Flow**




As indicated in Figure 3.6, the area of potential optimal Walleye spawning habitat is highest at flows of 10 to 30 $m^3/s$, compared to reduced areas of potential optimal spawning habitat at flows greater than 80 $m^3/s$ that typically occur during the spring spawning period. As indicated in Figure 3.7, New Post Creek flows during the spring spawning period are historically much higher than the optimal spawning flows. With the proposed Project reducing flows by up to approximately 50 $m^3/s$ due to flow diversion through the proposed GS, the likelihood of flows occurring in a more optimal zone for spawning downstream of the waterfalls increase significantly.

**Figure 3.7 Median New Post Creek Flows**




The relationship of suitable spawning habitat to flow in any river will approximately follow a bell-shaped distribution, with its exact shape and the position of the peak determined by the morphology of the channel. In the case of habitat below the waterfalls in New Post Creek, a limited area of suitable depth for Walleye spawning becomes increasingly unavailable as flow and flow velocity increase, whereas in rivers where suitable depth is widespread, the area of suitable spawning habitat may remain high or increase as flow increases towards the capacity of the channel. For New Post Creek, the potential Walleye spawning habitat area is greater at flows that are considerably less than what occurs during the typical period of Walleye spawning. Therefore, the projected overall decrease in flow that will occur below the waterfalls (i.e., ~50 $m^3$/s) as a result of the proposed Project, will provide more optimal Walleye spawning habitat compared to current conditions.

While the peak spawning habitat suitability occurs between approximately 15 to 20 $m^3$/s (Figure 3.6), a minimum flow of 10 $m^3$/s was recommended because it provides a significant improvement in Walleye spawning conditions over existing conditions, while not limiting the proposed Project viability. In terms of energy impact, current data estimate that for every 1 $m^3$/s increase in minimum flow during this period there would be a loss of annual energy production of 0.25 GWh.

This minimum flow of 10 $m^3/s$ represents a targeted minimum flow and is not expected to be required every year. This minimum flow will be required approximately 1 in 10 years during the typical Walleye spawning period, rising to approximately 1 in 4 years by the end of the typical Walleye fry dispersal period.

This recommended minimum flow of 10 $m^3/s$ should not affect other spring spawning fish species. Longnose Sucker spawn at about the same time as Walleye (being often observed together during nighttime observations) and generally use the same habitats. White Sucker usually spawn immediately following Walleye and can utilize a broader range of spawning habitats than Walleye. Shorthead Redhorse may start to spawn immediately after Walleye, but over a wider range of temperature and probably in slower water velocities and somewhat deeper water in large rivers. No Shorthead Redhorse have been caught in New Post Creek during the short-term gillnet sets to confirm Walleye spawning in 2009, 2010 and 2011 (Coker and Portt, 2012a, b).

Details on the fieldwork and modelling used to quantify Walleye and Lake Sturgeon spawning habitat in New Post Creek downstream of the waterfalls, as well as the rationale for the proposed minimum flow of 10 $m^3/s$ during the Walleye spawning and egg incubation period, is provided by Coker and Portt (2012e). This report is provided in Appendix C of this TSD.

<u>Minimum Flows Proposed by CRP/OPG for the Summer Period (July – September)</u>

Coker and Portt (2012e) proposed a minimum flow of 3 $m^3/s$ in New Post Creek to maintain basic ecological function from the end of spring to the end of September, i.e., during the more active production phase of fish and benthic macroinvertebrates.

As indicated in Section 2.2.6.2, the post-diversion fish community in New Post Creek upstream of the waterfalls is characterized by low diversity and small populations. Based on habitat observations and due to channel morphology, the proposed minimum flow of 3 $m^3/s$ should be sufficient to maintain summer ecological function between the proposed intake weir location and the waterfalls. The majority of wetted habitat will be maintained, although some minor losses will occur along the shoreline of flatwater sections, with somewhat greater losses of area at the three localized flow control points in this section of New Post Creek. Aquatic habitats will remain productive, although the lower water levels throughout and the generally lower flow velocities may result in shifts in benthic macroinvertebrate and fish communities. Given the sparse nature of the fish community and the existing barrier of the waterfalls that prevents fish from moving upstream to utilize these habitats, any effects on the local fish community will have little significance, and broader effects to downstream and upstream fish communities will be insignificant. The seasonal losses of habitat area downstream of the proposed intake weir due to the proposed minimum summer flow of 3 $m^3/s$ will probably be more than offset by the area of habitat gained due to the higher water levels that will be maintained upstream of the proposed intake weir.

As indicated in Section 2.2.6.4, the fish community in the shallow water and rapids of New Post Creek downstream of the waterfalls is fairly typical of this type of habitat but sparse.

The projected reduction in the area of rapids habitat below the waterfalls at the proposed minimum flow of 3 $m^3$/s will probably result in a reduction in local benthic macroinvertebrate production; however, the effect on local fish productivity is unknown given the existing low fish densities observed in the creek. The habitat in New Post Creek below the waterfalls is illustrated in Figure 3.8). Below the waterfalls, flow passes over the alluvial fan via three main routes. Most of the flow passes along the north side and then down the west side (solid line), with the remaining flow split between two other routes (dashed lines). Habitat quality does not appear to decrease appreciably within the primary channel (solid line in Figure 3.8), because as flow is reduced it is initially at the expense of the two minor channels (dashed lines in Figure 3.8). Based on hydraulic modeling, almost all flow would pass down the primary channel at approximately 3 $m^3$/s. Although habitat area would be decreased, and therefore assumed to represent a loss in productivity, the habitat components in this area at higher flows are still present at a flow of 3 $m^3$/s. The resultant habitat changes in the summer are considered a local adverse effect rather than affecting the broader aquatic community in the downstream habitats of New Post Creek and the Abitibi River. Moreover, the tailrace area of the proposed GS will provide flowing-water habitat with coarse substrate that does not currently exist, providing some compensation for the loss of similar habitat in New Post Creek below the waterfalls.

**Figure 3.8 Primary (solid line) and Secondary (dashed lines) Flows in New Post Creek Channels Below the Waterfalls**

Details on the fieldwork and modelling used to assess effects of the recommended minimum flow of 3 $m^3/s$ on aquatic habitat in New Post Creek upstream and downstream of the waterfalls during the summer period is provided in Appendix C of this TSD.

Minimum Flows Proposed by CRP/OPG for the Winter Period (October - April)

Coker and Portt (2012e) proposed a minimum flow of 1 $m^3/s$ in New Post Creek to maintain basic ecological function during the winter.

Based on habitat observations and due to channel morphology, the proposed minimum flow of 1 $m^3/s$ should be sufficient to maintain winter ecological function between the proposed intake weir location and the waterfalls. Water temperatures will be at or close to $0^oC$, and most fish and benthic macroinvertebrates will be in a state of minimal activity. The majority of wetted habitat upstream of the waterfalls will be maintained, although some minor losses will occur along the shoreline of flatwater sections, with somewhat greater losses of area at the three localized flow control points. Aquatic habitats will remain productive, although the lower water levels and flow velocities will likely result in shifts in benthic macroinvertebrate and fish communities.

The majority of wetted habitat area in New Post Creek downstream of the waterfalls will be maintained, because water levels downstream of the alluvial fan are controlled by the Abitibi River. However, although riffle habitats of similar quality will be maintained in the alluvial fan, they will be reduced in area. Given the sparse nature of the fish community and the low winter activity of most fish and benthic invertebrates in New Post Creek, any effects on the local fish community will have little significance and broader effects to downstream fish communities will be insignificant. Transition from the 3 $m^3/s$ summer flow to 1 $m^3/s$ winter flow should occur at the end of September when fish and benthic macroinvertebrates are still active. As a result, no further dewatering of habitat will occur after they take up their overwintering positions.

Details on the fieldwork and modelling used to assess effects of the recommended minimum flow of 1 $m^3/s$ on aquatic habitat in New Post Creek upstream and downstream of the waterfalls during the winter period is provided in Appendix C of this TSD.

$Q_{95}$ Approach to Minimum Flow Proposed by MNR

The minimum flow assessment findings and the proposed minimum flows of 10 $m^3/s$ for the spring spawning period (May and June), 3 $m^3/s$ for the summer period (July to September) and 1 $m^3/s$ for the winter period (October to April) were presented to MNR, Ontario Parks, DFO and MOE at a meeting on April 11, 2012. A report on the minimum flow assessment findings and the proposed minimum flows was subsequently prepared by Coker and Portt (2012e) and provided to the agencies in July 2012.

After the meeting and prior to receipt of the Coker and Portt (2012e) report, the MNR proposed a $Q_{95}$ approach (flows equal to or exceeded 95% of the time) and defined as low flow or extreme low flow as presented below:

- 19.8 $m^3/s$ for the spring spawning period of May and June, compared to 10.0 $m^3/s$ proposed by CRP/OPG (it should be noted that at the time of this proposal there was uncertainty regarding Lake Sturgeon spawning in New Post Creek);
- 7.5 $m^3/s$ for the summer period of July, August and September, compared to 3.0 $m^3/s$ proposed by CRP/OPG;
- 9.8 $m^3/s$ for the fall period of October and November, compared to 1.0 $m^3/s$ proposed by CRP/OPG; and
- 5.0 $m^3/s$ for the winter period of December to April, compared to 1.0 $m^3/s$ proposed by CRP/OPG.

During a subsequent meeting on October 30, 2012, the MNR reiterated their position that the $Q_{95}$ approach is scientifically defensible as an extreme low flow. However, the MNR did present revised (minimum acceptable) low flows and their rationale. These are presented in Table 3.2.

**Table 3.2 Revised MNR Flow Requirements for New Post Creek**

| | Minimum Flow ($m^3/s$) | | | |
|---|---|---|---|---|
| | **Spring** | **Summer** | **Fall** | **Winter** |
| $Q_{95}$ | 19.8 | 7.5 | 9.8 | 5.0 |
| Minimum Acceptable | 15 | 7.5 | 3.0 | 3.0 |
| Difference from $Q_{95}$ | -4.8 | 0 | -6.8 | -2.0 |
| Pulsing | No | Yes (0.5 m) | Yes (0.5 m) | Yes (0.5 m) |

The minimum flow of 15 $m^3/s$ during the spring (May 1 to June 30) should adequately protect aquatic values below the waterfalls. Based on the fisheries information and habitat modeling provided, MNR determined that it was acceptable to depart from the preferred $Q_{95}$ value. However, MNR was not convinced that Lake Sturgeon do not spawn below the waterfalls.

The minimum flow of 7.5 $m^3/s$ during the summer (July 1 to September 30) is defensible as a required low flow. It may or may not fully meet the summer aesthetics flow requirements. However, as the $Q_{95}$, a minimum flow of 7.5 $m^3/s$ in the summer avoids the question of a net negative change in the ecological integrity of LAPP. A net negative change in ecological integrity would trigger an Ontario Parks review/compensation process that could be lengthy.

MNR agreed that the fall minimum flow should serve as a cap for winter flows and therefore proposed an increase of the low flow requirement during the months of October and November from 1 $m^3/s$ to 3 $m^3/s$ to correspond with that for the winter months (see below).

Being significantly less than the $Q_{95}$, MNR was uncertain that a minimum flow of 1 $m^3/s$ during the winter (December 1 to April 30) would be sufficient to adequately protect aquatic values, particularly the provision of sufficient overwintering refuge above the waterfalls for benthic macroinvertebrate and fish communities to protect them from freezing and desiccation. However, MNR is also sensitive to the strategic importance the winter season has with respect to power production and proposed Project viability. Therefore, a moderate departure from the $Q_{95}$ to a minimum flow of 3 $m^3/s$ provides a balanced approach that meets both environmental protection and proposed Project viability objectives.

#### *3.2.1.3 Minimum Flows Proposed by MNR and Ontario Parks*

Based on further feed-back and deliberations with MNR, Ontario Parks, DFO and MOE, the following minimum flows were proposed by MNR and Ontario Parks for New Post Creek during proposed Project operation.

<u>Proposed Minimum Flow during the Spring Walleye Spawning Period</u>

A minimum flow of 15 $m^3/s$ is proposed for the spring Walleye spawning period (approximately May 1 to mid-June). Based on the modeling results, peak Walleye spawning habitat suitability occurs between 15 and 20 $m^3/s$ (see Figure 3.6). The duration of minimum flow adherence will be dependent on water temperatures encompassing the initiation of Walleye spawning and completion of fry emergence.

Figure 3.9 presents a histogram of historical flows in New Post Creek, ranked in order of lowest to highest, during the typical start of Walleye spawning in early May. The proposed spring minimum flow of 15 $m^3/s$ is represented by the green bar portions. The blue bar portions represent the expected flow diversion of up to 50 $m^3/s$ through the proposed GS, and the red bar portions represent the additional flow downstream of the proposed intake weir location on New Post Creek. For the 32 years of recordings, flow in New Post Creek was low enough during only 3 years that some curtailing of flow diversion to the proposed GS would have been required in order to provide the proposed spring minimum flow of 15 $m^3/s$.

Figure 3.9 also indicates that reducing flows downstream of the waterfalls by the proposed GS flow of 50 $m^3/s$ will increase the amount of optimal Walleye spawning habitat (see Figure 3.6). For example, under the current flow regime, flow in New Post Creek was below of 50 $m^3/s$ for only 2 of the 32 years. With the operation of the proposed GS, flow below of 50 $m^3/s$ would have occurred during the spring of 8 years. Therefore, an overall reduction of 50 $m^3/s$ will provide a greater amount of optimal Walleye spawning habitat than what currently becomes available under typical spring flows.

**Figure 3.9 Histogram of Flow Redistribution during the Walleye Spawning Period due to Flow Diversion and Minimal Flow Adherence**

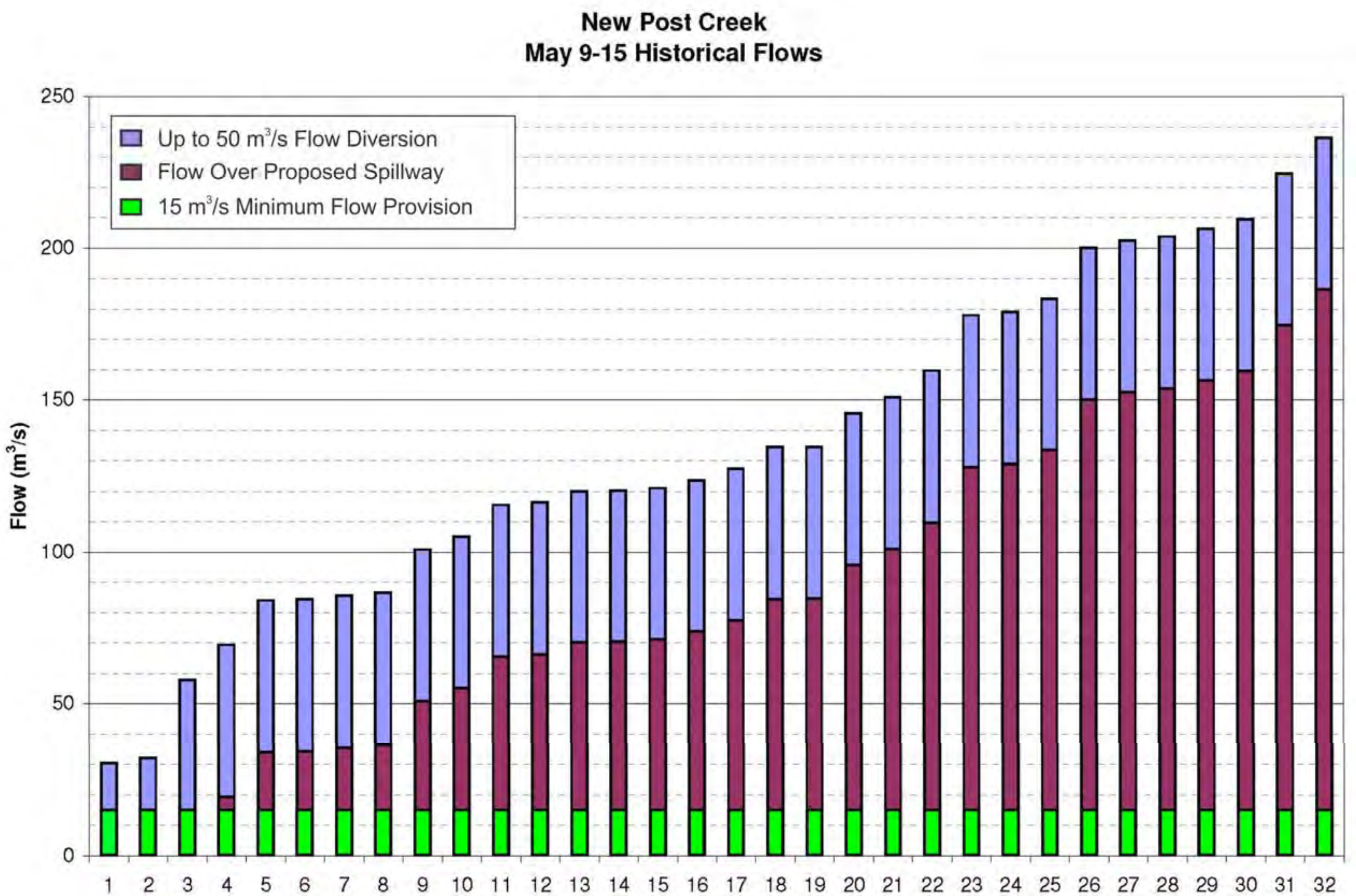


Figure 3.10 presents a histogram of historical flows in New Post Creek, ranked in order of lowest to highest, during the typical end of Walleye fry emergence in early June. As in Figure 3.9, the green bar portions represent the proposed minimum flow of 15 $m^3/s$, the blue bar portions represent the expected flow diversion of up to 50 $m^3/s$ through the proposed GS, and the red bar portions represent the additional flow downstream of the proposed intake weir location on New Post Creek.

For the 34 years of recordings, flow in New Post Creek was low enough during the spring of 12 years that some curtailing of flow diversion to the proposed GS would have been required in order to provide the proposed spring minimum flow of 15 $m^3/s$. Moreover, the range of flows over the spring spawning period will be compressed due to the flow diversion of 50 $m^3/s$ and maintaining a minimal flow of 15 $m^3/s$. This will reduce the range of flow reduction that typically occurs over the Walleye spawning and egg incubation period, and therefore, reduce the potential for Walleye eggs becoming dewatered when flows decrease during the incubation period.

In summary, the diversion of 50 $m^3/s$ through the proposed GS and the proposed minimum flow of 15 $m^3/s$ will provide more good quality Walleye spawning habitat than typical spring flows. The proposed minimum flow of 15 $m^3/s$ will be required approximately 1 in 10 years during the spawning period, rising to about 1 in 3 years by the end of the fry dispersal period. The maintenance of a target minimum flow will reduce the range of flows that typically occur during Walleye spawning, potentially improving embryo survival.

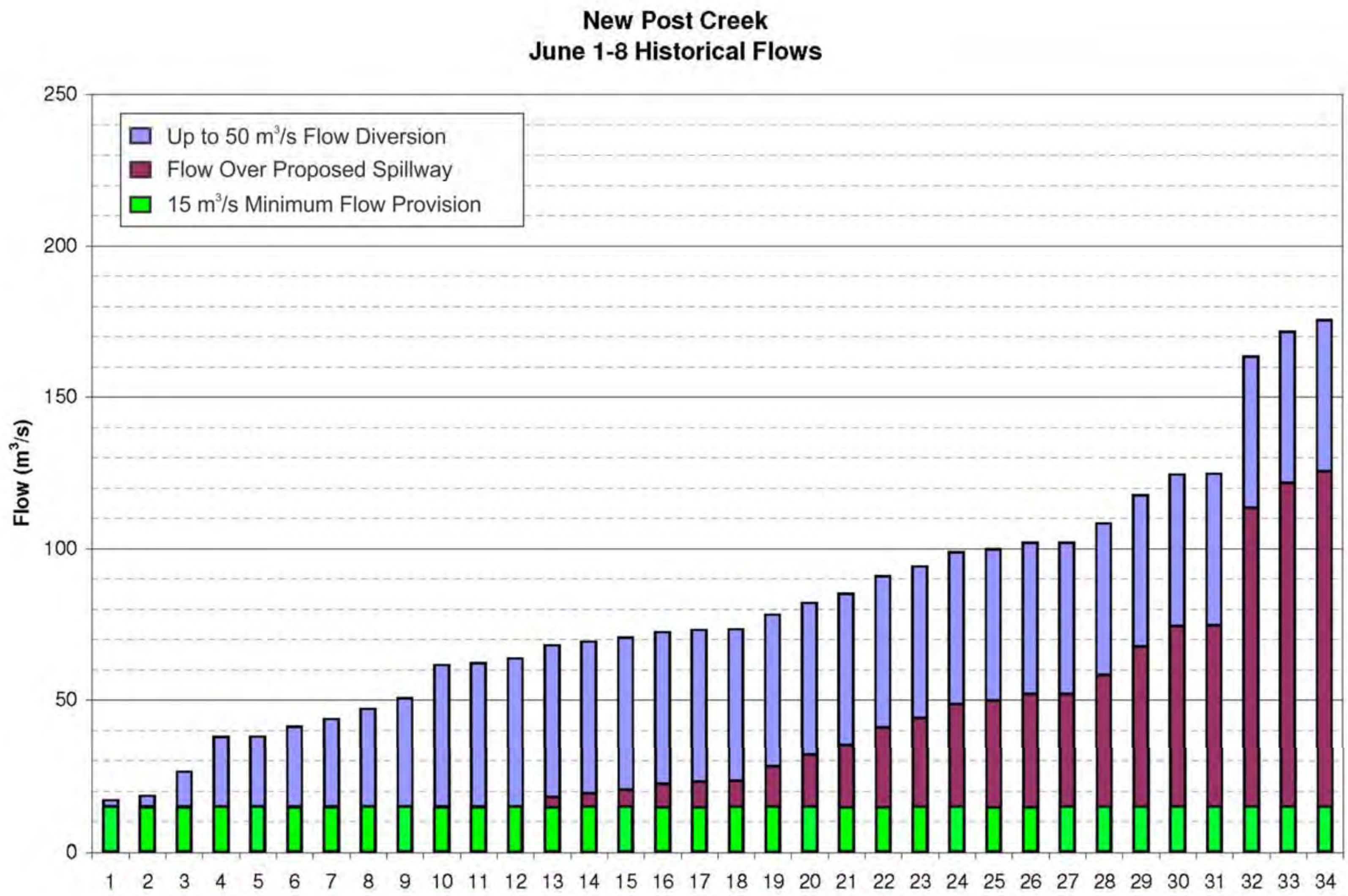
As indicated in Section 2.2.6.8, White Sucker and Longnose Sucker spawning also occurs in New Post Creek downstream of the waterfalls, generally after Walleye spawning. Although the focus had been on Walleye spawning, the timing window for minimum flow maintenance will account for suitable conditions for catostomid spawning and egg incubation. Therefore, a minimum flow of 15 $m^3/s$ will be maintained for the spring spawning and egg incubation period, approximately May 1 to mid-June. As indicated in Section 2.2.6.6, study findings support the conclusion that Lake Sturgeon do not spawn in New Post Creek. However, if spawning is demonstrated in New Post Creek, the timing window would be expanded to include the Lake Sturgeon spawning and egg incubation period.

Proposed Minimum Flow during the Summer Period (mid-June – September 1)

A brief transitional flow from 15 to 7.5 $m^3/s$ will be permitted from the end of fry emergence (based on thermal units accumulated) with the rampdown rate ($m^3/s$ per day) to be determined in consultation with the MNR and DFO. A minimum flow of 7.5 $m^3/s$ will be maintained between approximately mid-June and September 1 to ensure sufficient flow over the New Post Creek waterfalls to not diminish visitor (tourist) experience appreciation value.

No visual record of the waterfalls is available for a 7.5 $m^3/s$ flow; however, Photograph 3.1 shows the waterfalls on September 17, 2011 when average daily flow was 9.17 $m^3/s$.

**Figure 3.10 Histogram of Flow Redistribution during the Walleye Fry Emergence Period due to Flow Diversion and Minimal Flow Adherence**



**Photograph 3.1 New Post Creek Waterfalls, September 17, 2011, Average Daily Flow of 9.17 $m^3$/s**

The minimum flow of 7.5 $m^3$/s is approximately four to five times lower than the mean post-diversion flows recorded in New Post Creek in July and August, but is generally comparable to (albeit lower than) the minimum flows recorded (see Table 2.4). Moreover, the minimum flow of 7.5 $m^3$/s is approximately two and seven times higher than the mean and minimum pre-diversion flows in New Post Creek, respectively (see Table 2.3).

Proposed Minimum Flow during September

A minimum flow of 5 $m^3$/s will be maintained from September 1 to 30.

The minimum flow of 5 $m^3$/s is approximately seven times lower than the mean post-diversion flow recorded in New Post Creek in September, but 1.5 times higher than the minimum flow recorded (see Table 2.4). Moreover, the minimum flow of 5 $m^3$/s is approximately 1.4 and 12 times higher than the mean and minimum pre-diversion flows in New Post Creek, respectively (see Table 2.3).

Proposed Minimum Flow during the Winter Period (October 1 – Walleye Spawning Initiation)

A minimum flow of 2 $m^3$/s will be maintained from October 1 to the start of the Walleye spawning period. This minimum flow would provide for ongoing flow in the secondary channels below the waterfalls (see Figure 3.8). The modeling results for a minimum flow of 2 $m^3$/s are presented in Figure 23 of the Coker and Portt (2012e) report (see Appendix C).

The minimum flow of 2 $m^3/s$ is approximately 14 times lower than the mean post-diversion flow recorded in New Post Creek during the October – April period, and below the minimum flow range of 4.5 to 9.6 $m^3/s$ recorded between October and April (see Table 2.4). Moreover, the minimum flow of 2 $m^3/s$ is within the range of mean pre-diversion flows (1.1 to 4.8 $m^3/s$) and above the range of minimum flows (0.5 to 1.0 $m^3/s$) in the creek (see Table 2.3).

Proposed Minimum Flows Summary

The minimum flows proposed by MNR and Ontario Parks are summarized below:

- 15 $m^3/s$ for the spring spawning and egg incubation period approximately May 1 to mid-June (to be expanded to include Lake Sturgeon spawning and egg incubation period if spawning occurrence is demonstrated);
- brief transition of flows from 15 to 7.5 $m^3/s$ from the end of egg incubation (based on thermal units accumulated) with the rampdown rate ($m^3/s$ per day) to be determined in consultation with the MNR and DFO;
- 7.5 $m^3/s$ during the summer period (mid-June to August 31);
- 5 $m^3/s$ for September 1-30; and
- 2 $m^3/s$ during the winter period (October 1 to approximately April 30 with timing dependant on Walleye spawning initiation).

As indicated in Section 1.3.2.2, pulsing will be permitted at any time of the year within the operating range of 0.5 m provided minimum flows are directed over the spillway and no negative effects due to pulsing, that can not be otherwise mitigated, are observed (G. Funnell, MNR, 2013, pers. comm.).

This proposed operating regime is subject to further discussions with key stakeholders on ecological, economic and social concerns prior to and during proposed Project operation. Adaptive management will be a key principle moving forward.

### 3.2.2 Groundwater Hydrology

No effects on groundwater hydrology are anticipated as a result of the operation of the proposed GS; therefore, no mitigation is required.

### 3.2.3 Water Quality

During proposed Project operation, a proportion of water from New Post Creek will be diverted to the Abitibi River approximately 2.8 km upstream of the New Post Creek outlet. This water diversion will not have a measurable effect on overall Abitibi River water quality or water quality in New Post Creek downstream of the proposed Project spillway.

As indicated in Section 1.2.3, normal operation of the proposed New Post Creek Project will increase the water level in New Post Creek at the proposed intake weir location by approximately 6.5 m, from a natural creek level of approximately 180.50 m.a.s.l. to a FSL of 187.00 m.a.s.l. The resultant total reservoir would be approximately 170 ha (see Figure 1.9). Much of the inundation would occur immediately upstream and to the west encompassing the drainage basin of the permanent unnamed tributary that discharges into New Post Creek approximately 150 m upstream of the proposed Project intake location. The upstream extent of the inundated areas is limited by the rather steep gradient at the upstream limit. As indicated in Figure 1.9, the inundated area would occur within a total park area of approximately 197 ha upstream of the proposed Project intake weir.

Due to the expanded inundation surface area, higher surface water temperatures can be expected during the summer due to solar radiation.

Temporary water quality alteration may occur due to the inundation of adjacent forested riparian areas and wetlands. Although CRP/OPG is proposing to clear the reservoir (flooded) area (see Section 3.2.10), a subsequent period of localized trophic surge can be expected due to the residual organic material present in the substrate. The trophic surge effect (higher nutrient concentrations due to decomposition of organic material) is expected to be greatest in the first year, with a rapid return to background. Ontario Hydro (1988) undertook water quality simulations for a proposed inundation area of approximately 4,400 ha and determined that the trophic surge effect would last three to five years. Since the proposed Project headpond is smaller in area (170 ha) and with a much faster flushing rate, a more rapid return to background water quality can be expected, within two years of proposed headpond creation.

The inundation of adjacent wetland and cleared forested areas is expected to result in increased mercury concentrations in fish resident in the reservoir but not in Walleye or other fish species downstream of the New Post Creek waterfalls (see Section 3.2.10).

Clearing of the reservoir (flooded) area will also result in the disturbance and exposure of soil with potential for increased erosion and resuspension in the water column. Stumps are to remain in the ground so as to maintain root mat, limit soil disturbance and lower the risk of erosion and TSS released to the reservoir. It is anticipated that increases in TSS will be temporary (see below).

After the anticipated trophic surge, water quality is expected to be similar to pre-inundation baseline conditions, even with water-level fluctuations due to the proposed seasonal mode of operation. When an oligotrophic lake in northwestern Ontario was subjected to experimental fluctuations of water levels, Turner *et al*. (2005) determined that changes in water quality were minimal. Although there were differences between pre- and post-drawdown water chemistry, these changes were generally small and did not alter the basic nutrient characterization of the oligotrophic lake. After three years of drawdown of 2 to 3 m, conductivity levels and concentrations of cations and macronutrients such as nitrogen and phosphorus remained extremely low. As water-level fluctuations in the proposed headpond will range only up to 0.5 m, it is anticipated that water quality will not be affected.

Flow diversion will result in lower flows in New Post Creek from the proposed Project spillway location to its outlet, resulting in diminution of bank erosion and consequent turbidity levels (see Section 3.2.4).

As indicated in Section 2.3.1, the actual need to clear the sediment trap would be with a frequency in the order of years if not decades. However, CRP/OPG has considered this issue and is suggesting that a yearly flushing occur during near the start of the freshet, i.e., mid-April. This timing will avoid amphibian breeding and fish spawning periods. A yearly flushing would reduce the severity of a sudden increase in TSS concentrations due to a larger less frequent (e.g., every 10 years) flushing event and may also help in providing sediment bank stabilization for the by-pass reach that otherwise may be starved of sediment. The TSS concentrations resulting from this evacuation operation will be well below the sub-lethal effects threshold of 1,000 mg/L for fish for short-term exposures, i.e., 4 to 14 h (Fitchko *et al.*, 2008) and will be of short duration (less than 1 h). As indicated in Section 3.3, TSS concentrations will be measured during the initial two sediment evacuation events.

During operation, the plowing of roads to the proposed GS site and transmission ROW will avoid snow disposal into watercourses.

The limited monitoring and maintenance activities will have a negligible effect on water quality of the water bodies traversed by the access roads and transmission line.

### 3.2.4 Sediment Erosion and Transport

As indicated in Section 2.1.4.2, the diversion of the Little Abitibi River has significantly increased the flow of New Post Creek, resulting in a dramatic impact on channel morphology and accelerated rate of erosion along the watercourse (Parish, 1990). These responses would occur over decades, and if the channel flows do not change further, a stable channel form would eventually be attained. Over the almost 50 years since the diversion, the rate of erosion in New Post Creek is expected to have decreased as the hydraulic regime approaches a more balanced and stable condition.

During operation of the proposed Project, flows will be reduced downstream of the proposed spillway location with the hydraulic regime approaching that of pre-diversion New Post Creek. The maximum flow withdrawal of 50 $m^3/s$ by the proposed Project would reduce the intensity of peak events, thereby providing a net reduction in erosion potential along the lower 4.4 km of the creek downstream of the proposed intake weir location during freshet conditions. The lower flows in this creek section will result in an increase of exposed shorelines and banks. Although there may be more exposed streambed under the reduced flows, most of this will be coarse material that will provide a new and harder shoreline for the reduced stream size. Most of the finer substrate that is prone to erosion occurs higher up along the banks and will subsequently be less often subject to eroding flows. These exposed areas of finer substrate would be prone to erosion as flows fluctuate; however, this erosion is expected to stabilize over time as this creek section moves toward a state of equilibrium. Moreover, the implementation of minimum flows will promote attainment of the state of equilibrium.

Pulsing will be implemented during low flows (see Sections 1.3.2.1 and 1.3.2.2). Intermittent operation of the GS using water stored in the headpond would mitigate against sudden flow changes and associated erosion downstream of the proposed intake weir location, caused by the shutdown and start-up of the proposed GS.

It is expected that water level fluctuations due to pulsing may result in proposed headpond shoreline erosion; however, stabilization of the erosion processes can be expected within one complete growing season. As indicated in Section 3.3, visual monitoring of shoreline erosion and sedimentation will be undertaken after one complete growing season after proposed GS operation initiation. These water-level fluctuations have the potential to result in localized increases of TSS concentrations. As indicated in Section 3.2.3, after three years of experimental drawdown of 2 to 3 m in a northwestern Ontario lake, concentrations of TSS remained extremely low (Turner *et al*., 2005). As water-level fluctuations in the inundation area will range only up to 0.5 m, it is anticipated that changes to TSS concentrations will be small.

Without mitigation, tailwater discharges during powerhouse operation would result in scouring of the Abitibi River bed with consequent development of a turbidity plume downstream. As indicated in Section 1.3.1, rip-rap lining will be provided in the tailrace area to protect against sloughing of the river bank overburden and riverbed erosion. Upon completion of tailrace construction, the temporary cofferdam material will be re-used as rip rap. Portions of the Abitibi River bank in the immediate vicinity of the tailrace area may also require shoreline rip-rap protection to minimize toe erosion due to scouring and to reduce bank sloughing along the river bank.

### 3.2.5 Plankton, Aquatic Vegetation and Benthic Macroinvertebrates

As indicated in Section 3.2.3, a period of trophic surge is expected due to the inundated area upstream of the proposed Project intake weir. In the short-term, a more productive planktonic community is expected to develop in response to the more lentic environment and increased nutrient loadings from the newly flooded lands.

The magnitude of the trophic surge is likely to be small compared to that observed in some large reservoirs (Baxter and Glaude, 1980). Nutrient concentrations are expected to be higher and may stimulate local plankton production.

Paterson *et al*. (1997) reported increases in bacterial, phytoplankton and zooplankton biomass due to increased nutrient concentrations following experimental flooding of a peatland reservoir in northwestern Ontario.

The release of dissolved nutrients from inundated soils would benefit aquatic macrophyte and periphyton growth, with epiphytic periphyton likely increasing in response to increase in attachment surfaces.

Overall benthic macroinvertebrate biomass in the inundated area will increase in response to an increase in substrate area. The benthic macroinvertebrate communities currently present in the lotic environmental conditions of New Post Creek would be replaced by those adapted to more lentic conditions.

During typical operation a consistent headpond water level will be maintained. However, during some years, there may be periods of time when there will not be enough flow in New Post Creek to provide the specified minimum flow downstream of the intake weir, and continuously operate the proposed GS. During these periods the required minimum flows will be provided downstream in New Post Creek, but the proposed GS will be shut down. Any water in excess to the minimum flow will be accumulated in the proposed headpond so that the proposed GS can be operated periodically using the stored water (see Sections 1.3.2.1 and 1.3.2.2). When this situation arises, the proposed GS will be shut down when the headpond water level drops to 0.5 m below the usual full headpond water level. Once the headpond refills to its normal level, the proposed GS will restart and operate until the specified lower headpond water level is again reached. This operational pulsing will continue until there is sufficient water for continuous operation.

A number of studies have investigated the effects of seasonal water level fluctuations on plankton, aquatic vegetation and benthic macroinvertebrate communities in natural and/or regulated lakes. These studies have indicated that seasonal water-level fluctuations below 1 m had little or no effect on phytoplankton and zooplankton communities (Turner *et al*., 2005), periphyton species richness (Turner *et al*., 2005; White *et al*., 2008), aquatic macrophyte species richness (White *et al*., 2008) and benthic macroinvertebrate communities (Arovita and Hämäläinen, 2008; White *et al*., 2011).

Water levels presently vary by about 3 m in New Post Creek during the year. Water level fluctuations associated with the intermittent operation of the GS will be less, i.e., 0.5 m, but will occur over much shorter periods of time. Although less than the 1 m seasonal water-level fluctuations that have little or no effect, occasional water level fluctuations of 0.5 m will likely have some influence on the composition of periphyton, aquatic macrophyte and benthic macroinvertebrate communities established after inundation, particularly if they occur every year.

Anticipated mercury increases in zooplankton and benthic macroinvertebrates due to the proposed inundation area are discussed in Section 3.2.10.2.

### 3.2.6 Walleye Spawning

As indicated in Section 2.2.6.5, Walleye spawning does occur in the lower section of New Post Creek, downstream of the waterfalls (Coker and Portt, 2012a, b). As indicated in Section 3.2.1.2, River2D hydraulic and habitat modelling was undertaken in lower New Post Creek between the waterfalls and its outlet to the Abitibi River.

Based on the hydraulic and habitat modelling findings, a minimum flow of 15 $m^3/s$ would provide the maximum amount of optional habitat for Walleye spawning and egg incubation (see Figure 3.6).

### 3.2.7 Other Fish Species Habitat Utilization

As indicated in Section 2.2.6.6, Lake Sturgeon spawning is confined to the Abitibi Canyon GS tailrace area (Coker and Portt, 2013e). There was no evidence of Lake Sturgeon spawning in New Post Creek between the waterfalls and its outlet to the Abitibi River. However, Lake Sturgeon were caught in New Post Creek prior to and after the Abitibi Canyon spawning period, suggesting that the watercourse does provide an important habitat function, e.g., availability of higher benthic macroinvertebrate densities for forging (see Section 2.2.5).

As indicated in Section 2.2.6.7, there was no evidence of Lake Whitefish spawning in New Post Creek between the waterfalls and its outlet to the Abitibi River (Coker and Portt, 2012c). If Lake Whitefish spawning occurs within the study area, it is likely confined to the area below the Abitibi Canyon GS. As a result, no mitigation measures need to be considered, e.g., with respect to minimum flows or restriction of in-stream construction during the fall and winter.

The upstream limit of the zone of influence is considered to be the upstream limit of backwater effects from the proposed intake weir in New Post Creek, as direct effects upon upstream habitats will occur this far. There is a set of rapids at this location, but there are also rapids downstream of this location that have incrementally raised the stream's surface elevation to a point that it is no longer affected by the backwater effect from the proposed weir. There are also rapids upstream from this location. The establishment of a lacustrine fish community within the proposed headpond may result in some changes to the fish community farther upstream, since some members of the new lacustrine fish community may migrate upstream to spawn or feed.

The downstream limit of the zone of influence is at the mouth of New Post Creek at the Abitibi River. Upstream of its outlet, New Post Creek will be influenced by minimum flows and the operation of the proposed GS. A short section of the Abitibi River between the proposed tailrace and New Post Creek mouth will have increased flow reflecting that passed through the proposed GS. Upstream of the proposed tailrace and downstream of the New Post Creek mouth in the Abitibi River, flows will not be affected.

As indicated in Section 2.2.6.8, White Sucker and Longnose Sucker spawning also occurs in the lower section of New Post Creek, downstream of the waterfalls (Coker and Portt, 2012a, b). The minimum flow of 15 $m^3/s$ recommended for Walleye spawning and egg incubation would also be suitable for spawning and egg incubation of suckers and other spring spawners.

As indicated in Section 3.2.3, higher surface water temperatures can be expected during the summer due to the proposed headpond. During the spring and fall field work for this project, it was observed that New Post Creek water temperatures display a larger and more rapid response to changes in weather, compared to water temperatures in the Abitibi River. This is likely due to the large volume and greater depth of the Abitibi River, compared to the much smaller volume and shallower New Post Creek, as well as the New Post Creek Diversion Dam reservoir upstream. The proposed headpond, with its large surface area and extensive shallow areas, will likely exaggerate this effect. Water temperatures downstream of the proposed headpond will be warmer earlier in the spring, and cooler earlier in the fall, possibly affecting the timing of late spring and summer spawning that occurs in lower New Post Creek, and any future spawning that may occur in the proposed GS tailrace at the Abitibi River.

Summer water temperatures in New Post Creek downstream of the proposed intake weir will likely be warmer due to the surface area of the reservoir, the top draw of the proposed weir discharging the minimum flows downstream, and the reduced volume of flow. However, the magnitude of this change is unknown. As Longnose Sucker, Slimy Sculpin, and Burbot prefer coldwater temperatures, their populations in New Post Creek, although sparse, may be negatively affected by this potential increase in water temperature downstream of the proposed intake weir. The potential exists that the benthic macroinvertebrate and fish communities in this area may shift towards one that can tolerate slightly warmer conditions.

Flooding upstream of the proposed intake weir will result in the creation of shallow lacustrine habitat. The existing community of riverine fishes in the proposed headpond area will in structure to one that is more typical of a lacustrine system. As indicated in Section 2.2.6.8, a YOY Northern Pike was captured in drift nets set in New Post Creek at the Otter Rapids Road Bridge. The likely source of Northern Pike immigration to New Post Creek would be the Little Abitibi River upstream of the New Post Creek Diversion Dam that would entail being spilled over the dam. As indicated by Seyler (1997), Walleye, Northern Pike and White Sucker are the predominant sportfish in the Little Abitibi River. Other species likely present are those collected in New Post Creek upstream of the waterfalls, including Fallfish, Longnose Sucker, Lake Herring and Burbot. Based on distribution mapping provided by Seyler (1997), the Little Abitibi River does not appear to support populations of Lake Sturgeon, Smallmouth Bass, Lake Whitefish, Goldeye, Mooneye and Sauger. The creation of shallow lacustrine habitat will likely promote aquatic macrophyte growth and the concomitant spawning habitat may result in the establishment of a resident Northern Pike population.

Changes in the water levels of lakes, either natural or anthropogenic, affect temporal and spatial distribution of littoral fish communities, especially in large lakes with an extensive, shallow slope littoral area. A variety of studies on the population structure of littoral fish communities have indicated that seasonal fluctuations in water levels not only determine the presence or absence of any species in a temporally inundated area but can provoke subtle changes in the community structure of the littoral community (e.g., Sloman *et al*., 2001; Fischer and Öhl, 2005).

Based on comparison of long-term (~20 years) data for two natural lakes in northern Wisconsin, White *et al*. (2008) reported that there was no significant relationship between natural water-level fluctuations (0.35 and 0.88 m) and fish species richness. These seasonal water-level fluctuations are similar to those more frequent fluctuations, i.e., 0.50 m, during pulsing operations. As the pulsing operations are expected to occur outside the fish spawning period, significant negative effects on fish species richness is not expected to occur. In fact, fish species richness is expected to be enhanced by the increased habitat diversity due to the proposed inundation.

Pulsing would be undertaken during low flow periods, e.g., in the winter and possibly late summer (see Table 2.4). It is anticipated that 0.5 m water-level fluctuations during the winter period will have only minimal effects on the aquatic ecosystem in the proposed headpond. Water temperatures will be at or close to $0^{o}$C, and most fish will be in a state of minimal activity. Intermittent pulsing in the late summer with water-level fluctuations of 0.5 m will have minimal negative effects on fish as spawning would have been completed; however, fish utilization of shallow habitats will be temporarily disrupted. Most fish present in the nearshore shallow waters would move to deeper waters to avoid the water-level fluctuations.

Moreover, it is anticipated that intermittent operation of the proposed GS will not have negative effects on downstream habitat and fish communities, as may occur in the absence of intermittent operation.

The following provides a discussion on the effects of immediate flow increases based on the operation of the proposed GS **without pulsing**.

As Walleye spawn early in the spring, sufficient flows can be expected to provide for the minimum flow of 15 $m^3$/s and continuous operation of the proposed GS. However, other fish species such as Shorthead Redhorse and some cyprinids spawn later in the spring (e.g., June) when flows are lower. During early June, a minimum flow of 15 $m^3$/s would apply to cover the Walleye egg incubation period and be transitional to 7.5 $m^3$/s at the end of the egg incubation period. After these minimum flow requirements are met, the proposed GS can operate continuously with diverted flows through the intake greater than 10 $m^3$/s. In the absence of intermittent GS operation, if flow in New Post Creek decreases below 25 $m^3$/s during the 15 $m^3$/s minimum flow requirement (and below 25 to 17.5 $m^3$/s during the transitional period), the proposed GS would shut down. Therefore, for the 15 $m^3$/s minimum flow requirement, if flow in New Post Creek decreased below the 25 $m^3$/s and without the pulsing capability, the proposed GS would shut down and flow downstream of the intake weir and over the spawning grounds below the waterfalls would increase immediately from 15 $m^3$/s to as much as 24.9 $m^3$/s (66% increase). For a minimum flow requirement of 7.5 $m^3$/s, the immediate flow increase would be over two times higher. These significant percentage increases in flow may dislodge eggs deposited in the spawning area. Moreover, if flow in New Post Creek was 24 $m^3$/s, then this flow would be passing over the spawning area during and after egg deposition. If New Post Creek flow were to increase to 25 $m^3$/s, the proposed GS would restart and take 10 $m^3$/s, quickly reducing flow over the spawning area to 15 $m^3$/s, potentially resulting in the dewatering of deposited eggs/embryos.

Based on June 1998 flow data, flows were greater than 25 $m^3$/s on June 1 to 3 and would have permitted continuous operation of the proposed GS. After dropping below 25 $m^3$/s on June 4, without the pulsing option, the proposed GS would have had to shut down releasing significant increased flow. During the remainder of the month, flows were variable (i.e., above and below the 25 $m^3$/s threshold for proposed GS operation), resulting in a number of additional startups and shutdowns, and associated sudden downstream flow changes. Intermittent operation of the proposed GS using water stored in the headpond would mitigate against these sudden and potentially frequent flow increases downstream of the intake weir and over the spawning area downstream of the waterfalls.

With pulsing as part of the proposed operating regime of the GS, significant immediate increases to flow in New Post Creek downstream of the intake weir will not occur. The pulsing operation will mitigate the potential effects of intermittent GS operation on the spawning habitat in New Post Creek below the waterfalls.

As indicated in Section 1.3.2.1, pulsing will be permitted at any time of the year within the operating range of 0.5 m provided minimum flows are directed over the spillway and no negative effects due to pulsing, that can not be otherwise mitigated, are observed (G. Funnell, MNR, 2013, pers. comm.).

### 3.2.8 Fish Habitat Loss and Gain/Enhancement

<u>Fish Habitat Loss and Gain/Enhancement Due to Construction</u>

As indicated in Section 3.1.3.7, fish habitat loss and gain due to direct construction effects of the proposed New Post Creek Project are relatively minor. The footprint of the proposed intake weir will result in the loss of approximately 1,832 $m^2$ of fish habitat, but will be offset by the same area (approximately 1,832 $m^2$) of habitat gained by the construction of the tailrace in the Abitibi River. In addition, approximately 604 $m^2$ of nearshore habitat in the Abitibi River will be permanently altered by tailrace construction, but is expected to remain productive habitat.

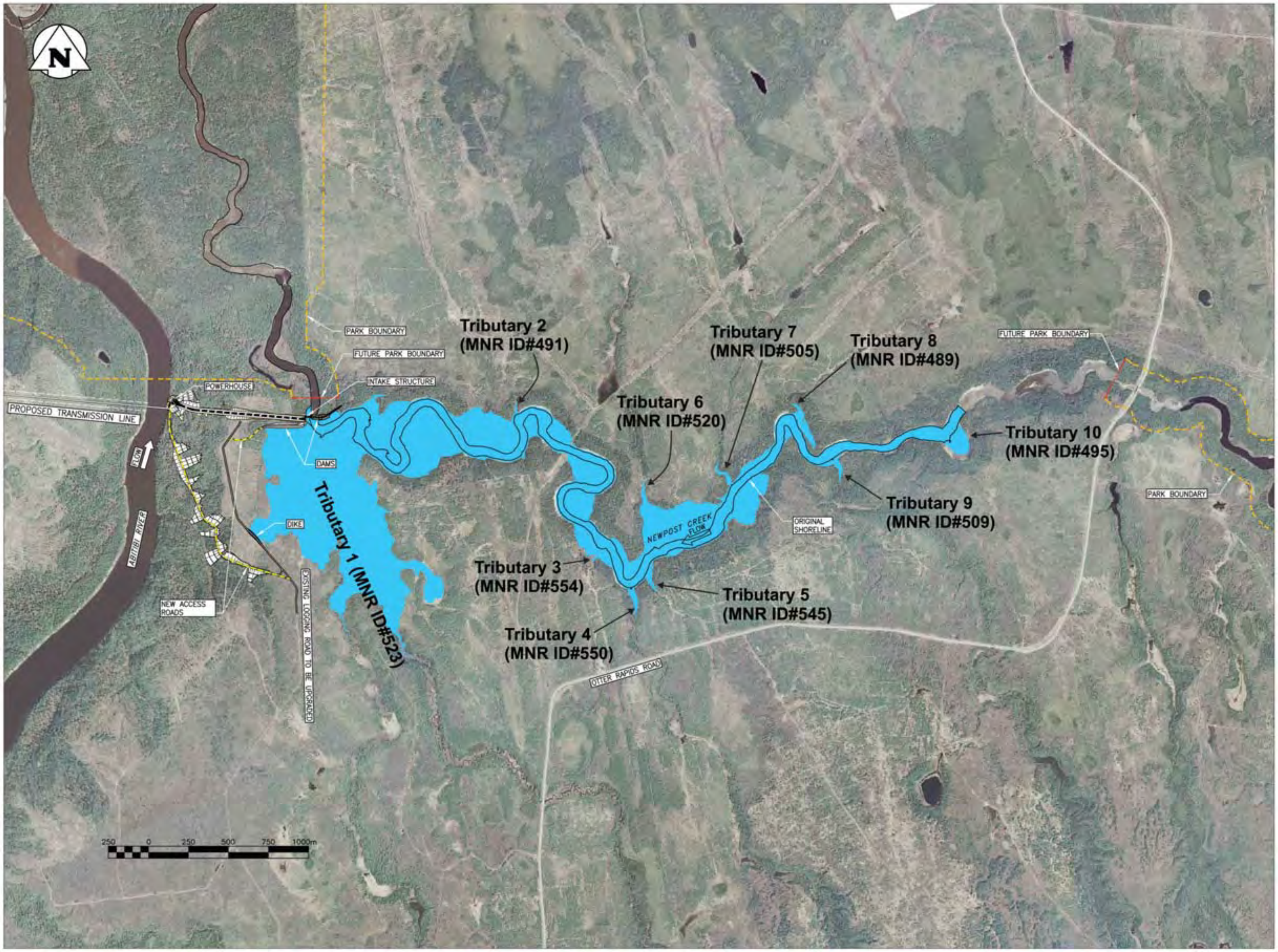
The following provides a summary of the potential operational effects of the proposed Project on fish habitat (Coker and Portt, 2013a; see Appendix A).

Inundation Upstream of the Proposed Intake Weir

The existing water level immediately upstream of the proposed intake weir location is approximately 181 m.a.s.l. The proposed operational water level of the GS headpond is 187 m.a.s.l. This will result in an increase in the water depth immediately upstream of the weir by 6 m, affecting water levels for a distance of 7,166 m upstream. Overbank flooding will occur for approximately 5,419 m upstream of the proposed weir, with approximately half of the area flooded occurring within the valley associated with Tributary 1 (Figure 3.11). Approximately 37.5 ha of existing riverine habitat will be altered to lacustrine habitat. The proposed headpond area is projected to be 1,693,924 $m^2$ or 169.4 (~170) ha, which results in a 131.9 ha increase in wetted area (see Figures 1.9 and 3.11). This increase in wetted area represents a significant increase in fish habitat, although of a different type than currently exists. Approximately 1,528 m (linear) of riffle habitat with coarse substrates will be flooded by the proposed headpond. Habitat diversity will be significantly increased, because the drowned stream channel within the proposed headpond will provide deeper habitats than what presently exists. Moreover, much of the flooded area will provide a large expanse of shallow, still water habitat that is also currently not represented in New Post Creek. Significant amounts of riffle habitat will remain available to the fish community upstream of the proposed intake weir. There are 772 m (linear) of riffle habitat with coarse substrate within the 1,321 m of stream between the upstream limit of the proposed headpond and the Otter Rapids Road bridge. Another 1,965 m (linear) of riffle habitat occurs within the next 6 km upstream of the bridge.

The existing community of riverine fishes that occur within the proposed headpond area will shift in structure to one that is more typical of a lacustrine system. Although most of the known fish species present can also live in lacustrine habitats of this size, with the possible exception of Longnose Dace, shifts in relative abundance will likely occur, and other fish species may become established. Assuming that the significant expanse of shallow habitat within the headpond develops areas of aquatic plants, this may provide spawning habitat for a Northern Pike population (if established). The proposed headpond will also allow the establishment of, or increase in, populations of fish such as White Sucker that will utilize the slower and deeper water in the headpond, but require the faster waters that are plentiful upstream for spawning.

**Figure 3.11 New Post Creek Tributaries Affected by Proposed Inundation**



Flooding Upstream into Tributary Streams

As indicated in Section 2.2.6.1, there are 10 tributary streams that flow into the section of New Post Creek that will become the proposed headpond. To varying degrees, the proposed headpond will flood upstream into these tributaries. Tributary 1 (MNR ID#523) is the largest watercourse flowing into New Post Creek in the proposed headpond area. It will be affected the most from headpond development due to its proximity to the proposed weir and being subjected to the highest water level increase, as well as its low gradient channel. Approximately 64 ha of its valley will be flooded by the proposed Project, encompassing a length of 2,492 m of Tributary 1 (Figure 3.11). Almost all of the channel being flooded has an average width of approximately 4 m, with patchy substrates of gravel, sand, cobble, silt or soil, and riparian vegetation dominated by alder. The fish community is dominated by Slimy Sculpin. Based upon aerial photograph examination, it appears that this type of habitat extends almost continuously in Tributary 1 for approximately 9 km upstream of New Post Creek. The proposed headpond will inundate approximately 28% of this habitat type in Tributary 1. It is unlikely that this 28% of habitat being affected will contain unique or uncommon habitats that do not occur in the remaining 72%. Therefore, the remaining 72%, or approximately 6,500 m of watercourse, will continue to provide current system functions with the 28% being inundated continuing to be fish habitat, but as part of the proposed headpond.

Tributaries 4 (MNR ID#550), 6 (MNR ID#520), 7 (MNR ID#505), 8 (MNR ID#489) and 9 (MNR ID# 509) are watercourses with defined channels, with either permanent or intermittent flow, and all apparently have permanent water somewhere along their length. The proposed headpond would extend, respectively, 205, 530, 217, 201 and 174 m upstream into these watercourses (Figure 3.11). Tributaries 4, 6, and 8 have simple fish communities that were confirmed by sampling, whereas Tributaries 7 and 9 likely have simple fish communities despite no fish being collected. No sport fish were found. None of the habitats inundated in these watercourses are considered critical or unique, and the inundated area represents a small portion of each watercourse. For some of these watercourses the section closest to New Post Creek is relatively steep, and therefore inundation by the headpond may facilitate access to these watercourses by fish from New Post Creek.

The proposed headpond would extend approximately 78, 103, 146 and 23 m upstream into Tributaries 2 (MNR ID#491), 3 (MNR ID#554), 5 (MNR ID#545) and 10 (MNR ID#495), respectively. These watercourses are usually dry and likely do not support fish; therefore, no fish habitat will be affected.

The length and drainage area for each New Post Creek tributary to be affected by the proposed inundation are summarized in Table 3.3.

**Table 3.3 Lengths and Drainage Areas of New Post Creek Tributaries to be Affected by the Proposed Inundation**

| Tributary | Distance of Outlet Downstream of Proposed Weir (m) | Length of Channel to be Inundated (m) | Total Watershed Area ($km^2$) | Watershed Area to be Inundated ($km^2$) | Watershed Area to be Inundated (%) |
|---|---|---|---|---|---|
| 1 (MNR ID#523) | 108 | 2,492 | 36.6 | 0.642434 | 1.76 |
| 2 (MNR ID#491) | 2,338 | 78 | 0.73 | 0.000874 | 0.12 |
| 3 (MNR ID#554) | 3,943 | 103 | 0.24 | 0.004888 | 2.04 |
| 4 (MNR ID#550) | 4,279 | 205 | 5.95 | 0.004632 | 0.08 |
| 5 (MNR ID#545) | 4,392 | 146 | 0.60 | 0.002983 | 0.50 |
| 6 (MNR ID#520) | 4,528 | 530 | 1.99 | 0.060005 | 3.02 |
| 7 (MNR ID#505) | 5,233 | 217 | 2.66 | 0.003591 | 0.14 |
| 8 (MNR ID#489) | 5,860 | 201 | 1.27 | 0.003717 | 0.29 |
| 9 (MNR ID#509) | 6,240 | 174 | 4.65 | 0.003283 | 0.07 |
| 10 (MNR ID#495) | 6,995 | 215 | 0.35 | 0.013241 | 3.78 |

Summary of Overall Habitat Loss and Gain/Enhancement

Table 3.4 provides a summary of the fish habitat lost, gained, or altered. While it is not possible to compare all habitat effects as losses or gains; overall, approximately 131 ha of aquatic habitat will be gained, and approximately 70 ha of aquatic habitat will be altered to some degree.

Transmission Line ROW Maintenance

A potential adverse effect on fish habitat and fisheries could be the maintenance of riparian vegetation in a more open state due to vegetation management in the proposed ROW. These effects would be negligible for those watercourses where the riparian habitat is currently dominated by open wetlands such as bog and swamp. Some of the watercourses in the proposed ROW are dominated by these low plant communities, which are expected to remain similar even with vegetation management. The loss of riparian trees could result in less shading, potentially increased water temperatures, reduced allochtonous inputs (i.e., woody debris and litter fall in the stream) and reduced inputs of terrestrial invertebrate prey from overhanging vegetation (Richardson and Moore, 2005). However, overall adverse effects on any watercourse due to non-compatible riparian tree removal are expected to be minor given that the proposed ROW is only 30.5 m wide and will represent a very small proportion of the total length of the watercourse to be traversed. It is the intention of CRP/OPG to not fully clear the AoC at stream crossings but to manually clear only the non-compatible trees and retain the residual shrubby and ground level vegetation.

**Table 3.4 Summary of Fish Habitat Alterations**

| Habitat Component | Analysis |
|---|---|
| Proposed intake weir | Approximately 1,832 $m^2$ of habitat in New Post Creek will be permanently lost to the weir footprint. This area is mostly bedrock and would not provide a significant amount of spawning habitat for any of the fishes found in New Post Creek. This area is general (feeding or residence) fish habitat. |
| Flooding upstream of the proposed intake weir in the main channel of New Post Creek | Approximately 131.9 ha of aquatic habitat will be created and 37.5 ha of existing riverine habitat will be altered to lacustrine habitat (with a total inundation area of approximately 170 ha). A large portion of this area will provide shallow lacustrine habitat, which is currently not present in this portion of New Post Creek. This body of water will support a typical shallow lacustrine fish community. |
| Flooding upstream into tributary streams | Approximately 4,361 m of watercourse length will be flooded (altered) in 10 tributaries, with more than half of this occurring in one tributary (2,492 m). No critical or unique habitats will be lost from the system, and in some cases the flooding of the downstream portions of watercourses will enhance access to these tributaries by fishes in New Post Creek. |
| Reduction of flow downstream of the proposed intake weir | Water depth and flow velocity will generally be lower during proposed GS operation. While some shifts in aquatic communities are expected, the minimum flows that have been established will ensure that key habitat components and functions (e.g., Walleye spawning) will be maintained.<br>The area altered is approximately 32.8 ha. Reductions in habitat area under minimum flows cannot be quantified with the available information, but are considered to be minor. |
| Intermittent operation of proposed GS | Occasional water level fluctuation of 0.5 m is considered to have no significant direct effects to fish; in fact, intermittent operation would mitigate against sudden downstream flow changes due to proposed GS start-ups and shutdowns. These fluctuations will likely have some influence on nearshore periphyton, aquatic macrophyte and benthic macroinvertebrate community composition. |
| Proposed headpond impacts upon water temperature | The proposed headpond has the potential to increase water temperature downstream in New Post Creek although the magnitude of this effect is unknown. This may slightly shift spawning periods of fishes, but not impair spawning. However, summer water temperatures may increase in New Post Creek, potentially causing a shift in fish and benthic macroinvertebrate communities to those more tolerant of warmer water. |
| Proposed tailrace at the Abitibi River | Approximately 604 $m^2$ of the Abitibi River will be deepened to accommodate the outflow from the proposed GS tailrace, but habitat alteration is expected to be minor due to the type of habitat affected. Approximately 1,832 $m^2$ of tailrace channel will be constructed, representing an increase in habitat area. |

CRP/OPG will adhere to the requirements provided in the DFO (2010g) Ontario Operational Statement "Maintenance of Riparian Vegetation in Existing Rights-of-Way" as listed below:

- combined maintenance activities (e.g., mowing, brushing, topping, slashing, etc.) will affect no more than one-third of the total woody vegetation, such as trees and shrubs, in the ROW within 30 m of the ordinary high water mark in any given year;
- when practicable, riparian vegetation in the ROW will be altered by hand. If machinery must be used, it should be operated on land and in a manner that minimizes disturbance to the banks of the water body:
  - machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks,
  - washing, refuelling and servicing of machinery and storage of fuel and other materials for the machinery, including hand tools, should be undertaken at locations away from the water to prevent any deleterious substance from entering the water body,
  - an emergency spill kit should be kept on site in case of fluid leaks or spills from machinery, and
  - banks should be restored to original condition if any disturbance occurs;
- machinery fording the watercourse to bring equipment required for maintenance to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use:
  - if minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage,
  - grading of the stream banks for the approaches should not occur,
  - if the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas,
  - the one-time fording should prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see Section 3.1.3.1), and
  - fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding;
- when altering a tree that is located on the bank of a water body, the root structure and stability should be maintained;
- any waste materials removed from the work site should be stabilized to prevent them from entering the water body, including covering spoil piles with biodegradable mats or tarps;
- all long-term storage of waste materials should be kept outside of the riparian area;
- in order to prevent erosion and to help seeds germinate, any disturbed areas should be vegetated by planting and seeding preferably with native trees, shrubs or grasses and covered with mulch;

- if there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring; and
- effective sediment and erosion control measures should be maintained until re-vegetation of disturbed areas is achieved.

As the proposed transmission line will span the Abitibi River with access obtained from both sides, fish habitat will not be affected.

### 3.2.9 Fish Entrainment and Survival

Potential fish injury and/or mortality due to entrainment at power plants is an issue that has received technical consideration and analysis. Fish injury/mortality will vary with GS size, flow, turbine design, head, and the abundance and size of the fish population susceptible to entrainment. It should be noted that unlike the large hydroelectric developments in Québec, Manitoba and Labrador, such as Churchill Falls (5,428 MW), the proposed New Post Creek Project is a small- to medium-sized project (25 MW) with specific design features which will limit fish entrainment.

Trash racks will be positioned at the upstream face of the intake to prevent entrainment of debris and will be removable. The spacing of the rack bars shall be in accordance with the requirements of the turbine manufacturer, but will not exceed 150 mm (clear) between bars, or as per DFO and MNR approved spacing.

As indicated in Section 1.3.2, the proposed Project GS will be operated at design flow velocities that will minimize fish entrainment.

The proposed GS will operate two Francis turbines each with 13 blades. Extensive studies on various species, turbine sizes and operating regimes have shown survival rates for Francis turbines ranging from 52.2 to 100.0% (average of 76.8%) (JRP, 2009).

Fish survival through hydroelectric turbines is a function of fish size. Fish survival can be high especially if the entrained fish are very small. For example, Dedual (2007) has shown high survival (93.1% at 96 h after passage) of Rainbow Trout (*Oncorhynchus mykiss*) with fork lengths of 81 mm or smaller. The author concluded that the Francis turbine at the Hinemaiaia Power Plant which has 15 blades and a head of 22.6 m will provide a safe route for migrating fish less than 80 mm in size. Similarly, Cada (1990) estimated that a 4-cm fish (Walleye fingerling) would have a probability of runner contact of 5% or less. Higher mortality and fish injury is expected for larger-sized fish. For example, Ferguson *et al*. (2008) reported that mean blade-strike mortality was higher for adult Atlantic Salmon and sea-run Brown Trout (*Salmo trutta*) (25.2-45.3%) than for juveniles (5.3-9.7%).

Gross head of a GS is another design feature that should be taken into consideration with respect to fish injury/mortality. There is likely a higher probability of fish injury and mortality at larger facilities than smaller facilities with lower heads due to the higher pressure differentials. The proposed New Post Creek Project has a gross head of only 66 m, considerably less than facilities such as the Churchill Falls GS (324 m). Minimal fish injury is expected for the proposed Project relative to larger facilities such as those in Québec or Labrador. OPG has operated the bulk of northern Ontario's hydroelectric facilities for over 100 years with typical low to medium heads, including Kakabeka Falls GS with a head of 56 m and capacity of 23 MW and Wawaitin GS with a head of 37.8 m and capacity of 15 MW. Discussions with OPG biologists and environmental consultants who have worked on these facilities have not identified aggregations of piscivorous birds such as gulls or fish feeding on injured and/or stunned entrained fish as an issue in the tailraces of these facilities.

Watercourses affected by diversions such as New Post Creek generally support a low diversity of fish species (C. Jorgensen, DFO, 2011, pers. comm.). Colonization from the Abitibi River is prevented by the waterfalls. As indicated in Section 2.2.6.4, no fish were captured by electrofishing at the proposed intake location in August 2009, although some Mottled Sculpin were observed. In 2010, low numbers of Sculpin (Mottled or Slimy) and Burbot were collected by electrofishing at this location. No fish were captured by gillnet in 2009, whereas a decomposed Longnose Sucker was collected in 2010. Despite intensive gillnetting and electroshocking in 2011, low numbers of Longnose Dace, Longnose Sucker, White Sucker, Burbot, Johnny Darter, Pearl Dace and Sculpin were captured. In June 2012, larval drift netting at the Otter Rapids Road bridge upstream of the proposed intake weir location also captured a few juvenile and adult fish were also captured including Northern Redbelly Dace, Lake Chub, Longnose Dace, Spottail Shiner, Blacknose Shiner and Fallfish.

Initially, very low fish entrainment mortality is expected for the proposed New Post Creek Project primarily due to the low numbers of small fish present in New Post Creek. However, as indicated in Section 3.2.8, creation of the proposed headpond may result in the establishment of fish populations of larger size, e.g., Northern Pike and White Sucker. As indicated in Section 3.3., an Adaptive Management Program (AMP) will be developed that will consider effects monitoring, adaptive management measures and adjustments to mitigation measures based on observed conditions, e.g., mitigation of fish entrainment if adverse effects on fisheries resources are determined. This monitoring plan will be designed and implemented to meaningfully assess impingement and entrainment effects on fish populations, and inform mitigation design and implementation effectiveness. The monitoring plan will follow a protocol and schedule developed in consultation with MNR and DFO.

Entrainment monitoring will be required as part of the AMP. If entrainment is deemed high relative to local populations, a retrofit fish diversion system will be considered following Best Available Technology Economically Achievable. There are many examples where successful retrofit diversion systems such as angled bar racks and other fish guidance systems have been installed when a significant entrainment problem has been identified after hydroelectric facility development in the United States.

In summary, no mitigation measures are recommended initially due to the low numbers of small resident fish; however, the establishment of fish populations of larger size should be monitored and the need for mitigation assessed.

### 3.2.10 Mercury

#### *3.2.10.1 Background*

Reservoir creation has been well documented to result in increased THg concentrations in fish (Bodaly *et al*., 1997, 2007; Bodaly and Fudge, 1999; St. Louis *et al*., 2004). While most mercury in the environment is inorganic, some is converted in aquatic systems to methylmercury (MeHg), which bioaccumulates in fish. Food is the dominant pathway of MeHg uptake by fish (Hall *et al*., 1997). Mercury concentrations in fish can be high enough to represent a risk to the health of humans and wildlife consuming fish (Mergler *et al*., 2007; Scheuhammer *et al*., 2007).

Mercury is biomagnified through the food chain such that piscivorous fish and bird species have significantly higher concentrations than planktivorous and benthivorous fish species, benthivorous or vegetarian bird species, or organisms lower in the food chain.

Mercury biomagnification in aquatic avifauna is not expected to be a concern based on studies undertaken by Vermeer *et al*. (1973) and Barr (1986) on hatching success of Herring Gull (*Larus argentatus*) and Common Loon (*Gavia immer*), respectively. Moreover, the proposed Project area does not provide important breeding habitat (see Section 2.2.7).

The primary cause of increased mercury body burden in fish in new reservoirs is increased decomposition in flooded terrestrial areas due to increased microbial activity resulting in increased methylation of inorganic mercury. As a result of higher MeHg production rates, MeHg concentrations increase in fish with elevated concentrations typically lasting up to three decades in boreal reservoirs as the rates of MeHg production decline (Bodaly *et al*., 1997, 2007). Peak THg concentrations, especially in top predatory fish can be, but are not always, up to seven times greater than background levels, often exceeding the Canadian limit of 0.5 µg/g wet weight for domestic commercial sale (Health Canada, 2007) in higher trophic level species such as Northern Pike or Walleye. Lower trophic level fish species such as Lake Whitefish tend to have lower THg concentrations. THg concentrations are analyzed in fish tissue as over 90% of the mercury is MeHg.

For example, Bodaly *et al*. (2007) analyzed THg concentrations in three species of fish for up to 35 years after impoundment of 14 boreal reservoirs in northern Manitoba. In the benthivorous Lake Whitefish, THg concentrations increased after flooding to between 0.2 and 0.4 µg/g compared with pre-impoundment concentrations between 0.05 and 0.14 µg/g. THg concentrations in Lake Whitefish were usually highest within six years after impoundment and took 10 to 20 years after impoundment to decrease to background concentrations in most reservoirs. THg concentrations in piscivorous Northern Pike and Walleye were highest two to eight years after flooding at 0.7 to 2.6 µg/g compared to pre-impoundment concentrations of 0.19 and 0.47 µg/g, respectively. THg concentrations in these two species decreased consistently in subsequent years and required 10 to 23 years to return to background levels.

#### *3.2.10.2 Potential Mercury Biomagnification in Fish*

The proposed Project intake weir, located about 4.5 km of the New Post Creek waterfalls, would result in upstream inundation of the creek for a distance of approximately 7.4 km, effectively converting this reach from lotic to lentic conditions with an inundation area of approximately 170 ha.

Mercury levels in fish due to the proposed Project will be influenced by a number of factors including:

- type of terrain flooded;
- water-level fluctuations;
- hydraulic residence time;
- mercury levels in the inundation area;
- fish community, habitat and movement;
- fish entrainment, injury and mortality; and
- discharge to a large waterbody (Abitibi River).

<u>Type of Terrain Flooded</u>

Flooded wetlands have been suggested to sustain increased MeHg production longer than flooded uplands (Bodaly *et al*., 2004, St. Louis *et al*., 2004, Hall *et al*., 2005) inferring that the smaller the wetland area inundated the faster the recovery of mercury body burden in fish to regional background levels. As indicated in Section 4.4.5.3, of the total terrestrial inundation area of 129.9 ha, only 3.7 ha consist of organic meadow marsh, organic shallow marsh and open water marsh, whereas an additional 16 ha consist of mineral thicket swamp and organic thicket swamp. Approximately 83% of the total wetland area (19.7 ha) to be inundated is associated with the ten tributaries (16.4 ha) draining into the proposed headpond. Significant enhancement of mercury methylation is not anticipated due to this relatively small area of inundated wetland area. It should be noted that mercury attenuation predictive models do not take into account the area of wetland inundation.

It is also expected that mercury contributions from wetland areas that will not be inundated will remain unchanged.

Water-level Fluctuations

Water-level fluctuations may also affect MeHg production. Fagerström and Jernelöv (1972) reported that when sediments containing mercury are exposed to air after dredging or due to fluctuations in water level, the rate of biological methylation of mercury may be extremely high, i.e., $10^3$ to $10^4$ times the "normal" methylation rate in the aquatic environment. A number of studies have shown that the mercury methylation rate in sediments is significantly higher in aerobic systems than in anaerobic systems, particularly when under anoxic conditions large amounts of sulphides are present which will make the mercury less available for methylation due to the formation of the almost insoluble mercuric sulphide (Fagerström and Jernelöv, 1971; Jacobs and Keeney, 1974; Bisogni and Lawrence, 1975; Compeau and Bartha, 1983; Berman and Bartha, 1986).

As indicated in Section 2.4.2.1, annual water levels in New Post Creek vary by approximately 3 m. With pulsing, water-level fluctuations will be less, but occur more frequently over short periods of time. Water-level fluctuations will be limited to 0.5 m below the usual full headpond water level. Pulsing will be permitted at any time during the year within this operating range of 0.5 m provided minimum flows are directed over the spillway and no negative effects due to pulsing, that can not be otherwise mitigated, are observed (G. Funnell, MNR, 2013, pers. comm.). As indicated in Section 2.4.2.2, water-level fluctuations in the proposed headpond due to pulsing are intended to provide operation during low flow periods, primarily in late winter and late summer. As biological production is significantly reduced in the winter due to low temperatures, the rate of microbial mercury methylation will be minimal. During the late summer, with mean flows approximately three times greater than in the late winter (see Table 3.4), pulsing will be less frequent and not likely to the low FSL of 186.50 m.a.s.l.

As indicated above, the majority of the total wetland area to be inundated is associated with the ten tributaries. During pulsing, the wetland areas to be inundated at the minimum and maximum operating levels are 12.5 ha and 16.4 ha, respectively, a difference of only 3.9 ha.

Hydraulic Residence Time

The short hydraulic residence time in the proposed headpond may contribute to a faster recovery period for the proposed Project, i.e., the faster the removal of mercury, the faster recovery times.

Mercury Levels in the Inundation Area

Increases in THg and MeHg have been observed in zooplankton (Bodaly *et al*., 1997; Paterson *et al*., 1998), benthic macroinvertebrates (Bodaly *et al*., 1997; Hall *et al*., 1998) and a cyprinid fish, Finescale Dace (*Chrosomus neogaeus*) (Bodaly *et al*., 1997; Bodaly and Fudge, 1999) following experimental flooding of a peatland reservoir in northwestern Ontario. The THg and

MeHg concentrations remained elevated for the duration of the nine-year study (St. Louis *et al*., 2004).

A similar scenario can be expected for the inundated area upstream of the proposed Project intake weir. However, most of the MeHg generated will likely be retained within the inundated area. Although flux of MeHg to the Abitibi River will occur via the proposed GS or downstream over the waterfalls, most of the flux would be waterborne associated with suspended matter, rather than due to the movement of fish with elevated mercury body burdens (see below).

Fish Community, Habitat and Movement

As indicated in Section 2.2.6.2, watercourses affected by diversions such as New Post Creek generally support a low diversity of fish (C. Jorgensen, DFO, 2011, pers. comm.). New Post Creek waterfalls is a complete barrier to upriver fish movement from the Abitibi River. As a result, species diversity is reduced with relatively low numbers of small fish (see Section 2.2.6.4).

Only 14 fish species in small numbers have been collected in New Post Creek and its tributaries above the waterfalls compared to 22 species below the waterfalls (not including the dead and decomposing YOY Cisco which likely originated from the Little Abitibi River) (see Table 2.20). These species are generally small and/or benthivorous, except for Northern Pike and Burbot which becomes piscivorous when it reaches a length of 50 cm (Scott and Crossman, 1973). As a result, increases in mercury concentrations in most of these fish species will be lower than that of piscivorous species (Northern Pike and larger Burbot). At present, the absence of larger piscivorous sportfish such as Walleye in New Post Creek upstream of the waterfalls will result in no risk with respect to human consumption of fish with elevated mercury concentrations. However, with the creation of the shallow lacustrine habitat in the proposed headpond, Northern Pike may become established in the future.

Slimy Sculpin, the most numerous species at present, is generally sedentary. While the other species occurring in fewer numbers are more mobile, negligible juvenile or adult fish movement downstream over the waterfalls can be expected.

Fish Entrainment, Injury and Mortality

An issue that has been raised with hydroelectric development is the entrainment of reservoir fish with elevated mercury concentrations and their availability, due to injury/mortality, as forage in and downstream of the tailrace resulting in elevated THg concentrations in the feeding fish (Brouard *et al*., 1994; Anderson, 2011). This situation has been associated with large hydroelectric plants in Québec and Labrador even suggesting a shift of the planktivorous Lake Whitefish and benthivorous Longnose Sucker to piscivory resulting in higher mercury concentrations than would be expected. The concentrations in Northern Pike were also elevated, possibly due to predation on Longnose Sucker.

As indicated in Section 3.2.9, fish entrainment mortality is expected to be very low for the proposed Project primarily due to low numbers of small fish present in New Post Creek. Therefore, the availability of fish with elevated mercury body burdens as a food source in and downstream of the proposed Project tailrace will also be very low.

Presence of a Large Waterbody Downstream (Abitibi River)

As indicated above, migration of fish from the inundated area created by the proposed Project in New Post Creek into the Abitibi River over the waterfalls or due to entrainment is expected to be very low. MeHg concentrations in the water column and lower food web are expected to decline in the Abitibi River due to natural removal mechanisms including sedimentation and photochemical degradation. Dilution is also considered as a mechanism to reduce MeHg levels in the water column. As a result, MeHg concentrations will decline in the Abitibi River with distance from the proposed Project tailrace and the New Post Creek waterfalls. Moreover, it is expected that only a portion of a sportfish's life cycle will be spent in these localized areas of elevated exposure.

Mitigation Measures

The two primary mitigation measures to minimize peak mercury concentrations in the food chain and the duration of elevated mercury concentrations in reservoirs are:

1. minimize the size of the inundated area; and
2. minimize the amount of available organic material (Kelly *et al*., 1997; Bodaly *et al*., 2007; Hall *et al*., 2009).

As indicated in Table 1.3, the proposed New Post Creek Project would result in a total inundation area of only approximately 170 ha involving the submergence of 133 ha of riparian and forested lands.

In order to minimize the amount of available organic material, CRP/OPG is proposing to clear the headpond/reservoir (flooded) area associated with the proposed GS. In addition to reducing the mercury effect, this is being done to eliminate trees, vegetation and other material as barriers to navigation; ensure harvest (including wood supply directives) are appropriately permitted; and protect the new riparian edge.

CRP/OPG will ask the DBC to follow the Ontario Provincial Standard (OPS201) for "Close cut clearing", i.e., the cutting of all standing trees, brush, bushes and other vegetation at original ground level and the removal of felled material and windfalls.

The following is a preliminary description of the proposed headpond/reservoir clearing to be given to the DBC:

- clearing, cleaning and removal of all trees and significant vegetation (large woody shrubs) from the proposed inundated area;
- trees should be harvesting using full tree method with branches and tops removed at landings rather than in the proposed inundated area;
- clearing to the high water mark of the proposed reservoir plus an additional 1 m back to prevent trees and vegetation from falling into the reservoir;
- all cleared material to be removed from the potential inundated area;
- all merchantable timber to be stacked to roadside;
- harvest to be conducted in the winter to lessen the amount of site disturbance;
- the DBC to obtain a Forest Resource Licence (FRL) for the authority to cut the wood;
- as the FRL is issued under the *Crown Forest Sustainability Act,* all specified conditions and requirements to be followed by the DBC;
- the FRL to also indicate where wood is to be directed including rights of refusal on the wood (it is impossible to know the specifications at this point as this would be based on the market/industry conditions at the time of the clearing);
- all non-merchantable material (slash, such as tops and branches, vegetation, stumps and other woody material) to be utilized as firewood, ground to mulch or burned with approval to be obtained by MNR;
- all sorting, grinding and/or burning to be done away from the proposed inundated area and preferably at or near roadside; and
- all access roads and skidder paths used to gain access to the proposed reservoir to be decommissioned, including the destruction of all temporary roads, removal of all water crossings (including culverts) and the successful re-planting of road beds.

The Environmental Management Plan will incorporate the proposed reservoir clearing requirements.

#### *3.2.10.3 Summary and Conclusions*

Mercury concentrations are expected to increase in fish resident in the inundated area (primarily Slimy Sculpin) as a result of the proposed New Post Creek Project. However, the resident fish are non-sport species and as they are primarily benthivores/planktivores, the increased THg concentrations will not be significant with respect to the aquatic food chain.

In the Abitibi River, MeHg concentrations are expected to diminish with distance from the proposed Project tailrace and New Post Creek waterfalls due to natural removal processes for MeHg and the intermittent exposures of migrating fish. Due to limitations in the state of knowledge of mercury behavior in the aquatic systems, validated models are not currently available to accurately predict the rate of decline of THg concentrations in fish in the Abitibi River as a function of distance. However, it is anticipated that mercury concentrations in Walleye in New Post Creek below the waterfalls will be comparable to the pre-development mercury concentrations in Walleye (see Section 2.2.6.9).

Post-inundation fish mercury body burden monitoring programs will be implemented to confirm predicted increased THg concentrations in Slimy Sculpin within the proposed Project inundated area and unchanging THg concentrations in Walleye in New Post Creek downstream of the waterfalls (see Section 3.2.13). If inadequate numbers of Slimy Sculpin are available for analysis, CRP/OPG will consult with the MOE on alternative locations/species. As indicated in Section 3.3, monitoring of THg concentrations in Northern Pike will be undertaken, if a population becomes established in the proposed headpond.

THg body burden data for Northern Pike from Little Abitibi Lake were obtained from the MOE Environmental Monitoring and Reporting Branch (C. Mahon, MOE, 2013, pers. comm.) and will be used as baseline THg concentrations should a Northern Pike population becomes established in the proposed headpond. These data are summarized below:

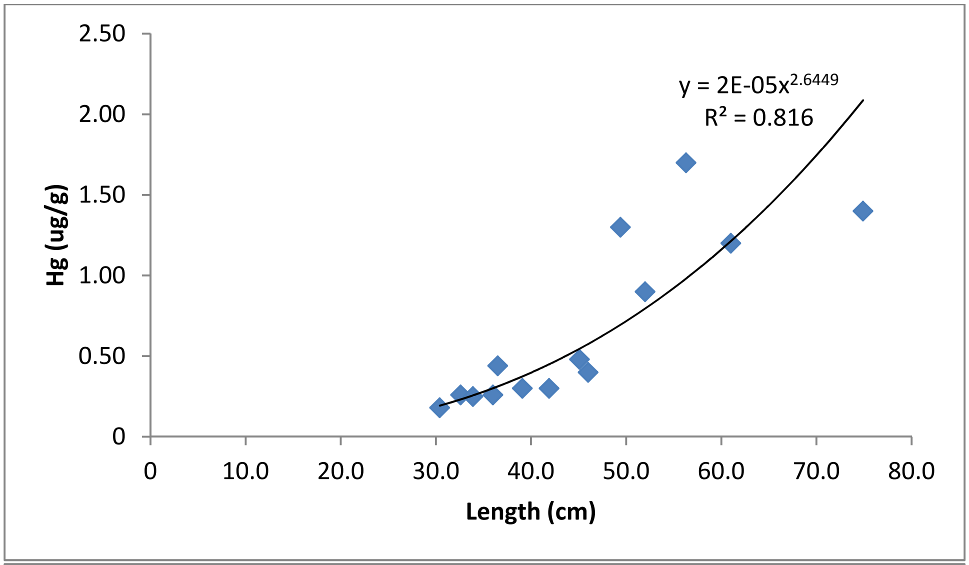
- Number Analyzed for: 14;
- Mean Length (cm) (Range): 45.4 (30.4 – 74.9);
- Mean Weight (g) (Range): 755 (175 – 1,275);
- Mean THg Concentration (Range) (µg/g): 0.67 (0.18 – 1.70);
- THg Concentration (µg/g) for 55 cm Fish: 0.80.

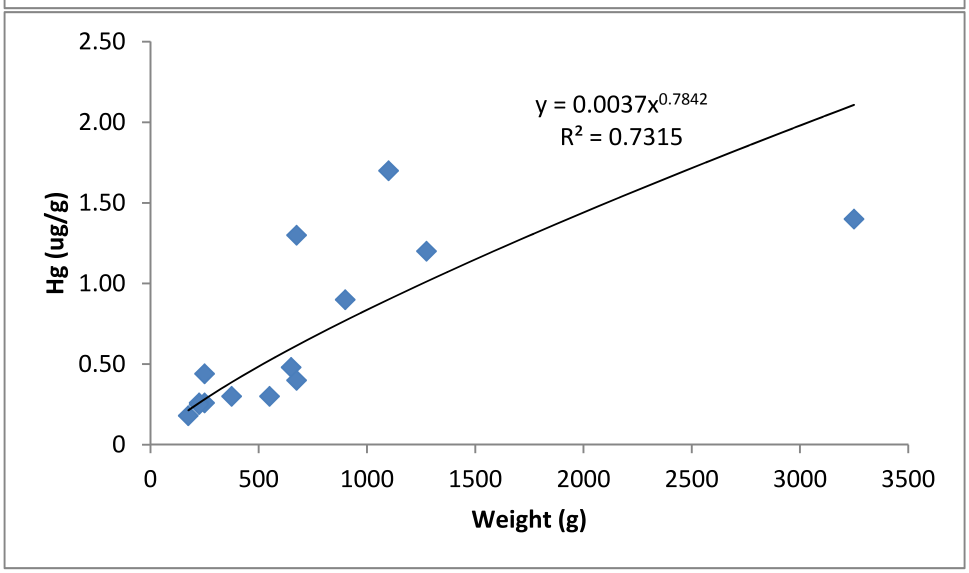
The relationships between the THg concentrations and lengths and weights were statistically significant (see Figure 3.12).

### 3.2.11 Aquatic Avifauna

During operation, noise will be generated from the proposed GS. This steady noise will not elicit an adverse reaction from nearby habituated aquatic avifauna (see Terrestrial Environment TSD for more detail).

**Figure 3.12 Relationships between THg Concentrations and Length and Weight for Northern Pike in Little Abitibi Lake (1997)**



### 3.2.12 Watercourse Uses

Although New Post Creek was not navigable during the summer prior to flow diversion, Ontario Parks may wish that sufficient flows be available during this period to facilitate canoeing within LAPP downstream of the proposed Project intake weir location. This would necessitate the establishment of a new portage either around the proposed Project intake weir in order to continue downstream to the portage around the waterfalls, or alternatively provide access from New Post Creek to the Abitibi River. The existing portage around the waterfalls occurs along a poorly marked upper trail with significant blowdown obstructions and a very steep and slippery trail down to the base of the waterfalls. This portage has been designated as difficult (http://www.myccr.com).

An alternative portage trail approximately 1 km long from New Post Creek to the Abitibi River could be provided to the south of the proposed Project site to facilitate further access for canoeists to LAPP. This alternative would enhance public safety by precluding the need to portage around the proposed Project intake weir on the east side of New Post Creek, and to locate and access the difficult portage around the waterfalls. The areas associated with the proposed alternative portage would be delineated by public safety measures such as booms, buoys and signage, in accordance with MNR and OPG dam safety requirements.

Prior to initiation of construction of the proposed Project, the DBC will identify disembark/launch locations (with appropriate signage) for canoeists to access the new portage trail between New Post Creek and the Abitibi River during the construction period. A map showing the proposed location of the new portage trail will be provided to Ontario Parks and MNR for review and approval. The disembark/launch location on New Post Creek will subsequently likely need to be relocated due to the proposed inundation and the final portage trail location between New Post Creek and the Abitibi River will be discussed with Ontario Parks during the construction phase.

As indicated in Section 2.3.4, the New Post Creek waterfalls has been identified as a tourism destination by the www.northernontario.travel website under Wilderness Heritage Canoe Tours. Two tourism operators located in Smooth Rock Falls provide half, full and/or two-day trips to “New Post Falls” and New Post. Reduction of flows over the waterfalls to historic levels may possibly diminish visitor experience appreciation value, particularly with respect to the mist generated by the waterfalls. Although no visual record of the waterfalls is available for the proposed minimum flow of 7.5 and 5 $m^3/s$ during July/August and September, respectively, the waterfalls did generate appreciable mist during an average daily flow of 9.17 $m^3/s$ (see Photograph 3.1). Appreciable mist generation is also expected at the minimum flow of 7.5 and 5 $m^3/s$.

A reduction of water flowing over New Post Creek waterfalls due to the proposed New Post Creek Project would result in flows more typical of natural conditions as recalled by TTN Elders (P. Archibald Sr., TTN, 2011, pers. comm.). As described by Bell (1904), “an interesting fall is that on the Blue Water river or New Post brook just behind New Post. At this point the small stream enters the Abitibi with an almost vertical fall of ninety feet, flowing directly over the edge of the plateau in a veritable hanging valley" (see Photograph 2.9).

As part of a monitoring commitment (see Section 3.3), CRP/OPG will be undertaking a photographic and video documentation of the minimum flows over the New Post Creek waterfalls in July/August (7.5 $m^3$/s) and September (5 $m^3$/s) of the first year of proposed GS operation, particularly with respect to aesthetics (e.g., mist generation). CRP/OPG does not expect this documentation of minimum flows to be significantly different than the average daily flow of 9.17 $m^3$/s indicated in Photograph 3.1. The photographic and video documentation of minimum flows over the waterfalls will be provided to the MNR for review of aesthetic values and assessment for potential adjustment up or down taking into account net societal economic costs and benefits.

With respect to sportfishing, as concluded in Section 3.2.10.3, mercury concentrations in Walleye in New Post Creek below the waterfalls are anticipated to be comparable to pre-development concentrations.

The effects of the proposed Project on water uses and the recommended mitigation measures are summarized below and are described in more detail in the Socio-economics and Land Use TSD.

## 3.3 SUMMARY OF MITIGATION, ENHANCEMENT AND MONITORING MEASURES

Table 3.5 summarizes potential construction and operation effects, the recommended mitigation/remedial measures to minimize or obviate these effects and the net effects of the proposed New Post Creek Project.

## Table 3.5 Summary of Potential Effects and Recommended Mitigation/ Remedial Measures

| Effect/Activity | Recommended Mitigation/Remedial Measures | Net Effect |
|---|---|---|
| Construction | | |
| Soil erosion | • Adherence to Erosion and Sediment Control Plan | No adverse residual effect |
| Incidental spills | • Adherence to Spills Emergency Preparedness and Response Plan | No adverse residual effect |
| Hazardous Materials/Waste | • Adherence to Hazardous Materials Management Plan and Waste Management Plan<br>• Waste disposal in accordance with regulatory requirements | No adverse residual effect |
| Blasting | • Adherence to DFO guidelines (Wright and Hopky, 1998) and blasting engineer recommendations<br>• Potential use of blast rock for fish habitat enhancement and/or nearshore/shoreline erosion protection, or removal for suitable upland disposal | No adverse residual effect |
| In-water construction activities | • Use of clean rock fill for cofferdam<br>• Judicious selection of discharge location and water pressure during dewatering<br>• Adherence to in-water construction timing restrictions<br>• Transfer of fish stranded behind cofferdam prior to complete dewatering | No adverse residual effect |
| Fish habitat | • Potential use of blast rock for fish habitat enhancement to be discussed with DFO | Potential net benefit |
| Sportfish populations | • As a condition of employment, prohibition of sportfishing by construction workers while at camp | No adverse residual effect |
| Operation | | |
| Incidental spills | • Adherence to Spills Emergency Preparedness and Response Plan | No adverse residual effect |
| Seasonal minimal flow shifting on hydrology | • None recommended: overall peak flows in New Post Creek downstream of the proposed intake weir location to be lower than those occurring in past | No adverse residual effect |
| Sediment erosion and transport | • None recommended: net reduction in erosion potential due to inundated area and along lower New Post Creek due to flow regulation | No adverse residual effect |
| Inundated area creation on water quality | • None recommended: anticipated trophic surge to be temporary with rapid water quality return to baseline levels | No long-term adverse residual effect |
| Inundated area creation on aquatic biota | • None recommended: inundation will increase biotic biomass, which may be beneficial to fish production in the proposed headpond and possibly below the waterfalls (to be monitored); benthic macroinvertebrate communities in lotic conditions replaced by those adapted to lentic conditions; daily water-level fluctuations are below the 1 m trigger of negative effects | No adverse residual effect (potential net benefit in proposed headpond) |
| Inundation effects on mercury | • Low numbers of small resident fish at present<br>• Monitoring of THg concentrations in Walleye downstream of proposed intake weir, as well as Slimy Sculpin (and any piscivorous species that may become established) in the headpond; based on results, implementation of appropriate fish consumption advisories | No long-term adverse residual effect |
| Loss/gain of fish habitat | • Overall, approximately 132 ha of aquatic habitat will be gained, and approximately 70 ha of aquatic habitat will be altered with total inundation area of approximately 170 ha (see Table 3.3) | Potential net benefit |
| Pulsing | • None recommended (see Table 3.4) | No adverse residual effect |
| Fish entrainment and survival | • None recommended initially due to low numbers of small resident fish; however, the establishment of fish populations of larger size should be monitored and the need for mitigation assessed | No adverse residual effect initially; future effect unknown |
| Water uses | • Deployment of public safety measures | No adverse residual effect |

The proposed New Post Creek Project will not have a negative effect upon the fish communities of New Post Creek or the Abitibi River, although local shifts in community structure are expected due to physical habitat and water temperature changes. Upstream of the proposed intake weir, the headpond will create an additional 131.9 ha of aquatic habitat, and alter an existing 37.5 ha of riverine habitat to be slower flowing and deeper (with a total inundation area of approximately 170 ha). This will provide a greater area and diversity of habitats that could potentially result in a more productive and diverse fish community. Downstream of the proposed intake weir a set of seasonally appropriate minimum flows will ensure that the habitat components and functions in New Post Creek are maintained, including the important Walleye spawning habitat below the waterfalls. The downstream area altered is approximately 32.8 ha. Reductions in downstream habitat area under minimum flows cannot be quantified with the available information, but are considered to be minor. The tailrace discharging to the Abitibi River will not result in the loss of habitat, but will increase habitat diversity in the vicinity of the tailrace.

During construction and operation, an Environmental Compliance Monitoring Program will be implemented to ensure that all construction and operation related commitments are met. Details on the Environmental Compliance Program are provided in the ER.

Flow discharge, water levels and water temperature will be monitored throughout proposed Project operation.

Recommended aquatic environment monitoring during operation includes:

- visual monitoring (with photographic documentation) of shoreline erosion and sedimentation upstream and downstream of the proposed dam, at the proposed tailrace and in the watercourses traversed by the proposed transmission line ROW after one complete growing season after initiation of proposed GS operation (water samples for TSS analysis to be collected in any areas of visible turbidity and water temperature to be measured in Pinard Creek) with subsequent monitoring of any sites requiring additional stabilization mitigation;
- temperature/D.O. profile monitoring in the proposed headpond during the summer one and five years after initiation of proposed GS operation to confirm anticipated isothermal conditions, together with the water sample collection for metal (including low-level THg and MeHg) analysis;
- benthic macroinvertebrate community sampling program (using standard techniques) to be undertaken in September in the proposed headpond and at locations previously sampled downstream of the proposed intake weir location one and five years after initiation of proposed GS operation;
- benthic macroinvertebrate community and drift sampling program (using standard techniques) to be undertaken in September in New Post Creek below the waterfalls prior to proposed Project construction initiation to provide a baseline for a subsequent identical sampling program to be undertaken one and five years after initiation of proposed GS operation;

- confirmation and quantification (based on relative abundance) of fish spawning and spawning success (including the Lake Sturgeon spawning period) based on gillnetting, egg collection mat deployment and drift netting in New Post Creek below the waterfalls during the first year of proposed GS operation with minimum flow (15 $m^3/s$);
- assessment of effects on fish populations and species richness in the proposed headpond based on gillnetting, seining and/or electroshocking approximately one, five and ten years after initiation of proposed GS operation with frequency established in the finalized Monitoring Program;
- monitoring of THg body burden in Walleye in New Post Creek below the waterfalls and Slimy Sculpin (and any piscivorous fish population, if established) in the inundated area upstream of the proposed Project intake weir location one year after the start of operations and based on findings of significantly elevated fish body burden every five years until mercury concentrations decline to previous background;
- monitoring of TSS concentrations in New Post Creek during the initial two sediment trap evacuation events; and
- photographic and video documentation of minimum flows over the New Post Creek waterfalls, particularly with respect to aesthetics (e.g., mist generation), in July/August (7.5 $m^3/s$) and September (5 $m^3/s$) of the first year of proposed GS operation.

<u>Adaptive Management Program</u>

In addition to the above recommended mitigation and monitoring measures, CRP/OPG will develop an overall AMP for the proposed New Post Creek Project that will consider effects monitoring, adaptive management measures and adjustments to mitigation measures based on observed conditions, e.g., potential adjustment up or down of minimum flows to meet waterfalls aesthetics objectives, mitigation of fish entrainment if adverse effects on fisheries resources are determined.

The AMP will be implemented once the proposed GS becomes operational and maintained at least until THg fish body burdens decline to previous backgrounds. The AMP will take into consideration the findings of environmental monitoring during operation and in consultation with MNR, DFO, MOE and Joint Working Group monitoring components will be modified or discontinued. The AMP will address any circumstance indicating that proposed GS operation is having an adverse effect on fisheries resources. The AMP may be combined and/or coordinated with the effectiveness monitoring program of the amended WMP.

# 4.0 SUMMARY AND CONCLUSIONS

This TSD provides an aquatic environment baseline, as well as the potential effects of the proposed New Post Creek Project on the aquatic environment and the recommended mitigation measures to minimize these effects.

During proposed Project construction, potential effects on the aquatic environment may occur due to soil erosion causing turbidity and sedimentation in surface waters, waste generation, incidental spills, hazardous materials usage, blasting, in-water construction activities and fish habitat enhancement/creation. Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term with no adverse residual effects. Fish habitat enhancement/creation during construction will offset fish habitat loss.

During the operation of the proposed Project, potential effects on the aquatic environment may occur due to incidental spills, seasonal flow shifting, reservoir creation, water level and flow fluctuations, fish habitat loss/gain, fish entrainment, increased fish mercury body burden and water use experience diminution. Based on assessment of the baseline information and potential effects, and implementation of recommended mitigation measured, it is concluded that the operation of the proposed Project no adverse residual effects on the aquatic environment.

The proposed New Post Creek Project will not have a negative effect upon the fish communities of New Post Creek or the Abitibi River, although local shifts in community structure are expected due to physical habitat and water temperature changes. Upstream of the proposed intake weir, the headpond will create an additional 131.9 ha of aquatic habitat, and alter an existing 37.5 ha of riverine habitat to be slower flowing and deeper (with a total inundation area of approximately 170 ha). This will provide a greater area and diversity of habitats that could potentially result in a more productive and diverse fish community. Downstream of the proposed intake weir a set of seasonally appropriate minimum flows will ensure that the habitat components and functions in New Post Creek are maintained, including the important Walleye spawning habitat below the waterfalls. The downstream area altered is approximately 32.8 ha. Reductions in downstream habitat area under minimum flows cannot be quantified with the available information, but are considered to be minor. The tailrace discharging to the Abitibi River will not result in the loss of habitat, but will increase habitat diversity in the vicinity of the tailrace.

With respect to fish mercury body burden, it is anticipated that mercury concentrations in Walleye in New Post Creek below the waterfalls will be comparable to the pre-development mercury concentrations in Walleye. This will be confirmed by post-inundation fish mercury body burden monitoring programs.

Environmental protection during proposed New Post Creek Project construction and operation will be ensured by adherence to the site-specific Environmental Management Plan, as well as compliance with regulatory standards and guidelines.

The Environment Management Plan ensures that environmental protection will be achieved during construction by describing government agency requirements, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan and Waste Management Plan.

During operation, environmental protection will be achieved by adherence to the Spills Emergency Preparedness and Response Plan and the amended Abitibi River WMP, deployment of public safety measures and environmental monitoring.

## 5.0 REFERENCES


Anderson, M.R. 2011. *Duration and Extent of Elevated Mercury Levels in Downstream Fish Following Reservoir Creation*. River Syst. 19: 167-176.

Aroviita, J. and H. Hämäläinen 2008. *The Impact of Water-level Regulation on Littoral Macroinvertebrate Assemblages in Boreal Lakes*. Hydrobiologia 613: 45-56.

Barr, J.F. 1986. *Population Dynamics of the Common Loon (Gavia immer) Associated with Mercury-contaminated Waters in Northwestern Ontario*. Canadian Wildlife Service, Occasional Paper Number 56: 23 p.

Baxter, R.M. and P. Glaude 1980. *Environmental Effects of Dams and Impoundments in Canada: Experience and Prospects*. Can. Bull. Fish. Aquat. Sci. 205: 34 p.

Beacon Environmental (Beacon) 2010. *Ecological Integrity Assessment Little Abitibi Provincial Park.* Report to Coral Rapids Power and Ontario Power Generation. 38 p.

Becker, G.C. 1983. *Fishes of Wisconsin*. University of Wisconsin Press, Madison, Wisconsin. 1,052 p.

Bell, J.M. 1904. *Economic Resources of the Moose River Basin*, pp. 135-179. *In*: Report of the Bureau of Mines, 1904, Part 1. Royal Ontario Museum of Mineralogy, Toronto, Ontario.

Berman, M. and R. Bartha 1986. *Control of the Methylation Process in a Mercury-polluted Aquatic Sediment.* Environ. Pollut. (Ser. B): 41-53.

Bird Studies Canada 2006. Ontario Breeding Bird Atlas. www.birdsontario.org/atlas/atlasmain.html

Bisogni, J.J., Jr. and A.W. Lawrence 1975. *Kinetics of Mercury Methylation in Aerobic and* Anaerobic Aquatic Environments. J. Wat. Pollut. Contr. Fed. 47: 135-152.

Bodaly, R.A. and R.J.P. Fudge 1999. *Uptake of Mercury by Fish in an Experimental Boreal Reservoir*. Arch. Environ. Contam. Toxicol. 37: 103-109.

Bodaly, R.A., W.A. Jansen, A.H. Majewski, R.J.P. Fudge, N.E. Strange, A.J. Derksen and D.J. Green 2007. *Postimpoundment Time Course of Increased Mercury Concentrations in Fish in Hydroelectric Reservoirs of Northern Manitoba, Canada*. Arch. Environ. Contam. Toxicol. 53: 379-389.

Bodaly, R.A., K.G. Beaty, L.H.Hendzel, A.R. Majewski, M.J. Paterson, K.R. Rolfhus, A.F. Penn, V.L. St. Louis, B.D. Hall, C.J.D. Matthews, K.A. Cherewyk, M. Mailman, J.P. Hurley, S.L. Schiff and J.J. Venkiteswaran 2004. *Experimenting with Hydroelectric Reservoirs.* Environ. Sci. Technol. 38: 347A-352A.

Bodaly, R.A., V.L. St. Louis, M.J. Paterson, R.J.P. Fudge, B.D. Hall, D.M. Rosenberg and J.W.M. Rudd 1997. *Bioaccumulation of Mercury in the Aquatic Food Chain in Newly Flooded Areas*, pp. 259-287. *In*: H. Sigel and A. Sigel [Eds.]. Mercury and its Effects on Environment and Biology. Marcel Decker, New York, New York.

Brouard, D., J-F. Doyon and R.Schetagne 1994. *Amplification of Mercury Concentrations in Lake Whitefish (Coregonus clupeaformis) Downstream of the La Grande 2 Reservoir, James Bay, Québec*, pp. 369-380. *In*: C.J. Watras and J.W. Huckabee [Eds.]. Mercury Pollution: Integration and Synthesis. Internat. Conf. Mercury as a Global Pollutant (1992), Monterey, California, Lewis Publishers, Boca Raton, Florida.

Brousseau, C.S. and G.A. Goodchild 1989. *Fisheries and Yields in the Moose River Basin, Ontario*, pp. 145-158. *In*: D.P. Dodge [Ed.]. Proc. Internat. Large River Symposium. Can. Spec. Publ. Fish. Aquat. Sci. 106.

Cada, G.F. 1990. *A Review of Studies Relating to the Effects of Propeller-type Turbine Passage on Fish Early Life Stages*. N. Amer. J. Fish. Manage. 10: 416-426.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier [Eds.] 2007. *Atlas of the Breeding Birds of Ontario, 2001-2005*. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. 706 p.

Canada Land Inventory (CLI) 1974. *Land Capability for Wildlife - Waterfowl,* Cochrane 42 H. Environment Canada.

Canada Land Inventory (CLI) 1972. *Land Capability for Recreation,* Cochrane – 42 H. Environment Canada.

Chamberlain, A.J. 1979. *Short-term Effects of Dock Construction Activity on Fishes in the Nanticoke Region of Long Point Bay, Lake Erie.* Report 2, Construction Phase 2, March-November 1976. Ministry of Natural Resources. 50 p.

Chamberlain, A.J. 1976. *The Acute and Subacute Effects of Underwater Rock Blasting, Dredging and other Construction Activity on the Fishes in the Nanticoke Region of Long Point Bay, Lake Erie*. Report No. 1, Construction Phase 1 March-November 1975. Ministry of Natural Resources. 117 p.

Cieslewicz, S. and R. Novembri 2004. *Utility Vegetation Management. Trends, Issues, and Practices*. CN Utility Consulting, LLC.

Coker, G. and C. Portt 2013a. *New Post Creek Hydroelectric Project Assessment of Effects to Fish Habitat in the Abitibi River and New Post Creek.* C. Portt and Associates Report to SENES Consultants Limited. 26 p.

Coker, G. and C. Portt 2013b. *New Post Creek Hydroelectric Project Fish Habitat Assessment of the Generating Station Access Road.* C. Portt and Associates Report to SENES Consultants Limited. 7 p.

Coker, G. and C. Portt 2013c. *New Post Creek Hydroelectric Project Fish Habitat Assessment of the Preferred Transmission Line Route.* C. Portt and Associates Report to SENES Consultants Limited. 7 p.

Coker, G. and C. Portt 2013d. *New Post Creek Hydroelectric Project Fish Habitat Assessment of the Parliament Loop Road Access.* C. Portt and Associates Report to SENES Consultants Limited. 8 p.

Coker, G. and C. Portt 2013e. *New Post Creek Abitibi River Lake Sturgeon Spawning Assessment 2011 and 2012.* C. Portt and Associates Report to SENES Consultants Limited. 21 p.

Coker, G. and C. Portt 2012a. *New Post Creek Abitibi River Walleye Spawning Assessment 2009 and 2010.* C. Portt and Associates Report to Ontario Power Generation Inc. 11 p.

Coker, G. and C. Portt 2012b. *New Post Creek Abitibi River Walleye Spawning Assessment 2011.* C. Portt and Associates Report to SENES Consultants Limited. 8 p.

Coker, G. and C. Portt 2012c. *New Post Creek Abitibi River Lake Whitefish Spawning Assessment 2009, 2010 and 2011.* C. Portt and Associates Report to SENES Consultants Limited. 11 p.

Coker, G. and C. Portt 2012d. *New Post Creek Abitibi River Lake Sturgeon Spawning Assessment 2010.* C. Portt and Associates Report to Ontario Power Generation Inc. 7 p.

Coker, G. and C. Portt 2012e. *Aquatic Assessment of Proposed Minimum Flows in New Post Creek.* C. Portt and Associates Report to Ontario Power Generation Inc. 53 p.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2012. *Canadian Wildlife Species at Risk, October 2012*. Ottawa, Ontario. 98 p.

Compeau, G. and R. Bartha 1984. *Methylation and Dimethylation of Mercury under Controlled Redox, pH, and Salinity Conditions.* Appl. Environ. Microbiol. 48: 1203-1207.

Dedual, M. 2007. *Survival of Juvenile Rainbow Trout Passing Through a Francis Turbine*. N. Amer. J. Fish. Manage. 27: 181-186.

Department of Fisheries and Oceans (DFO) 2010a. *Ontario In-Water Construction Timing Window Guidelines for the Protection of Fish and Fish Habitat*. Version 1.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010b. *Ontario Operational Statement, Temporary Stream Crossing*. Version 1.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010c. *Ontario Operational Statement, Culvert Maintenance*. Version 3.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010d. *Ontario Operational Statement, Clear Span Bridges*. Version 3.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010e. *Ontario Operational Statement, Bridge Maintenance*. Version 3.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010f. *Ontario Operational Statement, Isolated or Dry Open-cut Stream Crossings*. Version 1.0. 5 p.

Department of Fisheries and Oceans (DFO) 2010g. *Ontario Operational Statement, Maintenance of Riparian Vegetation in Existing Rights-of-Way*. Version 3.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010h. *Ontario Operational Statement, Overhead Line Construction*. Version 3.0. 4 p.

Department of Fisheries and Oceans (DFO) 2010i. *Ontario Operational Statement, Beaver Dam Removal*. Version 3.0. 4 p.

Diaz, R.J. 1994. *Response of Tidal Freshwater Macrobenthos to Sediment Disturbance.* Hydrobiologia 278: 201-212.

Electric Power Research Institute, Inc. (EPRI) 2002. Best Management Practices (BMPs) Manual for Access Road Crossings of Wetlands and Waterbodies.

Electric Power Research Institute, Inc. (EPRI) 1999. *Vegetation Dynamics Along Utility Rights-of-Way: Factors Affecting the Ability of Shrub and Herbaceous Communities to Resist Invasion by Trees.* TR-113377.

Environmental Applications Group Limited, The (EAG) 1981. *Onakawana Site Aquatic Studies Fall 1980*. Report to Ontario Hydro.

Environment Canada, Canadian Wildlife Service (CWS) 2010/2011. Species at Risk Web Mapping Application (http://www.sis.ec.gc.ca/ec_species/ec_species_e.phtml).

Environmental and Resource Development Engineering Inc. (ERDE) 1998. *Abitibi River, Newpost Creek Diversion, Shoreline Evaluation Program, Shoreline Condition Survey, May 5, 1998.* Report to Ontario Hydro Civil Field Services Department. 89 p.

Fagerström, T. and A. Jernelöv 1972. *Some Aspects of the Quantitative Ecology of Mercury.* Paper presented at 6th Internat. Conf. Water Pollution Research, Internat. Assoc. Wat. Pollut. Res., June 1972, Jerusalem, Israel. 12 p.

Fagerström, T. and A. Jernelöv 1971. *Formation of Methyl Mercury from Pure Mercuric Sulphide in Aerobic Organic Sediment.* Water Res. 5: 121-122.

Ferguson, J.W., G.R. Ploskey, K. Leonardsson, R.W. Zabel and H. Lundqvist 2008. *Combining Turbine Blade-strike and Life Cycle Models to Assess Mitigation Strategies for Fish Passing Dams.* Can. J. Fish. Aquat. Sci. 65: 1568-1585.

Ferguson, R.C. 1962. *The Effects of Underwater Explosions on Yellow Perch (Perca flavescens).* Can. Fish. Cult. 29: 31-39.

Fischer, P. and U. Öhl 2005. *Effects of Water-level Fluctuations on the Littoral Benthic Fish Community in Lakes: A Mesocosm Experiment*. Behav. Ecol. 16: 741-746.

Fiset, W. 1995. *Taxonomic List of Aquatic Invertebrates Collected in the Moose River Basin.* Ontario Ministry of Natural Resources, Northeast Science & Technology, Large River Ecosystem Unit, Timmins, Ontario, NEST Technical Report TR-023: 33 p.

Fitchko, J., M. Ernst, B. McCormick and L. Gresock 2008. *Lake Erie Link Project: Assessment of Potential Construction Effects of Electric Cable Crossing(s) of Lake Erie*, pp. 655-663. *In*: J.W. Goodrich-Mahoney, L.P. Abrahamson, J.L. Ballard and S.M. Tikalsky [Eds.]. The Eighth International Symposium on Environmental Concerns in Rights-of-Way Management, 12-16 September 2004, Saratoga Springs, New York, USA. Elsevier B.V., Amsterdam, The Netherlands.

Foye, R.E. and M. Scott 1965. *Effects of Pressure on Survival of Six Species of Fish*. Trans. Am. Fish. Soc. 94: 88-91.

Fry, D.H., Jr. and K.W. Cox 1953. *Observations on the Effect of Black Powder Explosions on Fish Life*. Calif. Fish Game 39: 233-236.

Griffith, J.S. and D.A. Andrews 1981. *Effects of a Small Suction Dredge on Fishes and Aquatic Invertebrates in Idaho Streams*. N. Amer. J. Fish. Mgt. 1: 21-28.

Griffiths, W.H. and B.D. Walton 1978. *The Effects of Sedimentation on the Aquatic Biota*. Prepared for the Alberta Oil Sands Environmental Research Program by Renewable Resources Consulting Services Ltd. AOSERP Report 35.

Hall, B.D., K.A. Cherewyk, M.J. Paterson and R.A. Bodaly 2009. *Changes in Methyl Mercury Concentrations in Zooplankton from Four Experimental Reservoirs with Differing Amounts of Carbon in the Flooded Catchments*. Can. J. Fish. Aquat. Sci. 66: 1910-1919.

Hall, B.D., V.L. St. Louis, K.R. Rolfhus, R.A. Bodaly, K.G. Beaty, M.J. Paterson and K.A. Peech Cherewyk 2005. *Impacts of Reservoir Creation on the Biogeochemical Cycling of Methyl Mercury and Total Mercury in Boreal Upland Forests.* Ecosystems 8: 248-266.

Hall, B.D., D.M. Rosenberg and A.P. Wiens 1998. *Methyl Mercury in Aquatic Insects from an Experimental Reservoir*. Can. J. Fish. Aquat. Sci. 55: 2036-2047.

Hall, B.D., R.A. Bodaly, R.J.P. Fudge, J.W.M. Rudd and D.M. Rosenberg 1997. *Food as the Dominant Pathway of Methylmercury Uptake by Fish*. Water Air Soil Pollut. 100: 13-24.

Headon, C.M. and G.F. Pope 1990. *Cumulative Impact of Mercury Contamination of Fish in the Moose River System – A Review of MOE Data*. Ontario Hydro, Environmental Studies and Assessments Department, Technical Memorandum 90/4: 30 p.

Health Canada 2007. *Health Canada's Revised Assessment of Mercury in Fish Enhances Protection While Reflecting Advice in Canada's Food Guide*. http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/_2007/2007_31-eng.php

Hendry, C. and C. Chang 2001. *Investigations of Fish Communities and Habitat in the Abitibi Canyon Generating Station Tailwater*. Ontario Ministry of Natural Resources, Northeast Science & Technology, NEST Information Report IR-026: 42 p.

Hirsch, N.D., L.H. DiSalvo and R. Peddicord 1978. *Effects of Dredging and Disposal on Aquatic Organisms*. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., Tech. Rpt. DS-78-5: 41 p.

Hubbs, C.L. and A.B. Rechnitzer 1952. *Report on Experiments Designed to Determine Effects of Underwater Explosions on Fish Life*. Calif. Fish Game 38: 333-366.

Hydro One Networks Inc. (Hydro One) 2010. *Final Customer Impact Assessment, New Post Creek GS 25 MW Hydroelectric Connection.* 7 p.

Hydro One Networks Inc. (Hydro One) 2008. E*nvironmental Guidelines for the Construction and Maintenance of Transmission Facilities.*

Independent Electricity System Operator (IESO) 2010. *System Impact Assessment Report for Newpost Creek Hydraulic Generation Development*. IESO_REP_0511: 43 p.

Jacobs, I.W. and D.R. Keeney 1974. *Methylmercury Formation in Mercury Treated River Sediments during In Situ Equilibration.* J. Environ. Qual. 3: 121-126.

Joint Review Panel (JRP) 2009. *Lower Churchill Hydroelectric Project.* Information Request No. JRP.51: 17 p.

Keevin, T.M., G.L. Hempen and D.J. Schaeffer 1997. *Use of a Bubble Curtain to Reduce Fish Mortality during Explosive Demolition of Locks and Dam 26, Mississippi River*, pp. 197-206. *In*: Proc. 23rd Ann. Conf. Explosives and Blasting Technique, February 1997, Las Vegas, Nevada. International Society of Explosive Engineers, Cleveland, Ohio.

Kelly, C.A., J.W.M. Rudd, R.A. Bodaly, N.P. Roulet, V.L. St. Louis, A. Heyes, T.R. Moore, S. Schiff, R. Aravena, K.J. Scott, B. Dyck, R. Harris, B. Warner and G. Edwards 1997. *Increases in Fluxes of Greenhouse Gases and Methyl Mercury Following Flooding of an Experimental Reservoir*. Environ. Sci. Technol. 31: 1334-1344.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2013a. *New Post Creek Hydroelectric Development Geotechnical Baseline Report.* Draft Report Revision C to Ontario Power Generation Inc. and Coral Rapids Power. 29 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2013b. *New Post Creek Hydroelectric Development Geotechnical Data Report.* Draft Report Revision B to Ontario Power Generation Inc. and Coral Rapids Power. 21 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2013c. *New Post Creek Hydroelectric Development Project Design Requirements*. Report to Ontario Power Generation Inc. and Coral Rapids Power. 138 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2013d. *New Post Creek Hydrodevelopment Project Peter Sutherland Sr. Generating Station Transmission Specification*. Revision A. Report to Ontario Power Generation and Coral Rapids Power. 53 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2013e. New Post Creek Hydro Development Summary of Sediment Studies. Memorandum to Ontario Power Generation - Coral Rapids Power, October 18, 2013. 26 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2012. *New Post Creek Generating Station Definition Phase Optimization Report.* Report to Ontario Power Generation Inc. and Coral Rapids Power. 68 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2010. *New Post Creek Generating Station Feasibility Update*. Final Report to Ontario Power Generation. 38 p.

Kontzamanis, Graumann, Smith, MacMillan Inc. (KGS Group) 2006. *Newpost Creek Generating Station Concept Phase Study*. Final Report to Ontario Power Generation.

Lammers, W., K.T. Wang, M.J. German and A.C. Roy 1972. *Water Resources in the Onakawana Area and the Anticipated Impact of the Proposed Lignite and Power Development*. Ontario Ministry of the Environment, Task Force Onakawana Working Paper #2: 63 p.

Luedtke, R.J. and M.A. Brusven 1976*. Effects of Sand Sedimentation on Colonization of Stream Insects*. J. Fish. Res. Board Can. 33: 1881-1886.

McAnuff, A.L. and R.T. Booren 1989. *Fish Mortality Study During Underwater Blasting Operations in Lake Erie Off Nanticoke, Ontario*. Paper Presented at the 15th Ann. Conf. Explosives and Blasting Technique, February 1989, New Orleans, Louisiana. International Society of Explosive Engineers, Cleveland, Ohio.

McCabe, G.T., Jr., S.A. Hinton and R.L. Emmett 1998. *Benthic Invertebrates and Sediment Characteristics in a Shallow Navigation Channel of the Lower Columbia River, Before and After Dredging*. Northwest Sci. 72: 116-126.

Mergler, D., H.A. Anderson, L. Hing Man Chan, K.R. Mahaffey, M. Murray, M. Sakamoto and A.H. Stern 2007. *Methylmercury Exposure and Health Effects in Humans: A Worldwide Concern*. Ambio 36: 3-11.

Natural Heritage Information Centre (NHIC) 2012. http://nhic.mnr.gov.on.ca/MNR/nhic/nhic/cfm

Natural Heritage Information Centre (NHIC) 2010. Species Information. http://nhic.mnr.gov.on.ca/MNR/nhic/species.cfm .

Ontario Hydro 1988. *Simulations of Water Quality Impacts of the Proposed Little Jackfish Hydroelectric Development*. Environmental Studies and Assessments Department. Report No. 88518: 64 p.

Ontario Hydro 1982. *Abitibi River – Newpost Creek Reconnaissance Geology, 1982.* Geotechnical Engineering Department, Report No. 82543: 8 p.

Ontario Hydro 1961. *Little Abitibi River Newpost Creek Diversion Downstream Geological Reconnaissance 1961*. Report 193-62: 6 p.

Ontario Ministry of Energy 2010. *Ontario's Long-Term Energy Plan – Building Our Clean Energy Future*. 68 p.

Ontario Ministry of the Environment (MOE) 2011a. *Guide to Eating Ontario Sport Fish, 2011 – 2012*. 285 p.

Ontario Ministry of the Environment (MOE) 2011b. *Evaluating Construction Activities Impacting on Water Resources. Part III A. Handbook for Dredging Material Disposal in Ontario – Legislation, Policies, Sediment Classification and Disposal Options*. 49 p.

Ontario Ministry of the Environment (MOE) 2011c. *Evaluating Construction Activities Impacting on Water Resources. Part III B. Handbook for Dredging Material Disposal in Ontario – Dredging Transport and Monitoring*. 23 p.

Ontario Ministry of the Environment (MOE) 2011d. *Evaluating Construction Activities Impacting on Water Resources. Part III B. Handbook for Dredging Material Disposal in Ontario – Sediment Sampling and Laboratory Analysis*. 32 p.

Ontario Ministry of the Environment (MOE) 2003. *Stormwater Management Planning and Design Manual*.

Ontario Ministry of the Environment (MOE) 1972. *Biological Studies of the Onakawana Area*. 60 p.

Ontario Ministry of Environment and Energy (MOEE) 1994. *Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*. 19 p. (reprinted 1999).

Ontario Ministry of Municipal Affairs and Housing (OMMAH) 2005. *2005 Provincial Policy Statement*. 37 p.

Ontario Ministry of Natural Resources (MNR) 2013. *Species at Risk in Ontario (SARO) List.* 11 p.

Ontario Ministry of Natural Resources (MNR) 2011. *2011 Fishing Ontario Recreational Fishing Regulations Summary*. 100 p.

Ontario Ministry of Natural Resources (MNR) 2006. *Crown Land Use Policy Atlas Policy Report P1748: Little Abitibi*.

Ontario Ministry of Natural Resources (MNR) 2005. *A Class Environmental Assessment for Provincial Parks and Conservation Reserves.* 120 p.

Ontario Ministry of Natural Resources (MNR) 1991. *Canoe Routes of Ontario*. 112 p.

Ontario Ministry of Natural Resources (MNR) 1988a. *Cochrane District Fisheries Management Plan (Draft) 1989-2000*. 49 p.

Ontario Ministry of Natural Resources (MNR) 1988b. *Environmental Guidelines for Access Roads and Water Crossings.* 64 p.

Ontario Ministry of Natural Resources (MNR) 1984. *Water Quantity Resources of Ontario*. OMNR Publication 5932: 72 p.

Ontario Parks 2006. *Little Abitibi Provincial Park Interim Management Statement.* 24 p.

Ontario Power Generation Inc., Abitibi Consolidated Company of Canada, Algonquin Power Income Trust and Ontario Ministry of Natural Resources (OPG *et al*.) *2006. Abitibi River Water Management Plan*.

Ontario Waterpower Association (OWA) 2012a. *Class Environmental Assessment for Waterpower Projects*. Third Edition. 106 p.

Ontario Waterpower Association (OWA) 2012b. *Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction*. 86 p.

Parish, J. 1998. *Fluvial Geomorphological Assessment Newpost Creek Diversion*. Parish Geomorphic Report to Ontario Ministry of Natural Resources, Cochrane District. 20 p.

Paterson, M.J., J.W.M. Rudd and V. St. Louis 1998. *Increases in Total and Methylmercury in Zooplankton Following Flooding of a Peatland Reservoir*. Environ. Sci. Technol. 32: 3868-3874.

Paterson, M.J., D.L. Findlay, K. Beaty, W. Findlay, L.L. Hendzel, E.U. Schindler, M.P. Stainton and G.K. McCullough 1997. *Changes in the Planktonic Food Web of a New Experimental Reservoir*. Can. J. Fish. Aquat. Sci. 54: 1088-1102.

Payne, D.A. 1987. *Biology and Population Dynamics of Lake Sturgeon (Acipenser fulvescens) from the Frederick House, Abitibi and Mattagami Rivers, Ontario*, pp. 10-19. *In*: C.H. Oliver [Ed.]. Proc. Workshop on the Lake Sturgeon (*Acipenser fulvescens*). Ontario Ministry of Natural Resources, Ontario Fisheries Technical Report Series No. 23.

Persaud, D. and R. Jaagumagi 1995. *Guidelines for Evaluating Construction Activities Impacting on Water Resources*. Ontario Ministry of Environment and Energy. 55 p.

Price, W.A. 1997. *Draft Guidelines and Recommended Methods for Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. B.C. Ministry of Employment and Investment. 141 p.

Richardson, J. and R.D. Moore 2010. *Stream and Riparian Ecology,* pp. 441-455. *In:* R.G. Pike, T.E. Redding, R.D. Moore, R.D. Winkler and K.D. Bladon [Eds.]. Compendium of Forest Hydrology and Geomorphology in British Columbia. British Columbia Ministry of Forests and Range, Forest Science Program, Victoria, British Columbia, FORREX Forum for Research and Extension in Natural Resources, Kamloops, British Columbia, Land Management Handbook 66.

Rosenberg, D.M. and N.B. Snow 1977. *A Design for Environmental Impact Studies with Special Reference to Sedimentation in Aquatic Systems of the MacKenzie and Porcupine River Drainages*, pp. 65-78. *In*: Proc. Circumpolar Conf. Northern Ecology. 15-18 September 1975, Ottawa, Ontario.

Round, F.E. 1973. *The Biology of the Algae*. Edward Arnold (Publishers) Limited, London, Great Britain. 278 p.

St. Louis, V.L., J.W.M. Rudd, C.A. Kelly, R.A. Bodaly, M.J. Paterson, K.G. Beaty, R.H. Hesslein, A. Heyes and A.R. Majewski 2004. *The Rise and Fall of Mercury Methylation in an Experimental Reservoir*. Environ. Sci. Technol. 38: 1348-1358.

Scheuhammer, A.M., M.W. Meyer, M.B. Sandheinrich and M.W. Murray 2007. *Effects of Environmental Methylmercury on the Health of Wild Birds, Mammals and Fish*. Ambio 36: 12-18.

Schwartz, F.J. 1961. *A Bibliography: Effects of External Forces on Aquatic Organisms*. Chesapeake Biological Laboratory, Solomons, Maryland, Contribution No. 168: 85 p.

Scott, W.B. and E.J. Crossman 1973. *Freshwater Fishes of Canada*. Fisheries Research Board of Canada Bulletin 184: 966 p.

SENES Consultants Limited (SENES) 2013. *Environmental Report for the New Post Creek Hydroelectric Project.* Report to Ontario Power Generation Inc. and Coral Rapids Power.

SENES Consultants Limited (SENES) 2011a. *Project Description for Federal Agency Review – New Post Creek Hydroelectric Project*. Report to Ontario Power Generation Inc. and Coral Rapids Power.

SENES Consultants Limited (SENES) 2011b. *Little Jackfish River Hydroelectric Project: Baseline Mercury Results 2009-2010.* Report to Ontario Power Generation Inc.

Seyler, J. 1998. *Walleye Contaminant Levels in the Moose River Basin: A Synthesis of Historical Data from the Provincial Sport Fish Contaminant Monitoring Program (1970-1995)*. Ontario Ministry of Natural Resources, Northeast Region, The Moose River Basin Environmental Information Partnership. 31 p.

Seyler, J. 1997. *Biology of Selected Riverine Fish Species in the Moose River Basin*. Ontario Ministry of Natural Resources, Northeast Science & Technology, Timmins, Ontario. 1R-024: 100 p.

Seyler, J.C. and J.D. Kristmanson 1999. *Mercury Contamination in Walleye (Stizostedion v. vitreum) in the Moose River Basin: 1996/97*. Ontario Ministry of Natural Resources, Northeast Region, The Moose River Basin Environmental Information Partnership. 27 p.

Silver, J. and J. Fitchko 1992. *As-Built Report, St. Lawrence River Crossing, Iroquois Extension*. Beak Consultants Limited Report to TransCanada PipeLines Limited.

Sloman, K.A., A.C. Taylor, N.B. Metcalfe and K.M. Gilmour 2001. *Effects of an Environmental Perturbation on the Social Behaviour and Physiological Function of Brown Trout.* Anim. Behav. 61: 325-333.

Teleki, G.C. and A.J. Chamberlain 1978. *Acute Effects of Underwater Construction Blasting on Fishes in Long Point Bay, Lake Erie*. J. Fish. Res. Board Can. 35: 1191-1198.

Turner, M.A., D.B. Huebert, D.L. Findlay, L.L. Hendzel, W.A. Jansen, R.A. Bodaly, L.M. Armstrong and S.E.M. Kasian 2005. *Divergent Impacts of Experimental Lake-level Drawdown on Planktonic and Benthic Plant Communities in a Boreal Forest Lake*. Can. J. Fish. Aquat. Sci. 62: 991-1003.

United States Environmental Protection Agency (U.S. EPA) 1976. *Quality Criteria for Water*. 256 p.

Vermeer, K., F.A.J. Armstrong and D.R.M. Hatch 1973. *Mercury in Aquatic Birds in Clay Lake, Western Ontario*. J. Wildl. Manage. 37: 58-61.

Wallis, A. 1998. *Memories Through the Mists of Time*. Arrow-Vision Consulting, Cochrane, Ontario. 159 p.

White, M.S., M.A. Xenopoulos, R.A. Metcalfe and K.M. Somers 2011. *Water Level Thresholds of Benthic Macroinvertebrate Richness, Structure, and Function of Boreal Lake Stony Littoral Habitats*. Can. J. Fish. Aquat. Sci. 68: 1695-1704.

White, M.S., M.A. Xenopoulos, K. Hogsden, R.A. Metcalfe and P.J. Dillon 2008. *Natural Lake Level Fluctuation and Associated Concordance with Water Quality and Aquatic Communities within Small Lakes of the Laurentian Great Lakes Region*. Hydrobiologia 613: 21-31.

Wilhm, J.L. and T.C. Dorris 1968. *Biological Parameters for Water Quality Criteria.* Bioscience 18: 477-481.

Williams, D.D. and H.B.N. Hynes 1977. *Benthic Community Development in a New Stream*. Can. J. Zool. 55: 1071-1076.

Williams, L.G. 1966. *Dominant Planktonic Rotifers of Major Waterways of the United States*. Limnol. Oceanogr. 11: 83 – 91.

Williams, L.G. and C. Scott 1962. *Principal Diatoms of Major Waterways of the United States*. Limnol. Oceanogr. 7: 365 – 379.

Wright, D.G. and G.E. Hopky 1998. *Guidelines for the Use of Explosives in or near Canadian Fisheries Waters*. Canadian Technical Report of Fisheries and Aquatic Sciences 2107: 34 p.

## 6.0 ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ~ | Approximately |
| = | Equals |
| > | Greater than |
| < | Less than |
| # | Number |
| + | Plus |
| x | Times or By |
| ABA | Acid Base Accounting |
| AMP | Adaptive Management Program |
| AoC | Area of Concern |
| AP | Acid Potential |
| ARD | Acid Rock Drainage |
| ATV | All-terrain vehicle |
| Beacon | Beacon Environmental |
| c. | Chapter |
| $CaCO_3$ | Calcium carbonate |
| *CEAA* | *Canadian Environmental Assessment Act* |
| *CEAA 2012* | *Canadian Environmental Assessment Act, 2012* |
| circa | At approximately; around; used of dates |
| Cl. | Class |
| CLI | Canada Land Inventory |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| COSSARO | Committee on the Status of Species at Risk in Ontario |
| $CO_2$ | Carbon dioxide |
| CRP | Coral Rapids Power Inc. |
| CWS | Canadian Wildlife Service |
| DBC | Design Build Contractor |
| DFO | Department of Fisheries and Oceans |
| D.O. | Dissolved oxygen |
| EA | Environmental assessment |
| *EA Act* | *Environmental Assessment Act* |
| EAG | The Environmental Applications Group Limited |
| Ed. | Editor |
| e.g. | For example (exempli gratia) |
| EPRI | Electric Power Research Institute, Inc. |
| EPT Index | Ephemeroptera/Plecoptera/Trichoptera Index |
| ER | Environmental Report |
| ERDE | Environmental and Resource Development Engineering Inc. |
| *ESA* | *Endangered Species Act* |
| *et al.* | And others (et alia) |
| etc. | And so on (et cetera) |

| | |
|---|---|
| F. | Family |
| FRL | Forest Resource Licence |
| FSL | Full Supply Level |
| GPS | Global Positioning System |
| GS | Generating Station |
| H | Horizontal |
| HBC | Hudson's Bay Company |
| HSI | Habitat Suitability Index |
| Hydro One | Hydro One Networks Inc. |
| ID | Identification |
| ID# | Identification number |
| i.e. | That is (id est) |
| IESO | Independent Electricity System Operator |
| IFN | In-stream Flow Need |
| Inc. | Incorporated |
| IR | Indian Reserve |
| JRP | Joint Review Panel |
| KGS Group | Kontzamanis, Graumaun, Smith, MacMillan Inc. |
| LAPP | Little Abitibi Provincial Park |
| LP | Limited Partnership |
| Ltd. | Limited |
| Max | Maximum |
| MeHg | Methylmercury |
| Min | Minimum |
| MNR | Ontario Ministry of Natural Resources |
| MOE | Ontario Ministry of the Environment |
| MOEE | Ontario Ministry of Environment and Energy |
| MoU | Memorandum of Understanding |
| N | North or Nitrogen |
| NA | Not applicable |
| NECC | North East Control Centre |
| NEPG | North East Plant Group |
| NHIC | Natural Heritage Information Centre |
| No. | Number |
| NP | Neutralization Potential |
| NP/AP | Neutralizing Potential to Acid Potential |
| O. | Order |
| OMMAH | Ontario Ministry of Municipal Affairs and Housing |
| ONR | Ontario Northland Railway |
| OPG | Ontario Power Generation Inc. |
| O.Reg. | Ontario Regulation |
| OWA | Ontario Waterpower Association |
| OWA Class EA | Class Environmental Assessment for Waterpower Projects |

| | |
|---|---|
| *OWRA* | *Ontario Water Resources Act* |
| P | Phosphorus |
| P. | Phylum |
| PCBs | Polychlorinated biphenyls |
| pers. comm. | Personal communication |
| *PPCRA* | *Provincial Parks and Conservation Reserves Act* |
| Project | New Post Creek Hydroelectric Project or New Post Creek Project |
| PTTW | Permit-To-Take-Water |
| PWQO | Provincial Water Quality Objective |
| $Q_{80}$ | Flows equal to or exceeded 80% of the time |
| $Q_{95}$ | Flows equal to or exceeded 95% of the time |
| ROW | Right-of-way |
| S1 | Critically imperiled – due to extreme rarity (often five or fewer occurrences) or because of some other factor(s) such as very steep declines making it especially vulnerable to extirpation from the Province |
| S3 | Vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. |
| S4 | Apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors |
| S4? | Apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors – rank uncertain |
| S4S5 | Apparently secure to secure |
| S5 | Secure – common, widespread and abundant in the Province |
| SAR | Species at risk |
| *SARA* | *Species at Risk Act* |
| SARO List | Species at Risk in Ontario List |
| S.C. | Statutes of Canada |
| SENES | SENES Consultants |
| S.F. | Subfamily |
| SIA | System Impact Assessment |
| sp. | Species |
| spp. | Two of more species |
| Sr. | Senior |
| ssp. | Subspecies |
| 2D | Two-dimensional |
| TDS | Total dissolved solids |
| THg | Total mercury |
| TP | Total phosphorus |
| TSD | Technical Support Document |
| TSS | Total Suspended Solids |
| TTN | Taykwa Tagamou Nation |
| U.S. EPA | United States Environmental Protection Agency |
| V | Vertical |

| | |
|---|---|
| W | West |
| WMP | Water Management Plan |
| WSC | Water Survey of Canada |
| YOY | Young-of-the-year |

**MEASUREMENT UNITS**

| | |
|---|---|
| ° | degree |
| ‘ | minute |
| “ | second |
| cm | centimetre |
| °C | degree Celsius |
| ft | foot |
| FTU | Formazin Turbidity Unit |
| g | gram |
| GWh | gigawatt hour |
| h | hour |
| ha | hectare |
| JTU | Jackson Turbidity Unit |
| kg | kilogram |
| kg $CaCO_3$/t | kilogram calcium carbonate per tonne |
| km | kilometre |
| $km^2$ | square kilometre |
| KP | Kilometre Post |
| kV | kilovolt |
| kW | kilowatt |
| L | litre |
| L/s | litre per second |
| m | metre |
| m.a.s.l. | metre above sea level |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| m/km | metre per kilometre |
| $m^3$/s | cubic metre per second |
| mi | mile |
| µg/g | microgram per gram |
| µg/L | microgram per litre |
| µmhos/cm | micromhos per centimetre |
| µ | micron (micrometre) |
| µS/cm | microsiemens per centimetre |
| mg/L | milligram per litre |
| mm | millimetre |

| | |
|---|---|
| mm/s | millimetre per second |
| MW | megawatt |
| NTU | Nephelometric Turbidity Unit |
| % | percent |
| rpm | revolution per minute |
| TCU | True Colour Unit |

## 7.0 GLOSSARY

| | |
|---|---|
| Acarina | Mites and ticks. |
| Aerobic | Denotes the presence of gaseous or dissolved oxygen. |
| Algae (Algal) | A group of unrelated simple plant organisms that live in aquatic habitats. |
| Algal bloom | Proliferation of living algae usually due to nutrient enrichment. |
| Alkalinity | Measure of a water’s capacity to neutralize an acid. |
| Alluvial (alluvium) | Of material deposited by rivers. |
| Amphipoda (Amphipods) | Order of crustaceans of the subclass Malacostraca commonly known as scuds. |
| Anaerobic | Denotes the absence of gaseous or dissolved oxygen. |
| Anion | A negatively charged ion |
| Annelida | A phylum of invertebrates comprising the segmented worms. |
| Anode Cathodic Protection | Technique use to control corrosion of a metal surface by making it a cathode of an electrochemical cell by connecting the metal to be protected with another more easily corroded metal to act as the anode of the electrochemical cell. |
| Anoxic | See anaerobic. |
| Anthropogenic | Human-caused; due to human activities. |
| AoC Prescription | Mitigation direction prescribed by the MNR to minimize or obviate a potential adverse effect on a habitat value or feature. |
| Aquatic macrophyte | Rooted, usually vascular, aquatic plants, such as water lily, cattail, coontail, etc. |
| Arachnida | A class of joint- and eight-legged invertebrates with the body separated into two parts, including spiders, ticks, mites, chiggers and scorpions. |
| Arthropoda (Arthropods) | Highly specialized invertebrates including insects. |
| Avifauna | Birds. |
| Bedload | The solid debris transported in a stream on or near its bed; because this material is too heavy to be carried in suspension, it is moved by rolling, sliding or saltation (sudden jumps) along the bottom. |
| Benthic | Pertaining to the bottom of aquatic habitats and the organisms that inhabit the bottom. |

| | |
|---|---|
| Benthic macroinvertebrates | Larger bottom-dwelling organisms, e.g., snails, clams, worms, insect larvae, crustaceans, etc. living on or within the sediment substrate of waterbodies. |
| Benthivorous (benthivores) | Bottom-feeding. |
| Biological Oxygen Demand | The amount of oxygen required to oxidize the organic matter by aerobic microbial decomposition to a stable inorganic form. |
| Bivalvia | Pelecypoda; clams |
| Bog | Peatland with the water table at or near the surface with the surface often raised above the surrounding terrain; strongly acidic and extremely nutrient-poor; ground cover of *Sphagnum*, usually with ericaceous shrubs (of the family Ericaceae). |
| Brownian movement | The random movement of microscopic particles suspended in a gas or liquid. |
| Bryophyte | Moss. |
| Bulkhead | A steep or vertical wall retaining an embankment, often used to line shorelines, maintain embankment stability and absorb the energy of waves and currents. |
| Canal | A channel dug or built to carry water. |
| Capacity | The greatest load which a unit, station or system can supply (usually measured in kilowatts, megawatts, etc.) |
| Catastomidae (catostomid) | Sucker family. |
| Cation | A positively charged ion. |
| Centrarchidae (centrarchid) | Sunfish family. |
| Chaeta | Chitinous bristle or seta found on an insect, arthropod or annelid worms. |
| Chlorophyll | A class of pigments found in all photosynthetic organisms; chlorophyll molecules are the principal sites of light absorption in the light reaction of photosynthesis. |
| Class | A category used in the classification of organisms that consists of similar or closely related orders. |

| | |
|---|---|
| Cofferdam | A temporary dam made of concrete, rockfill, sheet-steel piling, timber/timber-crib or other non-erodible material and commonly utilized during construction to exclude water from an area in which work is being executed. |
| Coldwater habitat | Habitat for fish having a water temperature preference of 10 to 18ºC. |
| Coleoptera | Beetles. |
| Conductivity | Numerical expression of a water's ability to conduct an electric current; the conductivity of water is dependent on its ionic concentrations and temperature. |
| Coolwater habitat | Habitat for fish having a water temperature preference of 18 to 25$^{o}$C. |
| Coregonidae (coregonid) | Family of soft-finned fishes comprising the freshwater whitefishes. |
| Cottidae (cottid) | Sculpin family. |
| Crest gate (Control gate) | The gate that controls water flow into a hydroelectric dam. |
| Crustacea (crustaceans) | Crustaceans form a very large group of arthropods including crabs, lobsters, crayfish, shrimp and krill. |
| Cyprinidae (cyprinid) | Minnow or carp family. |
| Dam | A concrete or earthen barrier constructed across a river and designed to control water flow or create a reservoir. |
| Diatoms | Unicellular algae, usually microscopic, that are characterized by having a cell wall of silica. |
| Diptera | True flies. |
| Draft tube | The flared passage leading vertically from a turbine to its tailrace. |
| Drawdown | The release of water from a reservoir for power generation, flood mitigation, irrigation or other water management activity. |
| Dyke | Embankment against flooding. |
| Endangered | A species facing imminent extirpation (no longer existing in the wild in Canada, but occurring elsewhere) or extinction (no longer exists). |
| Ephemeroptera | Mayfly nymphs. |
| Epilithic | Attached to rocks. |
| Epipelic | Associated with (attached to) bottom sediments in waterbodies. |
| Epiphytic | Attached to vegetation, e.g., larger filamentous algae, mosses and aquatic macrophytes. |

| | |
|---|---|
| EPT Index | A measure of the diversity of the relatively more sensitive benthic macroinvertebrate groups, Ephemeroptera, Plecoptera and Trichoptera based on the sum of all taxa within these three orders. |
| Ericaceous | Plants belonging to the Heath (Ericaceae) family; require acidic soil with pH less than 7. |
| Extirpation | Elimination of a species in the wild of a particular area (e.g., Ontario), but occurring elsewhere. |
| Family | A category used in the classification of organisms that consists of one or several similar or closely related genera. |
| Feldspar | A group of common aluminum silicate minerals that contains potassium, sodium or calcium; the most important group of rock-forming minerals, making up about 60% of the rocks of the earth's crust. |
| Fen | Peatland with water table at or just above the surface and with very slow internal drainage by seepage; more nutrient-rich than bogs; sometimes occurs as a floating mat; vegetation consists of sedges, mosses, shrubs and sometimes a sparse tree layer. |
| Forebay | The part of a dam's reservoir that is immediately upstream from the powerhouse. |
| Freshet | High flows caused by snow melt, runoff, heavy rains and/or high inflows. |
| Fulvic acids | Yellow to yellow-brown humic substances that are soluble in water under all pH conditions. |
| Gastropoda (gastropods) | Snails. |
| Generator | A machine that changes water power, steam power, or other kinds of mechanical energy into electricity. |
| Genus | A group of animals and plants having common structural characteristics distinct from those of all other groups and usually containing several species. |
| Geotechnical | Concerned with the physical properties of soil, rock and groundwater usually in relation to the design, construction and operation of engineered works. |
| Gneiss | A coarse-grained metamorphic rock commonly composed of quartz and feldspar, with lesser amounts of mica. |
| Granite | Medium to coarse grained igneous rock that is rich in quartz and potassium feldspar. |

| | |
|---|---|
| Habitat | The environment in which the life needs of a plant or animal is supplied. |
| Hardness | Related to a water's capability to produce lather from soap (the harder the water, the more difficult it is to lather soap), principally determined by the sum of calcium and magnesium. |
| Head | The difference in elevation between the water surface at the intake and tailrace. |
| Headpond | The reservoir from which the hydroelectric facility draws water flow for generation. |
| Headwater | The section of a river or stream with the highest elevation above sea level. |
| Hemiptera | True bugs. |
| Herb (Herbaceous) | A non-woody vascular plant. |
| Humic acids | A mixture of various dark-coloured organic acids that are the principal components of humic substances which are the major organic constituents of soil, peat and many upland streams. |
| Hydraulic | Of water conveyed through a pipe or channel. |
| Hyporheic | After burial. |
| Igneous | Rocks formed from the solidification of molten magma either beneath (intrusive igneous rock) or at (extrusive igneous rock) the earth's surface. |
| Insecta | Insects. |
| Ion | An atom that is either negatively or positively charged. |
| Intake | A structure which regulates the flow of water into a water-conveying conduit. |
| Lacustrine | Of lakes. |
| Lentic | Slow flowing or still water, e.g., in ponds and lakes. |
| Lithification | Process by which sediments are consolidated into sedimentary rock. |
| Littoral | The shoreward region of a body of water. |
| Lotic | Flowing water, e.g., in streams and rivers. |
| Magma | Molten or fluid material generated from rock deep within the earth that may force its way upward into the crust (as igneous rock) or onto the surface (as lava). |
| Megaloptera | Alderflies, dobsonflies and fishflies. |

| | |
|---|---|
| Metamorphic | A rock that forms from the recrystallization of igneous, sedimentary or other metamorphic rocks through pressure increase, temperature rise, or chemical alteration. |
| Mica | Silicate mineral that exhibits a platy crystal structure and perfect cleavage. |
| Mollusca | Molluscs (snails and clams). |
| Moraine | A landform generally composed of till and created by glacial action. |
| Muskeg | A term describing a type of landscape, environment, vegetation and deposit; peatland and organic terrain are equivalent terms generally referring to northern landscapes characterized by a wet environment and vegetation (e.g., Black Spruce) botanically classified as mire (subdivided into bogs and fens). |
| Nematoda (nematodes) | A phylum of pseudocoelomate (lacking a true coelum) invertebrates comprising the roundworms, characterized by a smooth narrow cylindrical unsegmented body tapered at both ends. |
| Odonata | Dragonflies and damselflies. |
| Oligochaeta (oligochaetes) | Worms. |
| Oligotrophic | Waters with a small supply of nutrients and therefore a small organic production. |
| Order | A category used in the classification of organisms that consists of one or several similar or closely related organisms. |
| Organic | Soils that have developed from accumulations of organic materials such as grasses, reeds, rushes, sedges, mosses and ferns. |
| Overburden | The soil, rock and other material which lie on top of the underlying mineral or other deposit, e.g., bedrock. |
| Peaking | Generating stations that are normally operated only to provide power during maximum load periods. |
| Peat | Partly decomposed plant material; refers to soils containing >30% organic matter by weight. |
| Pelecypoda | Bivalva; clams. |
| Penstock | A structure associated with a hydroelectric station designed to carry water from the intake to the turbine. |
| Periphyton | The organisms, collectively, that live attached to rocks, gravel, aquatic vegetation and other substrate. |

| | |
|---|---|
| pH | Indicates the balance between the acids and bases in water and is a measure of the hydrogen ion concentration in solution. |
| Photosynthesis | The process which takes place in green plants by which simple sugars are manufactured from $CO_2$, water and mineral nutrients with the aid of chlorophyll within the plant cells in the presence of light. |
| Phylum | A major division of the animal kingdom containing classes of animals. |
| Physoclistic | With swim bladder isolated from the oesophagus. |
| Physostomic | With swim bladder connected to the oesophagus by an open duct. |
| Pier | As part of a hydroelectric station, an abutment extending from the station, either upstream or downstream, and lending foundation support and directionality to water passed through the structure. |
| Piscivorous (piscivores) | Fish-feeding. |
| Planform | A body of water’s outline or morphology as viewed from above. |
| Planktivorous (planktivores) | Plankton-feeding. |
| Plankton | Minute organisms that drift or float passively with the current of a lake. |
| Plecoptera | Stonefly nymphs. |
| Pneumatic | Involving the mechanic properties associated with air or other gas pressure. |
| Potamoplankton | Drift plankton (associated with flowing water, i.e., streams and rivers). |
| Powerhouse | A primary part of a hydroelectric facility where the turbines and generators are housed and where power is produced by falling water rotating the turbine blades. |
| Quartz | A mineral: an oxide of silicon which is abundant and widespread occurring as an important constituent in many igneous, sedimentary and metamorphic rocks. |
| Reservoir | A body of water collected and stored in an artificial lake behind a dam. |
| Riparian | Of or on a watercourse bank. |
| Rotifera (rotifers) | Small, usually microscopic, pseudocoelomate (lacking a true coelum) unsegmented animals, with a ciliated region, the corona, at the anterior end, comprising the zooplankton community in waterbodies. |
| Runner | An enclosed water wheel that transforms the static and kinetic energy of the water into useful work. |

| | |
|---|---|
| Run-of-the-river | Passing all flows as they come. |
| Secchi disc | Circular disc used to measure transparency in lakes; the depth at which the pattern on the disc is no longer visible is taken as a measure of the transparency of the water. |
| Sedimentary | Rock formed by the deposition, alteration and/or compression and lithification of weathered rock debris, chemical precipitates, or organic sediments. |
| Shannon-Weiner Diversity Index | A measure of the number of species and individuals present at a given location as well as the distribution of those individuals among the various species. |
| Sluice | An open channel designed to divert excess water which could be within the structure of a hydroelectric dam or separate of the main dam (see spillway). |
| Sluice gate | Gate used to regulate the flow of water through an opening usually used to pass water over or around dams. |
| Special Concern | A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. |
| Species | A group of closely related individuals which can and normally do interbreed to produce fertile offspring. |
| *Sphagnum* | A genus containing the species of moss responsible for the production of peat – common within bog wetlands. |
| Spillway | A passageway located near or at the top of a dam through which excess water is released or “spilled” past the dam without going through the turbine(s); as a safety valve for the dam, the spillwall must be capable of discharging major floods without damaging the dam while maintaining the reservoir level below some predetermined maximum level. |
| Stop log | A gate (sometimes made from squared lumber) which can be placed into an opening to shut off or regulate the flow of water. |
| Subfamily | Taxonomic category of related organisms ranking between family and genus. |
| Swamp | Wooded mineral wetland or peatland. |
| Tailrace | A channel through which the water flows away from a hydroelectric plant following its discharge from the turbine(s). |
| Tailwater | The water from a generating station after it has passed through the turbine. |

| | |
|---|---|
| Tannins | Large polyphenolic compounds that form strong complexes with proteins and other macromolecules. |
| Till | Material derived from bedrock and overlying unconsolidated material and deposited directly by glacial ice with its characteristics dependent upon the source rock. |
| Threatened | A species likely to become endangered if limiting factors are not reversed. |
| Total dissolved solids | An index of the amount of dissolved substances in a water. |
| Total Kjeldahl nitrogen | Measure of both ammonia and organic nitrogen. |
| Total organic carbon | Composed of both dissolved and particulate organic carbon, with the bulk comprised of humic substances and partly degraded plant and animal materials. |
| Total suspended solids | Measure of particle weight obtained by separating particles from a water sample using a filter. |
| Trash rack | Bar screen with larger space openings installed to prevent logs, stumps and other larger solids from penetrating the intake. |
| Trichoptera | Caddisfly larvae. |
| Trophic | Level of organization in the food chain, e.g., producers, herbivores, carnivores. |
| Turbidity | A measure of the suspended particles such as silt, clay, organic matter, plankton and microscopic organisms in water which are usually held in suspension by turbulent flow or Brownian movement. |
| Turbine | A mechanism in an electrical generation facility which converts the kinetic and potential energy of water (in the case of hydroelectric turbines) into mechanical energy which is then used to drive a generator converting mechanical to electrical energy. |
| Vascular | Made up of vessels or ducts for conveying water. |
| Warmwater biota | Having a water temperature preference of 25°C or higher. |
| Weir | A dam in the river to stop and raise the water. |
| Young-of-the-year | Fish that hatched during the year when caught. |
| Zooplankton | That portion of the plankton consisting of animals, usually minute crustaceans and other small multicellular and single-cell animals. |

# APPENDIX A

## Fisheries Survey Reports
## (Coker and Portt, 2012a, b, c, d; 2013a, b, c, d, e)

# NEW POST CREEK
# ABITIBI RIVER
# WALLEYE SPAWNING ASSESSMENT
# 2009 AND 2010

Report date: August 3, 2012.
Update: April 22, 2013.
Prepared for: OPG, Corporate Business Development
700 University Avenue, Office H18 E17
Toronto, Ontario
M8Z 5S4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS


1.0 INTRODUCTION ........ 1
2.0 BACKGROUND ........ 2
3.0 METHODS ........ 2
4.0 RESULTS ........ 3
5.0 DISCUSSION ........ 4
6.0 CONCLUSIONS ........ 5
7.0 REFERENCES ........ 11

## 1.0 INTRODUCTION

C. Portt and Associates was retained by Ontario Power Generation Inc. (OPG), and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of lower New Post Creek and the tailrace location of a proposed generating station on the Abitibi River, located approximately 80 km north of Smooth Rock Falls, and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2009 and 2010 investigations of Walleye (*Sander vitreus*) spawning activity, undertaken in support of this project.

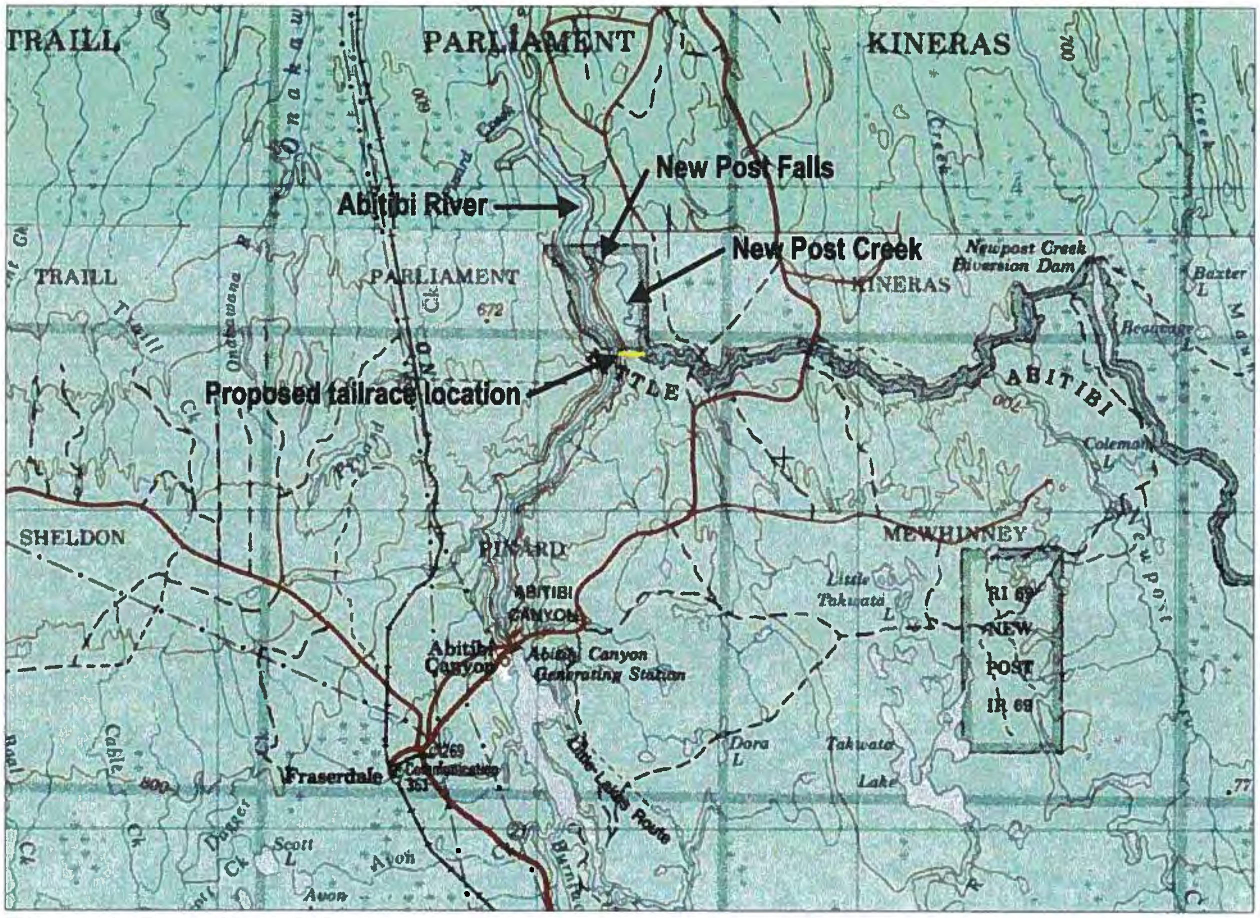



**Figure 1: Location of the proposed New Post Creek Generating Station. The yellow line indicates the approximate proposed location of the penstock that will divert water from New Post Creek to a tailrace on the Abitibi River.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a generating station that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfall located approximately 800 m upstream from its confluence with the Abitibi River. These Walleye spawning assessments examined New Post Creek between its confluence with the Abitibi River and the waterfall.

Walleye typically spawn at temperatures of 5.6 to 11.1°C over boulder to coarse gravel (Scott and Crossman, 1973), generally in water less than 1.2 m deep (Smith, 1985), and in velocities from 0.3-1.0 m/s (McMahon *et al*, 1984).

## 3.0 METHODS

Field investigations were conducted by C. Portt and Associates staff (George Coker and Jim Reid) on May 19 - 22, 2009, and May 3, 2010. David Iserhoff (TTN) assisted on May 3, 2010. Additional field observations of water temperature in the Abitibi River and New Post Creek during April and early May were provided by OPG staff to aid in determining the timing for the field investigation.

The section of New Post Creek downstream of the waterfall was examined during daylight hours on the first day of field work each year, in order to identify safety hazards, access routes, and potential Walleye spawning habitat. In 2009 the Abitibi River in the vicinity of the proposed tailrace was also examined, but because it was found that there was no potential Walleye spawning habitat at that location, it was not examined further. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to locate and identify key features. Digital photographs were taken at selected GPS referenced locations.

In 2009 a fyke net (4.5 cm stretch multi-filament mesh, 76 x 109 cm box, 6 hoops, two funnels, 2.13 m long wings plus a 33.5 m long lead of 18 cm stretch multifilament mesh) and two panels (each 30 m long and 1.8 m deep) of 4 inch stretched-mesh monofilament gillnet, were set during the day and overnight immediately downstream of the potential Walleye spawning area, in an attempt to catch spawning fish (Figure 2). During the 2010 field work two gillnets were set immediately downstream of the potential Walleye spawning area during daylight hours only (Figure 2). The 2010 gillnets were 53.34 m long, 1.83 m deep, and composed of seven 7.6 m long panels of 2, 2.5, 3, 3.5, 4, 5 and 6 inch stretched-mesh monofilament mesh joined together in order of size.

In 2009, spawning observations were conducted downstream of New Post Creek Falls after nightfall on May 20, at approximately 10:30 pm. In 2010, spawning observations were conducted downstream of New Post Creek Falls after nightfall on May 3, between 10:00 and 10:45 pm. A 1.5 million candlepower spotlight was used to search for Walleye along the edge of the river. At night, walleye can be differentiated from other fishes primarily by the light reflected by the *tapetum lucidum* of their eyes, as well as the white tip of the lower caudal lobe.

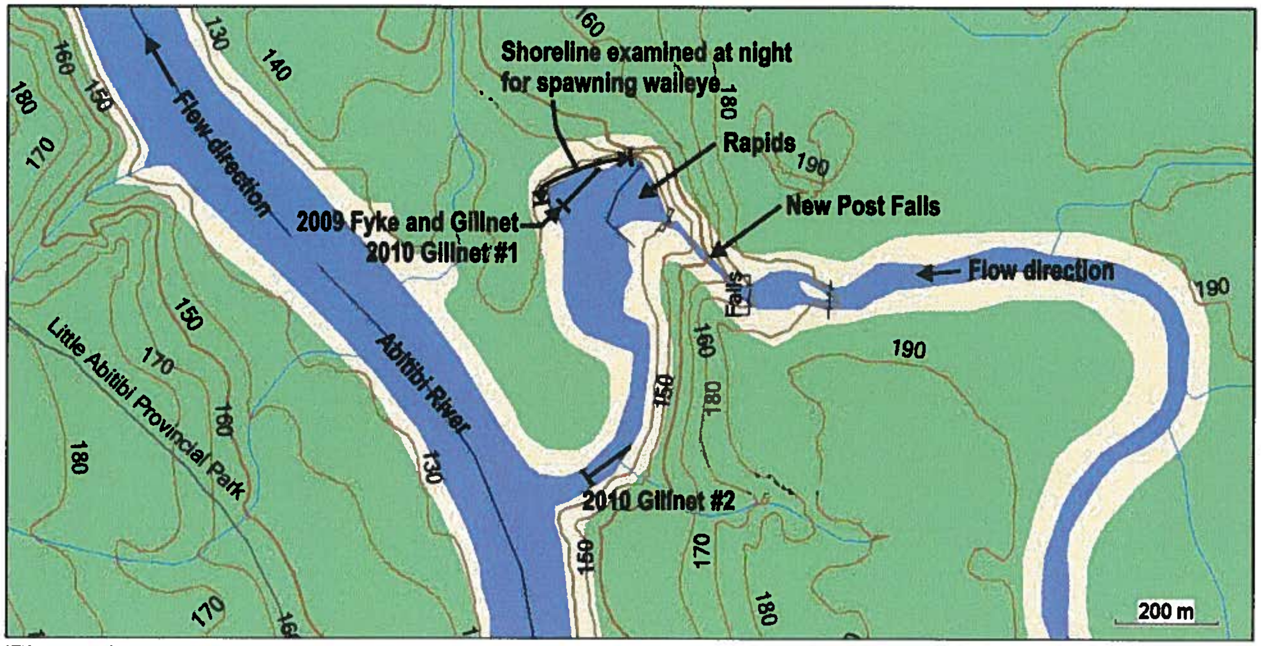



**Figure 2: The lower New Post Creek study area, showing the 2009 and 2010 net set locations, the shoreline section searched at night for spawning walleye, and the location of the New Post Falls and associated downstream rapids.**

## 4.0 RESULTS

2009

The vicinity of the proposed tailrace on the Abitibi River is deep, with low flow velocities and does not appear to be suitable for Walleye spawning (Photograph 1). This area provides similar habitat to most of the adjacent sections of Abitibi River.

The water temperature downstream of New Post Creek Falls ranged from 4.9 – 5.2°C over May 21 and 22, 2009. On May 13 the temperature in New Post Creek at the upstream road crossing (Figure 1) was measured at 5.8°C by OPG staff, but cooler weather occurred for several days prior to the start of the field investigation, and continued through the field investigation period. There is habitat that appears to be suitable for Walleye spawning, based on the substrate and water velocities, in New Post Creek downstream from the falls (Photographs 2 and 3, Figure 2). Walleye were not observed in this area during the night observations on May 20, however, the water was very turbid and this limited the potential to observe Walleye. The overnight (18 hours) hoop net set, lifted on May 21, 2009, resulted in the capture of one male Walleye in spawning condition. The gillnet was set for two short sets (1.5 and 6 hours) during daylight hours on May 21, capturing one large, nearly spent, female Walleye in the first set, and two large male White Suckers (*Catostomus commersonii*) in spawning condition in the second set. The gillnet was then reset overnight (14.5 hours) and lifted on May 22, capturing one very large male

Walleye in spawning condition. The net set location ranged in depth from approximately 1 m near shore, to approximately 6 m at the offshore end of net. All captured fish were alive and vigorous and were released immediately.

**2010**

The water temperature downstream of New Post Creek Falls was 11.9°C at 13:46 on May 3, 2010. At approximately the same time, the Abitibi River water temperature was 6.9°C. There is habitat that appears to be suitable for Walleye spawning, based on the substrate and water velocities, in New Post Creek downstream from the falls (Photographs 4 and 5; Figure 2). Three small Walleye were observed along the shore of this area during the night observations on May 3, however, the water was very turbid and this limited the potential to observe Walleye. Gillnet #1 was set from 14:02 to 16:43 on May 3, and captured 6 male Walleye, but no females, as well as 9 Longnose Sucker (*Catostomus catostomus*), 3 White Sucker (*Catostomus commersonii*), and 1 Northern Pike (*Esox lucius*). All the Walleye, as well as some of the male White and Longnose Suckers, expelled gamets when handled, indicating that they were in spawning condition. Gillnet #2 was set from 14:50 to 17:18, but no fish were captured. All captured fish were alive and vigorous and were released immediately.

## 5.0 DISCUSSION

2009 and 2010 were very different in terms of spring streamflow and warming pattern. 2009 was a very cool spring with high flows in New Post Creek (204.66 $m^3/s$), while 2010 was a warmer than normal spring with low flows (34.6 $m^3/s$). There was about a month difference in when the water temperature became suitable for Walleye spawning between these two years.

**2009**

The low number of Walleye in spawning condition captured in 2009 may be due to the timing of the investigations, which may have been near the end of the spawning run, as suggested by the almost spent female Walleye captured and the presence of White Suckers in spawning condition. White Suckers normally spawn immediately after Walleye. The rise in spring water temperature was delayed by several weeks in 2009 by colder than usual weather, and it is possible that peak Walleye spawning occurred when water temperature was briefly within the lower limit for spawning, approximately one week prior to the field visit.

**2010**

Despite the fact that the water temperature was at the upper end of the typical temperature range preferred by spawning Walleye, the 2010 observations were likely near the beginning of the spawning run, due to the earlier than expected onset of spawning temperatures. Evidence for this is the fact that all three of the spawning fish observed at night were small, and likely males, and that all the Walleye captured by gillnet were small un-spent males in spawning condition. Male Walleye are known to arrive on the spawning grounds first (Scott and Crossman, 1973). The lower than usual flows in New Post Creek in the spring of 2010, combined with unseasonably warm air temperatures, resulted in water temperatures reaching the preferred spawning temperature for Walleye about a month earlier than in 2009. It is speculated that this early and rapid warming resulted in spawning temperatures being reached before the Walleye were physiologically ready to spawn, and that, as a result, Walleye spawned at higher than usual temperatures.

## 6.0 CONCLUSIONS

Walleye spawning does occur in the lower section of New Post Creek, downstream of the waterfalls. Although visual inspection of the site was largely ineffective because of the turbid water conditions, a few Walleye were observed at night in the spawning area in 2010, and Walleye in spawning condition were captured by netting in 2009 and 2010. The lower flows within New Post Creek in 2010 (Photograph 5) likely resulted in better habitat conditions for spawning walleye than the higher flows observed in 2009 (Photograph 3). Walleye spawning is not a concern in the Abitibi River in the vicinity of the tailrace of the proposed generating station, as there does not appear to be suitable spawning habitat at that location, and the habitat that occurs there is common and widespread in this part of the river.

Photograph 1. View upstream along the east side of the Abitibi River, in the vicinity of the proposed tailrace. May 20, 2009.


Photograph 2. View along shoreline searched at night for spawning walleye. May 20, 2009.


Photograph 3. View of a portion of the rapids and complex currents in habitats below the New Post Creek Falls during the previous walleye spawning investigation in 2009. May 20, 2009, with a flow of 204.66 $m^3/s$.

Photograph 4. View of portion of shoreline (foreground) searched at night for spawning walleye. May 3, 2010, with a flow of 34.6 $m^3/s$.


Photograph 5. View of a portion of the rapids and complex currents in habitats below the New Post Creek Falls in 2010. May 3, 2010, with flow of 34.6 $m^3/s$.

## 7.0 REFERENCES

McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984, "Habitat suitability information: walleye", U.S. Dept. Int. Fish Wildl. Serv., FWS/OBS-82/10.56.

Scott, W. B., and E. J. Crossman. 1973, "Freshwater fishes of Canada", Bull. Fish. Res. Bd. Can. 184, 966p.

Smith, C.L. 1985, "The inland fishes of New York State", New York State Department of Environmental Conservation, 522 p.

# NEW POST CREEK
# ABITIBI RIVER
# WALLEYE SPAWNING ASSESSMENT
# 2011

Report date: **November 21, 2012.**
Update: April 22, 2013.

Prepared for SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION .......... 1
2.0 BACKGROUND .......... 2
3.0 METHODS .......... 2
4.0 RESULTS .......... 3
5.0 CONCLUSIONS .......... 8
6.0 REFERENCES .......... 8

## 1.0 INTRODUCTION

C. Portt and Associates and SENES Consultants Limited were retained by Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek generating station. The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2011 investigation of Walleye (*Sander vitreus*) spawning activity, which is the third year of Walleye spawning investigations undertaken in support of this project.

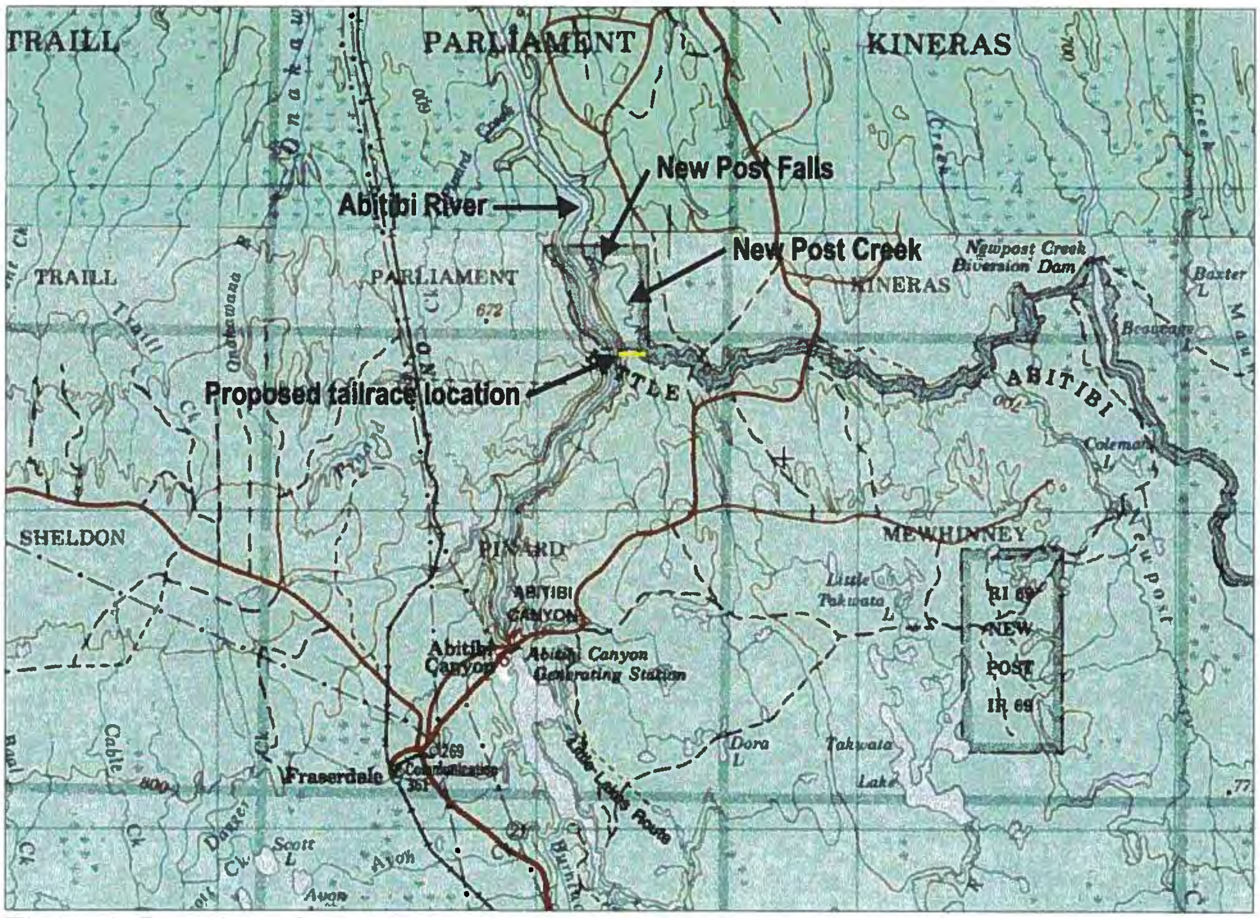



**Figure 1: Location of the proposed New Post Creek Generating Station. The yellow line indicates the approximate proposed location of the penstock, that will divert water from New Post Creek to a tailrace on the Abitibi River.**

## 2.0 BACKGROUND

The OPG and TTN Partnership is proposing to construct a generating station that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek. That section includes a high falls, located approximately 800 m upstream from the confluence with the Abitibi River. This Walleye spawning assessment examined New Post Creek between its confluence with the Abitibi River and the waterfall.

Walleye typically spawn at temperatures of 5.6 to 11.1°C over boulder to coarse gravel (Scott and Crossman, 1973), generally in water less than 1.2 m deep (Smith, 1985), and in velocities from 0.3-1.0 m/s (McMahon *et al*, 1984).

## 3.0 METHODS

Field investigations for this project were conducted by C. Portt and Associates staff (George Coker and Jim Reid) and assisted by George Ross (SENES) on May 14, 2011. Additional field observations of water temperature in the Abitibi River and New Post Creek during late April and early May were provided by OPG staff to aid in determining the timing for the field investigation.

The section of New Post Creek downstream of the waterfalls was examined during daylight hours on May 14 in order to identify safety hazards, access routes, and potential Walleye spawning habitat. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to locate and identify key features. Digital photographs were taken at selected GPS referenced locations. Four gillnets were set for approximately four hours during daylight on May 14, 2011 (Figure 2). Each gillnet was 53.34 m long, 1.83 m deep, and composed of seven 7.6 m long panels of 51 mm (2 in), 64 mm (2.5 in), 76 mm (3 in), 89 mm (3.5 in), 102 mm (4 in), 127 mm (5 in) and 152 mm (6 in) monofilament mesh joined together in order of size.

Spawning observations were conducted downstream of New Post Creek Falls after nightfall on May 14, between 10:00 and 10:45 pm (Figure 2). A 1.5 million candlepower spotlight was used to search for Walleye along the edge of the river. At night, Walleye can be differentiated from other fishes primarily by the light reflected by the *tapetum lucidum* of their eyes, as well as the white tip of the lower caudal lobe.

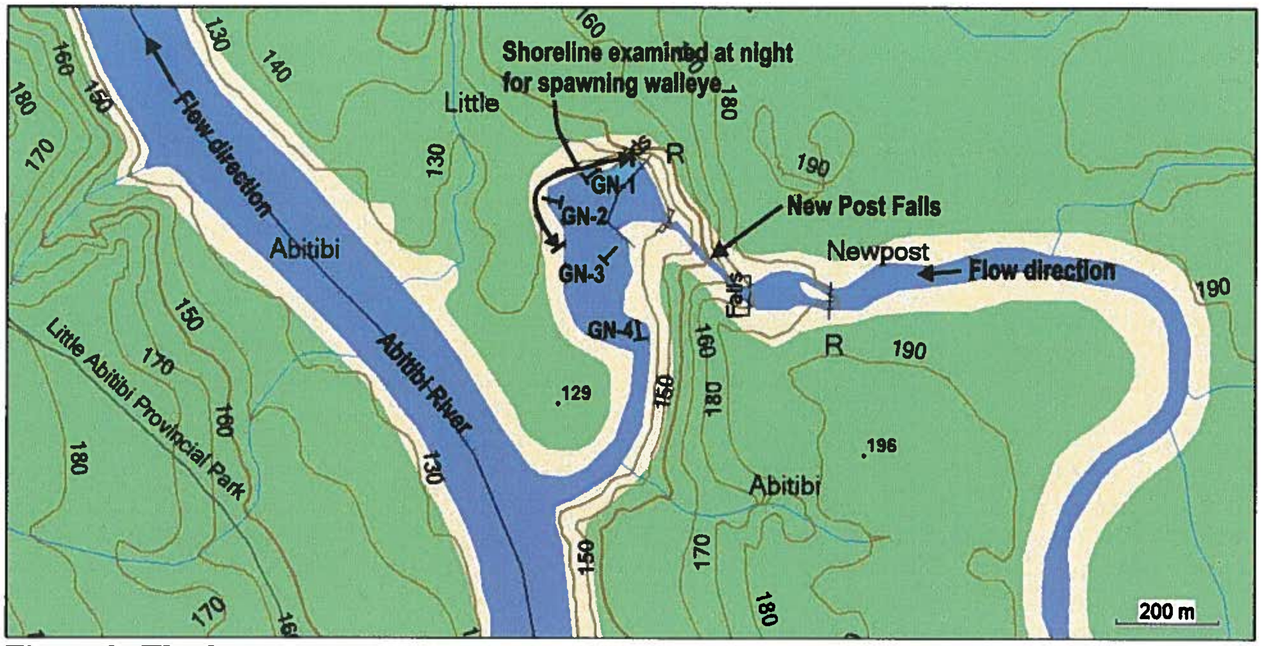



**Figure 2: The lower New Post Creek study area, showing the gillnet set locations (GN-1, GN-2, GN-3 and GN-4) and the shoreline section searched at night for spawning Walleye. May 14, 2011.**

## 4.0 RESULTS

The water temperature downstream of New Post Creek Falls was 7.9°C at 16:38 on May 14, 2011. At approximately the same time, the Abitibi River water temperature was 7.6°C.

The gillnet catch is provided in Table 1. All the Walleye, as well as the White and Longnose Suckers identified as male, expelled gametes when handled, indicating that they were in spawning condition. The Walleye were captured in gillnets #1 and #2 (Figure 2), which were located in the shallower, faster flowing, habitats associated with the shoreline searched for Walleye at night. All captured fish were alive and vigorous and were released immediately.

**Table 1. Gillnet catch in New Post Creek. May 14, 2011.**

| | Gillnet #1 | Gillnet #2 | Gillnet #3 | Gillnet #4 |
|---|---|---|---|---|
| Set time | 13:00-16:47 | 13:09-16:56 | 13:19-17:12 | 13:30-17:28 |
| | | | | |
| Walleye (*Sander vitreus*) | 2 males | 1 female | | |
| Longnose Sucker (*Catostomus catostomus*) | 1 male | | 1 | |
| White Sucker (*Catostomus commersonii*) | | 2 (1 male) | 3 males | |
| Northern Pike (*Esox lucius*) | 1 | | 6 | |
| Mooneye (*Hiodon tergisus*) | | | | 1 |

As observed during all three Walleye spawning assessments (2009, 2010 and 2011), there is habitat that appears to be suitable for Walleye spawning, based on the substrate type, water depth and water velocities, in New Post Creek downstream from the falls (Photographs 1 and 2). Walleye were observed along the shore of this area during the night observations in 2010 when the flow was unusually low and the water was marginally clear (Photograph 3), however, the water was very turbid in 2009 (Photograph 4) and 2011 (Photographs 1 and 2), when flows were higher, and no spawning Walleye were observed.

**Photograph 1. Upstream view of cobble shoreline below New Post Creek falls that was examined at night for spawning Walleye. May 14, 2011, with flow of 166.6 $m^3/s$.**

**Photograph 2. Downstream view of cobble shoreline below New Post Creek falls that was examined at night for spawning Walleye. May 14, 2011, with flow of 166.6 $m^3/s$.**

**Photograph 3. View of a portion of the rapids and complex currents in habitats below the New Post Creek Falls during the 2010 Walleye spawning investigation. May 3, 2010, with flow of 34.6 $m^3/s$.**

Photograph 4. View of a portion of the rapids and complex currents in habitats below the New Post Creek Falls during the 2009 walleye spawning investigation. May 20, 2009, with flow of 204.66 $m^3/s$.

## 5.0 CONCLUSIONS

In 2011, as in 2009, visual inspection of the site was ineffective because of the turbid water conditions. In 2010 when the water in New Post Creek was somewhat less turbid during the Walleye spawning period, a few Walleye were observed in very shallow water along the shore in the suspected spawning area. Walleye in spawning condition were captured in the vicinity of the suspected spawning area by gillnetting in 2011, as they were in 2009 and 2010.

Based on the capture of ripe Walleye in all three years of observations, observations of Walleye in suitable spawning habitats in 2010, and the presence of suitable habitats, it is concluded that Walleye spawning does occur in the lower section of New Post Creek, downstream of the waterfalls. The lower flows within New Post Creek in 2010 (Photograph 3) likely resulted in better habitat conditions for spawning Walleye than what occurred during the higher flows observed in 2009 (Photograph 4) and 2011 (Photographs 1 and 2).

## 6.0 REFERENCES

McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984, "Habitat suitability information: walleye", U.S. Dept. Int. Fish Wildl. Serv., FWS/OBS-82/10.56.

Scott, W. B., and E. J. Crossman. 1973, "Freshwater fishes of Canada", Bull. Fish. Res. Bd. Can. 184, 966p.

Smith, C.L. 1985, "The inland fishes of New York State", New York State Department of Environmental Conservation, 522 p.

# NEW POST CREEK
# ABITIBI RIVER
# LAKE WHITEFISH SPAWNING ASSESSMENT
# 2009, 2010 AND 2011

Report date: November 20, 2012.
Update: April 23, 2013.
Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION ........ 1
2.0 BACKGROUND ........ 2
3.0 METHODS ........ 2
4.0 RESULTS ........ 8
5.0 CONCLUSIONS ........ 10
6.0 REFERENCES ........ 11

# 1.0 INTRODUCTION

C. Portt and Associates, as a part of an environmental assessment team lead by SENES Consultants Limited, was retained by Ontario Power Generation Inc. (OPG), who are in partnership with Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek generating station. The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the combined results of the 2009 and 2010 investigations undertaken directly for OPG, and the 2011 investigation undertaken as part of the SENES team, to assess Lake Whitefish (*Coregonus clupeaformis*) spawning activity.

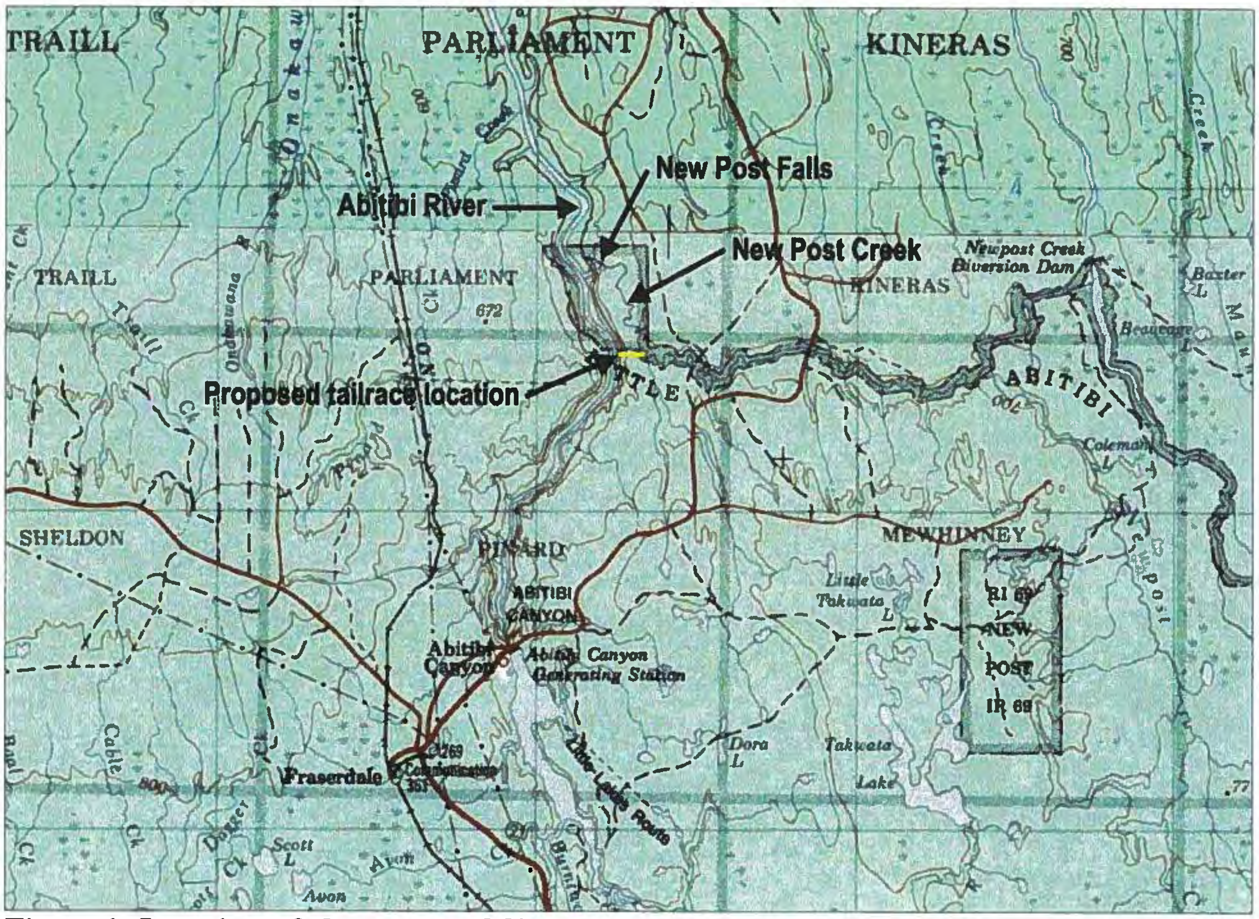



**Figure 1: Location of the proposed New Post Creek Generating Station. The yellow line indicates the approximate proposed location of the penstock that will divert water from New Post Creek to a tailrace on the Abitibi River.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a generating station that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek. That section includes a high falls located approximately 800 m upstream from the confluence with the Abitibi River. Flow through the powerhouse would enter the Abitibi River approximately 2.8 km upstream from its confluence with New Post Creek. These Lake Whitefish spawning assessments examined New Post Creek between its confluence with the Abitibi River and the waterfall, as well as the Abitibi River in the vicinity of the tailrace of the proposed generating station.

Lake Whitefish in Canada typically spawn from late September to December, beginning at a temperature of 7.8°C, and peaking at lower temperatures (Scott and Crossman, 1973). Bégout Anras *et al* (1999) found that intense spawning occurred from less than 6°C down to 2°C over two years of observations. Substrate type varies widely, and some populations spawn in rivers, while others spawn in lakes (Becker, 1983; Scott and Crossman, 1973). Scott and Crossman (1973) report that spawning usually occurs in water less than 7.8 m deep, while Becker (1983) gives a range from 2 to 18 m. Lake Whitefish in the Columbia River spawn at depths >0.5 m (Roberge *et al.* 2002). Spawning occurred in the Peace River on a shelf 0.6 to 1.0 m deep, and in the Athabasca River the most common spawning depth was 2.0 to 2.5 m (Evans *et al.* 2002). <u>Fishes of Alberta</u> (Nelson and Paetz, 1992) indicates spawning depths of 2 to 4 m, but does not specify whether this is for riverine or lacustrine populations. <u>The Freshwater Fishes of Manitoba</u> (Stewart and Watkinson, 2004) reports spawning depths of 1 to 3 m, but again does not specify whether this is for riverine or lacustrine populations. <u>Inland Fishes of Washington</u> (Wydoski and Whitney, 2003) reports an average spawning depth of 3 m for a boreal lake. Becker (1983) states that female Lake Whitefish rise to the surface while emitting spawn, accompanied by one or two males discharging milt. The broadcast eggs settle to the bottom and receive no parental care (Becker, 1983). The eggs are 2.95 ± 0.01 mm in diameter, and hatch during the early spring (Becker, 1983).

## 3.0 METHODS

Observations of water temperature in the Abitibi River and New Post Creek during October each year were provided by OPG staff to aid in determining the timing for the field investigations. Water temperature was determined during the field work with a Hanna Instruments Checktemp 1 thermometer that is routinely checked for accuracy at known temperatures (i.e. water at the freezing point and against a high-quality precision mercury thermometer).

The Abitibi River in the vicinity of the proposed tailrace, and the section of New Post Creek downstream of the waterfalls, was examined during daylight hours on the first day of field work each year, in order to identify safety hazards, access routes, and potential Lake Whitefish spawning habitat. No areas upstream of the waterfalls in New Post Creek were examined for

Lake Whitefish, as these areas are inaccessible to Lake Whitefish from the Abitibi River, and it is not thought that an endemic population of Lake Whitefish would exist in the available habitats in New Post Creek upstream or downstream of the proposed intake location. Regardless, one gillnet was set overnight in New Post Creek in 2009 near the proposed intake location, primarily to investigate if any fish could be captured upstream of the waterfalls. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to locate and identify key features. Digital photographs were taken at selected GPS referenced locations.

**2009**

Field investigations were conducted on October 26 - 28, 2009, by C. Portt and Associates staff (George Coker, Jim Reid), and assisted by Damien Sutherland (TTN). An Aquaview™ video system was employed on October 28, 2009, to search for Lake Whitefish immediately below the rapids in New Post Creek during daylight hours (Figure 2). The Aquaview™ system is comprised of a compact underwater video camera and a small transportable video monitor, connected via a 150 foot (45.7 m) transmission cable.

Two gillnets (GN) were set in New Post Creek near its mouth in an attempt to catch Lake Whitefish entering the creek to spawn. GN 1 was set about 630 m upstream from the creek mouth at the base of the rapids below the waterfalls, where Lake Whitefish would be most likely to spawn, and GN 2 was set about 140 m upstream from the creek mouth (Figure 3). As a precaution against catching too many fish, the initial net set was approximately three hours long to gauge fish abundance, and each gillnet was checked at least once per day after that. GN 1 was fished continually from 12:47 on October 26 to 12:55 on October 28, 2009. GN 2 was fished from 12:56 on October 26 to 9:24 on October 27, 2009, and then was moved to station GN 3 in a 3 m deep pool near the intake location where it was fished overnight (Figure 3) in an attempt to catch any fish upstream of the waterfalls. Each gillnet was 53.34 m long, 1.83 m deep, and composed of seven 7.6 m long panels of 51 mm (2 in), 64 mm (2.5 in), 76 mm (3 in), 89 mm (3.5 in), 102 mm (4 in), 127 mm (5 in) and 152 mm (6 in) monofilament mesh, joined together in order of size. GN 1 was set in about 2 m of water over patchy substrates of sand, cobble, and a few scattered boulders, in an area with some current near the base of the rapids where it was thought that Lake Whitefish may spawn (Photograph 1). GN 2 was set in about 3 m of water and extended from shore to approximately half way across the creek channel, to catch Lake Whitefish that might be moving up the creek to potential spawning locations.

**2010**

Field investigations were conducted on October 19 - 20, 2010, by C. Portt and Associates staff (George Coker, Jim Reid), and assisted by Kevin Ross (TTN). An Aquaview™ video system was employed on October 19, 2010, to search for Lake Whitefish downstream of the waterfalls in New Post Creek during daylight hours. The deep pool at the base of the falls, and two pools within the rapids, were checked by suspending the camera from a buoy that was floated within the pools (Figure 2). New Post Creek downstream of the rapids at the base of the falls was checked with the camera suspended from a boat, using GPS to record the track followed (Figure 2). Initially the boat was under power to check the area at the base of the rapids, but for the length of creek from the rapids to the Abitibi River, the motor was shut off and the boat was allowed to drift slowly with the current (Figure 2).

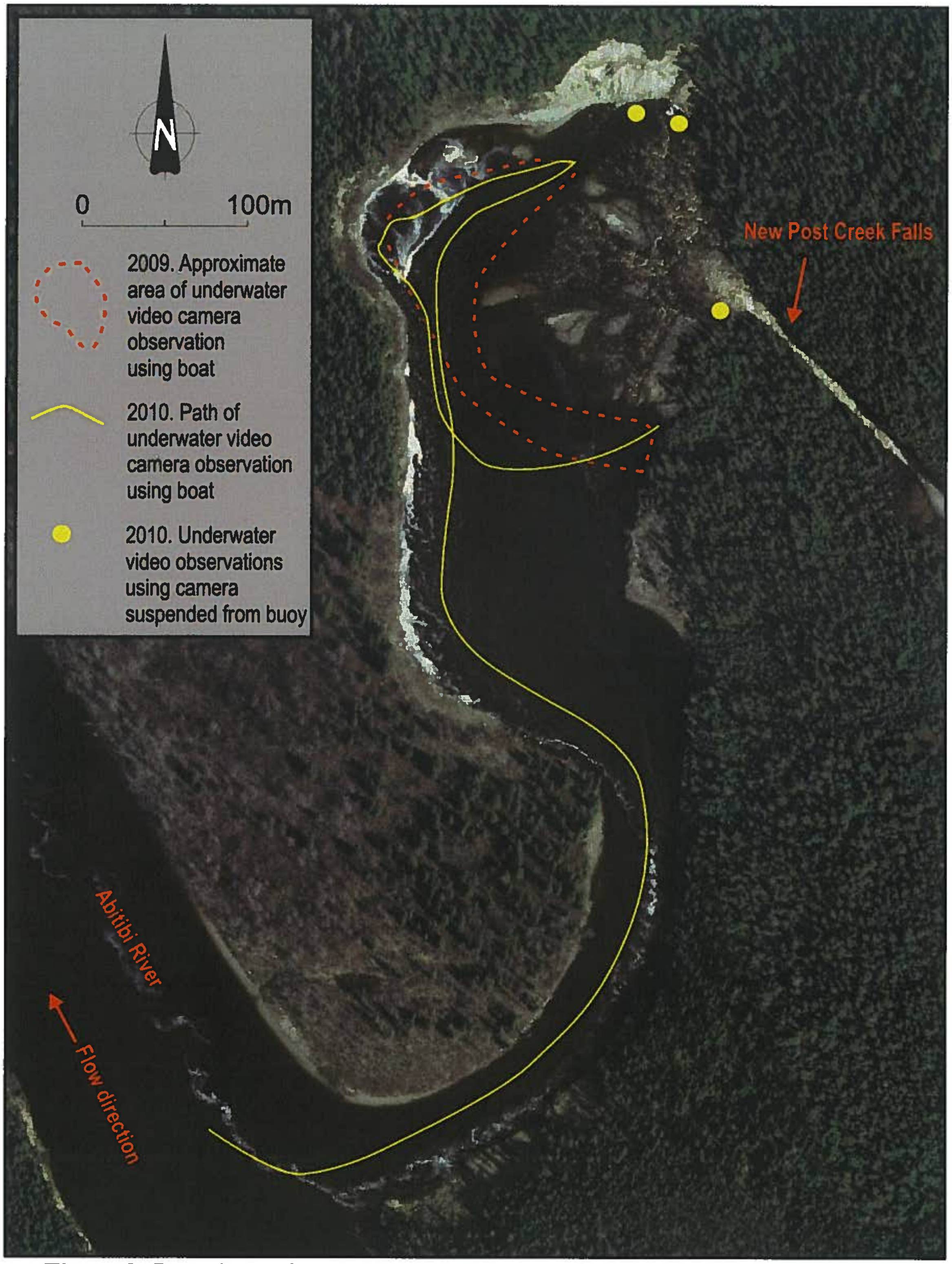



**Figure 2: Locations of underwater video examinations for Lake Whitefish at New Post Creek. October 28, 2009, and October 19, 2010.**

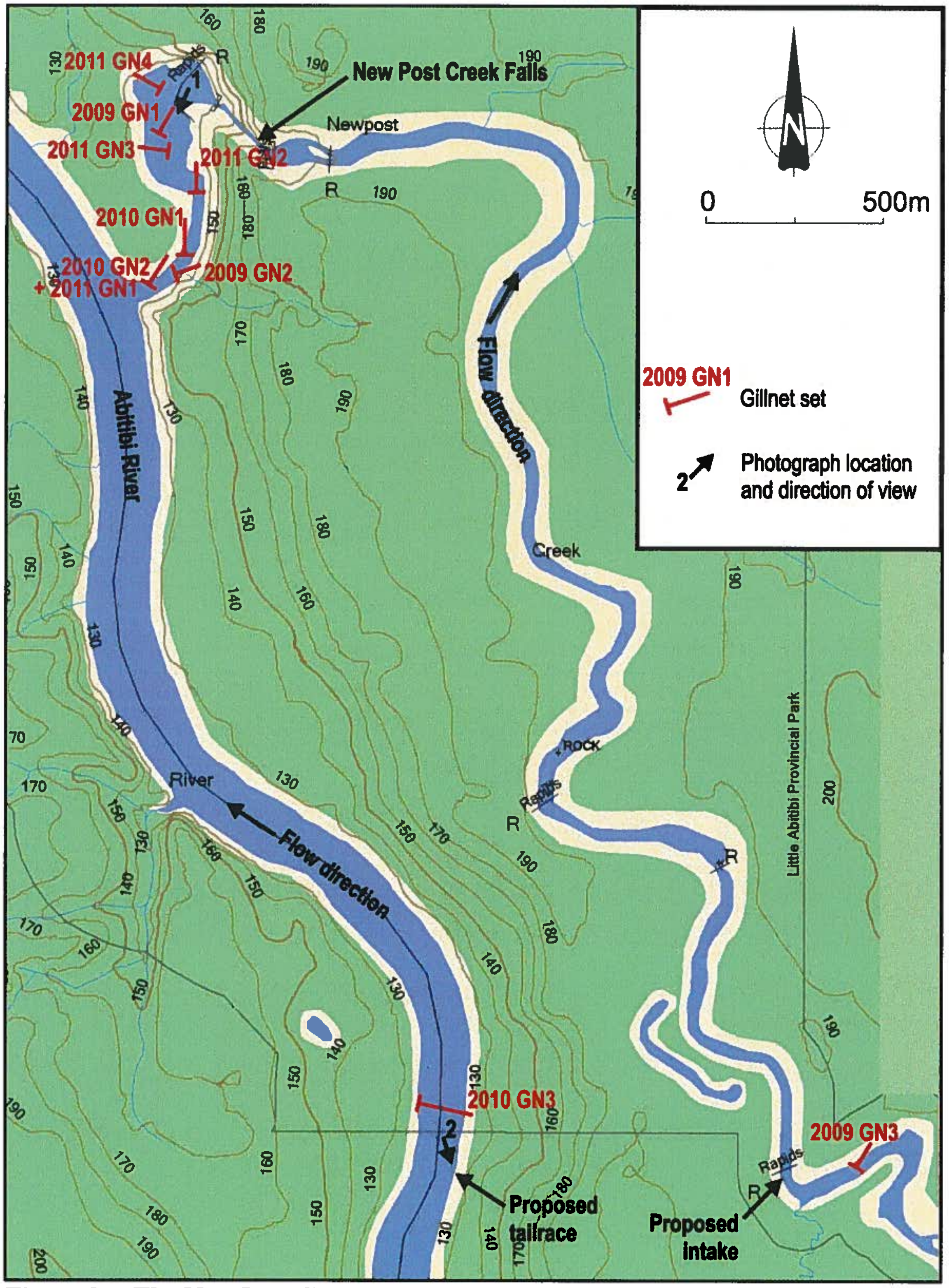



**Figure 3: The New Post Creek study area, showing the location of gillnet sets and photographs. October 26 - 28, 2009, October 19 - 20, 2010, and October 31 - November 2, 2011.**

**Photograph 1. View downstream from the base of the rapids below the waterfalls on New Post Creek, where GN 1 was set from October 26-29, 2009.**

Gillnetting was conducted at three locations on October 19 – 20, 2010. Two GN were set in New Post Creek near its mouth in an attempt to catch Lake Whitefish in spawning condition that may be moving into New Post Creek. GN 1 was set about 305 m upstream from the creek mouth, downstream from where the creek deepens to greater than 2 m, and GN 2 was set about 185 m upstream from the creek mouth (Figure 3). GN 1 and 2 were set from shore to a maximum water depth of 4 m, over substrates of sand and clay. A third gillnet (Figure 3: 2010 GN 3) was set in the Abitibi River near the proposed tailrace location (Photograph 2). GN 1 and 2 were each 76.2 m long, 1.83 m deep, and composed of 102 mm (4 in) stretch monofilament mesh. GN 3 was 121.9 m long, 1.83 m deep, and composed of 102 mm (4 in) stretch monofilament mesh. GN 3 was set from shore to a maximum water depth of 9 m, over substrates of sand and clay and wood debris. As a precaution against catching too many fish, each net was initially set for approximately four hours, lifted, and then set for approximately 18 hours (overnight).

**Photograph 2. View along the Abitibi River shoreline in the vicinity of the proposed tailrace. October 28, 2009.**

**2011**

Field investigations were conducted on October 31 - November 3, 2011, by C. Portt and Associates staff (George Coker), with George Ross (TTN) and Kevin Ross (TTN) providing assistance. Gillnetting was conducted at four locations (Figure 3) from October 31 to November 2, 2011. GN 1 was set in 4 m of water in New Post Creek near its mouth in an attempt to catch Lake Whitefish in spawning condition that might be moving into New Post Creek. GN 2 was set in 3 m of water in an area of little current that could be used as a resting area for Lake Whitefish on their spawning run. GN 3 was set in 3 m of water with some current at the approach to the rapids below the falls, in the vicinity where Lake Whitefish would be expected to spawn. GN 4 was set in 2 m of water with some current at the base of the rapids below the falls, in the vicinity where Lake Whitefish would be expected to spawn. Each gillnet set consisted of two linked 25 m long standard MNR river index nets (RIN), resulting in a 50 m long and 0.9 m high monofilament net, of equal portions of 51 mm (2 in), 64 mm (2.5 in), 76 mm (3 in), 89 mm (3.5 in), 102 mm (4 in), and 127 mm (5 in) stretched mesh. An underwater video system was not used to look for Lake Whitefish in 2011.

# 4.0 RESULTS

**2009**

The water temperature in the Abitibi River ranged from 7.1°C on October 26, to 6.7°C on October 28, 2009. New post Creek at its mouth ranged from 2.2°C on October 26, to 2.5°C on October 28, 2009. The water temperature in New Post Creek in the vicinity of the proposed intake was 2.0°C on October 27, 2009. These temperatures are within the range for Lake Whitefish spawning, however, no Lake Whitefish were captured, and the catch of other fish species was low (Table 1). Lake Whitefish were not observed with the underwater video system. As confirmation that the timing of this field investigation was appropriate, Lake Whitefish were observed at a water temperature of 5.5°C on October 29, 2009, at a known Lake Whitefish spawning location south of Timmins on the Mattagami River.

**Table 1: Gillnet catches. New Post Creek. October 2009.**

| | Set 1 | Set 2 | Set 3 |
|---|---|---|---|
| **Gillnet 1** | Oct 26, 12:47-15:37<br>1 northern pike<br>(*Esox lucius*) | Oct 26, 15:49-Oct 27, 9:36<br>1 northern pike<br>1 longnose sucker<br>(*Catostomus catostomus*) | Oct 27, 9:47-Oct 28, 12:55<br>no catch |
| **Gillnet 2** | Oct 26, 12:56-15:26<br>no catch | Oct 26, 15:59-Oct 27, 9:24<br>1 sauger<br>(*Sander canadensis*) | |
| **Gillnet 3** | Oct 27, 16:10-Oct 28, 10:00<br>no catch | | |

The vicinity of the proposed tailrace on the Abitibi River is deep, with substrates of fine sand and clay with patches of coarser material along the shore (Photograph 2). It appeared indistinguishable from adjacent sections of the Abitibi River, and unsuitable for Lake Whitefish spawning.

**2010**

The water temperature in the Abitibi River was 9.1°C on October 19 and 8.7°C on October 20, 2010. New post Creek at its mouth was 5.8°C on October 19 and 4.8°C on October 20, 2010. The temperatures in New Post Creek were within the range for Lake Whitefish spawning, while those taken in the Abitibi River were about 1.3 degrees higher than what is generally thought for the initiation of spawning. No Lake Whitefish were captured, and the catch of other fish species was low (Table 2), similar to the low numbers of fish captured by gillnet during the Lake Whitefish spawning investigation in October 2009. One unidentified sucker, but no Lake Whitefish, was observed with the underwater video system.

As was observed in 2009, in 2010 the location of the proposed tailrace on the Abitibi River becomes deep a short distance from shore, with substrates of fine sand and clay with patches of coarser material along the shore (Photograph 2). It appeared indistinguishable from adjacent sections of the Abitibi River, and unsuitable for Lake Whitefish spawning.

**Table 2: Gillnet catches. New Post Creek and Abitibi River. October 2010.**

| | Set 1 | Set 2 |
|---|---|---|
| **Gillnet 1** | Oct 19, 10:26-14:44<br>no catch | Oct 19, 14:52-Oct 20, 9:45<br>1 northern pike |
| **Gillnet 2** | Oct 19, 10:33-14:55<br>no catch | Oct 19, 15:01-Oct 20, 10:05<br>no catch |
| **Gillnet 3** | Oct 19, 11:00-15:11<br>1 goldeye (*Hiodon alosoides*) | Oct 19, 15:30-Oct 20, 10:32<br>1 longnose sucker<br>2 walleye (*Sander vitreus*)<br>1 shorthead redhorse (*Moxostoma macrolepidotum*) |

**2011**

The water temperature in the Abitibi River ranged from 8.8°C on October 31, to 8.5°C on November 3, 2011. New Post Creek at its mouth ranged from 4.4°C on October 31, to 4.9°C on November 2, 2011. The temperatures in New Post Creek were within the range for Lake Whitefish spawning, while those taken in the Abitibi River were about one degree higher than what is generally thought for the initiation of spawning. No Lake Whitefish were captured, and the catch of other fish species was low (Table 3). However, catch was somewhat higher in 2011 than in previous years, but this may be due to the greater range of gillnet mesh sizes used in 2011.

**Table 3: Gillnet catches. New Post Creek. October - November 2011.**

| | Set 1 | Set 2 | Set 3 |
|---|---|---|---|
| **Gillnet 1** | Oct 31, 14:27-Nov 1, 9:20<br>3 longnose sucker<br>1 yellow perch<br>(*Perca flavescens*)<br>1 walleye | Nov 1, 9:26-Nov 2, 10:55<br>3 longnose sucker | Nov 2, 11:07-Nov 3, 9:45<br>2 longnose sucker<br>1 sauger |
| **Gillnet 2** | Oct 31, 14:33-Nov 1, 9:38<br>3 longnose sucker<br>2 northern pike | Nov 1, 9:55-Nov 2, 11:10<br>1 longnose sucker<br>1 sauger<br>1 burbot<br>(*Lota lota*) | Nov 2, 11:23-Nov 3, 10:02<br>1 longnose sucker<br>1 burbot<br>1 northern pike |
| **Gillnet 3** | Oct 31, 14:43-Nov 1, 9:57<br>1 longnose sucker<br>1 white sucker<br>(*Catostomus commersonii*) | Nov 1, 10:04-Nov 2, 11:24<br>No catch | Nov 2, 11:28-Nov 3, 10:17<br>2 longnose sucker<br>1 walleye<br>2 white sucker |
| **Gillnet 4** | Oct 31, 14:59-Nov 1, 10:06<br>1 northern pike | Nov 1, 10:11-Nov 2, 11:30<br>No catch | Nov 2, 11:35-Nov 3, 10:31<br>1 northern pike |

As was observed in 2009 and 2010, in 2011 the location of the proposed tailrace on the Abitibi River becomes deep a short distance from shore, with substrates of fine sand and clay with patches of coarser material along the shore (Photograph 2). It appeared indistinguishable from adjacent sections of the Abitibi River, and unsuitable for Lake Whitefish spawning.

## 5.0 CONCLUSIONS

Lake Whitefish spawning is likely not a concern in the Abitibi River in the vicinity of the tailrace of the proposed generating station, as there does not appear to be suitable spawning habitat at that location, and the habitat that occurs there is common and widespread throughout this section of river. Lake Whitefish were also not captured in the gillnet set at the proposed tailrace location in 2010, during their typical spawning period. Lake Whitefish were not captured or observed during their typical spawning period in 2009, 2010 and 2011 in New Post Creek downstream of the waterfalls, even though the habitat appeared suitable for spawning and is accessible from the Abitibi River.

## 6.0 REFERENCES


Becker, G.C. 1983. Fishes of Wisconsin. Univ. of Wisconsin Press. Madison, Wisconsin. 1052 p.

Bégout Anras, M.L., P.M. Cooley, R.A. Bodaly, L. Anras, and R.J.P. Fudge. 1999. Movement and habitat use by lake whitefish during spawning in a boreal lake: Integrating acoustic telemetry and geographic information systems. Transactions of the American Fisheries Society 128: 939-952.

Evans, C.E., J.D. Reist and C.K. Minns. 2002. Life history characteristics of freshwater fishes occurring in the Northwest Territories and Nunavut, with major emphasis on riverine habitat requirements. Can. MS Rep. Fish. Aquat. Sci. 2614: xiii + 169 p.

Nelson, J.S. and M.J. Paetz. 1992. The Fishes of Alberta. 2nd edition. The University of Alberta Press, 438 p.

Roberge, M., J.M.B. Hume, C.K. Minns, and T. Slaney. 2002. Life history characteristics of freshwater fishes occurring in British Columbia and the Yukon, with major emphasis on stream habitat characteristics. Can. Manuscr. Rep. Fish. Aquat. Sci. 2611: xiv + 248 p.

Scott, W. B., and E. J. Crossman. 1973, "Freshwater fishes of Canada", Bull. Fish. Res. Bd. Can. 184, 966p.

Stewart, K.W., and D.A. Watkinson. 2004. The freshwater fishes of Manitoba. University of Manitoba Press, Winnipeg. 276 p.

Wydoski, R.S., and R.R. Whitney. 2003. Inland fishes of Washington. University of Washington Press. 320 p.

# NEW POST CREEK
# ABITIBI RIVER
# LAKE STURGEON SPAWNING ASSESSMENT
# 2010

Report date: **August 3, 2012.**
Update: April 22, 2013.
Prepared for: OPG, Corporate Business Development
700 University Avenue, Office H18 E17
Toronto, Ontario
M8Z 5S4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION .......... 1
2.0 BACKGROUND .......... 2
3.0 METHODS .......... 2
4.0 RESULTS .......... 4
5.0 CONCLUSIONS .......... 6
6.0 REFERENCES .......... 7

## 1.0 INTRODUCTION

C. Portt and Associates was retained by Ontario Power Generation Inc. (OPG), and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of lower New Post Creek and the tailrace location of a proposed generating station on the Abitibi River, located approximately 80 km north of Smooth Rock Falls, and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2010 investigation of Lake Sturgeon (*Acipenser fulvescens*) spawning activity, which is the first year of Lake Sturgeon spawning investigations undertaken in support of this project.

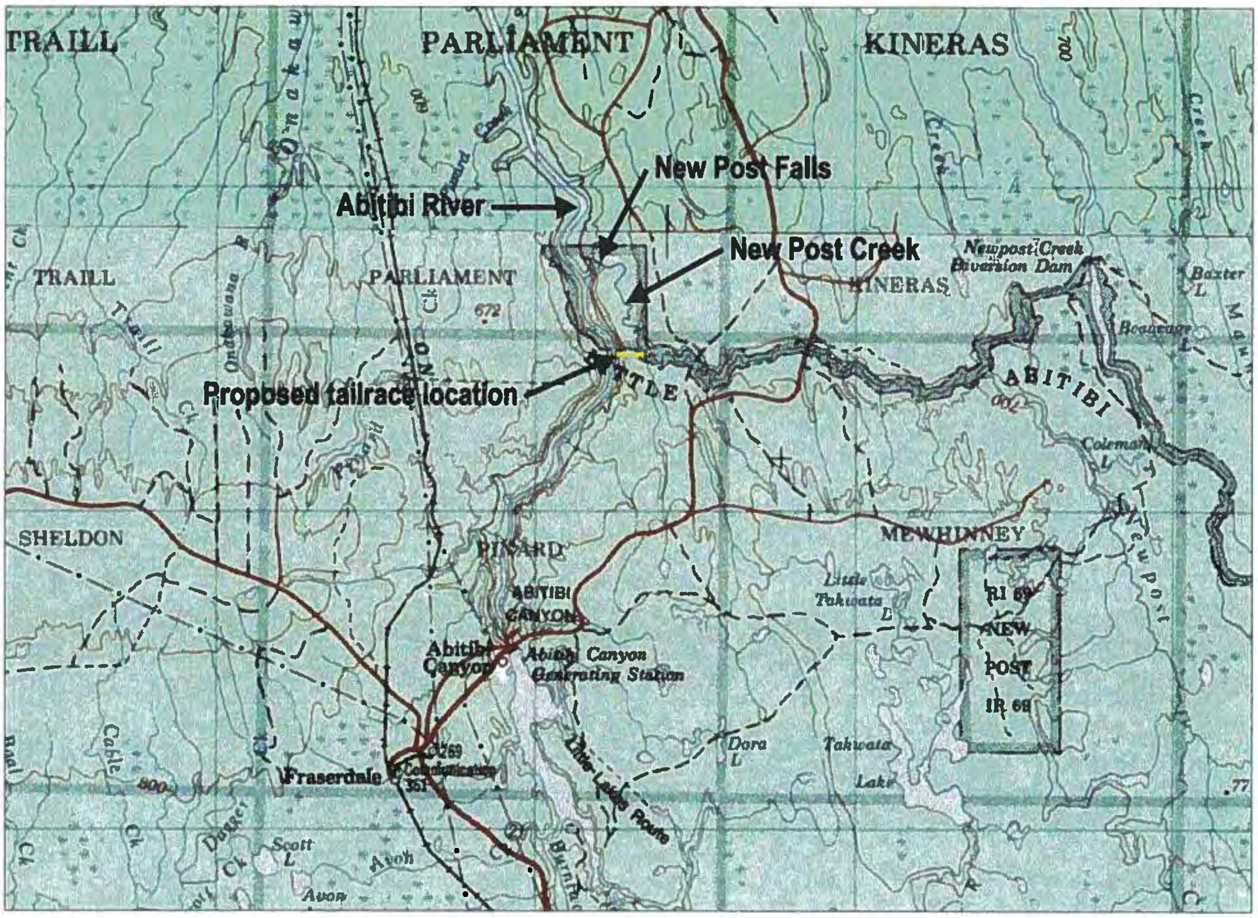



**Figure 1: Location of the proposed New Post Creek Generating Station. The yellow line indicates the approximate proposed location of the penstock that will divert water from New Post Creek to a tailrace on the Abitibi River.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a generating station that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfall located approximately 800 m upstream from its confluence with the Abitibi River. This Lake Sturgeon spawning assessment examined New Post Creek between its confluence with the Abitibi River and the waterfall.

During years when water temperature rises slowly, Lake Sturgeon typically begin to spawn when the water temperature reaches 11.7°C (Becker, 1983), with optimal spawning water temperatures of 13 to 18°C (Scott and Crossman, 1973). During years with lower water flow and more rapid temperature rise, spawning may be delayed until temperatures reach 14.5 to 15.0°C (Becker, 1983). Holm *et al.* (2009) gives the spawning temperature range as 13 to 21°C. They spawn at depths of 0.3 to 4.6 m (Becker, 1983), in areas of swift water or rapids often at the foot of low falls that prevent further migration (Scott and Crossman, 1973). Lake Sturgeon spawn over substrates of hardpan clay, sand, gravel, rubble, cobble or boulders (Lane *et al.* 1996). In the Des Prairies River (Quebec), spawning habitats are covered by a mix of fine- to medium-size gravel to boulders (LaHaye *et al.* 1992). Spawning in the Wolf River (Wisconsin) occurs along the outside of a river bend, especially where the current is upwelling or slowly boiling, and where rocks, boulders, and broken slabs of concrete have been riprapped at a steep angle into the water (Becker, 1983). Male Lake Sturgeon typically mature at around 15 years of age, while females typically mature around 20 years of age, though there is considerable variation across their Canadian range (Scott and Crossman, 1973).

## 3.0 METHODS

Field investigations for this project were conducted by George Coker (C. Portt & Associates) on May 20, 2010, and George Coker and Jim Reid (C. Portt & Associates), assisted by Kevin Ross (TTN) on May 25 to 27, 2010. Additional field observations of water temperature in the Abitibi River and New Post Creek during May were provided by OPG staff to aid in determining the timing for the field investigation.

The section of New Post Creek downstream of the waterfalls was examined to identify potential Lake Sturgeon spawning habitat and search for spawning sturgeon. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to locate and identify key features, mark gill net set locations, and record the position digital photographs. Gillnet set locations are illustrated in Figure 2. Each gillnet was 91.44 m long, 2.13 m deep, and composed of four 22.86 m long panels of 8 inch (20.32 cm), 9 inch (22.86 cm), 10 inch (25.40 cm) and 12 inch (30.48 cm) monofilament mesh. The dates and times that the nets were set and lifted are presented in Table 1. One net was set at location GN1 at mid-day on May 25, lifted and reset later that day, and then lifted on the morning of May 26. That net was moved to location GN3, where it was set on the morning of May 26, lifted and reset that evening, and lifted on the morning of May 27. The

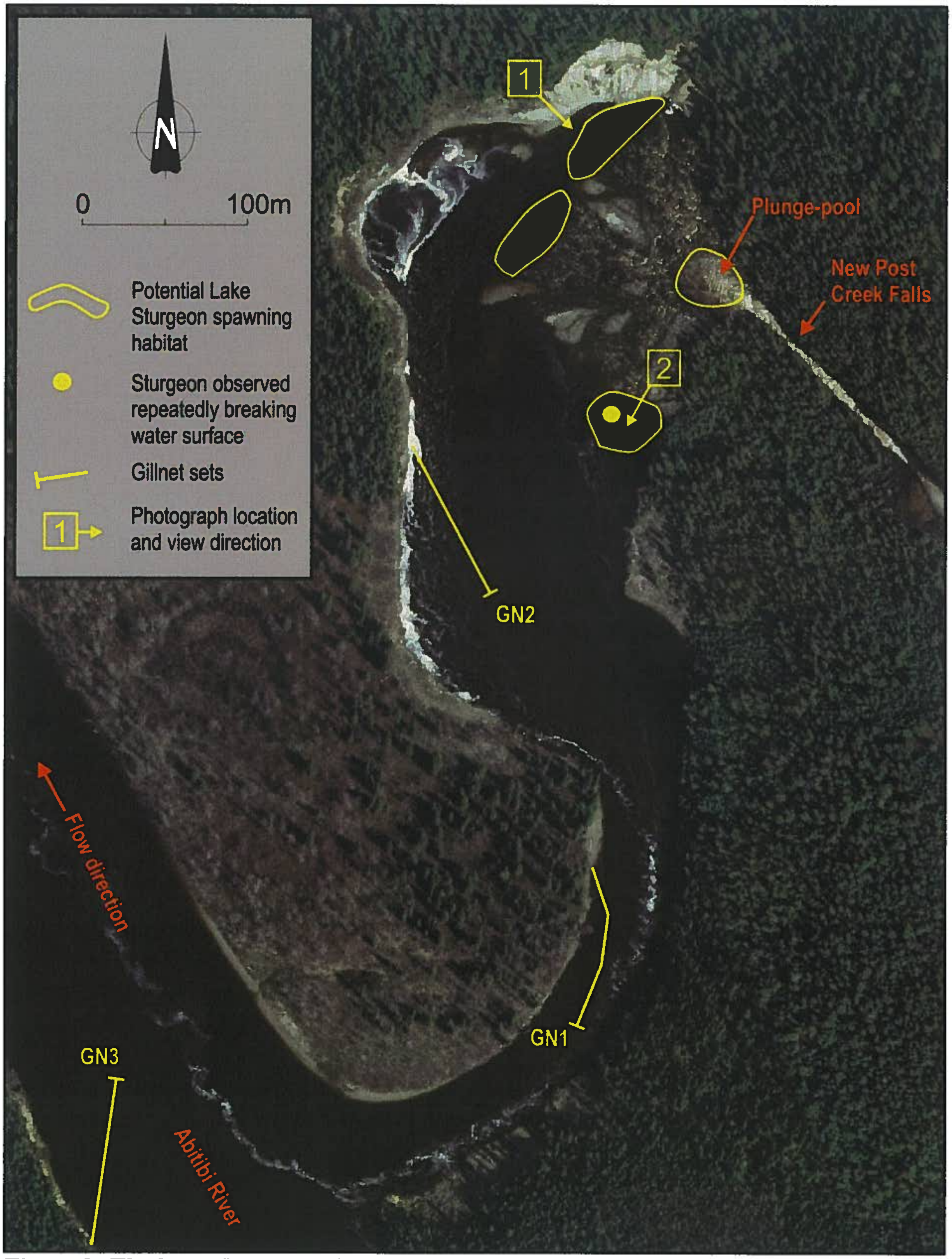



**Figure 2: The lower New Post Creek study area, showing the gillnet set locations and the potential Lake Sturgeon spawning areas. May 25 to 27, 2010.**

second gill net was set at location GN2 at mid-day on May 25 and lifted and reset twice, prior to being lifted and removed on the morning of May 27. Each Lake Sturgeon captured was examined for condition and measured for total length.

## 4.0 RESULTS

The water temperature downstream of New Post Creek Falls was 13.8°C at 9:25 on May 20, 2010, while the water temperature in the Abitibi River was 9.2°C. No sturgeon activity was seen during approximately 2 hours of observation.

On May 25, 2010, the water temperature in New Post Creek below the falls was 22.5°C at 12:45, and the nearby Abitibi River was 14.7°C at 15:00. On May 26, 2010, at 9:40, the water temperature in New Post Creek below the falls was 22.5°C, and on May 27, 2010, at 8:17 it was 22.2°C. At the flows and water levels observed, there appears to be habitat that is suitable for Lake Sturgeon spawning, based upon the substrate and water velocities, within the plunge-pool at the base of New Post Falls, and along the downstream edge of the shallow rapids below the falls (Figure 2; Photograph 1). What was thought to be a Lake Sturgeon was observed surfacing three times on May 25, 2010, in one area within the swift water at the base of some shallow rapids (Figure 2; Photograph 2). The water was too turbid to observe fish underwater.

The results of gillnetting is provided in Table 1. A total of 11 Lake Sturgeon, and no other fish species, were captured. All but one of the Lake Sturgeon were 100 cm or more long, and most of the adult Lake Sturgeon captured by gillnet downstream of the rapids appeared as if they had been spawning, as they were flattened on their ventral surface and one had a small amount of blood coming from its vent. No gametes were expressed by any of the fish during handling, however. All captured fish were alive and vigorous and were released after a brief examination.

**Table 1: Gillnet catches and total length of Lake Sturgeon. New Post Creek and Abitibi River. May 25-27, 2010.**

| Set | Gillnet 1 | Gillnet 2 | Gillnet 3 |
|---|---|---|---|
| 1 | May 25, 11:37-14:30.<br>1 Lake Sturgeon (150 cm). | May 25, 12:27-14:46.<br>No catch. | May 26, 10:03-19:34.<br>2 Lake Sturgeon (64, 120 cm). |
| 2 | May 25, 14:43-May 26, 8:30.<br>1 Lake Sturgeon (107 cm). | May 25, 14:58-May 26, 8:04.<br>4 Lake Sturgeon (110, 114, 127, 139 cm). | May 26, 19:52-May 27, 7:55.<br>No catch. |
| 3 | | May 26, 8:24-20:07.<br>3 Lake Sturgeon (100, 118, 118 cm). | |
| 4 | | May 26, approx. 20:30-May 27, 8:10.<br>No catch. | |

Photograph 1: Downstream of New Post Falls. May 20, 2010.

Photograph 2: Downstream from the base of the rapids below New Post Falls, showing area where what was thought to be a Lake Sturgeon was observed surfacing. May 25, 2010.

## 5.0 CONCLUSIONS

The Lake Sturgeon captured within New Post Creek downstream of the falls and in the nearby Abitibi River were in post-spawning condition (blood from vent, flaccid abdomens). It is not known where these fish spawned, but the rapids below Abitibi Canyon on the Abitibi River, and the rapids downstream of the falls on New Post Creek, are the only likely spawning locations. Visual inspection of the site was largely ineffective because of the turbid water conditions.

## 6.0 REFERENCES

Becker, G.C. 1983. Fishes of Wisconsin. Univ. of Wisconsin Press. Madison, Wisconsin. 1052 p.

Holm, E., N.E. Mandrak, and M.E. Burridge. 2009. The ROM field guide to freshwater fishes of Ontario. Royal Ontario Museum, Toronto. 462 p.

LaHaye, M., A. Branchaud, M. Gendron, R. Verdon and R. Fortin. 1992. Reproduction, early life history, and characteristics of the spawning grounds of the lake sturgeon (*Acipenser fulvescens*) in Des Praires and L'Assomption rivers near Montréal, Quebec. Canadian Journal of Zoology 70: 1681-1689.

Lane, J.A., C.B. Portt and C.K. Minns. 1996. Spawning habitat requirements of Great Lakes fishes. Can. MS Rpt. Fish. Aquat. Sci. 2368. 48 p.

Scott, W. B., and E. J. Crossman. 1973, "Freshwater fishes of Canada", Bull. Fish. Res. Bd. Can. 184, 966 p.

# NEW POST CREEK HYDROELECTRIC PROJECT
# ASSESSMENT OF EFFECTS TO FISH HABITAT
# IN THE ABITIBI RIVER AND NEW POST CREEK

Report date: **April 23, 2013.**
Updated: May 14, 2013. Maps updated October 23, 2013.
Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4


Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS


1.0 INTRODUCTION ..... 1
2.0 BACKGROUND ..... 2
3.0 METHODS ..... 2
4.0 RESULTS ..... 5
4.1 Abitibi River ..... 5
4.2 New Post Creek ..... 6
4.3 Tributaries of New Post Creek ..... 10
5.0 HABITAT EFFECTS ASSESSMENT ..... 14
6.0 CONCLUSIONS ..... 21
7.0 REFERENCES ..... 23

APPENDIX A Habitat maps 1 to 23
APPENDIX B Photographs
APPENDIX C Scientific nomenclature of fishes

## 1.0 INTRODUCTION

C. Portt and Associates and SENES Consultants Limited were retained by Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a habitat and fish community assessment of lower New Post Creek and the tailrace location of a proposed generating station (GS) on the Abitibi River, located approximately 80 km north of Smooth Rock Falls, and 13 km downstream from Abitibi Canyon (Figure 1). C. Portt and Associates conducted this work directly for OPG and CRP during 2009 and 2010, and by sub-contract with SENES during 2011 and 2012. This document presents the results of these field investigations, and an assessment of potential effects from the operation of the proposed New Post Creek GS.

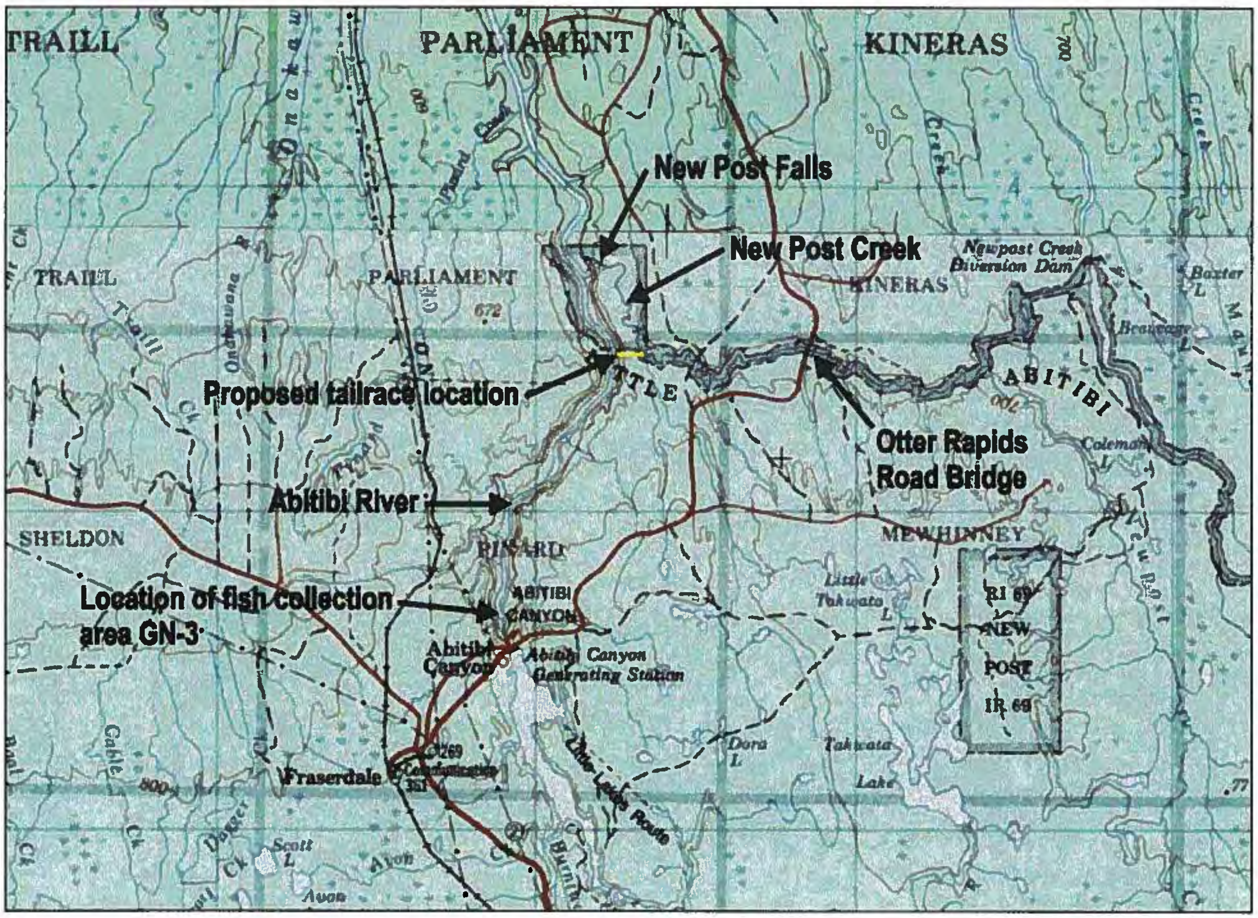



**Figure 1: Location of the proposed New Post Creek GS. The yellow line indicates the approximate location of the proposed penstock that will divert water from New Post Creek to a tailrace on the Abitibi River. The gillnet location GN-3 near Abitibi Canyon is shown.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a GS that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfalls located approximately 800 m upstream from its confluence with the Abitibi River. Flow through the powerhouse would enter the Abitibi River approximately 2.8 km upstream from the Abitibi River and New Post Creek confluence.

## 3.0 METHODS

All aquatic habitat investigations, habitat mapping, and fish collections, were conducted by C. Portt and Associates staff George Coker and Jim Reid, assisted by TTN members Francis Archibald and Damien Sutherland in 2009, Kevin Ross and David Iserhoff in 2010, George Ross and Kevin Ross in 2011, and George Ross, Kevin Ross and Kyle Ross in 2012.

### Habitat Characterization

Substrate mapping in the Abitibi River and New Post Creek is challenging, due to the high proportion of clay in the river substrate and soils in this part of Ontario, that results in consistently high turbidity. It is not possible to visibly discern the substrate in the Abitibi River beyond a water depth of a few centimetres. New Post Creek is similarly turbid during high flow, but during low flow and dry weather, when there is minimal flow from tributaries, visibility may extend to approximately 50 cm. River substrates, therefore, have been mapped to the extent possible during low flow periods when large areas of substrate are exposed and, in New Post Creek, where substrates can be observed in shallow areas. In deeper areas the substrates have been estimated by probing the river bottom with an iron weight attached to a measured rope, or by using a long wooden pole. Substrate is classed using a modified Wentworth (1922) scale (Table 1).

**Table 1: Substrate particle size terms and associated size ranges, modified from Wentworth (1922).**

| Particle size term | Particle size (mm) |
|---|---|
| clay | 0.001 - 0.004 |
| silt | 0.004 - 0.062 |
| sand | 0.062 - 2.0 |
| gravel | 2.0 - 64.0 |
| cobble | 64.0 - 256.0 |
| boulder | > 256 |
| bedrock | na - rock not granulated |

A Humminbird Matrix 12 depth sounder was used to determine water depth. A Garmin GPS 76CSx Global Positioning System (GPS) unit was used with an external antennae to determine locations, and the depth sounder's output was directed to the GPS unit so that depth was digitally recorded in conjunction with a set of GPS coordinates.

GPS coordinates and associated depth information were off-loaded from the GPS unit into an Excel® spreadsheet, into which the substrate information was added manually. The georeferenced substrate and depth information was imported into GIS software (Manifold System 8) for mapping. All distance measurements were either determined in the field using the handheld GPS unit, or from orthorectified digital aerial photographs and downloaded field GPS data using Manifold System 8 software. Likewise, the location of all digital photographs and other observations were associated with GPS waypoints imported into Manifold System 8.

Flow measurements were provided by OPG (Gillian MacLeod, personal communication). Since 2009, the raw data for determining flow in New Post Creek has been collected at a Water Survey of Canada (http://www.ec.gc.ca) gauge station that is located within the study area, approximately 1 kilometre downstream from the proposed intake weir location. The raw data for determining flow prior to 2009 were obtained from OPG's Little Abitibi River Diversion Dam, located 23.5 km upstream of the proposed intake weir location, which was then calibrated with the recent Water Survey of Canada data. The flow of tributaries to New Post Creek was visually estimated at locations with simple channel cross sections.

Water depth and substrate composition were determined in the Abitibi River in the vicinity of the proposed tailrace, as well as in New Post Creek downstream of the waterfalls, on August 25 and 26, 2009. Supplemental substrate mapping was conducted in this area on November 1, 2011. Water depth and substrate composition were determined in New Post Creek, upstream of the falls in the vicinity of the proposed intake location, on October 27, 2009, and over approximately 10 km of New Post Creek, from the brink of New Post Creek Falls upstream to as far as safely possible by boat, on September 27 and 28, 2010. Discharge in New Post Creek was 102 and 96 cubic metres per second ($m^3/s$) on September 27 and 28, 2010, respectively, allowing New Post Creek to be easily navigated by boat, but probing was required over most of the area to estimate substrate type. The substrate was re-mapped for approximately 6 km upstream of the proposed intake location on September 19 and 20, 2011, when streamflow was 8.9 and 10.0 $m^3/s$ respectively. On those dates, a significant portion of the substrate in this area was visible. This information was used to add detail to the substrate mapping over most of the portion of New Post Creek where the proposed intake weir is anticipated to influence water levels and flow characteristics. Habitat downstream of the proposed intake weir to the brink of the waterfalls was re-examined at selected locations on November 3, 2011, when streamflow was 26 $m^3/s$.

In 2012, design modifications to improve the generation potential of the proposed GS, led to an increase in the height of the proposed intake weir and a resulting increase in the upstream extent of anticipated water level and flow alterations. Therefore, the habitat mapping of New Post Creek was extended an additional 2,300 m upstream to the Otter Rapids Road bridge on September 17, 2012. On that date discharge was 7.81 $m^3/s$ and much of the substrate could be visually examined. Water depth was not mapped in this upstream area, as the water was too shallow to allow boating at the time of examination, and during higher flows the rapids in this area are too dangerous for boating.

The lower reaches of any accessible New Post Creek tributaries, upstream of the proposed intake weir, was also examined in 2011 and 2012. Upstream habitat in these tributaries was also examined at road and trail crossings, and at key locations that required some travel through trackless forest.

**Fish Community Characterization**

Electrofishing was undertaken using a Halltech 2000 backpack electrofisher. After field identification and enumeration, all fish were released alive at the point of capture, except for a few voucher specimens of sculpin that were retained for confirmation of identity. Electrofishing effort is expressed in electro seconds, which is the amount of time that electrical current is discharged into the water. Electrofishing generally targets small fishes in water up to 1 m deep, and is useful in extracting fish from coarse substrate or dense cover.

Gillnets were used to collect larger fishes in water greater than 1 m deep. Gillnets were retrieved and reset each day. Gillnets were usually set with one end attached to shore and the offshore end anchored and buoyed for retrieval, and were retrieved and reset each day. The GPS coordinates of each end of each gillnet set were recorded, as was water depth at the offshore end. Several types of gillnet were used in this assessment. River index nets (RIN) conform to a Ministry of Natural Resources (MNR) standard, and are comprised of panels of different size mesh (net specifics are provided in the tables that present the catches) to catch a broad spectrum of fish sizes. Additional sets of 102 mm (4 inch) net was used to target Walleye for mercury (Hg) analysis. In 2009 and 2010, a few sets of non-standard index gillnets were also conducted. Gillnets were also set in New Post Creek downstream of the waterfalls, and in the Abitibi River, during species-specific spawning periods to investigate the spawning of Walleye, Lake Whitefish, and Lake Sturgeon. The results of these latter gillnetting efforts have been reported in other assessment documents (C. Portt and Associates 2012a, 2012b, 2012c, 2013) and also do not contribute significantly to the characterization of the fish community as a whole, and therefore are not reported here. Detailed fish collection reports (FCRs) for all non-RIN collections, as well as RIN forms for the RIN collections, have been submitted to the MNR Cochrane office.

During 2010 the MNR conducted a RIN program in the Abitibi River between Abitibi Canyon and Otter Rapids. Rather than targeting specific areas of the Abitibi River, as was done for the New Post Creek GS assessment, the MNR netting program followed the methods outlined in the MNR RIN Instruction Manual, to characterize the fish community throughout this reach. The total catch of the MNR RIN netting program are presented below.

**Assessment of Effects to Fish Habitat**

Structural and operational details of the proposed GS were provided by KGS Group Consulting Engineers (Stefan Kohnen, personal communication). General arrangement drawings of the intake weir and associated structures, penstock, powerhouse, and tailrace, as well as the extent of the headpond at an elevation of 187 m ASL, were provided as shapefiles and imported into Manifold System 8 GIS, allowing the calculation of areas and lengths associated with potential impacts. A detailed assessment of minimum flow requirements, downstream of the proposed intake weir to the Abitibi River has been undertaken as a separate report, entitled Aquatic Assessment of Proposed Minimum Flows, New Post Creek, July 10, 2012, and so will not be addressed in detail as part of this report. Likewise, separate reports have been prepared to characterize habitat and fish communities in watercourses that may be affected along the access road to the proposed GS, the Parliament Loop Road, and the proposed transmission line right-of-way.

# 4.0 RESULTS

The results of the field mapping are provided in Appendix A (Maps 1 to 23) and the map locations are provided in Figure 2. The results of fish collections are summarized in Tables 2 to 7, and the fish collection locations shown in Figure 3. Selected photographs are provided in Appendix B and their locations are shown in Figure 4. The scientific nomenclature for fish species named in this report is provided in Appendix C.

## 4.1 Abitibi River

### Habitat

The Abitibi River at the mouth of New Post Creek is approximately 170 m wide with a maximum depth of about 10 m. The bathymetric map of the Abitibi River shows that the centre of the channel, accounting for approximately 50% of the river width, is relatively flat and deep and the river bottom then slopes up to each shore in a fairly uniform manner (Map 1).

The Abitibi River at the proposed tailrace location is approximately 140 m wide with a maximum depth of about 10.4 m (Map 23). The cross-channel profile of the Abitibi River at this location is U-shaped. Substrate is dominated by sand and clay with occasional patches of rocks or wood debris (Map 23).

### Fish Community

Table 2 provides a summary of the fish captured by gillnet in the Abitibi River during the course of investigations for the proposed New Post Creek GS, as well as the 2010 MNR collections. Fourteen fish species, in total, were captured. No attempts were made as part of this study to capture small bodied fishes in the Abitibi River, however, the small bodied fishes captured by electrofisher in New Post Creek, downstream of the waterfalls (Table 3), are also likely to occur in suitable habitats in the Abitibi River.

**Table 2: Summary of gillnet catches in the Abitibi River during 2010 and 2011. Locations GN-1 and GN-2 are shown on Figure 3, and location GN-3 is shown in Figure 1. The scientific nomenclature of fishes is provided in Appendix C.**

| Collection location | MNR collections between Abitibi Canyon and Otter Rapids | GN-1 Potential tailrace location | GN-2 Near mouth of New Post Creek | GN-3 Adjacent to boat ramp, below rapids at Abitibi Canyon |
|---|---|---|---|---|
| Date range | Sep 22-26, 2010 | Oct 18-20, 2010 | Sep 13-16, 2011 | Sep 14-20, 2011 |
| Net dimensions (m) (length x height) | 41 large RIN[1]<br>19 small RIN[2] | 121.9x1.83 | 60x1.83 | 90x1.83(9)<br>60x1.83(6) |
| Mesh size (mm) | see footnote | 102 | 102 | 102 |
| Overnight sets | 60 | 2 | 2 | 15 |
| **Species** | | | | |
| Lake Sturgeon | 27 | | 2 | 7 |
| Lake Whitefish | | | | 1 |
| Walleye | 1 | 2 | | 13 |
| Sauger | 8 | | | 2 |
| Northern Pike | | | | 6 |
| Shorthead Redhorse | 1 | 1 | 2 | 30 |
| Longnose Sucker | 17 | 1 | 4 | 2 |
| White Sucker | | | | 4 |
| Brown Bullhead | | | | 1 |
| Rock Bass | | | | 2 |
| Mooneye | | | 2 | 4 |
| Goldeye | 1 | 1 | 1 | 7 |
| Burbot | | | | 3 |
| Fallfish | 4 | | | |

[1] River index net comprised of panels of 38 mm, 51 mm, 64 mm, 76 mm, 89 mm, 102 mm, 114 mm, and 127 mm stretched mesh, for a total of 8 panels. Each panel is 3.1 m long and 0.9 m high, for a total net length of 24.8 m.

[2] River index net comprised of panels of 13 mm, 19 mm, 25 mm, 32 mm, and 38 mm stretched mesh, for a total of 5 panels. Each panel is 2.5 m long and 0.9 m high, for a total net length of 12.5 m.

## 4.2 New Post Creek

### Habitat

New Post Creek, at its mouth (Photograph 1), is approximately 45 m wide and 3 to 4 m deep, and its channel is similar for approximately 330 m upstream from the Abitibi River (Map 1). This section of channel is relatively uniform with mainly sand and sand/clay substrates, dropping to depth close to the left shore facing downstream, with a more gentle slope to depth along the right shore (Map 1; Photograph 2). Approximately 330 m upstream from the Abitibi River, the channel widens significantly to a maximum of approximately 230 m near the bottom of the rapids that are situated below the waterfalls. The irregularly wide section of channel downstream of the rapids is approximately 330 m long. The majority of this reach is between 1 and 2.5 m deep, but there are several very shallow bars (Photograph 3) and some limited deeper sections, with a maximum depth of about 3.6 m (Map 1). Substrate is a patchy mixture of clay/sand, sand, gravel, cobble and boulder, with one area of exposed bedrock (Map 1). Water depth in this section of New Post Creek is highly dependent upon the water level in the nearby Abitibi River, which varies with the operation of the two OPG facilities at Abitibi Canyon and Otter Rapids.

New Post Creek waterfalls consists of a 170 m long stretch of steep rapids at its upstream end, a vertical falls that drops approximately 40 m, an 8 to 19 m wide narrow chute that is 210 m long containing several smaller waterfalls (Photograph 4), and some very shallow rapids about 140 m long at the downstream end with mainly cobble/boulder substrate (Photograph 5; Map 1). The total difference in elevation between the upstream and downstream ends of these waterfalls, determined by GPS, is approximately 56 m.

Upstream of the waterfalls, for approximately 1,390 m (Maps 2 and 3), New Post Creek is flat and meandering with high eroding banks throughout much of the reach (Photograph 6), and ranges between 44 and 63 m wide (mean width=51.6 m, n=10). The substrate here is mainly a mixture of sand, clay, gravel, and cobble (Maps 2 and 3). The next 2,036 m upstream (Maps 4 – 7) has more diverse habitat due to a number of bedrock outcrops that create variation in depth and velocity (Photograph 7), with some outcrops creating short sets of rapids (Photograph 8), and others constricting the channel width, resulting in deeper habitats (Map 5). Through this section stream width ranges from 32 m to 92 m (mean width=55 m, n=10), and substrates are mainly some combination of cobble, gravel, and boulder, with occasional patches of bedrock. The next 1,076 m (Maps 8 and 9), up to the proposed intake weir location (Figure 2; Map 9), is relatively deep, and so has less variation in flow velocity (Photograph 9) and ranges from 32 to 56 m wide (mean width=46.4 m, n=8). A bedrock outcrop occurs at the proposed intake weir location, approximately 4,502 m upstream of the top of the waterfalls (Photographs 10 and 11).

Upstream of the proposed intake weir location, for approximately 2,380 m (Maps 9 to 12), the creek is low gradient and meandering (Photographs 12 and 13), and is dominated by fine-grained substrates. A sizable area where woody debris is abundant on the bottom occurs a short distance upstream from the weir location (Map 9). A couple of low gradient riffles, dominated by gravel and sand and some cobble, are apparent in this area during low flow, as on September 19, 2011, when flow was 9.07 $m^3/s$. On September 27, 2010, no riffles were apparent at these two locations when flow was 102 $m^3/s$. Water depth was approximately 3 m deeper in this section of New Post Creek on September 27, 2010, than it was on September 19, 2011. In this area the stream ranges from 30 to 91 m wide with an average (n=18) width of 48.9 m. At the upstream end of this reach, approximately 2,380 m upstream of the proposed intake, and 6,882 m upstream of the waterfalls, is the first main rapids upstream of the proposed intake. This set of rapids was apparent under all flows observed, and are approximately 135 m long with a broad range of patchy substrates (Map 12; Photographs 14 and 15).

For the next 3100 m upstream (Maps 13 to 17) the stream has a slightly greater gradient, higher flow velocities, and generally coarser-grained substrates. Riffle sections are more numerous than in the previously described downstream reach, but they remain relatively gentle (Photograph 16). Photograph 17 shows a typical flatwater area in this section. This reach of the stream ranged from 31 to 90 m wide with an average (n=12) width of 52.1 m. Approximately 5,600 m upstream of the proposed intake location, two relatively steep, rocky sets of rapids, separated by a short section of calmer water, was the upstream limit of boat access due to safety concerns at high water, and being too shallow to navigate during low water (Photographs 18 and 19). Therefore, no depth information was mapped within or upstream of this 448 m long set of rapids.

For 371 m immediately upstream of these rapids, a flatwater section has substrates dominated by sand, clay, gravel, and some cobble (Photograph 20; Map 18).

Starting at 6,419 m upstream of the proposed intake weir location, and continuing 2055 m upstream to the Otter Rapids Road bridge, New Post Creek was more than 50% riffle over its length on September 17, 2012, when streamflow was 7.81 $m^3/s$ (Maps 18-22). Cobble, boulder, and gravel dominated the substrates through the main channel of this reach (Photographs 21 and 22), though there were significant deposits of finer materials in backwater areas along the shore (Photograph 23). The only significant area of aquatic plants observed in New Post Creek occurs in one of these nearshore deposits of fine material. Moderate densities of Clasping-leaved Pondweed (Redhead Grass) (*Potamogeton richardsonii*), Variable (Grassy) Pondweed (*Potamogeton gramineus*), Tape Grass (*Vallisneria* sp.), Arrowhead (*Sagittaria* sp.), and (Broad) Waterweed (*Elodea canadensis*) were observed in a narrow shoreline band, approximately 270 m long, on the south side of New Post Creek (Maps 20 and 21). The estimated upstream extent of influence upon flow velocity and water depth, due to the proposed intake weir and operation of the GS, is expected to extend 7,166 m upstream (Map 20). An oxbow wetland occurs on the south side of New Post Creek, near the upstream extent of influence from the proposed GS and intake weir (Photograph 24; Map 19).

**Fish Community**

The 40 m vertical waterfall in New Post Creek, that is located 984 m upstream from the Abitibi River, is a complete barrier to upstream fish migration. The results of electrofishing in shallow water are provided in Table 3 and the results of gillnet sets for larger bodied fish in deeper water are provided in Table 4. A total of 18 species were captured. The fish community below the falls is more diverse than above the falls, likely because fishes that inhabit the various habitats of the Abitibi River can access this area.

**Table 3: Electrofishing in New Post Creek downstream the waterfalls. Collection site locations are shown in Figure 3.**

| Site | EF-1 | EF-1 | EF-1 | EF-1 | EF-1 |
|---|---|---|---|---|---|
| Date | August 24, 2009 | May 25, 2010 | May 27, 2010 | September 17, 2011 | May 22, 2012 |
| Electroseconds | 1482 | 649 | 496 | 1678 | 887 |
| **Species** | | | | | |
| Walleye (juvenile) | 1 | 2 | | | |
| Shorthead Redhorse | | 2 | | | |
| Longnose Sucker (juvenile) | | | | 1 | |
| White Sucker (YOY) | 1 | | | | 4 |
| Yellow Perch (YOY) | 1 | | | | |
| Sculpin (Mottled or Slimy) | 4 | | 1 | | |
| Slimy Sculpin | | | | | 4 |
| Spoonhead Sculpin | | | | 1 | |
| Logperch | 11 | 10 | | 2 | 2 |
| Johnny Darter | 1 | | | | 1 |
| Troutperch | | 1 | | | |
| Lake Chub | 6 | 5 | | | 3 |
| Longnose Dace | 1 | 3 | | 13 | |
| Burbot (juvenile) | | | 3 | | |

**Table 4: Summary of gillnet catch in New Post Creek during 2011, downstream of the waterfalls. Collection site locations are shown in Figure 3.**

| Site | GN-3 | GN-3 | GN-3 |
|---|---|---|---|
| Date range | Sep 13-17, 2011 | Sep 13-18, 2011 | Oct 31-Nov 3, 2011 |
| Net dimensions (m) (length x height) | 60x1.83 | RIN (x2)[1] | RIN (x2)[1] |
| Mesh size (mm) | 102 | see footnote | see footnote |
| Overnight sets | 3 | 8 | 12 |
| **Species** | | | |
| Lake Sturgeon | 1 | | |
| Lake Whitefish | | 1 | |
| Walleye | 1 | 4 | 2 |
| Sauger | | 3 | 2 |
| Northern Pike | 1 | 8 | 5 |
| Shorthead Redhorse | 1 | | |
| Longnose Sucker | 3 | 2 | 14 |
| White Sucker | 5 | 1 | 3 |
| Yellow Perch | | | 1 |
| Mooneye | 3 | 2 | |
| Burbot | | | 2 |

[1] River index net comprised of panels of 38 mm, 51 mm, 64 mm, 76 mm, 89 mm, 102 mm, 114 mm, and 127 mm stretched mesh, for a total of 8 panels. Each panel is 3.1 m long and 0.9 m high. Two nets were joined for these sets, for a total net length of 49.6 m per set.

The results of electrofishing in shallow water in New Post Creek upstream from the falls are provided in Table 5, and the results of gillnet sets for larger bodied fish in deeper water are provided in Table 6. Seven species, and no sport fish, were captured.

**Table 5: Electrofishing in New Post Creek upstream of the waterfalls. Collection site locations are shown in Figure 3.**

| Site | EF-2 | EF-2 | EF-2 | EF-3 | EF-4 | EF-5 |
|---|---|---|---|---|---|---|
| Date | Aug 25, 2009 | May 27, 2010 | Nov 2, 2011 | Sep 20, 2011 | Sep 20, 2011 | Sep 20, 2011 |
| Electroseconds | approx. 600 | 496 | 990 | 757 | 718 | 456 |
| **Species** | no catch | | | | | |
| Longnose Sucker (juvenile) | | | | | 1 | |
| White Sucker (YOY) | | | 1 | 1 | | |
| Sculpin (Mottled or Slimy) | | 1 | | 1 | 5 | 2 |
| Johnny Darter | | | | 1 | | |
| Longnose Dace | | | | | 2 | 1 |
| Pearl Dace | | | 2 | | | |
| Burbot (juvenile) | | 3 | | | | |

**Table 6: Summary of gillnet catch in New Post Creek, upstream of the waterfalls. Collection site locations are shown in Figure 3.**

| Site | GN-4 | GN-5 | GN-6 | GN-7 | GN-8 | GN-9 | GN-9 | GN-10 | GN-10 |
|---|---|---|---|---|---|---|---|---|---|
| Lift Date | Oct 28, 2009 | May 27, 2010 | May 27, 2010 | Sep 20, 2011 | Sep 20, 2011 | Sep 19, 2011 | Sep 20, 2011 | Sep 19, 2011 | Sep 20, 2011 |
| Net dimensions (m) (length x height) | 53.34x1.83[1] | 53.34x1.83 | 53.34x1.83 | RIN(x2)[2] | RIN(x2) | RIN(x2) | RIN(x2) | RIN(x2) | RIN(x2) |
| Mesh size (mm) | 51-152 | 51-152 | 51-152 | see footnote | | | | | |
| Time fished (hours) | 17:50 | 22:42 | 22:27 | 27:15 | 26:40 | 15:51 | 29:51 | 15:50 | 30:26 |
| **Species** | no catch | | no catch | | | | | | |
| Longnose Sucker | | 1 | | 2 | | 1 | | | |
| White Sucker | | | | 2 | 2 | | 1 | 1 | 1 |
| Burbot | | | | 1 | | | | | |

[1] 53.34 m long, 1.83 m deep, and composed of seven 7.6 m long panels of 51 mm, 64 mm, 76 mm, 89 mm, 102 mm, 127 mm and 152 mm stretched mesh, joined together in order of size.

[2] River index net comprised of panels of 38 mm, 51 mm, 64 mm, 76 mm, 89 mm, 102 mm, 114 mm, and 127 mm stretched mesh, for a total of 8 panels. Each panel is 3.1 m long and 0.9 m high. Two nets were joined for these sets, for a total net length of 49.6 m per set.

## 4.3 Tributaries of New Post Creek

There are ten tributaries to New Post Creek between the proposed intake weir location and the upstream extent of backwater effect caused by the weir and the operation of the proposed GS. These tributaries are shown in Figures 3 and 4.

### Tributary 1

This is the largest tributary entering New Post Creek within the study area (Figure 4). When examined near its downstream end on September 20, 2011, flow in this tributary was approximately 0.3 $m^3/s$. The channel width varies from 3 to 6 m. Substrate is patchy. Gravel and sand with some cobble appears to occur most commonly, but areas of sand and silt or soil are also present. The aquatic plant *Vallisneria* was observed in places. The stream banks are generally approximately 1 m high, but can be significantly higher or lower in places, and the surrounding overbank area floodplain has mainly alder (*Alnus* sp.) shrubs, with grass and herbaceous plants in isolated areas (Photograph 25). The thick alder growth that grows in the flood plain and over the channel along most of its length makes stream access and examination difficult in most places (Photograph 26). Examination of the aerial photographs reveal that the watercourse form described above occurs along most of the 4,542 m length of channel from New Post Creek to the Otter Rapids Road. Immediately upstream of the Otter Rapids Road there is a backwater effect that seems to have reduced the amount of alder overhanging the channel for approximately 650 m, but the alders reassert themselves upstream of this point. While the broad floodplain with alder gradually narrows in an upstream direction, it is apparent in the aerial photograph until approximately 9 km upstream from New Post Creek. On September 20, 2011, the water temperature in this watercourse near New Post Creek was 9.4°C, compared to 12.7°C in New Post Creek.

Electrofishing on two occasions in the first 170 m of Tributary 1 upstream from New Post Creek (Figure 3:EF-6) captured, in total, 55 Slimy Sculpin and one YOY White Sucker (Table 7).

Similarly at Otter Rapids Road (Figure 3:EF-7), Slimy Sculpin were the most abundant species, but three Brook Stickleback were also captured. Slimy Sculpin is a species that prefers cold water temperatures (Coker *et al.* 2001; Holm *et al.* 2009), and appears to dominate the fish community of Tributary 1.

**Tributary 2**

This tributary is very small and has a small watershed (Figure 4). Consequently, it does not have a lot of flow, as evidenced by the shallow channel that drops steeply into New Post Creek from the surrounding table lands. It was not flowing but did have some standing water at a small culvert crossing, approximately 516 m upstream from New Post Creek, after a couple of rainy days when examined on September 18, 2012 (Photograph 27). The aerial photograph does not show a well defined channel, and it likely is often dry. No electrofishing was attempted, but this watercourse is unlikely to support fish, due to the lack of water and the steep drop into New Post Creek that would likely be a barrier to upstream fish movement.

**Tributary 3**

This tributary is very small and has a small watershed (Figure 4). No outfall to New Post Creek was apparent when this area was examined on September 20, 2011, and the aerial photographs indicate that it is essentially a swale that appears to begin approximately 1,100 m upstream from New Post Creek. It likely does not provide habitat for fish.

**Tributary 4**

Tributary 4 is a relatively long watercourse with numerous beaver dams that occur upstream of a point that is approximately 1,200 m upstream from New Post Creek. The flow was estimated at 0.05 $m^3/s$ on September 20, 2011, and 0.02 $m^3/s$ on September 18, 2012. Near its mouth at New Post Creek it has mainly gravel and cobble substrates (Photograph 28) with lots of wood debris a short distance upstream (Photograph 29). The banks near its mouth are fairly high, and composed of clay and gravel. Approximately 212 m upstream from New Post Creek the channel substrate was mainly hard clay with some gravel and cobble, and with a greater amount of coarse material in riffles (Photograph 30). Approximately 510 m upstream from New Post Creek, at Otter Rapids Road, the terrain is relatively flat and Tributary 4 is more like a wetland immediately upstream of the road culvert (Photograph 31).

Electrofishing was undertaken near New Post Creek (EF-8: Figure 3,Table 7) and at Otter Rapids Road (EF-9: Figure 3,Table 7). At EF-8 only Slimy Sculpin and Pearl Dace were captured; both species have also been found in similar habitats in nearby New Post Creek. At EF-9 the species captured (Northern Redbelly Dace and Brook Stickleback) are typical of the boggy pond and beaver dam habitats that dominate upstream of the Otter Rapids Road (Scott and Crossman, 1973).

**Tributary 5**

Tributary 5 is very small and has a small watershed (Figure 4). No outfall to New Post Creek was apparent on September 20, 2011, and the aerial photographs as well as a second site examined approximately 150 m upstream from New Post Creek on September 18, 2012 (Photograph 32) indicate that it has a poorly defined channel. There was no water present at the Otter Rapids Road culvert or downstream on September 18, 2012, despite the previous 36 hours of rain. Because of the lack of water this watercourse likely does not provide habitat for fish.

**Tributary 6**

Tributary 6 begins in a large wetland approximately 2.8 km upstream from New Post Creek, and flows through a number of beaver ponds between there and the Parliament Loop Road, approximately 760 m upstream from New Post Creek (Figure 4). The last 350 m of this watercourse is a meander loop of the pre-diversion New Post Creek channel, that became isolated when the flows diverted from the Little Abitibi River system in 1963 eroded a new course for the creek that bypassed this loop (Figure 4). When examined near its mouth on September 20, 2011, there was some standing water in the pre-diversion New Post Creek channel (Photograph 33), but very little flow (Photograph 17), despite the heavy sustained rainfall of September 19. Substrate is clay, and the riparian vegetation is alder. The aerial photograph shows that farther upstream in the pre-diversion loop there are larger areas of ponding, that likely retain some water during extended dry periods. Approximately 760 m upstream from New Post Creek there is a large beaver pond with clay substrate and rooted aquatic plants. Immediately downstream of the beaver dam the small channel has substrate of clay mixed with sand, gravel, and cobble (Photograph 34).

Electrofishing was undertaken near New Post Creek (Figure 3,Table 7: EF-10) and below the beaver dam at the Parliament Loop Road (Figure 3, Table 7: EF-11). No fish were captured at EF-10, likely because this portion of channel is dry at times. At EF-11 the species captured (Northern Redbelly Dace and Brook Stickleback) are typical of the boggy and beaver pond habitats that occur in this area (Scott and Crossman, 1973).

**Tributary 7**

Tributary 7 begins in a large wetland approximately 3 km upstream from New Post Creek, and flows through a number of beaver ponds and marshy areas until a point approximately 850 m upstream from New Post Creek (Figure 4). It drops fairly steeply into New Post Creek at its mouth (Photograph 35). The substrate was hard clay or soil wherever examined. Between two beaver ponds, approximately 1500 m upstream from New Post Creek, it had a meandering entrenched channel (Photographs 36 and 37), and farther downstream it was a flooded alder swamp (Photograph 38). This tributary was electrofished at three locations, but no fish were captured (Figure 3, Table 7: EF-12, EF-13, and EF-14).

## Tributary 8

Tributary 8 begins in a large wetland approximately 1.7 km upstream from New Post Creek, and flows through a series of beaver ponds until a point approximately 470 m upstream from New Post Creek. There it descends a wooded slope in a ravine (Photograph 39) before leveling off for the last 100 m before its confluence with New Post Creek (Figure 4). Electrofishing at EF-15 (Figure 3) was difficult due to the amount of wood debris and undergrowth, and only one Northern Redbelly Dace was collected (Table 7: EF-15). This species is not typical for the riffle habitat with coarse substrates that occurs at EF-15, but is likely associated with the nearby upstream beaver ponds.

## Tributary 9

Tributary 9 is a relatively long watercourse that begins in a network of beaver ponds and a bog lake, at least 5 km upstream from New Post Creek. A series of active and inactive beaver ponds occur along the main channel closer to New Post Creek. The flow was estimated at 0.01 $m^3/s$ on September 17, 2012. Near its mouth at New Post Creek, and for 100 m upstream from New Post Creek the channel consists of clay with a small amount of coarse material on the bottom, and the adjacent flat overbank area is vegetated with alder (Photograph 40). Upstream of this, the watercourse descends the slope from the higher lands, and has cobble, sand, and gravel substrate (Photograph 41). Approximately 1,850 m upstream from New Post Creek at Otter Rapids Road, the terrain is relatively flat and Tributary 9 is more like a wetland immediately upstream of the perched road culvert, with flow estimated at 0.005 $m^3/s$ through the culvert on September 18, 2012.

Electrofishing was undertaken at Otter Rapids Road (Table 7: EF-16), but no fish were captured. However, because this watercourse has a diversity of pond habitats at various locations along its length, and habitats observed near New Post Creek are of reasonable quality, a simple fish community probably occurs here.

## Tributary 10

This tributary is very small and has a small watershed (Figure 4). Based on this and the absence of water observed during a day of steady rain on September 17, 2012, it is thought to typically be dry. The shallow soil channel that drops steeply into a pre-diversion channel of New Post Creek from the surrounding lands (Photograph 42), without creating a gully, also suggests that significant flow in this watercourse is rare. The aerial photograph does not show a defined channel. No electrofishing was attempted, but due to the lack of water this watercourse is unlikely to support fish. The section of pre-diversion New Post Creek channel that Tributary 10 discharges to is now an oxbow pond and wetland (Photograph 24).

**Table 7: Electrofishing in the tributaries of New Post Creek, upstream of the proposed intake weir location. Collection site locations are shown in Figure 3.**

| Site | EF-6 | EF-6 | EF-7 | EF-8 | EF-9 | EF-10 | EF-11 | EF-12 | EF-13 | EF-14 | EF-15 | EF-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tributary | 1 | 1 | 1 | 4 | 4 | 6 | 6 | 7 | 7 | 7 | 8 | 9 |
| Date | Sep 20, 2011 | Nov 2, 2011 | Sep 18, 2012 | Sep 20, 2011 | Sep 18, 2012 | Sep 20, 2011 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 |
| Electroseconds | - | 2443 | 588 | 294 | 560 | 60 | 549 | 206 | 565 | 72 | 120 | 232 |
| **Species** | | | | | | no catch | | no catch | no catch | no catch | | no catch |
| White Sucker (YOY) | 1 | | | | | | | | | | | |
| Slimy Sculpin | 11 | 44 | 10 | 1 | | | | | | | | |
| Pearl Dace | | | | 1 | | | | | | | | |
| Northern Redbelly Dace | | | | | 4 | | 1 | | | | 1 | |
| Brook Stickleback | | | 3 | | 9 | | 10 | | | | | |

# 5.0 HABITAT EFFECTS ASSESSMENT

## Intake Weir

The footprint of the diversion weir covers 1,832 m$^2$ of New Post Creek stream bottom that is typically covered by water during bankfull flow conditions. Almost all of the impacted area is rough bedrock with a small amount of coarser material along the banks and in bedrock pockets (Photographs 10 and 11; Map 9). Flow velocity is generally fast through this bedrock chute, but varies in speed and extent with water depth. Electrofishing found a sparse fish community with few species (Table 5: EF-2), and these were all collected along the shore in the coarser substrate material. No fish were captured on the offshore bedrock shown in Photographs 10 and 11. Due to the bedrock substrate, it is thought that this chute would not provide a significant amount of spawning habitat for any of the fishes found in New Post Creek (Tables 5 and 6). Therefore, the weir footprint is considered a loss of 1,832 m$^2$ of general (feeding or residence) habitat.

## Flooding upstream of the Intake Weir in New Post Creek

The existing water level immediately upstream of the proposed intake weir location is approximately 181 m a.s.l. The proposed operational water level of the GS headpond is 187 m a.s.l., increasing the water depth immediately upstream of the weir by 6 m, and affecting water level for a distance of 7,166 m upstream. Significant overbank flooding due to the weir will occur for approximately 5,419 m upstream of the weir, with approximately half of the area flooded occurring within the valley associated with Tributary 1 (Figure 5). The headpond area is projected to be 1,693,924 m$^2$ or 169 ha, which results in a 131 ha increase in wetted area (Figure 5), relative to the present condition. This increase in wetted area represents a significant increase in fish habitat, though of a different type than what exists here now. Approximately 1,528 m (linear) of riffle habitat with coarse substrates will be flooded by the headpond. Habitat diversity will be significantly increased, because the drowned stream channel within the headpond will provide deeper habitats than what presently exists, and much of the flooded area will provide a large expanse of shallow, still water habitat that is also not present now. There are 772 m (linear) of riffle habitat with coarse substrate within the 1,321 m of stream between the upstream limit of the proposed headpond and the Otter Rapids Road bridge. Another 1,965 m of riffle habitat occurs within the next 6 km of stream upstream of the bridge.

The existing community of riverine fishes that occur within the proposed headpond area will shift in structure to one that is more typical of a lacustrine system. Though most of the known community (Tables 5 and 6) can also live in lacustine habitats of this size, with the possible exception of Longnose Dace, shifts in relative abundance will likely occur, and other fish species may become established. Assuming that the significant expanse of shallow habitat within the headpond develops areas of aquatic plants, this may provide spawning habitat for a Northern Pike population (if established). The headpond will also allow the establishment of, or increase in, populations of fish such as White Sucker that will utilize the slower and deeper water in the headpond, but still require the faster waters of an accessible river, that are plentiful upstream, for spawning.

**Flooding upstream of the Intake Weir into Tributary Streams**

There are 10 tributary streams that flow into the section of New Post Creek that will become the headpond, and to varying degrees the flooding of the headpond will also flood upstream into these tributaries. Tributary 1 is the largest watercourse flowing to New Post Creek in the study area, and will be affected the most from development of the headpond, because it is the closest tributary to the weir and therefore subjected to the highest increase in water level, and because its channel has a low gradient. Tributary 1 appears to be permanently flowing. Approximately 64 ha of the Tributary 1 valley will be flooded by the proposed project, as well as a 2,492 m length of Tributary 1 channel (Figure 5). Almost all of the channel being flooded has an average width of approximately 4 m, with patchy substrates of gravel, sand, cobble, silt or soil, and riparian vegetation dominated by alder (Photographs 25 and 26). The fish community is dominated by Slimy Sculpin. Based upon the aerial photographs, it appears that this type of habitat extends almost continuously for approximately 9 km upstream from New Post Creek, and therefore the proposed headpond will inundate approximately 28% of this habitat type in Tributary 1. Based upon the field examinations and aerial photographs, it seems unlikely that the 28% of this habitat being affected will contain unique or uncommon habitats that do not occur in the remaining 72%. Therefore, the remaining 72%, or approximately 6,500 m of watercourse, will continue to provide any functions to the system that it currently provides, and the 28% being inundated will continue to be fish habitat, but as part of the headpond.

Tributaries 4, 6, 7, 8, and 9 are watercourses with defined channels, with either permanent or intermittent flow, and all apparently have permanent water somewhere along their length. The headpond extends, respectively, 205, 530, 217, 201, and 174 m upstream into these watercourses (Figure 5). Tributaries 4, 6, and 8 have simple fish communities that were confirmed by sampling during this study, and Tributaries 7 and 9 likely have simple fish communities even though no fish were collected at the locations sampled. No sport fish were found. None of the habitats inundated in these watercourses are considered critical or unique, and the inundated area represents a small portion of each watercourse. For some of these watercourses the section closest to New Post Creek is relatively steep, and therefore inundation by the headpond may facilitate access to these watercourses by fish from New Post Creek.

The proposed headpond will extend approximately 78 m upstream into Tributary 2. This watercourse is usually dry and likely does not contain fish, and so no existing fish habitat will be impacted. Tributary 3 is also usually dry and does not contain fish, and so extending the headpond 103 m upstream into this watercourse will not cause any impacts to existing fish habitat. Tributary 5 will have approximately 146 m of its downstream end inundated, and Tributary 10 will have approximately 23 m of its downstream end inundated, but both these are also thought to be dry most of the time and are unlikely to contain fish.

**Reduction of Flow Downstream of the Intake Weir**

The majority of flow will be diverted through the GS, leaving a specified minimum flow for ecological and aesthetic purposes in New Post Creek downstream of the proposed intake weir. A separate report, entitled Aquatic Assessment of Proposed Minimum Flows in New Post Creek, July 10, 2012, assessed minimum flow in detail. In summary, that report made use of a two-dimensional instream flow needs (2D IFN) model, developed by KGS Group Consulting Engineers, to aid in assessing minimum flows within the area downstream of the waterfall that is utilized by fishes from the nearby Abitibi River, while upstream of the waterfalls minimum flows were assessed by examining habitat and stream morphology. It was found that New Post Creek, between the falls and the proposed intake weir, is low gradient, with three water level control points that regulate upstream water levels. The bedrock outcrop at the brink of the falls is the first water level control point (Photograph 43), a shallow rapids located 2,584 m upstream of the falls is the second water level control point (Photograph 44), and a bedrock outcrop located 3,462 m upstream of the falls is the third water level control point (Photograph 8). These control points allow the deeper flatwater sections that occur upstream of these points (Photographs 6, 45, and 9), to remain largely wetted under very low flows. That report concluded with the following minimum flow recommendations to maintain basic habitat functions.

*Balancing the ecological and energy production impacts on minimum flow, CRP/OPG team recommends the following:*

- *10 $m^3$/s minimum flow during the Walleye spawning and incubation period will be adequate to protect the spring spawning fishes below New Post Creek Falls. Spawning fishes below New Post Creek falls contribute to the wider fish community of the adjacent Abitibi River. It is expected that the provision of this minimum flow will only be required occasionally.*
- *3 $m^3$/s minimum flow during the summer will maintain habitats in New Post Creek, but in a somewhat altered and/or reduced area from what occurs now. While this will likely have an insignificant impact upon the wider fish community upstream and downstream, because most of the impacted area is isolated from off-site habitats and fish from the Abitibi River do not appear to congregate in lower New Post Creek outside of the spring spawning period, habitat compensation may be required for the reduced habitat area of the rapids downstream of New Post Creek Falls.*
- *1 $m^3$/s minimum flow during the winter will maintain basic habitats during this time of minimal productivity.*

Using the above recommendations as a starting point for discussion and negotiations, MNR, OPG and CRP have since settled on the following minimum flow regime (SENES, 2013).

- Spring time flow for spawning of 15 cubic meters per second ($m^3/s$). This will occur from the start of Walleye spawning (approximately May 1) to the end of Walleye fry emergence from the spawning area substrate. The parties have agreed that a temperature based method could be used to determine this period each year.
- From the end of Walleye fry emergence to July 1, a transition flow will be provided.
- Summer flow of 7.5 $m^3/s$ from July 1 to August 31.
- 5 $m^3/s$ flow from September 1 to 30.
- 2 $m^3/s$ for the period of October 1 to the start of Walleye spawning (approximately May 1).

The July 2012 minimum flow assessment report presented modelling results that showed a maximum area of Walleye spawning habitat was attained at 15 $m^3/s$, though only marginally more than attained at 10 $m^3/s$. The modelling results also indicate that the amount of Walleye spawning habitat at 10 and 15 $m^3/s$ is significantly higher than during typical spring flows. Therefore, while marginally raising the potential area of Walleye spawning habitat during the years when spring flows are low enough that the minimum flow would come into effect, it is believed that 15 $m^3/s$ minimum flow, as compared to 10 $m^3/s$, will not significantly improve Walleye spawning success. The proposed July 1 to August 31 minimum flow of 7.5 $m^3/s$ is in the vicinity of the open water minimum flows in New Post Creek that were observed over the study period (Table 8), and therefore are unlikely to result in significant loss of habitat function or area. The proposed September 1 to 30 minimum flow of 5 $m^3/s$ is appropriate in that it provides a transition between the 7.5 $m^3/s$ summer flow and the 2 $m^3/s$ winter flow. The proposed 2 $m^3/s$ flow from October 1 to the start of Walleye spawning is twice that proposed in the July 2012 minimum flow assessment report, and so for the same reasons (i.e. wetted areas maintained by water level control points; sparse nature of the fish community and the low winter activity of most fish and invertebrates in New Post Creek and adjacent habitats; isolated nature of areas upstream of the falls, and the limited contributions to off-site fish communities) this minimum flow is adequate to maintain ecological function throughout the winter. The October 1 start of the winter minimum flow allows aquatic organisms to take up their overwintering positions at water levels that can be expected throughout the winter.

**Table 8: Minimum flows for each study year.**

| Date occurred | Flow ($m^3/s$) |
|---|---|
| October 23, 2009 | 8.62 |
| June 28, 2010 | 11.5 |
| September 12, 2011 | 8.92 |
| July 29, 2012 | 5.21 |

**Intermittent Operation of the GS**

During typical operation a consistent headpond water level will be maintained. However, in some years there may be periods of time when there will not be enough flow in New Post Creek to provide the specified minimum flow downstream of the intake weir and continuously operate the GS. During these periods, the required minimum flows will be provided downstream of the intake weir in New Post Creek but the GS will be shut down and any water in excess to the minimum flow will be accumulated in the headpond so that the GS can be operated periodically using the stored water. When this situation arises the GS will be shut down when the headpond water level drops to 0.5 m below the usual full headpond water level. However, for operational considerations, during periods of ice cover OPG may restrict the water level drop to 0.1 m below the usual full headpond level. Once the headpond refills to its normal level, the GS will restart and operate until the specified lower headpond water level is again reached. This operational pulsing will continue until there is sufficient water for continuous operation.

Water levels presently vary by about 3 m in New Post Creek over the course of a year. In the headpond, water level fluctuations associated with the intermittent operation of the GS will be less, but will occur over a much shorter period of time. It is thought that the 0.1 m water level fluctuation that may periodically occur through the winter, ice-covered period, will have a negligible impact upon the aquatic ecosystem. During the spring when headpond water level fluctuation may be 0.5 m, there is plenty of water most years to operate the GS and provide the minimum flow, and therefore it is unlikely that the GS will be operated intermittently during this period. The greatest impact in the headpond due to intermittent operation is likely to occur during the late summer, when shortages of water are most likely to occur and the water level could fluctuate by up to 0.5 m. Fortunately, no fishes will be spawning during the late summer, and so intermittent operation at that time will not affect reproduction and is unlikely to cause direct mortality of fish. However, short-term water level fluctuations during the late summer may affect the composition of any shallow water plant communities that may become established, by affecting aquatic plant species that are intolerant of dewatering.

It is thought that the intermittent operation of the GS by using the headpond for water storage will be the least impactful upon habitat and fish and invertebrate communities downstream of the intake weir, because it maintains stable flow conditions in this area, including the important spawning habitat downstream of the falls. Of course, Walleye spawn early in the spring when there will almost always be enough water to provide the proposed minimum flow as well as continuously operate the GS, and so fish species such as Shorthead Redhorse and some cyprinids, that spawn later in the spring, will be the primary beneficiaries of intermittent GS operation. As an example, consider that 15 $m^3/s$ will be required as the minimum flow during the spawning period, while the GS will require a minimum of 10 $m^3/s$ and a maximum of 50 $m^3/s$ to operate. Therefore, at flows of 25 $m^3/s$ to 65 $m^3/s$, the lower section of New Post Creek will receive 15 $m^3/s$ while the GS will pass the remainder. In the absence of intermittent GS operation, if the total New Post Creek flow drops below 25 $m^3/s$, then the GS shuts down and flow downstream of the intake weir and over the spawning grounds will increase almost immediately from 15 $m^3/s$ to as much as 24.9 $m^3/s$, which is a significant percentage increase that may dislodge deposited eggs. Also in the absence of intermittent GS operation, if total New

Post Creek flow was 24 $m^3/s$, then all 24 $m^3/s$ would potentially be passing over the important spawning area below the falls during egg deposition. If total New Post Creek flow were to then increase to 25 $m^3/s$, the GS would restart and divert 10 $m^3/s$ through the GS to the Abitibi River, quickly reducing flow over the spawning area to 15 $m^3/s$, potentially dewatering some eggs/embryos that were deposited at 24 $m^3/s$. Even more extreme changes in flow would occur if this were to happen when lower minimum flows are in effect. For example, during the winter period the minimum flow downstream of the intake weir will be 2 $m^3/s$. In the absence of headpond storage and intermittent GS operation, if the total flow in New Post Creek decreased to less than 12 $m^3/s$, the GS would be shut down and there would be a sudden flow increase from 2 $m^3/s$ to 11.9 $m^3/s$ downstream from the weir. Then, when total New Post Creek flow increased to 12 $m^3/s$ again there would be a sudden flow decrease from 11.9 $m^3/s$ to 2 $m^3/s$ downstream from the weir, which is almost a 6-fold change. By allowing intermittent GS operation by storing water in the headpond, the minimum flows downstream of the intake weir and in the important spawning area downstream of the falls would be maintained until flows exceeded 65 $m^3/s$, and when that happens downstream flows would not increase suddenly by a large increment, but at a natural and, presumably, more gradual rate.

**Headpond Impacts Upon Water Temperature**

During the spring and fall field work for this project, it was observed that New Post Creek water temperatures display a larger and more rapid response to changes in weather, compared to water temperatures in the Abitibi River. This is likely due to the large volume and greater depth of the Abitibi River, compared to the much smaller volume and shallower New Post Creek. The proposed headpond, with its large surface area and extensive shallow areas, will likely exaggerate this effect. Water temperatures downstream of the headpond will warm earlier in the spring, and cool earlier in the fall, possibly affecting the timing of spawning that occurs in lower New Post Creek, and any future spawning that may occur in the GS tailrace at the Abitibi River.

Summer water temperatures in New Post Creek downstream of the intake weir will likely be warmer than what occurs here at present, due to the surface area of the reservoir, the top draw of the outlet that discharges the minimum flow downstream of the intake weir, and the reduced volume of flow downstream of the weir, though the magnitude of this change is unknown. Longnose Sucker, Slimy Sculpin, and Burbot prefer cold water temperatures (Coker *et al.*, 2001), and their populations in New Post Creek, though sparse, may be negatively affected by this potential increase in water temperature downstream of the intake weir. The potential exists that the invertebrate and fish communities in this area may shift towards one that can tolerate slightly warmer conditions.

**Tailrace at the Abitibi River**

The tailrace of the proposed New Post Creek GS will discharge to the Abitibi River, approximately 2.7 km upstream from the mouth of New Post Creek (Figure 4). Similar to much of the Abitibi River shoreline, the tailrace location appears to be primarily clay and sand, with some rocks of various sizes (Photograph 46). The water depth increases rapidly with distance offshore (Map 23), minimizing the need for alteration to the bed of the Abitibi River, and ensuring that the nearshore modifications required will not significantly change the habitat character. Based upon the assumption of a typical 3 m deep tailrace for a GS this size, approximately 604 $m^2$ of Abitibi River bottom will require excavation The uniform nature of the habitat through this section of the Abitibi River, as well as habitat observations and gillnetting that have been undertaken at the proposed tailrace location over the study period, indicate that no unique or critical habitats occur at this location, and it is not used by spawning fishes. The tailrace channel that will be constructed between the powerhouse and the Abitibi River will have an area of approximately 1832 $m^2$, and will be lined with riprap to stabilize its shape. The tailrace channel and riprap lining will provide additional aquatic habitat, and add some habitat diversity to this area of the Abitibi River.

## Habitat Loss/Gain Summary

While it is not possible to compare all habitat effects as losses or gains, overall, approximately 131 ha of aquatic habitat will be gained, and approximately 70 ha of existing aquatic habitat will be altered to some degree. Table 9 provides a summary of the fish habitat lost, gained, or altered.

**Table 9: Summary of habitat changes.**

| Habitat component | Analysis |
|---|---|
| Intake weir | 1,832 $m^2$ of habitat in New Post Creek will be permanently lost to the weir footprint. This area is mostly bedrock and would not provide a significant amount of spawning habitat for any of the fishes found in New Post Creek. It is thought that this area is general (feeding or residence) fish habitat. |
| Flooding upstream of the intake weir in the main channel of New Post Creek | 131.9 ha of aquatic habitat will be created and 37.5 ha of existing riverine habitat will be altered to lacustine habitat. A large portion of this area will provide shallow lacustrine habitat, which is currently not present in this portion of New Post Creek. This body of water will support a typical shallow lacustrine fish community. |
| Flooding upstream of the intake weir in tributary streams | 4,169 m of watercourse length will be flooded (altered) in 10 tributaries, with more than half of this occurring in one tributary (2,492 m), and may account for an area of about 1 ha. No critical or unique habitats will be lost from the system, and in some cases the flooding of the downstream portions of watercourses will enhance access to these tributaries by fishes in New Post Creek. |
| Reduction of flow downstream of the intake weir | Water depth and flow velocity will generally be lower during the GS operation, then what occurs here at present. While some shifts in aquatic communities are expected, the minimum flows that have been established will ensure that key habitat components and functions (e.g. Walleye spawning) will be maintained.<br>The area altered is 32.8 ha. Reductions in habitat area under minimum flows are thought to be minor, but cannot be quantified with the available information. |
| Intermittent operation of the GS | Occasional water level fluctuation of 0.5 m during the open water period is thought to have no significant direct effects to fish, however, the aquatic vegetation community, if one becomes established, may be affected to some degree. The occasional water level fluctuation of 0.1 m during the winter ice cover period is thought to result in insignificant effects. |
| Headpond effects upon water temperature | The headpond has the potential to increase water temperature downstream in New Post Creek, though the magnitude of this effect is unknown. While this may slightly shift spawning periods of fishes, it is not thought to impair spawning. However, summer water temperatures may increase in New Post Creek, potentially causing a shift in fish and invertebrate communities to those more tolerant of warmer water. |
| Tailrace at the Abitibi River | Approximately 604 $m^2$ of the Abitibi River will be deepened to accommodate the outflow from the proposed GS tailrace, but habitat alteration is expected to be minor due to the type of habitat affected.<br>Approximately 1,832 $m^2$ of tailrace channel will be constructed, representing an increase in habitat area. |

## 6.0 CONCLUSIONS

**Habitat Assessment**

The habitat in the Abitibi River, in the vicinity of the proposed tailrace and at the mouth of New Post Creek, appears to be typical for the Abitibi River in this area, and therefore is not considered critical habitat for any fish species. The channel is deep and U-shaped in cross-section with fine-grained substrate and little instream structure, but with occasional patches of coarser material or wood debris. Most of the variation in flow velocity, substrate, and instream structure, that provide critical fish habitats in the Abitibi River, are found where bedrock outcrops create rapids or waterfalls, away from the mouth of New Post Creek and the proposed tailrace location.

Habitat in New Post Creek appears to be somewhat more diverse than the Abitibi River. The creek below the waterfall has a variety of substrates, depths and flow velocities, not found in nearby sections of the Abitibi River, and therefore provides seasonal habitats for fish populations from the Abitibi River. Walleye, White Sucker, and Longnose Sucker have been observed spawning here during their spring spawning periods. Lake Sturgeon are not thought to spawn here, based on investigations conducted during this study (C. Portt and Associates, 2013).

Upstream of the waterfall, New Post Creek is a meandering watercourse with long flatwater sections and a variety of substrates that are generally dominated by fine-grained material, punctuated occasionally by a few bedrock outcrops that result in short rocky chutes. Upstream of the proposed intake weir location some gently sloped gravel/sand/cobble riffles are present. Still farther upstream, the substrate material becomes coarser, and the number and length of riffles increases. Based on sampling conducted during this study, the aquatic habitats upstream of the waterfall support a sparse and relatively simple fish community. The waterfall is a complete barrier to upstream fish migration.

Upstream of the proposed intake weir, ten tributaries to New Post Creek were examined. Some of these tributaries are poorly defined and apparently contain no fish, due to the lack of flow. The remaining tributaries have simple fish communities, and some are reduced to standing water in places, while others appear to be permanently flowing. There were no sport fishes captured in any of these tributaries.

**Effects Assessment**

The proposed New Post Creek hydroelectric GS will not have a negative effect upon the fish communities of New Post Creek or the Abitibi River, though local shifts in community structure are expected due to physical habitat and water temperature changes. Upstream of the proposed intake weir, the headpond will create an additional 131.9 ha of aquatic habitat, and alter an existing 37.5 ha of riverine habitat to be slower flowing and deeper. This will provide a greater area and diversity of habitats that could potentially result in a more productive and diverse fish community. Downstream of the proposed intake weir a set of seasonally appropriate minimum flows will ensure that the habitat components and functions in New Post Creek are maintained, including the important Walleye spawning habitat below the waterfalls. The tailrace discharging to the Abitibi River will not result in the loss of habitat, but will increase habitat diversity in the vicinity of the tailrace.

## 7.0 REFERENCES


C. Portt and Associates. 2012a. New Post Creek, Abitibi River, Lake Whitefish spawning assessment, 2009, 2010 and 2011. Prepared for SENES Consultants Limited, Richmond Hill, Ontario. 11 p.

C. Portt and Associates. 2012b. New Post Creek, Abitibi River, Walleye spawning assessment, 2009 and 2010. Prepared for Ontario Power Generation, Toronto, Ontario. 11 p.

C. Portt and Associates. 2012c. New Post Creek, Abitibi River, Walleye spawning assessment, 2011. Prepared for SENES Consultants Limited, Richmond Hill, Ontario. 8 p.

C. Portt and Associates. 2013. New Post Creek, Abitibi River, Lake Lake Sturgeon spawning assessment, 2011 and 2012. Prepared for SENES Consultants Limited, Richmond Hill, Ontario. 21 p + Appendix.

Coker, G.A., C.B. Portt, and C.K. Minns. 2001. Morphological and ecological characteristics of Canadian Freshwater Fishes. Can. MS Rpt. Fish. Aquat. Sci. 2554: iv+86 p.

Holm, E., N.E. Mandrak, and M.E. Burridge. 2009. The ROM field guide to freshwater fishes of Ontario. Royal Ontario Museum, Toronto. 462 p.

Scott, W.B and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 183. Ottawa, Canada. 966 p.

SENES Consultants Limited (SENES). 2013. Aquatic Environment Technical Support Document for the New Post Creek Hydroelectric Project. Report to Ontario Power Generation Inc. and Coral Rapids Power.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. J. Geol. 30: 377-392.

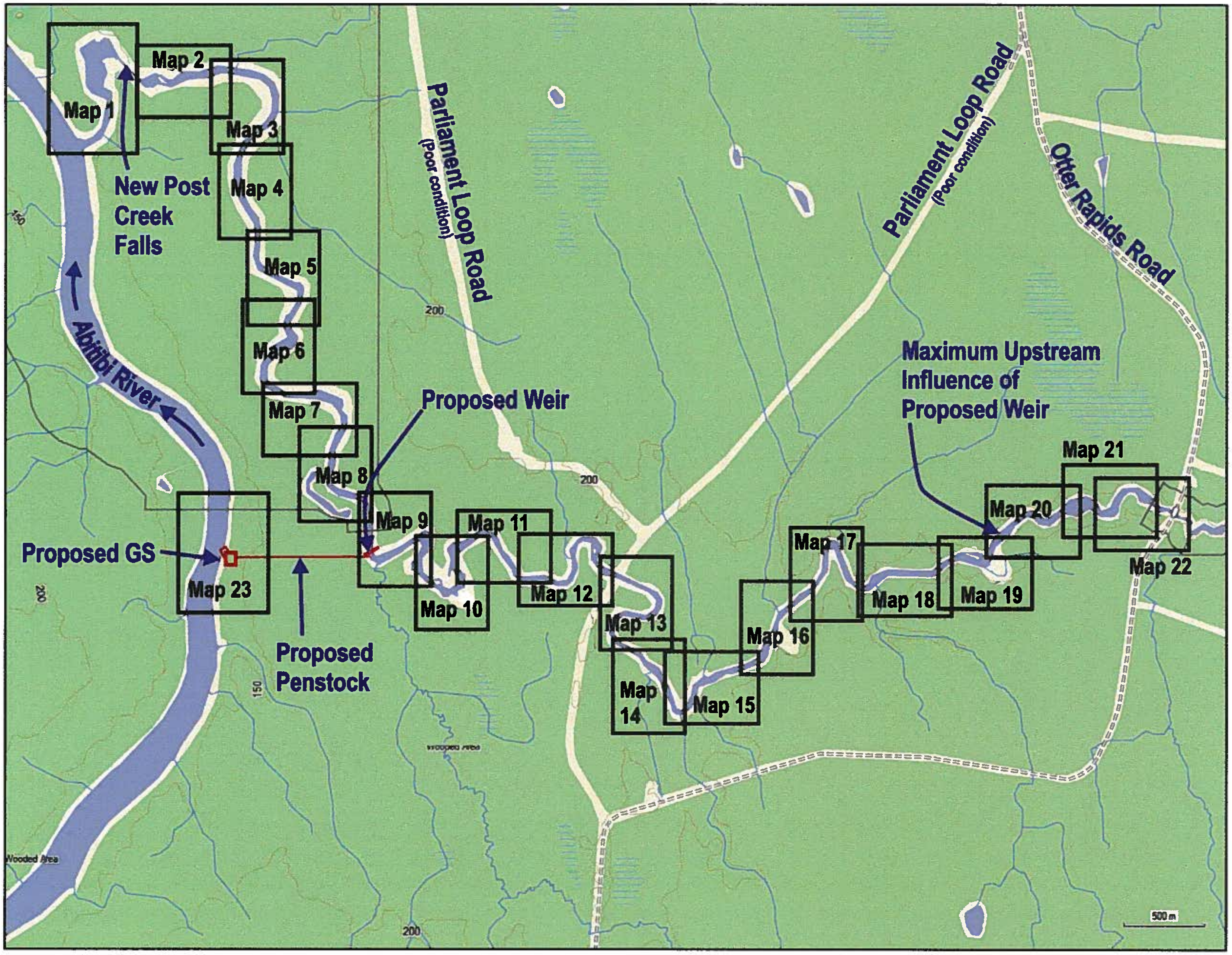



**Figure 2:** **Study area and location key for habitat Maps 1 to 23. These maps are provided in Appendix A.**

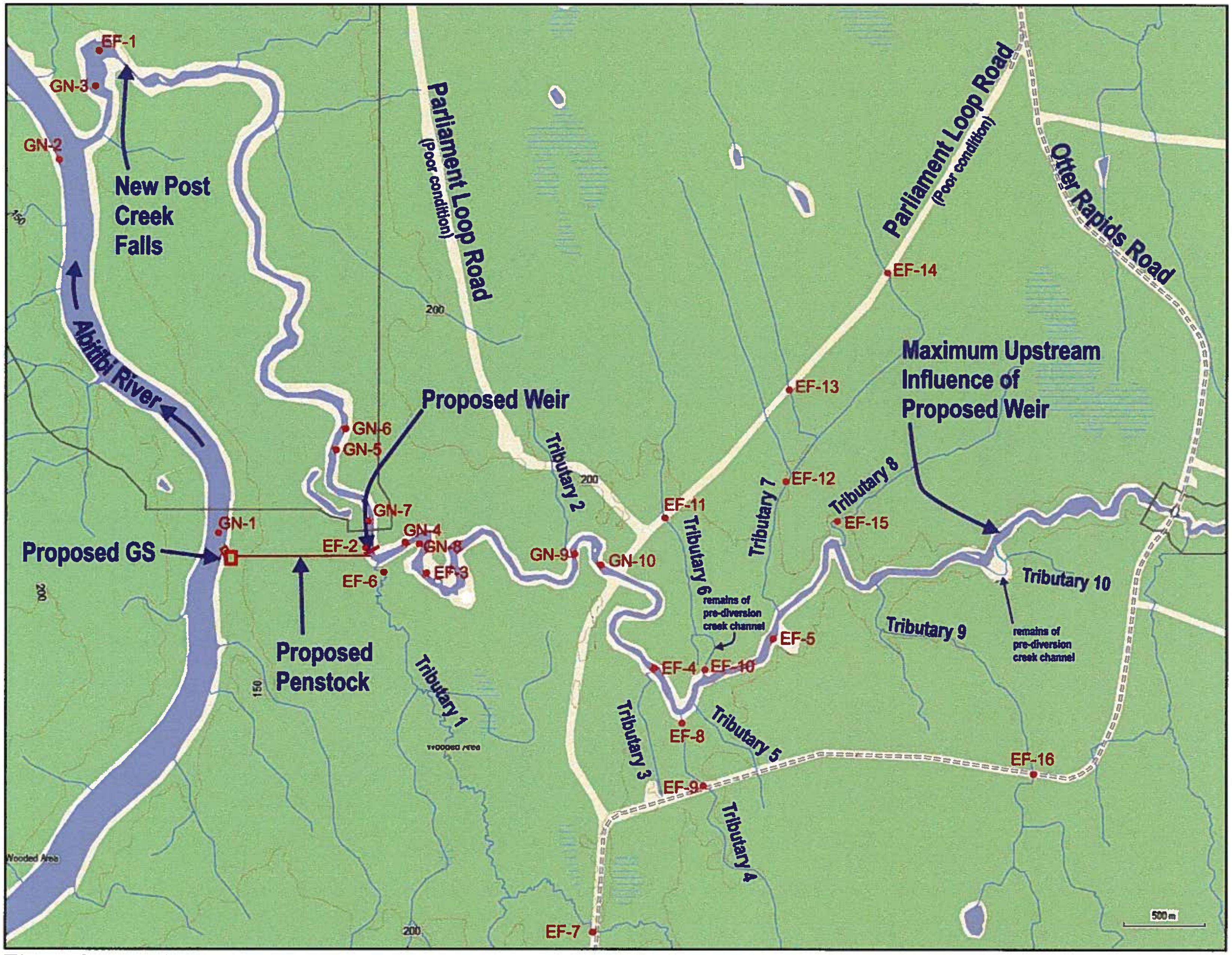



**Figure 3: Fish community sampling locations within the study area. GN=gillnet; EF=electrofisher.**

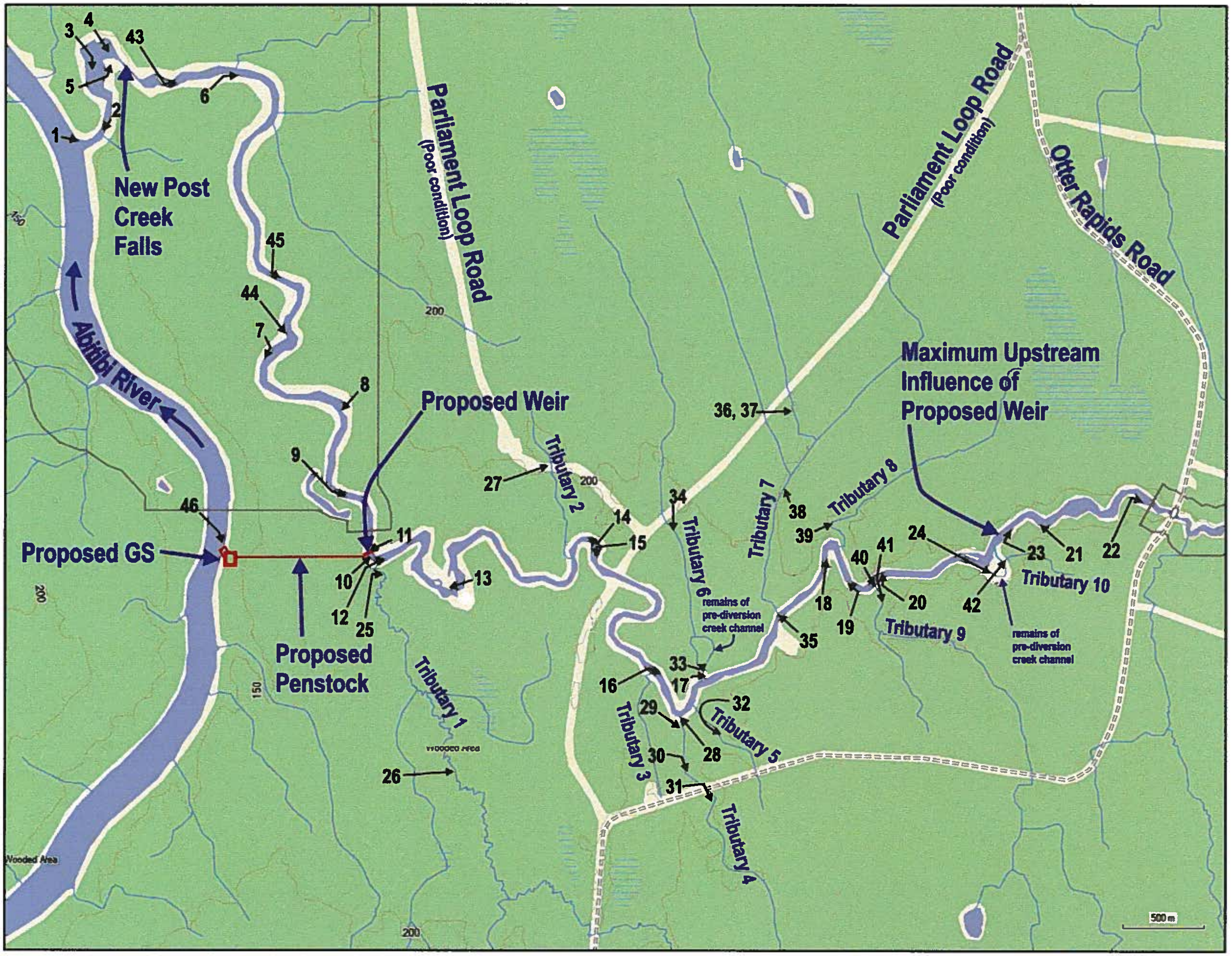



**Figure 4:** **Locations of selected photographs in the study area. Photographs are provided in Appendix B.**

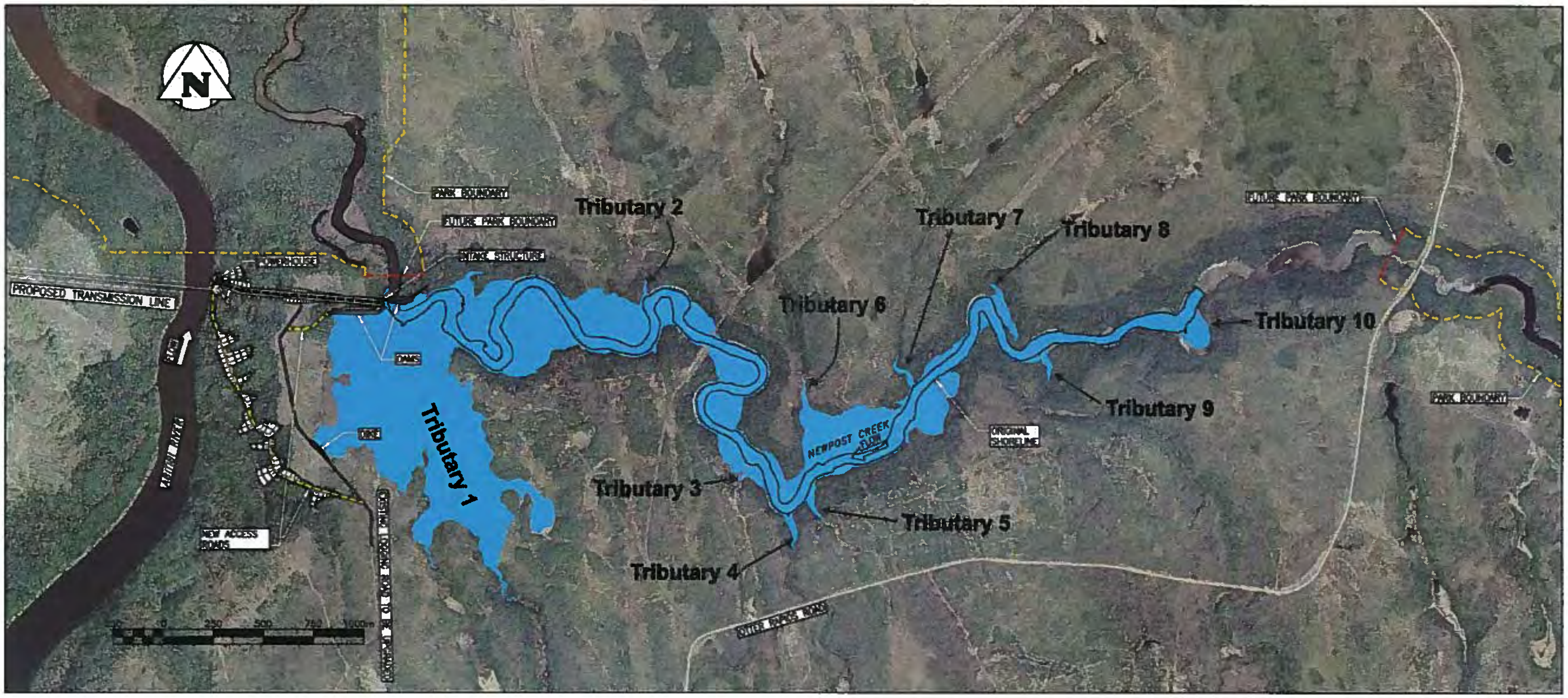
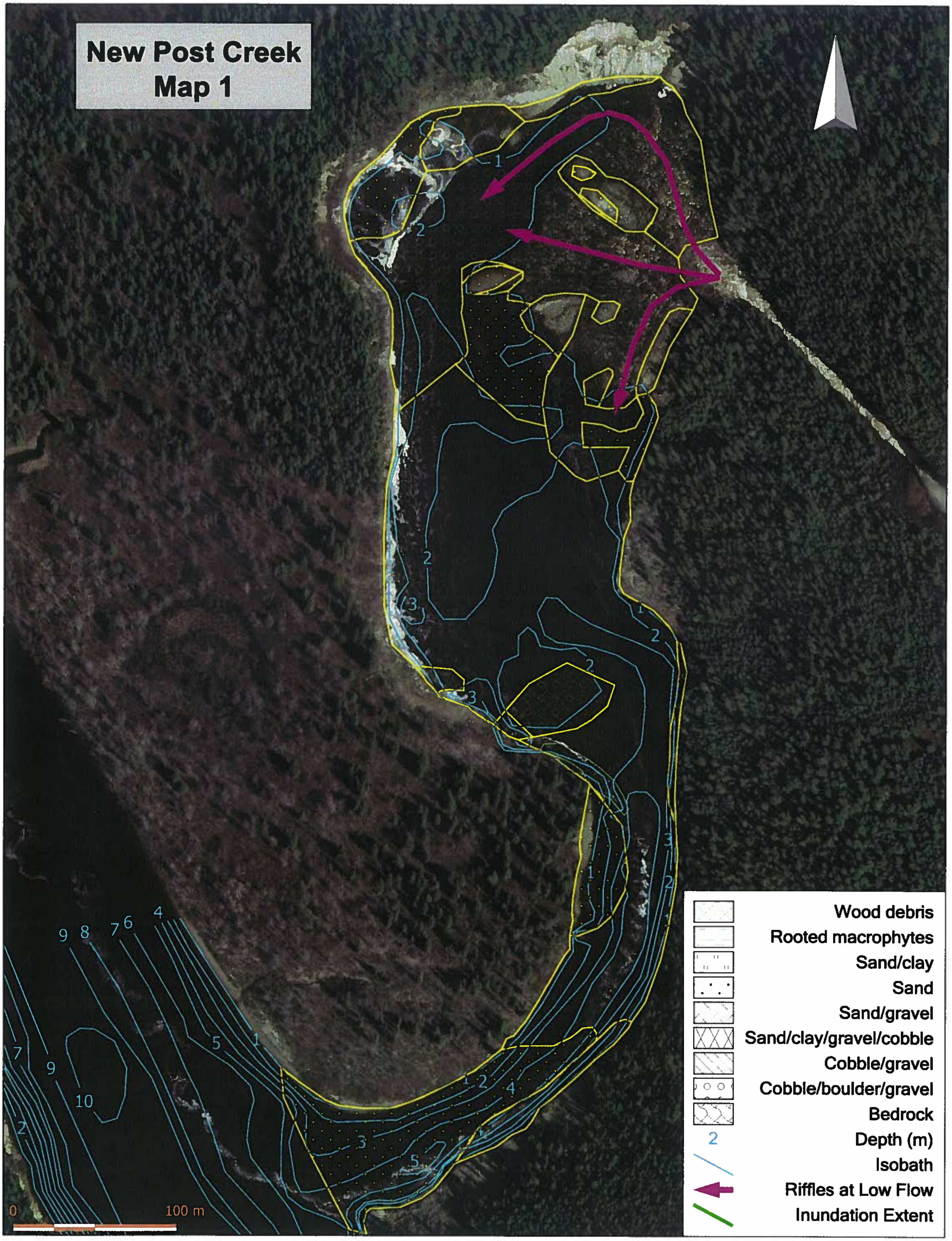
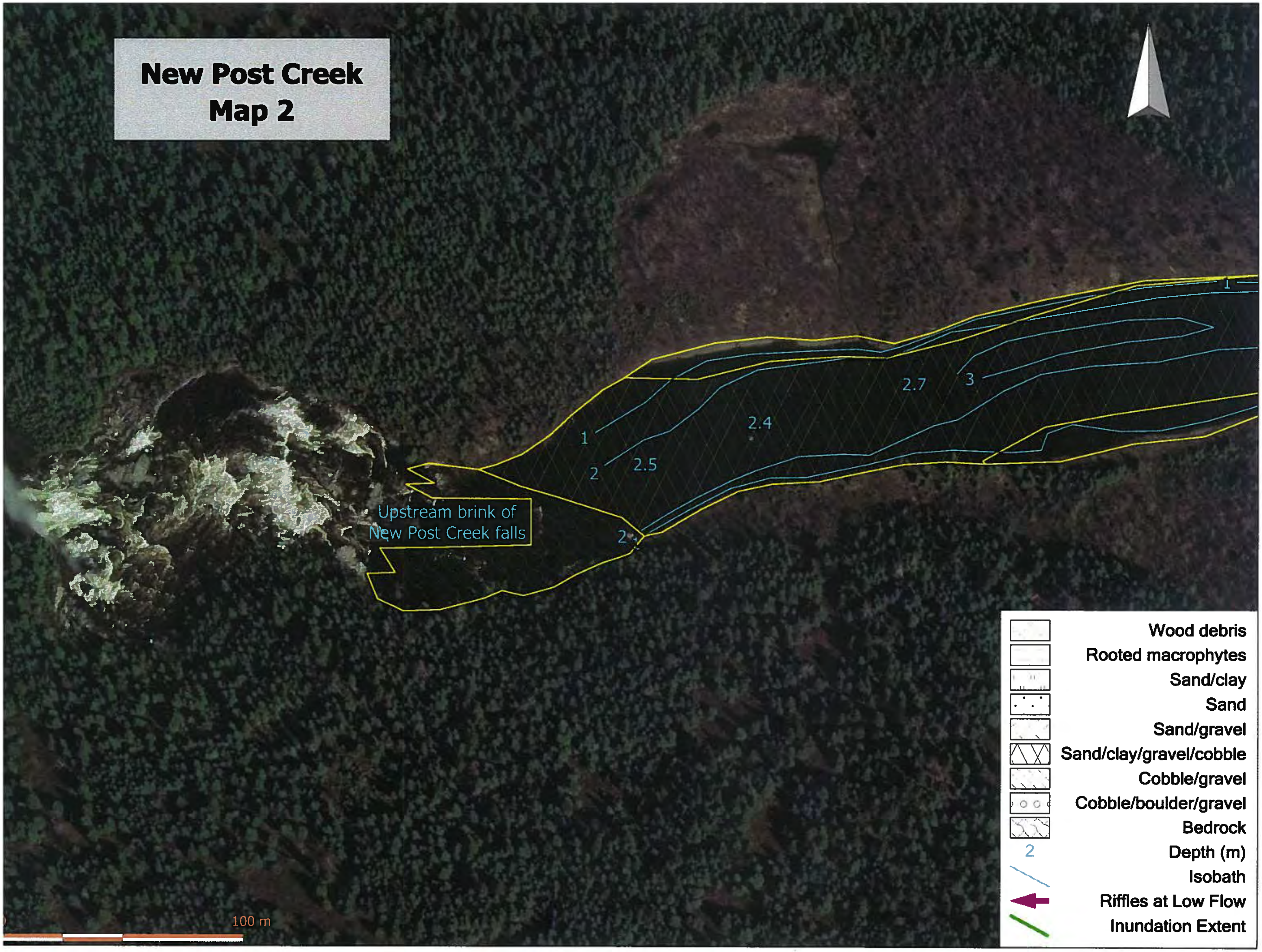


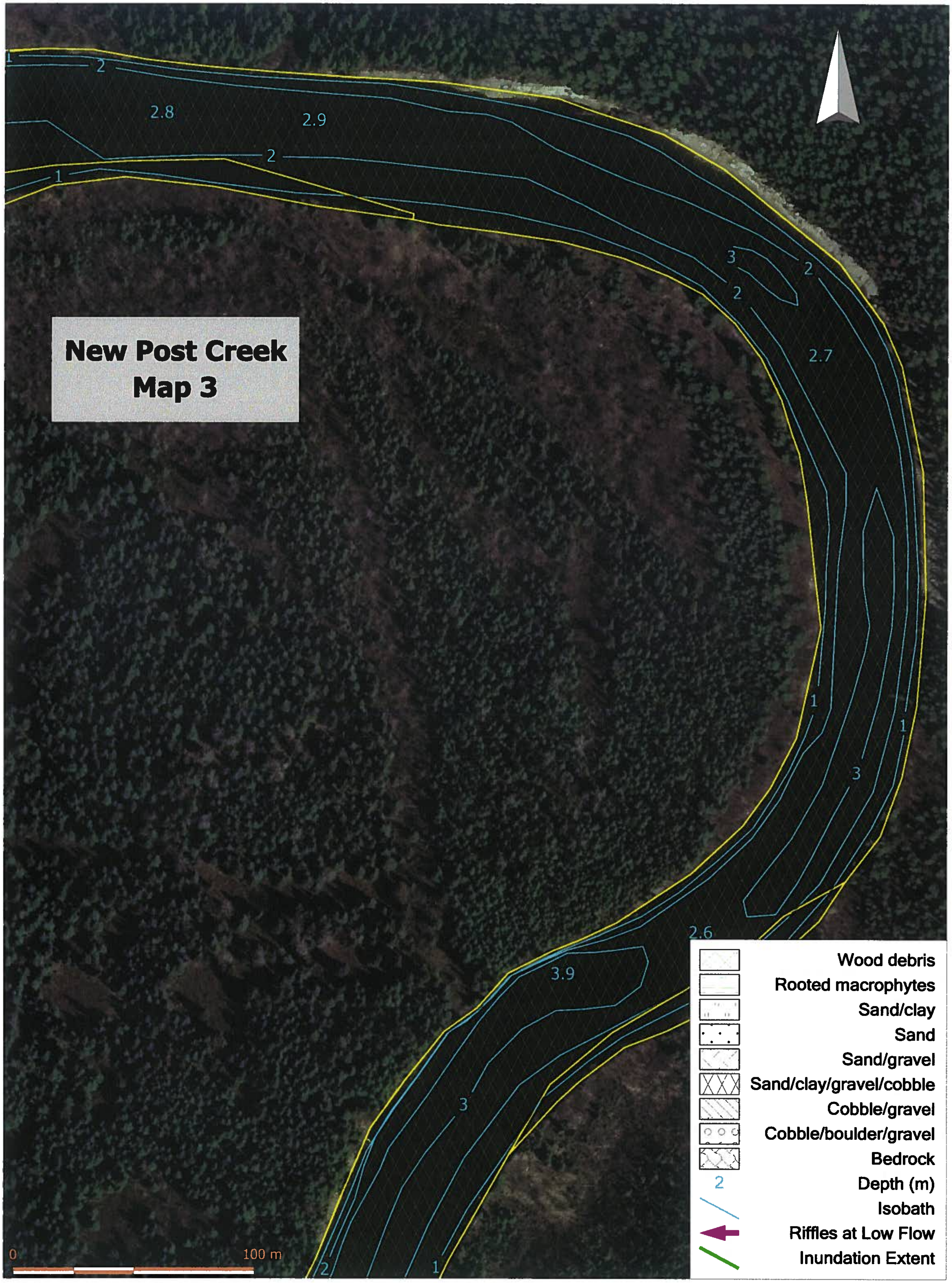

**Figure 5:** **Estimated extent of headpond, resulting from the proposed intake weir.**

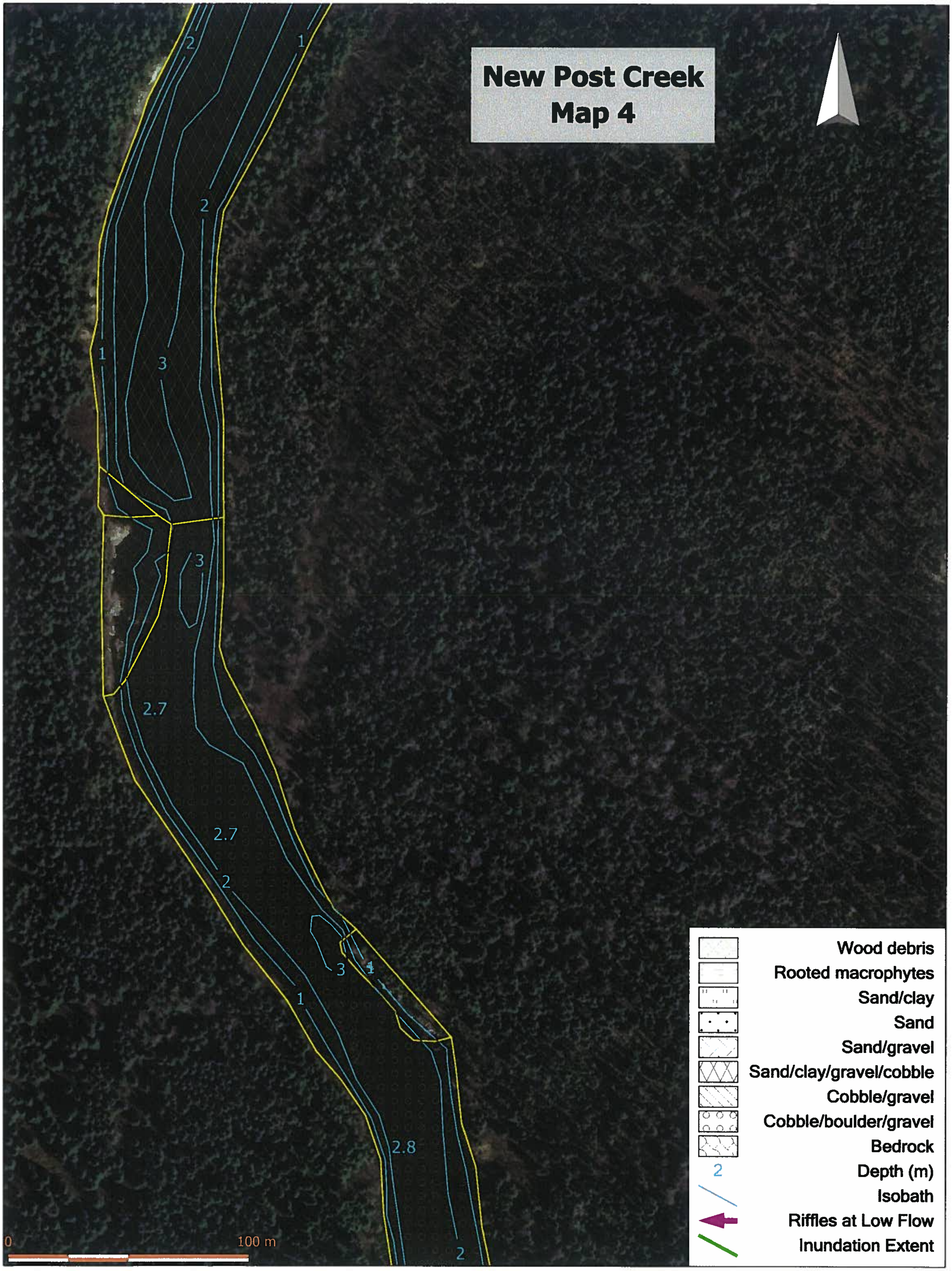
# Appendix A

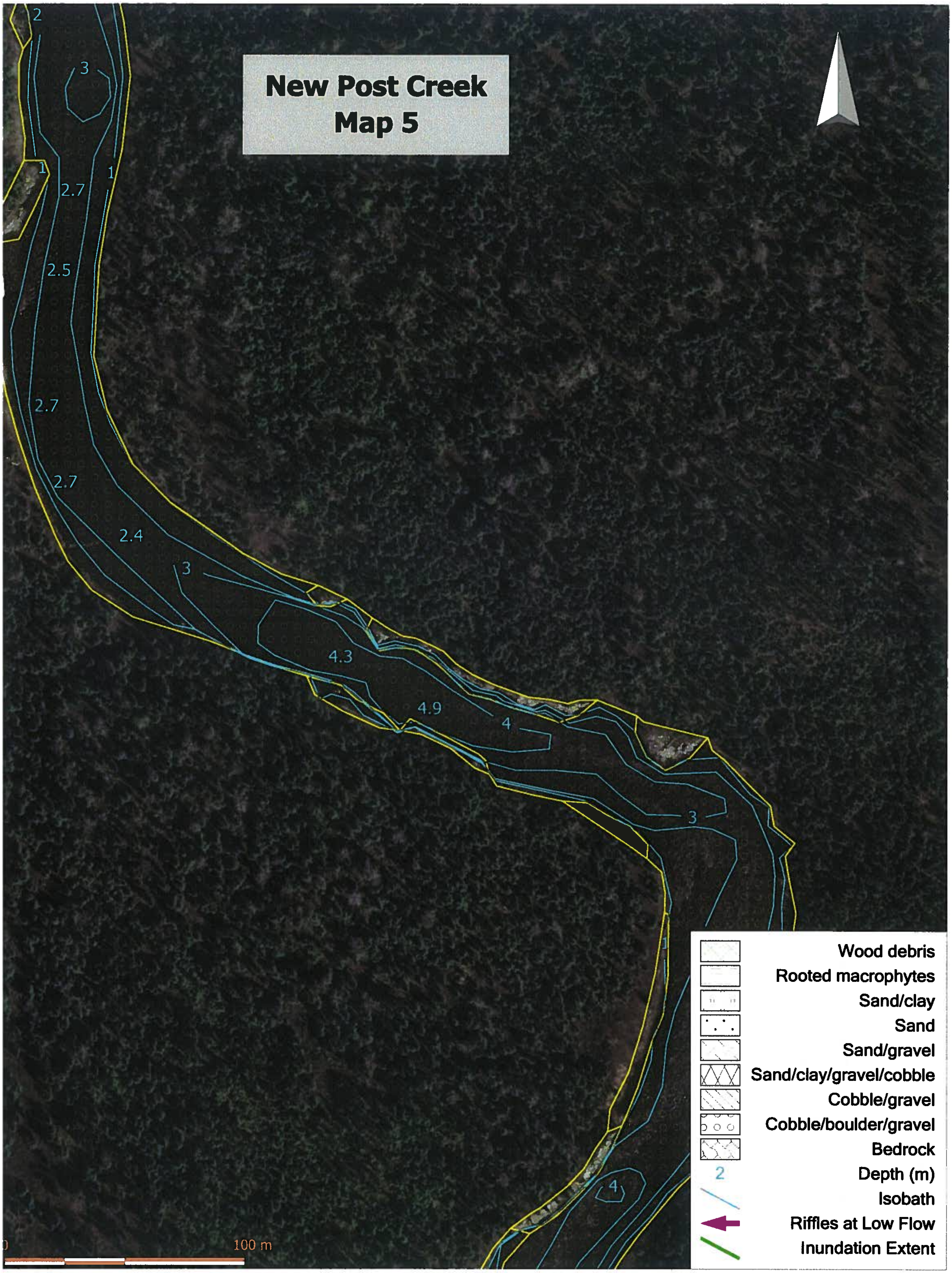
## Habitat Maps

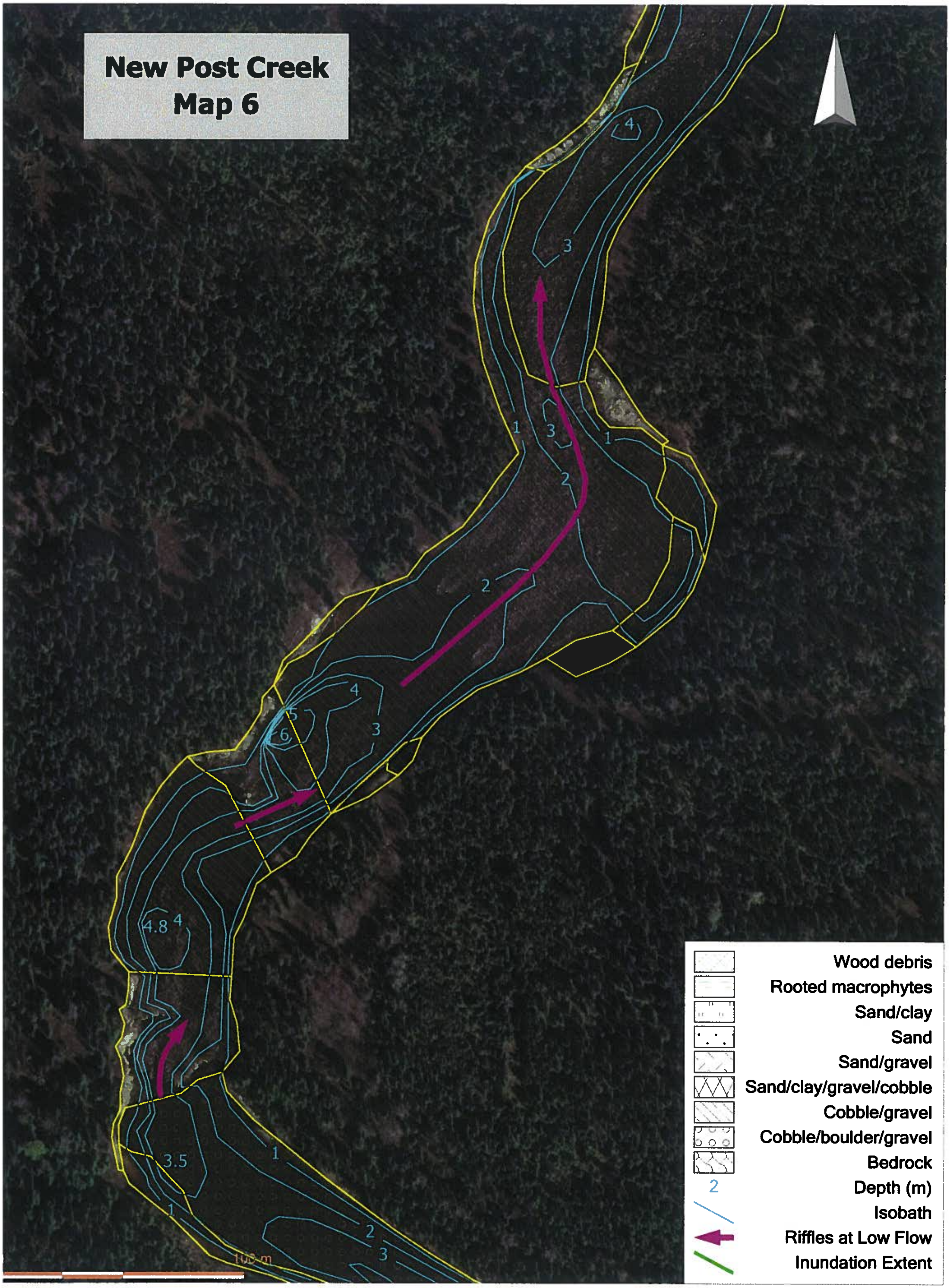

New Post Creek
Map 1
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
0
100 m


New Post Creek
Map 2
Upstream brink of
New Post Creek falls
1
2
2.5
2.4
2.7
3
2
1
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent

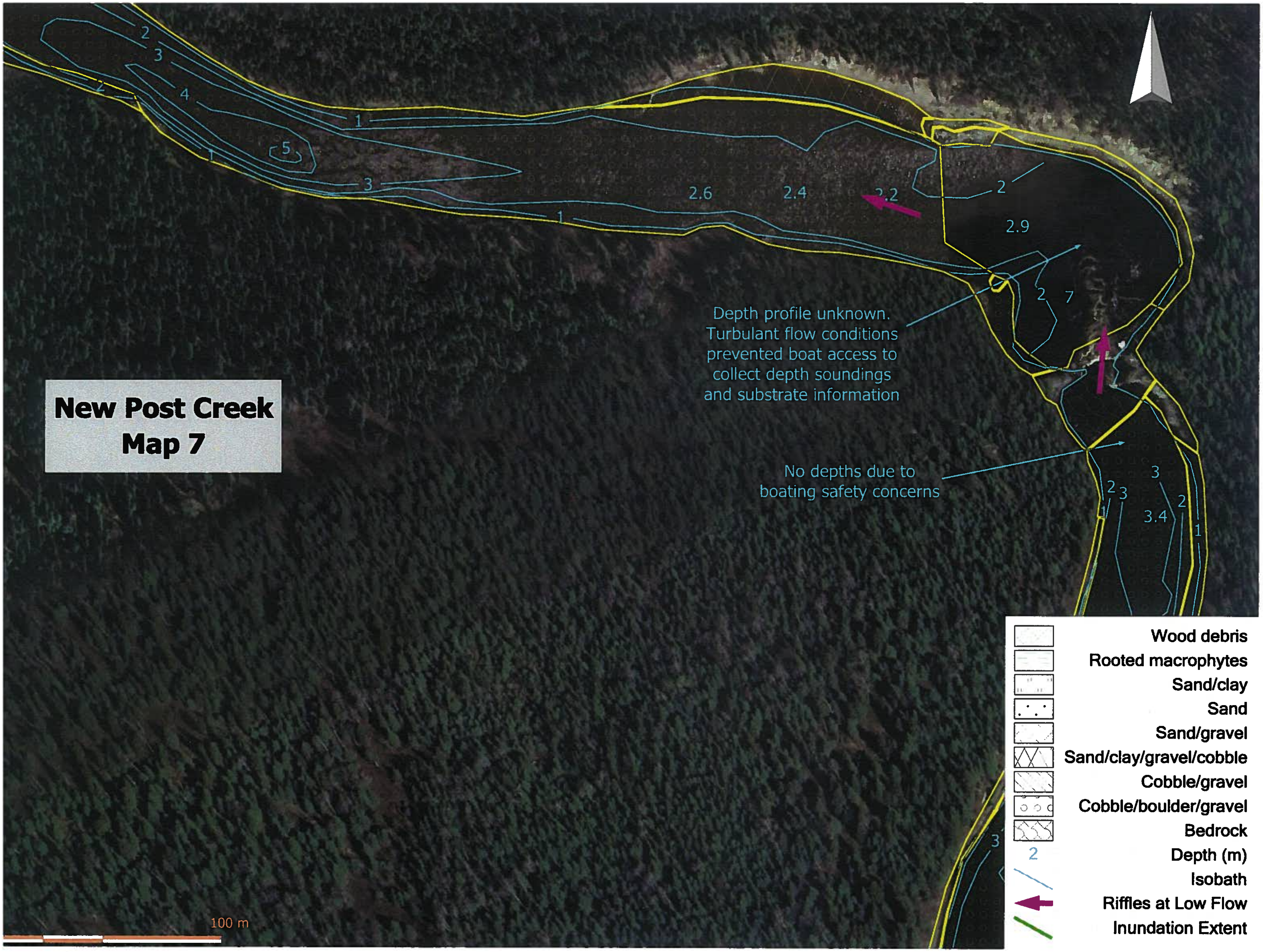

New Post Creek
Map 3
2.8
2.9
2.7
2.6
3.9
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
0
100 m


New Post Creek
Map 4
2
1
2
1
3
3
2.7
2.7
2
3
1
1
2.8
2
0
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent

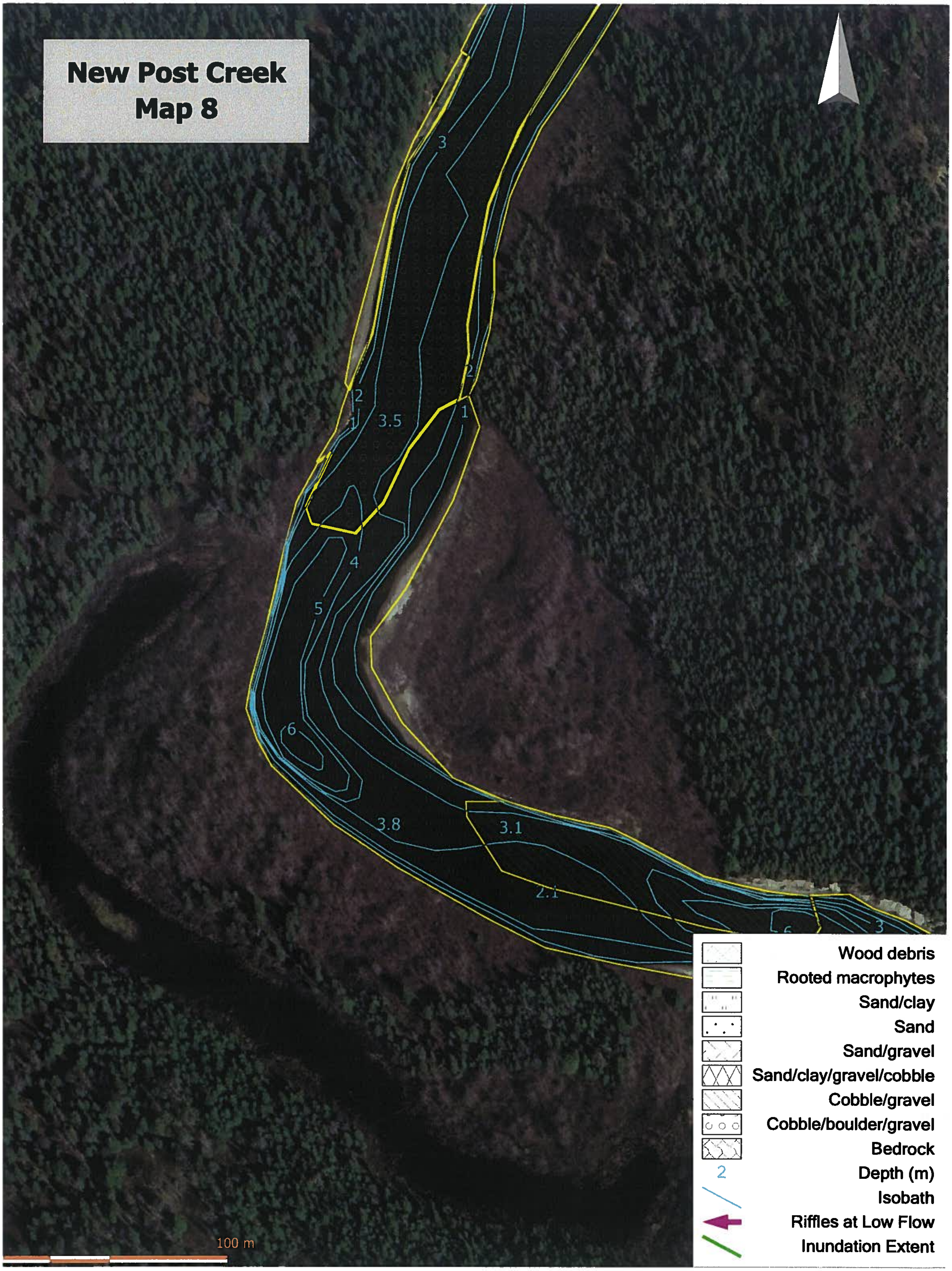

New Post Creek
Map 5
2
3
1
2.7
1
2.5
2.7
2.7
2.4
3
4.3
4.9
4
3
4
0
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent



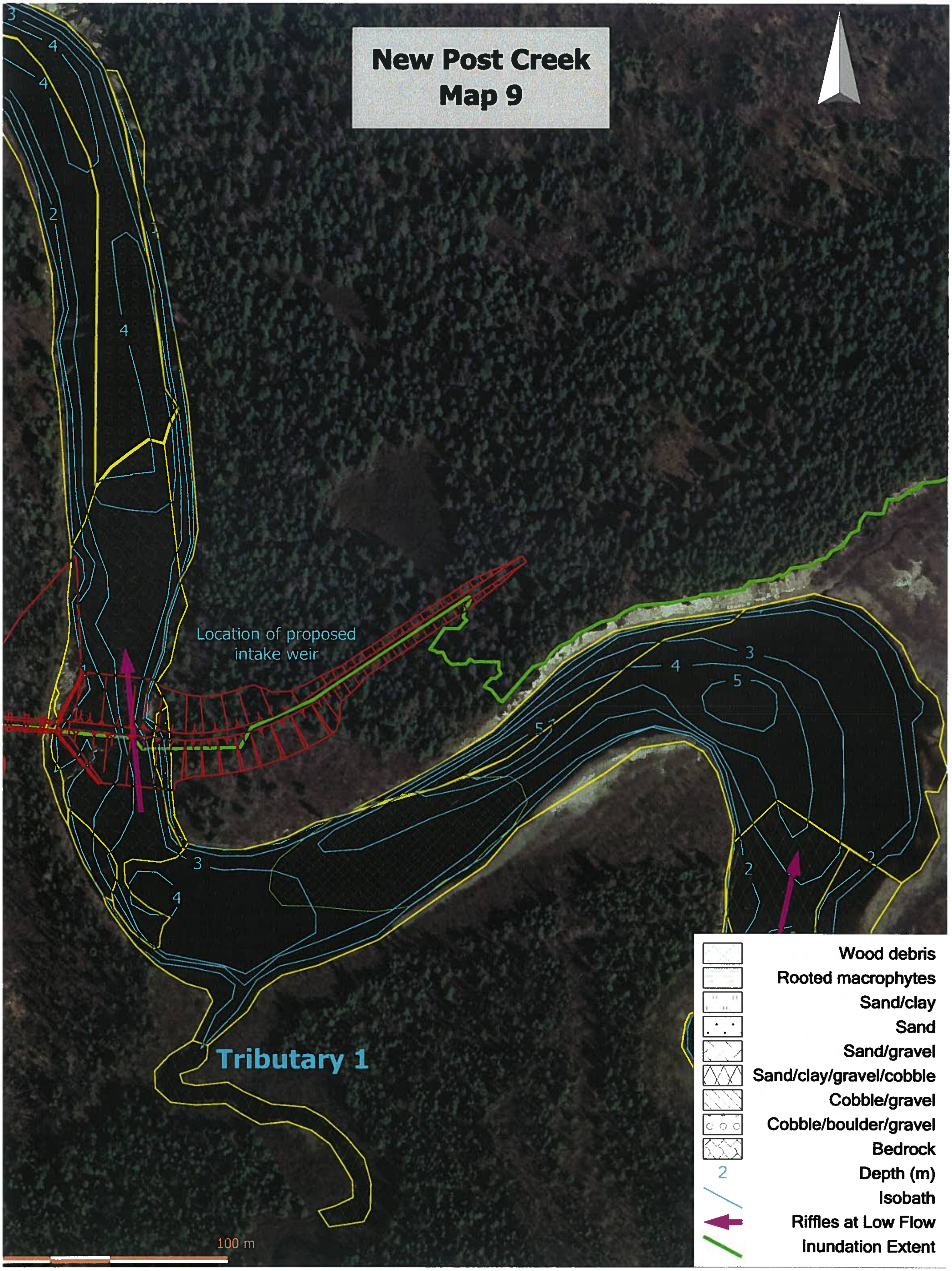
New Post Creek
Map 6
4
3
1
3
1
2
2
4
5
6
3
4.8
4
3.5
1
1
2
3
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent



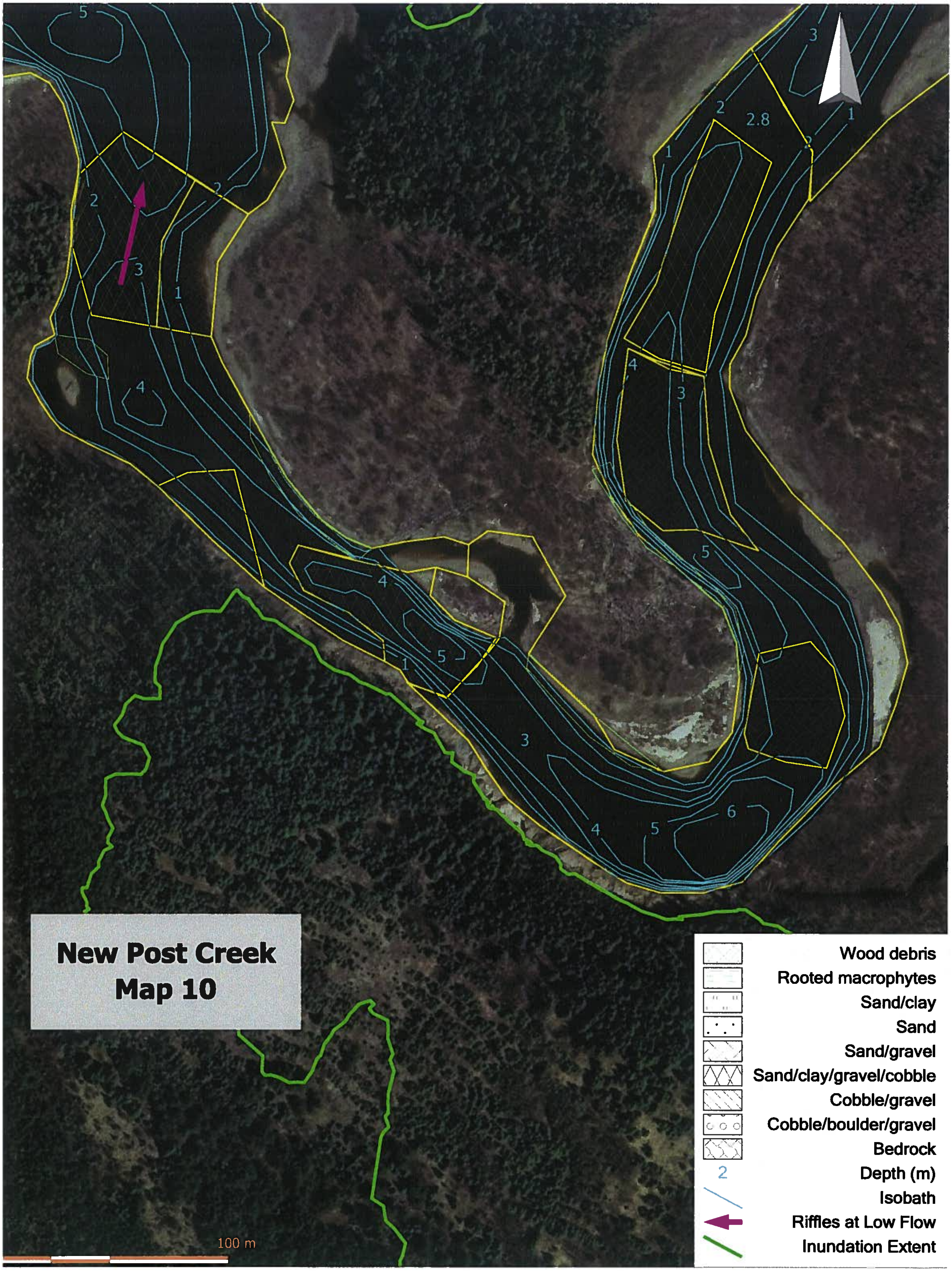
New Post Creek
Map 7
Depth profile unknown.
Turbulant flow conditions
prevented boat access to
collect depth soundings
and substrate information
No depths due to
boating safety concerns
2.6
2.4
2.2
2.9
3.4
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m



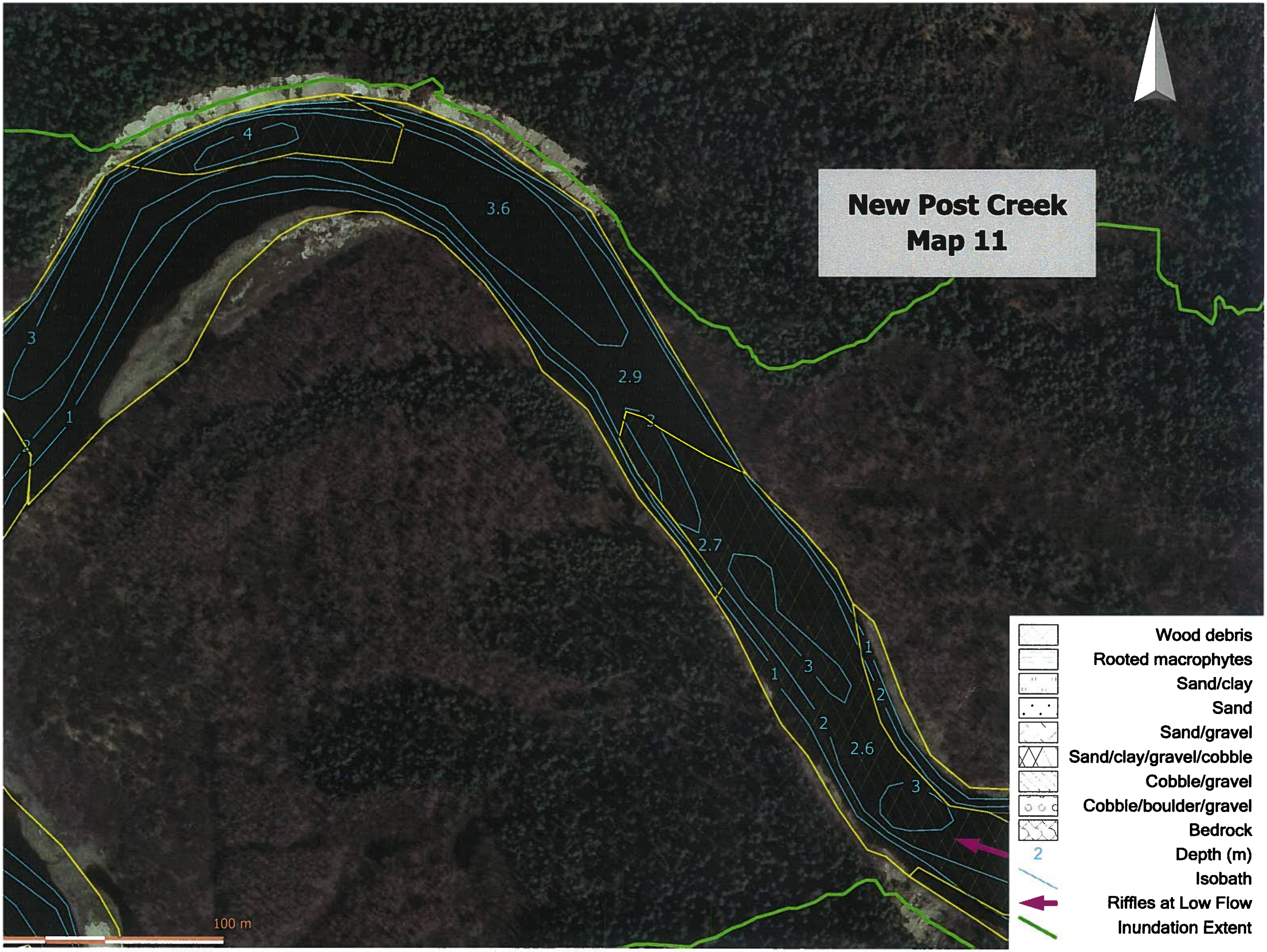
New Post Creek
Map 8
3
2
1
3.5
2
1
4
5
6
3.8
3.1
2.1
3
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

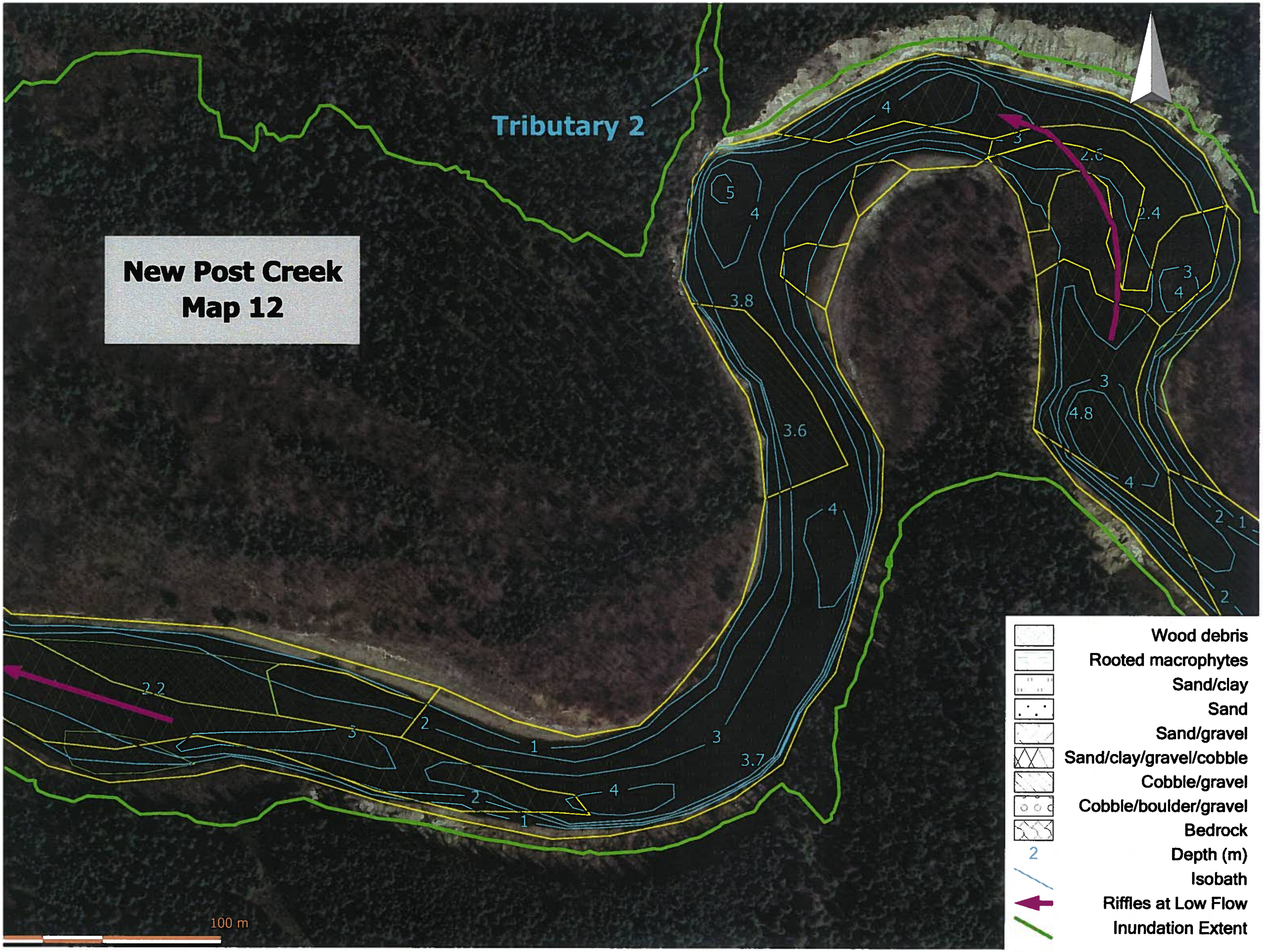


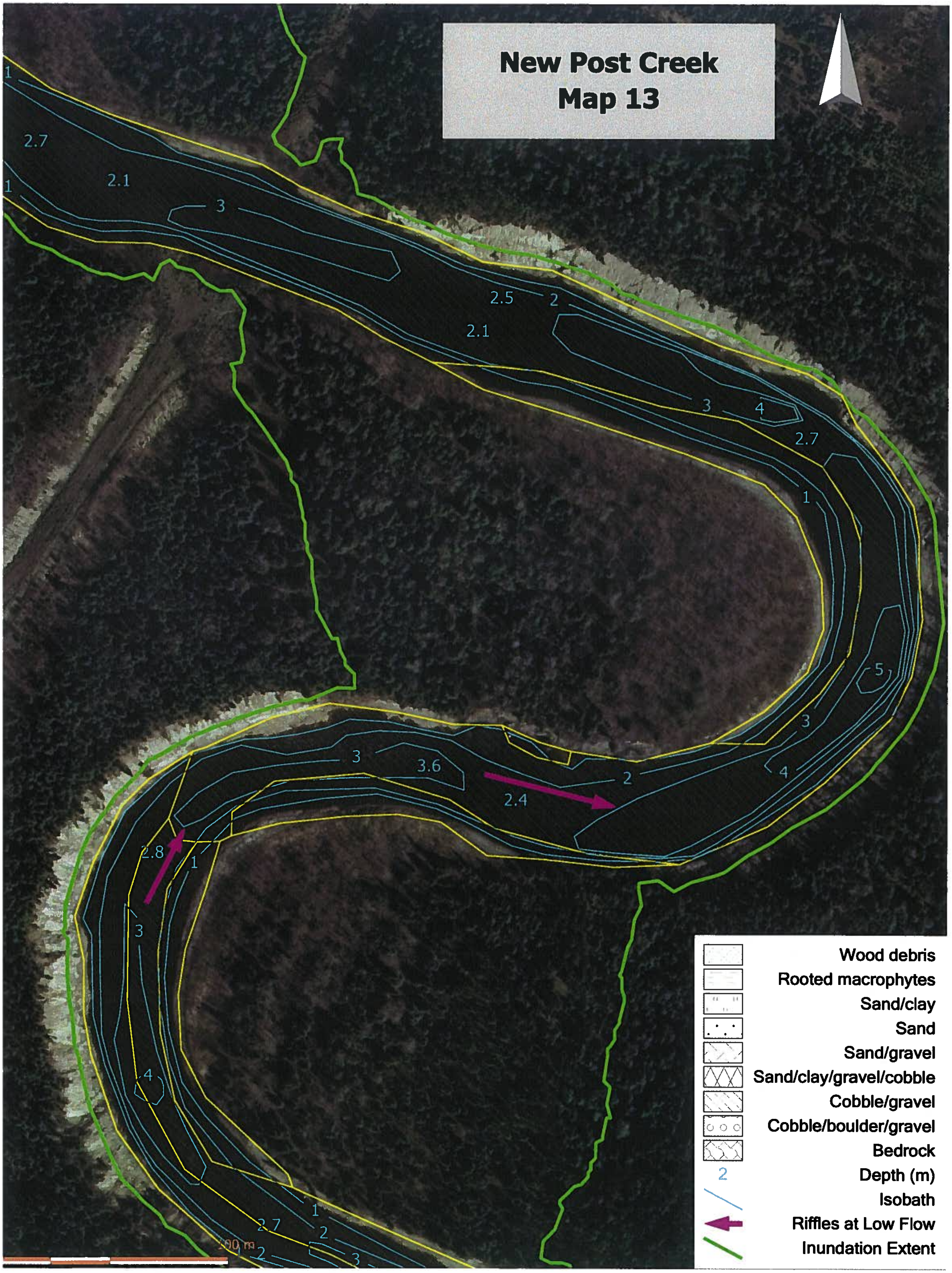
New Post Creek
Map 9
Location of proposed
intake weir
Tributary 1
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

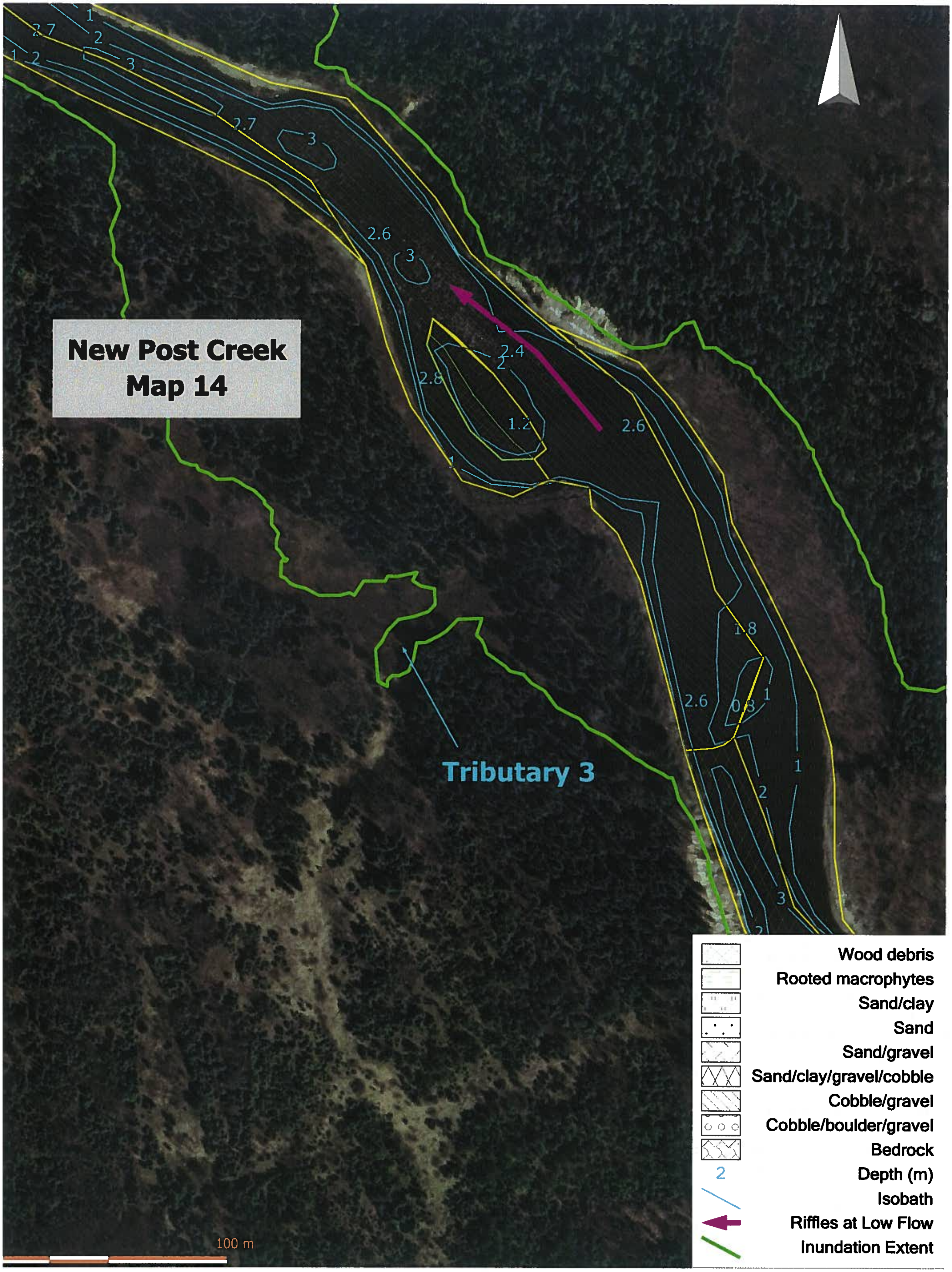


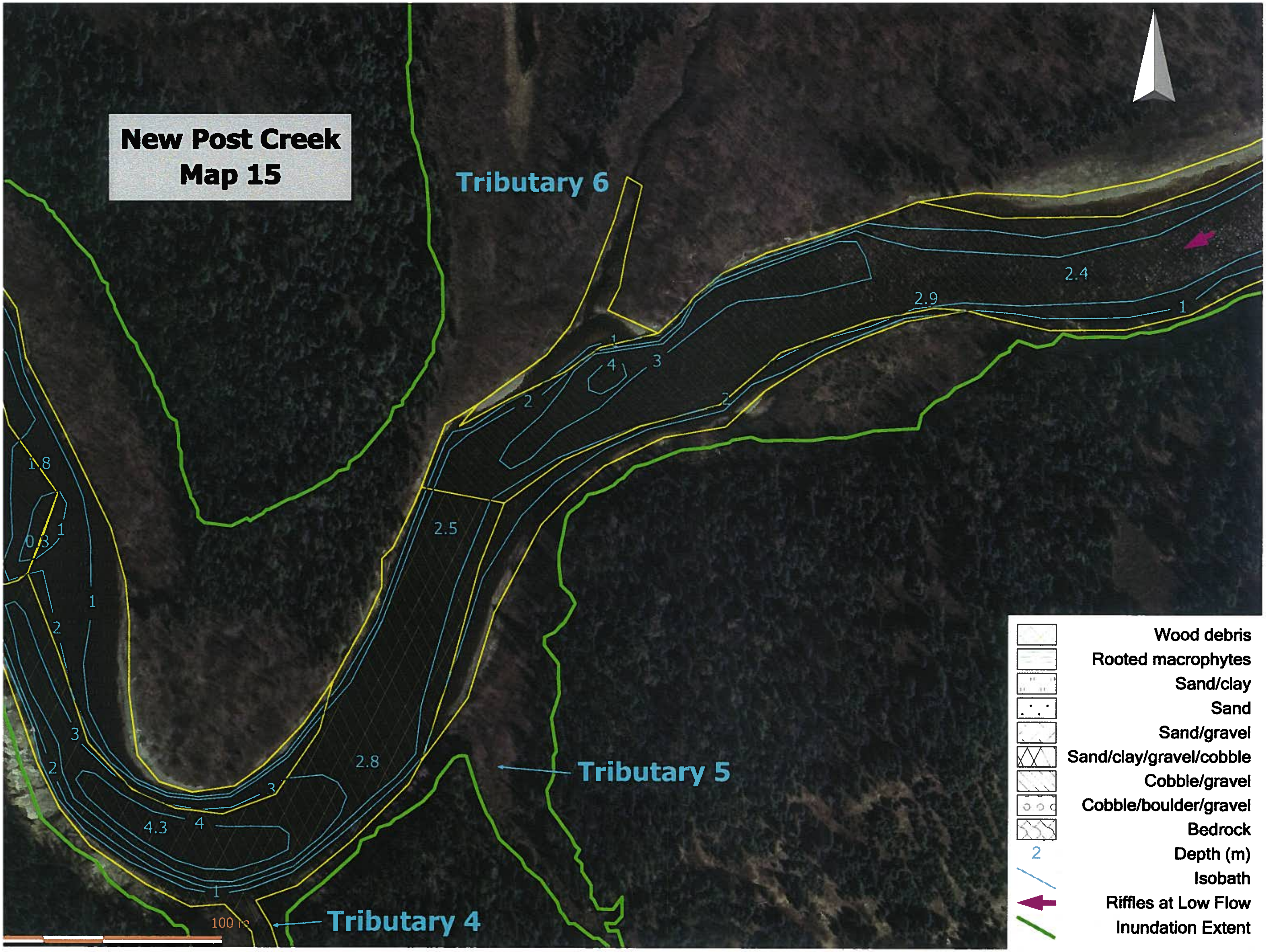
New Post Creek
Map 10
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m


New Post Creek
Map 11
3.6
2.9
2.7
2.6
4
3
2
1
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent

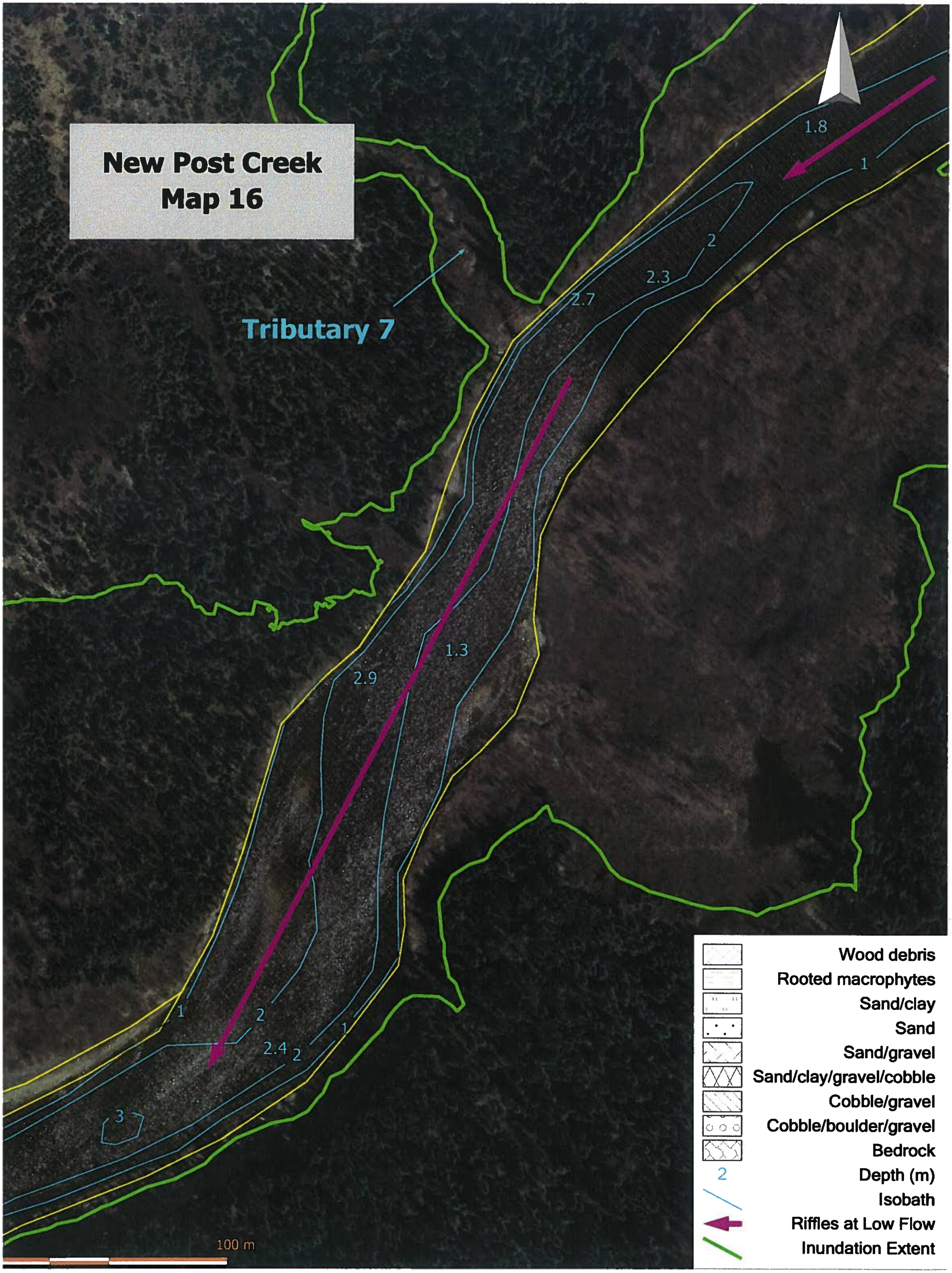

New Post Creek
Map 12
Tributary 2
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

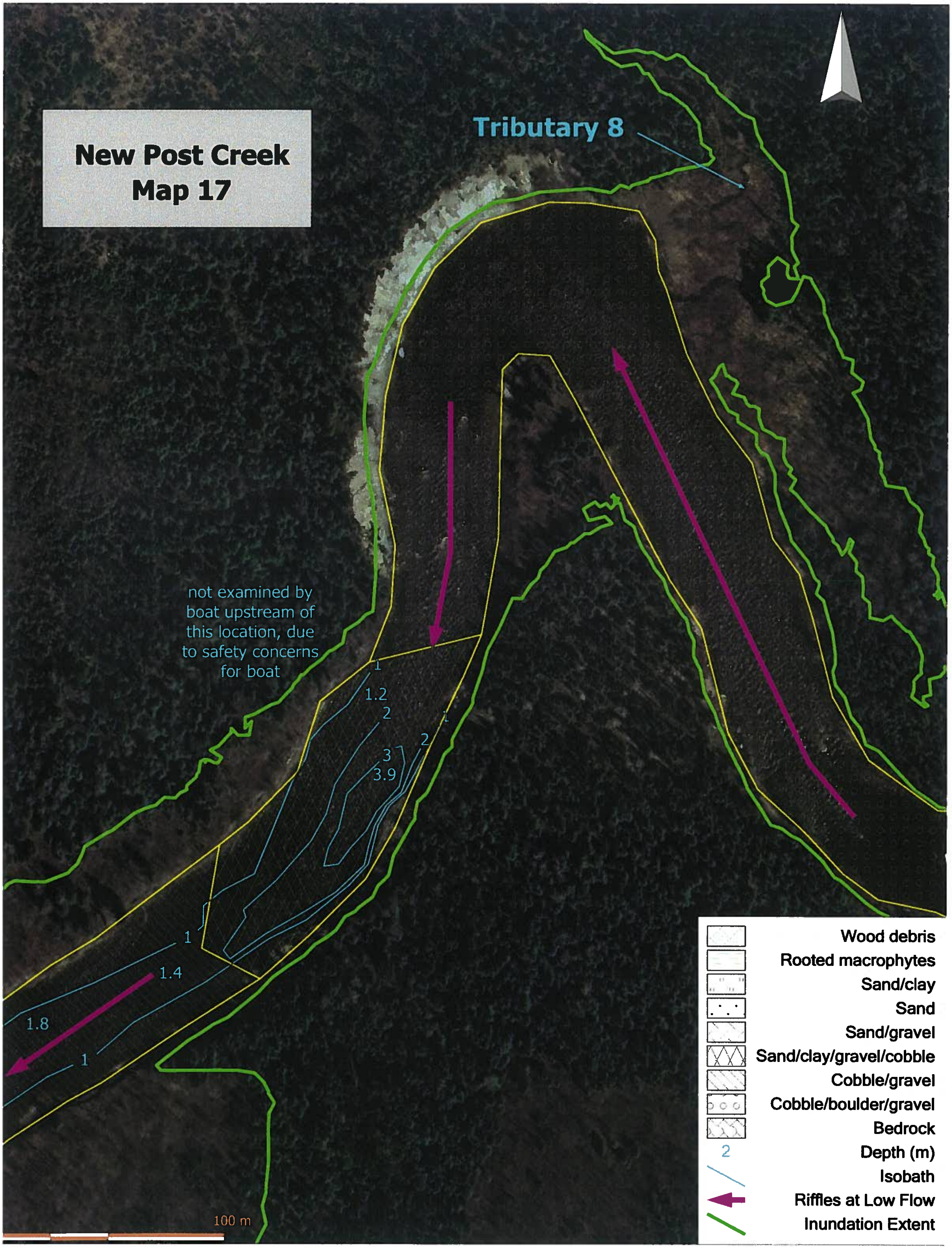

New Post Creek
Map 13
1
2.7
2.1
1
3
2.5
2
2.1
3
4
2.7
1
5
3
4
3
3.6
2
2.4
2.8
1
3
4
1
2.7
2
2
3
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent

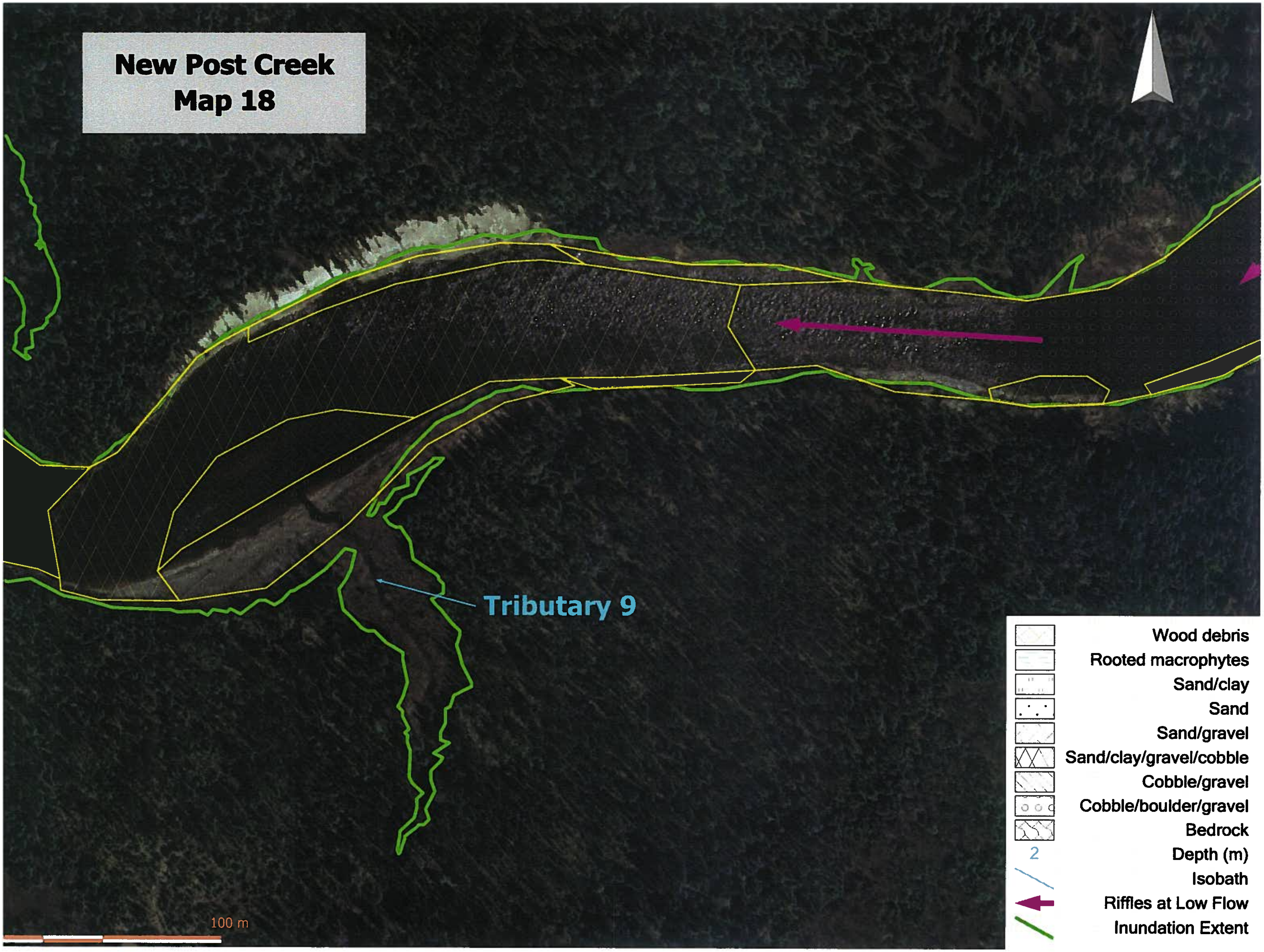

New Post Creek
Map 14
Tributary 3
2.7
2.6
2.4
2.8
1.2
1.8
0.8
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

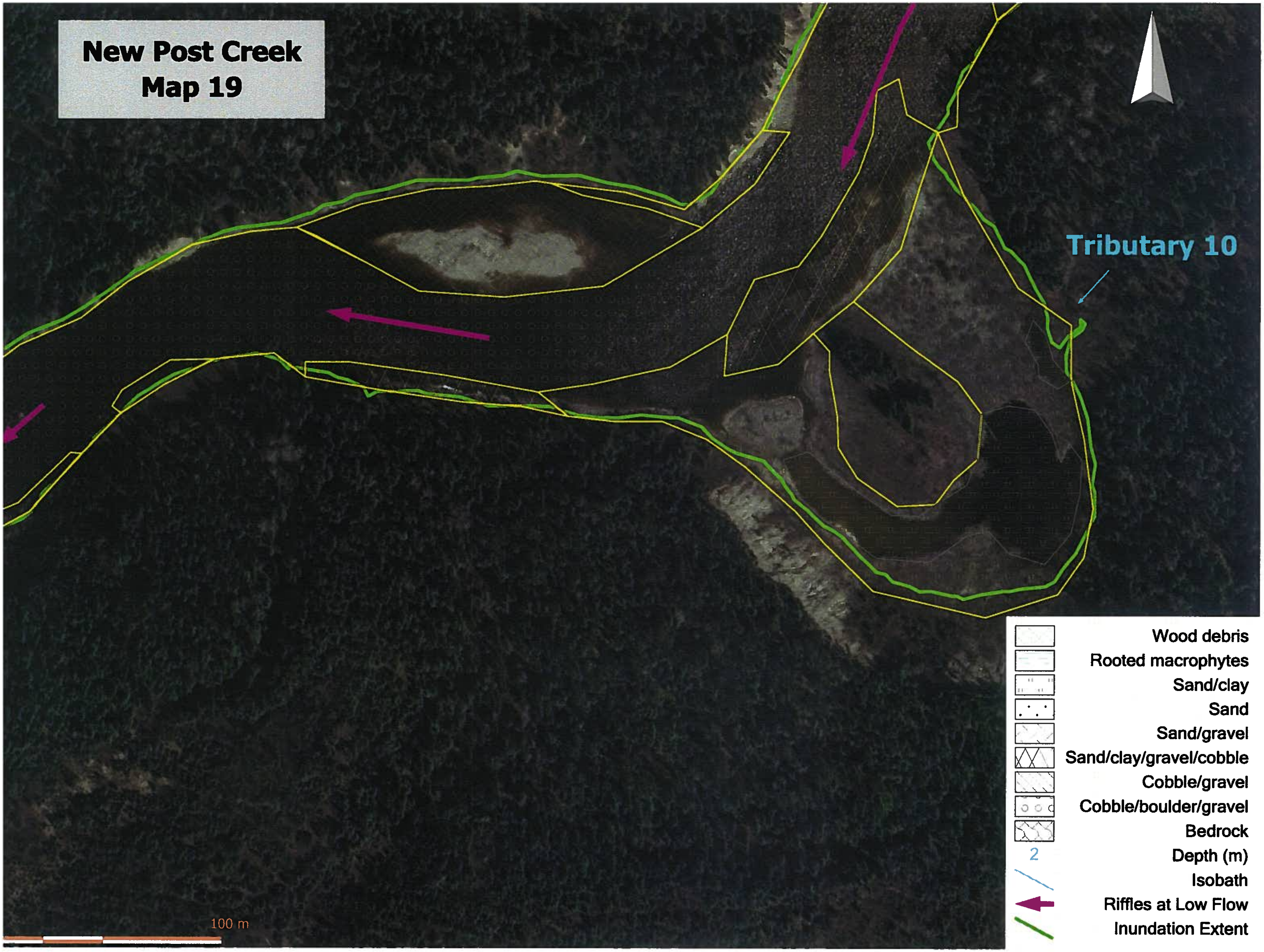


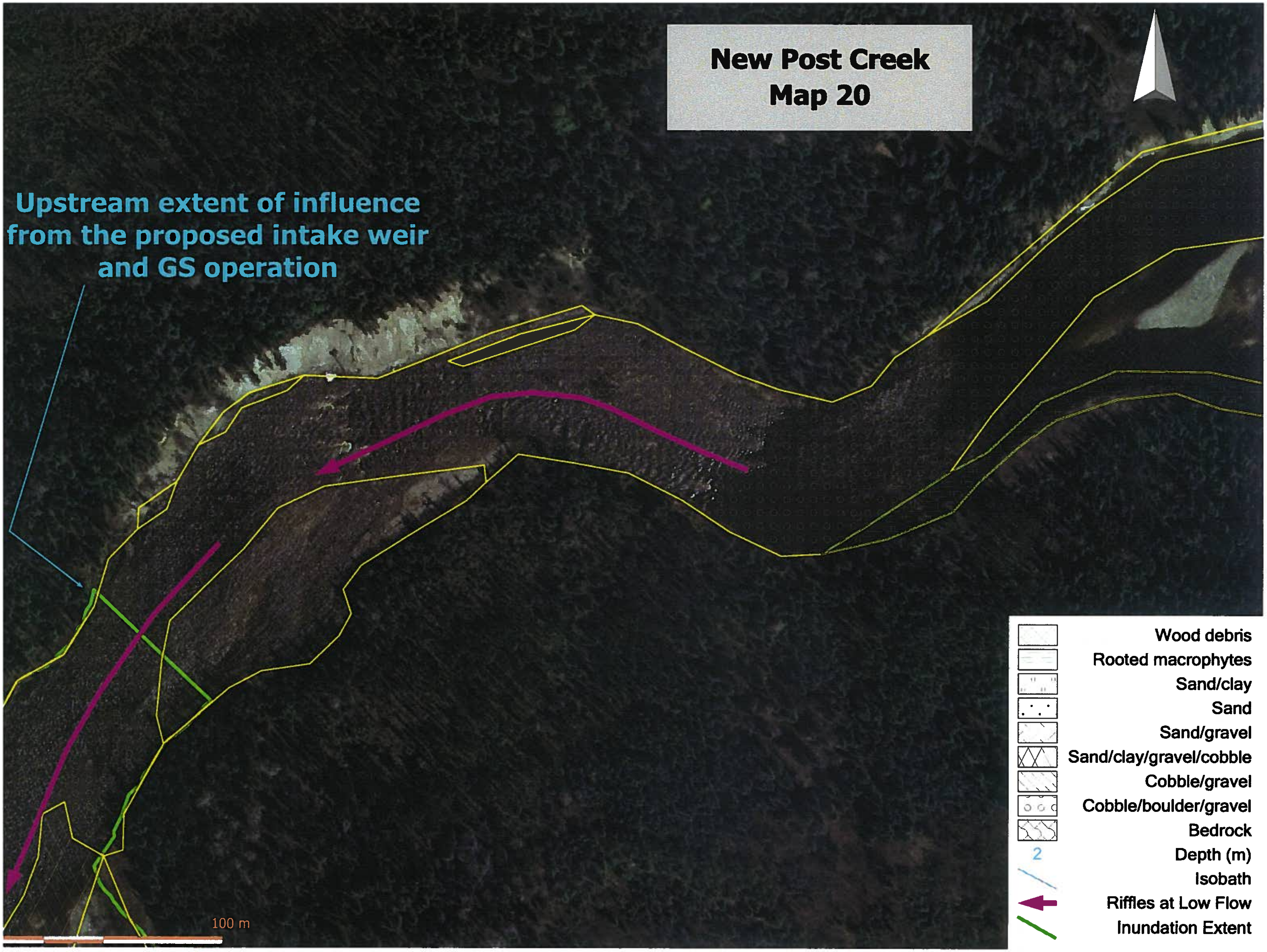
New Post Creek
Map 15
Tributary 6
Tributary 5
Tributary 4
2.4
2.9
1
3
4
2
2.5
1.8
0.3
2.8
4.3
100
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent

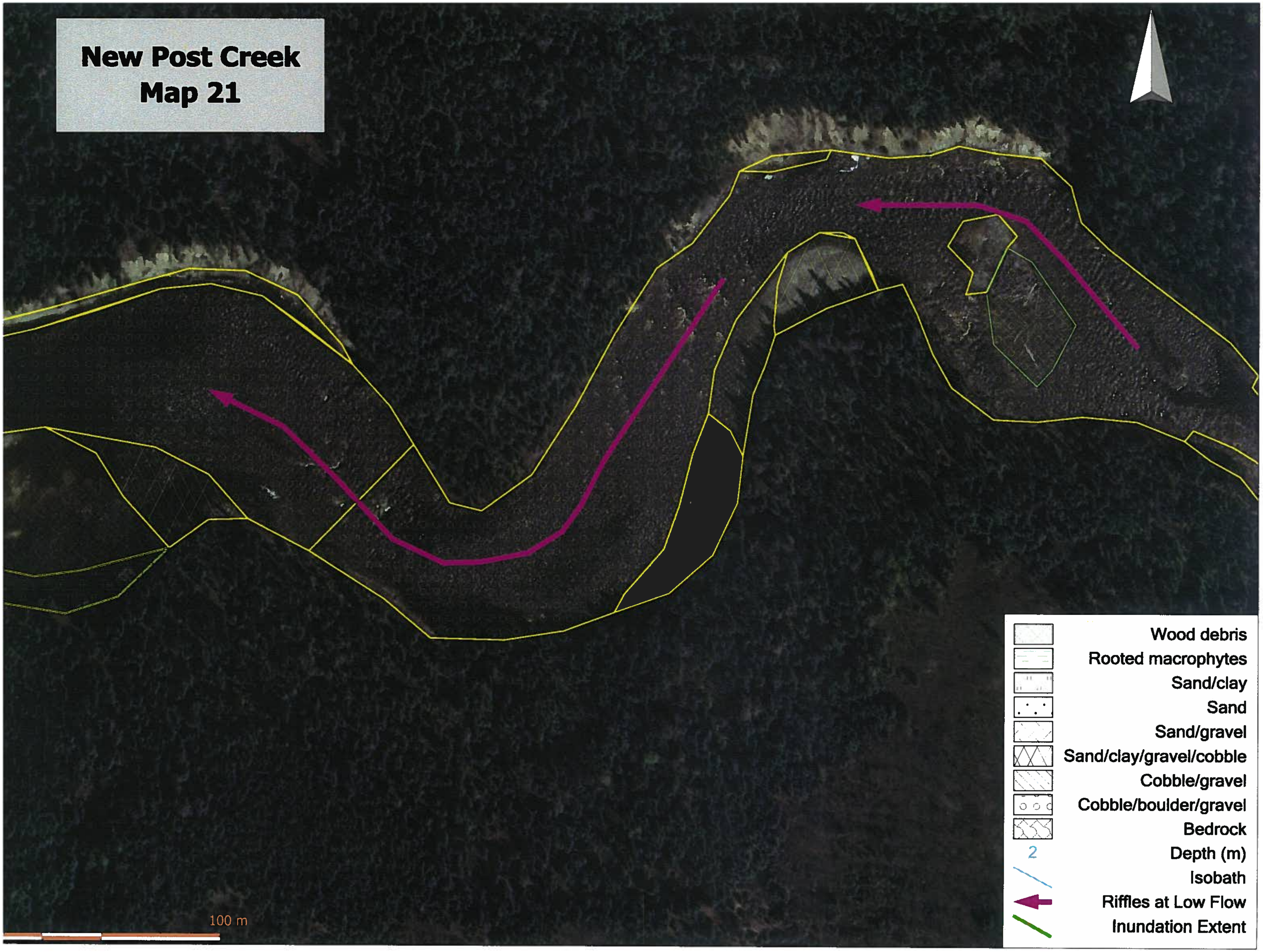

New Post Creek
Map 16
Tributary 7
1.8
1
2
2.3
2.7
1.3
2.9
1
2
2.4
2
1
3
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

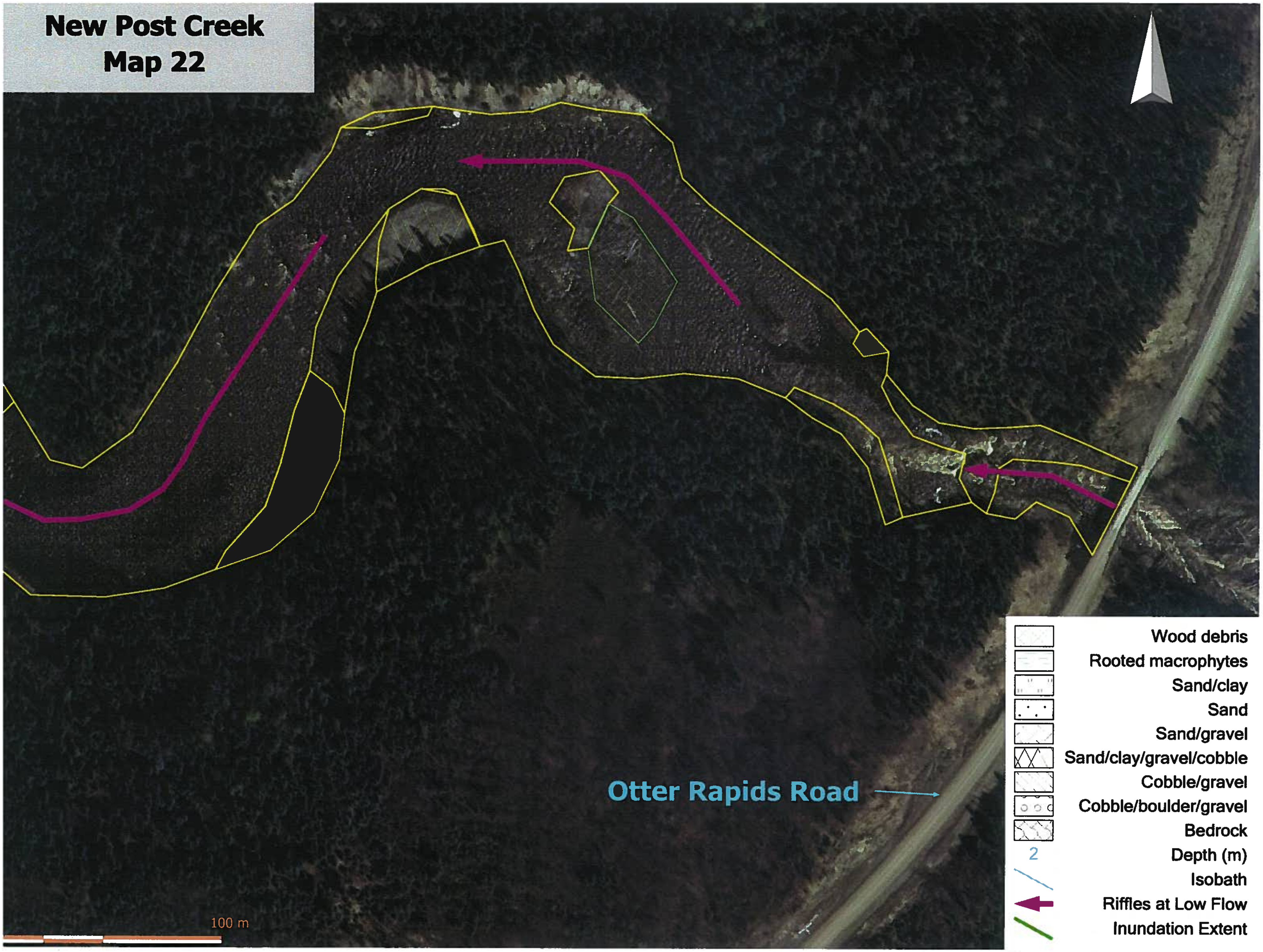

New Post Creek
Map 17
Tributary 8
not examined by boat upstream of this location, due to safety concerns for boat
1
1.2
2
3
3.9
1
2
1
1.4
1.8
1
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m

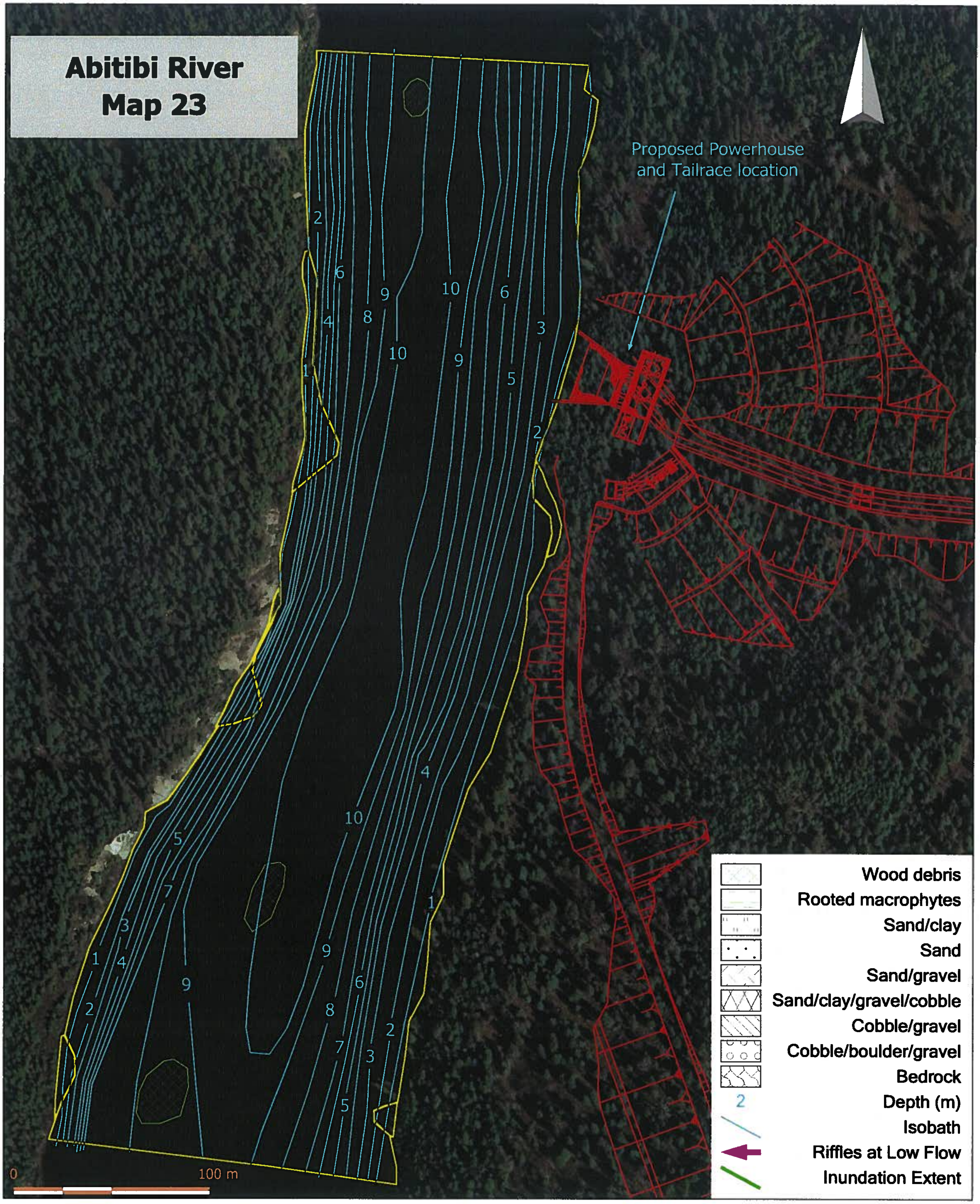

New Post Creek
Map 18
Tributary 9
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m


New Post Creek
Map 19
Tributary 10
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent


New Post Creek
Map 20
Upstream extent of influence from the proposed intake weir and GS operation
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m


New Post Creek
Map 21
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
100 m


New Post Creek
Map 22
Otter Rapids Road
100 m
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
2
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent



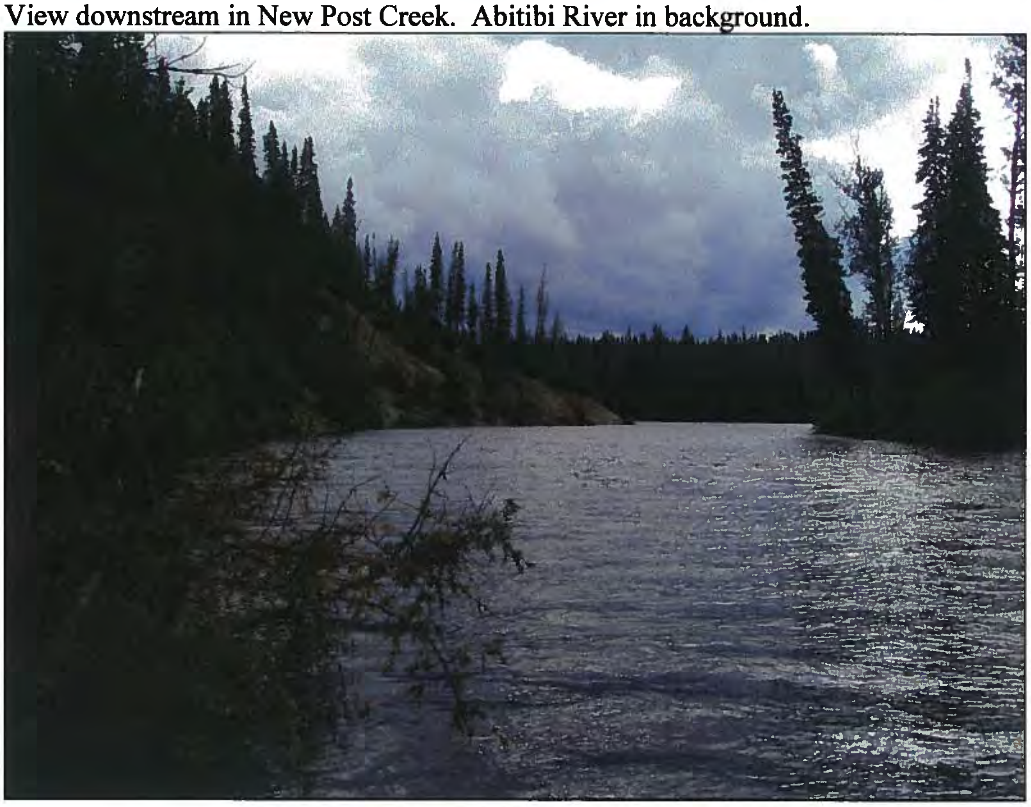
Abitibi River
Map 23
Proposed Powerhouse and Tailrace location
Wood debris
Rooted macrophytes
Sand/clay
Sand
Sand/gravel
Sand/clay/gravel/cobble
Cobble/gravel
Cobble/boulder/gravel
Bedrock
Depth (m)
Isobath
Riffles at Low Flow
Inundation Extent
0
100 m

# Appendix B

## Photographs

Photograph 1. May 20, 2009.
View of the mouth of New Post Creek from the Abitibi River.

Photograph 2. August 25, 2009.
View downstream in New Post Creek. Abitibi River in background.

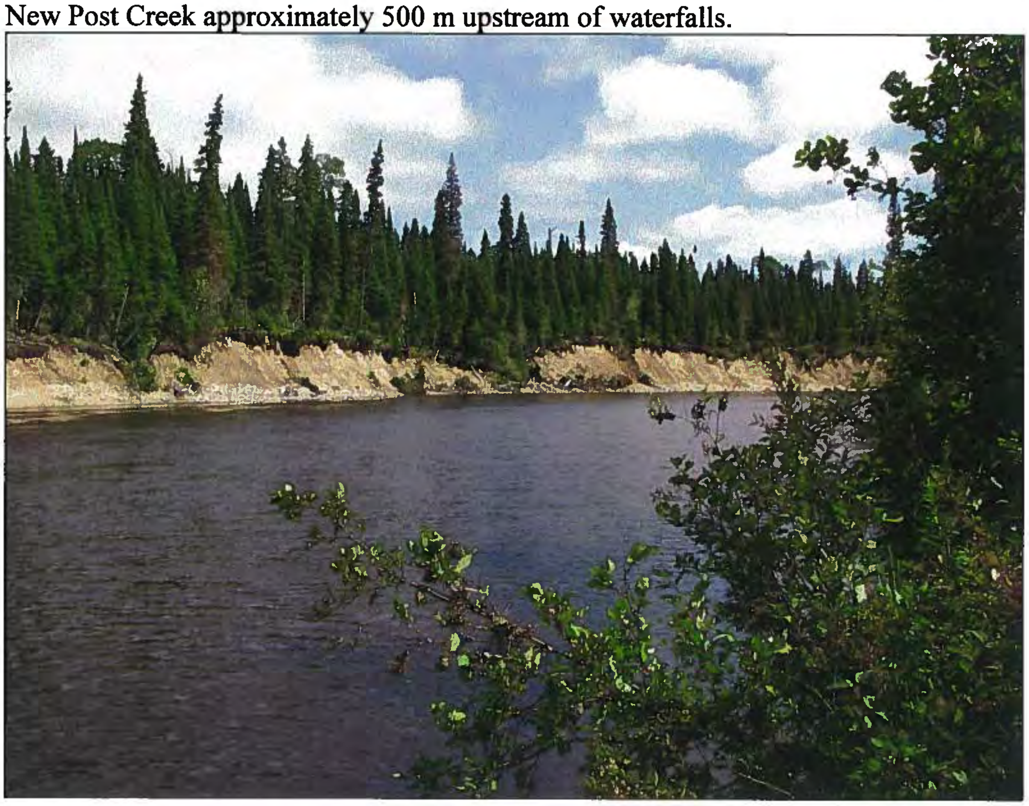


Photograph 3. August 24, 2009.
New Post Creek below waterfalls.

Photograph 4. August 24, 2009.
New Post Creek waterfalls.

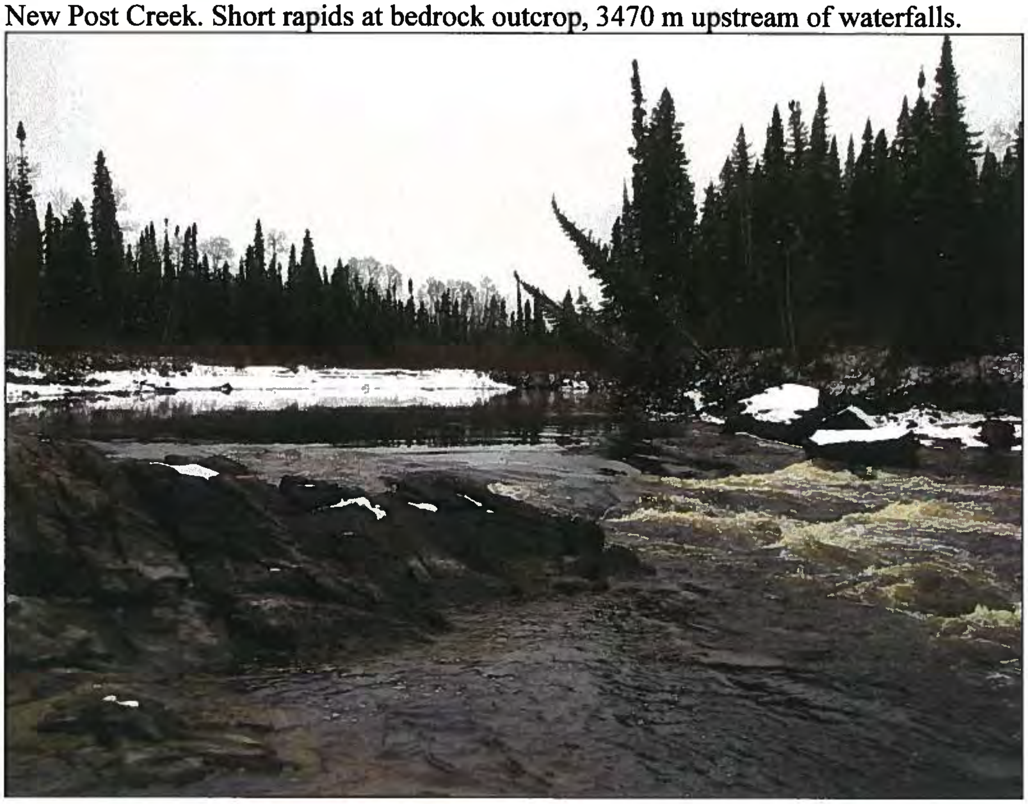
Photograph 5. August 26, 2009.
Shallow rapids immediately below New Post Creek waterfalls.

Photograph 6. August 26, 2009.
New Post Creek approximately 500 m upstream of waterfalls.



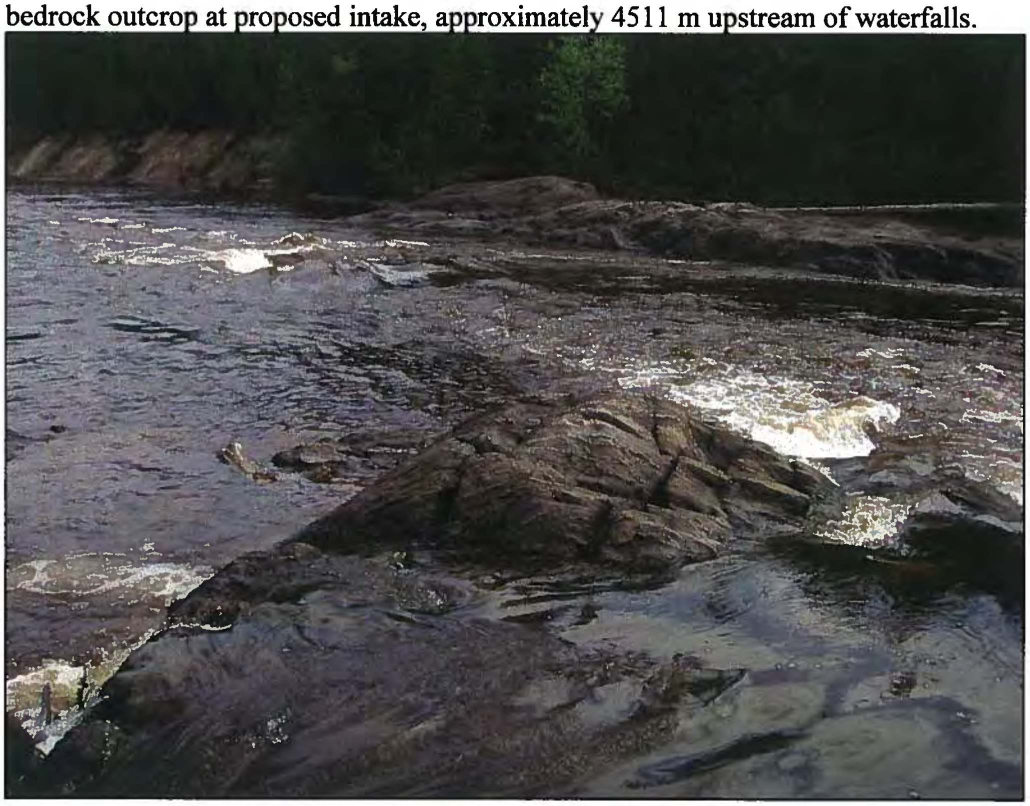
Photograph 7. September 28, 2010.
New Post Creek approximately 3840 m upstream of waterfalls.

Photograph 8. October 27, 2009.
New Post Creek. Short rapids at bedrock outcrop, 3470 m upstream of waterfalls.



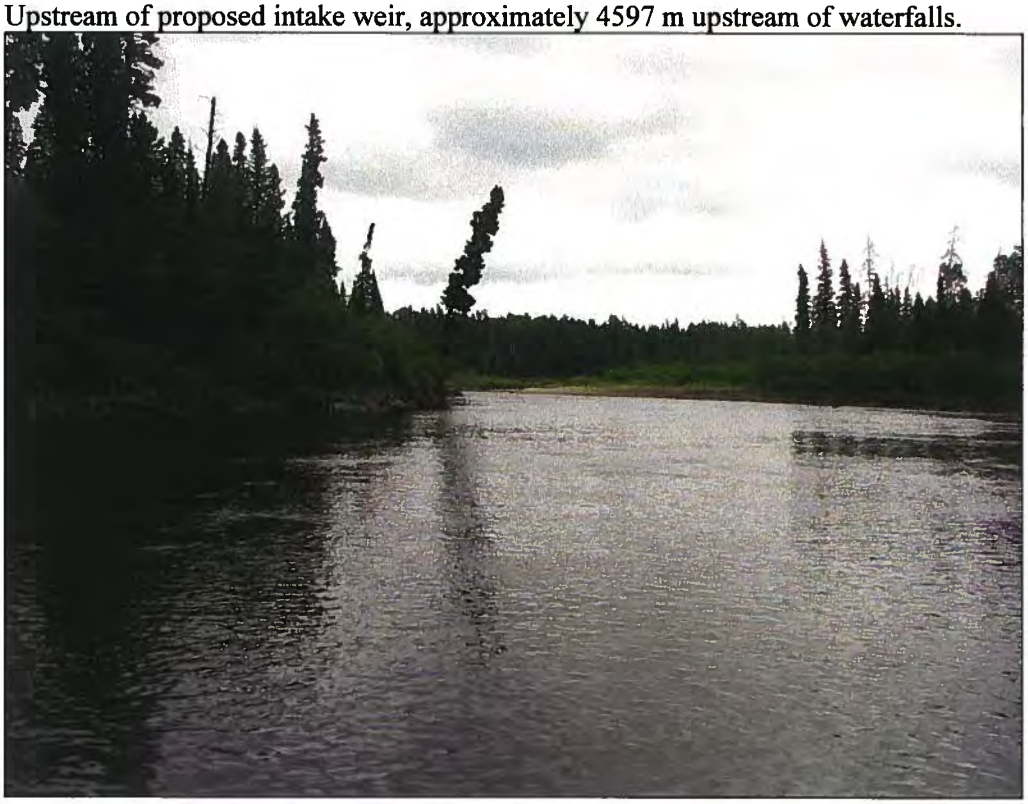
Photograph 9. September 28, 2010.
New Post Creek approximately 5043 m upstream of waterfalls.

Photograph 10. May 27, 2010. New Post Creek. View east from mid-channel at bedrock outcrop at proposed intake, approximately 4511 m upstream of waterfalls.



Photograph 11. May 27, 2010. New Post Creek. View west from mid-channel at bedrock outcrop at proposed intake, approximately 4511 m upstream of waterfalls.

Photograph 12. August 25, 2009. New Post Creek.
Upstream of proposed intake weir, approximately 4597 m upstream of waterfalls.



Photograph 13. September 27, 2010. New Post Creek.
Approximately 760 m upstream of the proposed intake weir.

Photograph 14. September 19, 2011. Downstream view in rapids in New Post Creek, approximately 2380 m upstream of the proposed intake location, at 9.07 $m^3/s$ flow.

Photograph 15. September 19, 2011. Upstream view in rapids in New Post Creek, approximately 2380 m upstream of the proposed intake location, at 9.07 $m^3/s$ flow.

Photograph 16. September 20, 2011. Riffle, approximately 3830 m upstream of the proposed intake weir location, at a low of 10.38 $m^3/s$.

Photograph 17. September 20, 2011. Flatwater area, 4455 m upstream of the intake weir location, at a flow of 10.38 $m^3/s$. Mouth of Tributary 6 in foreground.

Photograph 18. September 20, 2011. Upstream view of rapids approximately 5600 m upstream from the proposed intake location, at a flow of 10.38 $m^3/s$.

Photograph 19. September 20, 2011. Downstream view of rapids approximately 5600 m upstream from the proposed intake location, at a flow of 10.38 $m^3/s$.

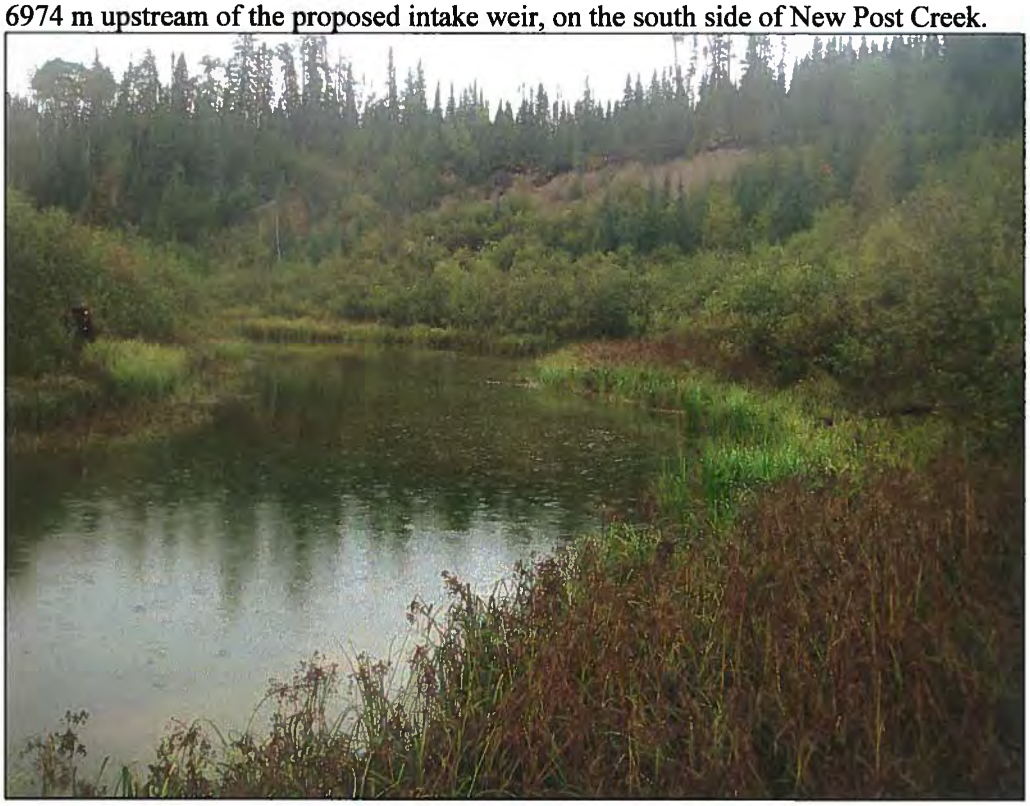
Photograph 20. September 17, 2012. Upstream view, approximately 6203 m upstream of the proposed intake weir, at a flow of 7.81 $m^3/s$.

Photograph 21. September 17, 2012. View of riffles, approximately 7409 m upstream of the proposed intake weir, at a flow of 7.81 $m^3/s$.

Photograph 22. September 17, 2012. View of riffles, 8222 m upstream of the proposed intake weir, at a flow of 7.81 $m^3/s$. Otter Road bridge in background.

Photograph 23. September 17, 2012. Finer substrate deposit, approximately 7150 m upstream of the proposed intake weir, at a flow of 7.81 $m^3/s$.

Photograph 24. September 17, 2012. Oxbow pond and wetland, approximately 6974 m upstream of the proposed intake weir, on the south side of New Post Creek.

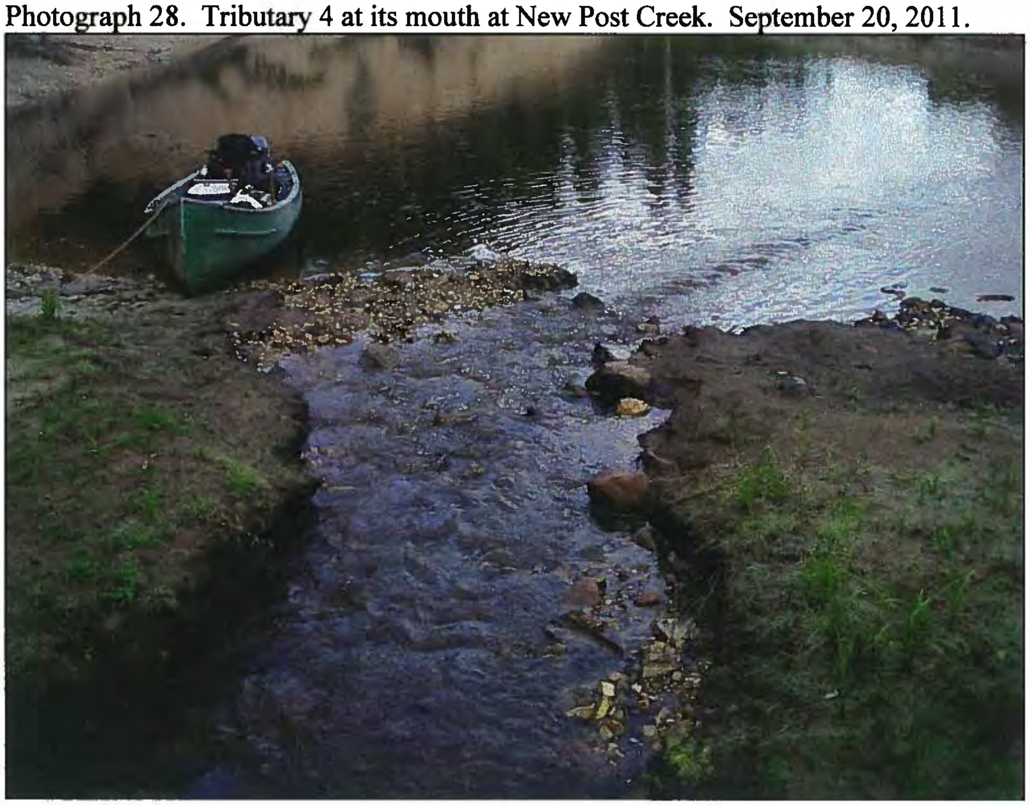


Photograph 25. Tributary 1 near its confluence with New Post Creek. September 20, 2011.

Photograph 26. Tributary 1 approximately 1140 m upstream from New Post Creek. September 18, 2011. Alder over the channel along most of the watercourse length.

Photograph 27. The upstream end of a small culvert in Tributary 2, beneath a forest access road 516 m upstream from New Post Creek. September 18, 2012.

Photograph 28. Tributary 4 at its mouth at New Post Creek. September 20, 2011.



Photograph 29. Tributary 4, approximately 40 m upstream from New Post Creek. September 20, 2011.

Photograph 30. Tributary 4, approximately 212 m upstream from New Post Creek. September 18, 2012.

Photograph 31. Tributary 4, upstream of Otter Rapids Road, approximately 510 m upstream from New Post Creek. September 18, 2012.

Photograph 32. Tributary 5, approximately 150 m upstream from New Post Creek. September 18, 2012. No water observed.

Photograph 33. Tributary 6, approximately 35 m upstream from New Post Creek. This is a remnant pre-1963 channel of New Post Creek.

Photograph 34. Tributary 6, approximately 760 m upstream from New Post Creek, in the channel downstream from a beaver dam.

Photograph 35. Tributary 7, at its confluence with New Post Creek. September 20, 2011.

Photograph 36. Tributary 7, approximately 1500 m upstream from New Post Creek. September 14, 2011.

Photograph 37. View of Tributary 7 channel at the same location as Photograph 36. September 14, 2011.

Photograph 38. Flooded alder swamp, approximately 900 m upstream from New Post Creek in Tributary 7. September 18, 2012.

Photograph 39. Tributary 8, approximately 240 m upstream of New Post Creek, at the location of fish collection site EF-15. September 18, 2012.

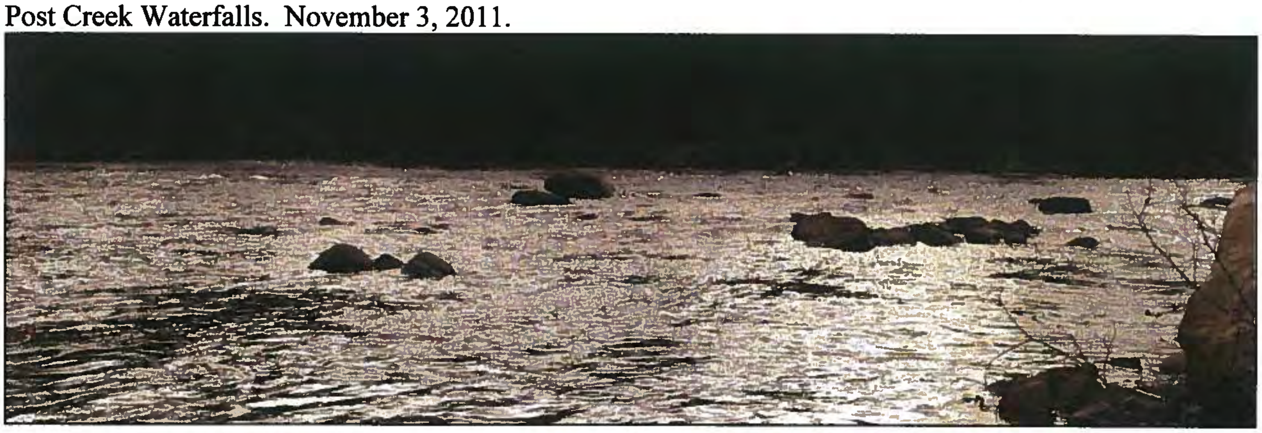
Photograph 40. Upstream view from the mouth of Tributary 9 at New Post Creek. September 17, 2012.

Photograph 41. Tributary 9, 100 m upstream from New Post Creek where the watercourse descends to the New Post Creek floodplain. September 17, 2012.

Photograph 42. Tributary 10 where it drops down the bank of the pre-diversion channel of New Post Creek. September 17, 2012.

Photograph 43. View upstream from the brink of New Post Creek Falls, showing the bedrock outcrop and the upstream low gradient watercourse. August 26, 2009.

Photograph 44. Shallow rapids located 2584 m upstream from the brink of the New Post Creek Waterfalls. November 3, 2011.



Photograph 45. Deep section of New Post Creek, approximately 1957 m upstream of the waterfalls. November 3, 2011.

Photograph 46. The proposed tailrace location on the east bank of the Abitibi River. October 28, 2009.

# Appendix C

**Scientific Nomenclature of Fishes.**

| Common name | Scientific name |
|---|---|
| Lake Sturgeon | *Acipenser fulvescens* |
| Lake Whitefish | *Coregonus clupeaformis* |
| Walleye | *Sander vitreus* |
| Sauger | *Sander canadensis* |
| Yellow Perch | *Perca flavescens* |
| Logperch | *Percina caprodes* |
| Johnny Darter | *Etheostoma nigrum* |
| Northern Pike | *Esox lucius* |
| Troutperch | *Percopsis omiscomaycus* |
| Shorthead Redhorse | *Moxostoma macrolepidotum* |
| Longnose Sucker | *Catostomus catostomus* |
| White Sucker | *Catostomus commersonii* |
| Brown Bullhead | *Ameiurus nebulosus* |
| Rock Bass | *Ambloplites rupestris* |
| Mooneye | *Hiodon tergisus* |
| Goldeye | *Hiodon alosoides* |
| Burbot | *Lota lota* |
| Slimy Sculpin | *Cottus cognatus* |
| Mottled Sculpin | *Cottus bairdii* |
| Spoonhead Sculpin | *Cottus ricei* |
| Fallfish | *Semotilus corporalis* |
| Lake Chub | *Couesius plumbeus* |
| Longnose Dace | *Rhinichthys cataractae* |
| Pearl Dace | *Margariscus margarita* |
| Northern Redbelly Dace | *Chrosomus eos* |
| Brook Stickleback | *Culaea inconstans* |

# NEW POST CREEK HYDROELECTRIC PROJECT
# FISH HABITAT ASSESSMENT OF THE
# GENERATING STATION ACCESS ROAD

Report date: **April 16, 2013.**

Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION .......... 1
2.0 BACKGROUND .......... 2
3.0 METHODS .......... 2
4.0 RESULTS .......... 3
5.0 CONCLUSIONS .......... 5
6.0 REFERENCES .......... 6

APPENDIX A Photographs

## 1.0 INTRODUCTION

C. Portt and Associates and SENES Consultants Limited were retained by Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek generating station (GS). The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2011 aquatic habitat and fish community assessment of the main access route to the proposed GS, that runs generally north from approximately Kilometre 6 on the Otter Rapids Road.

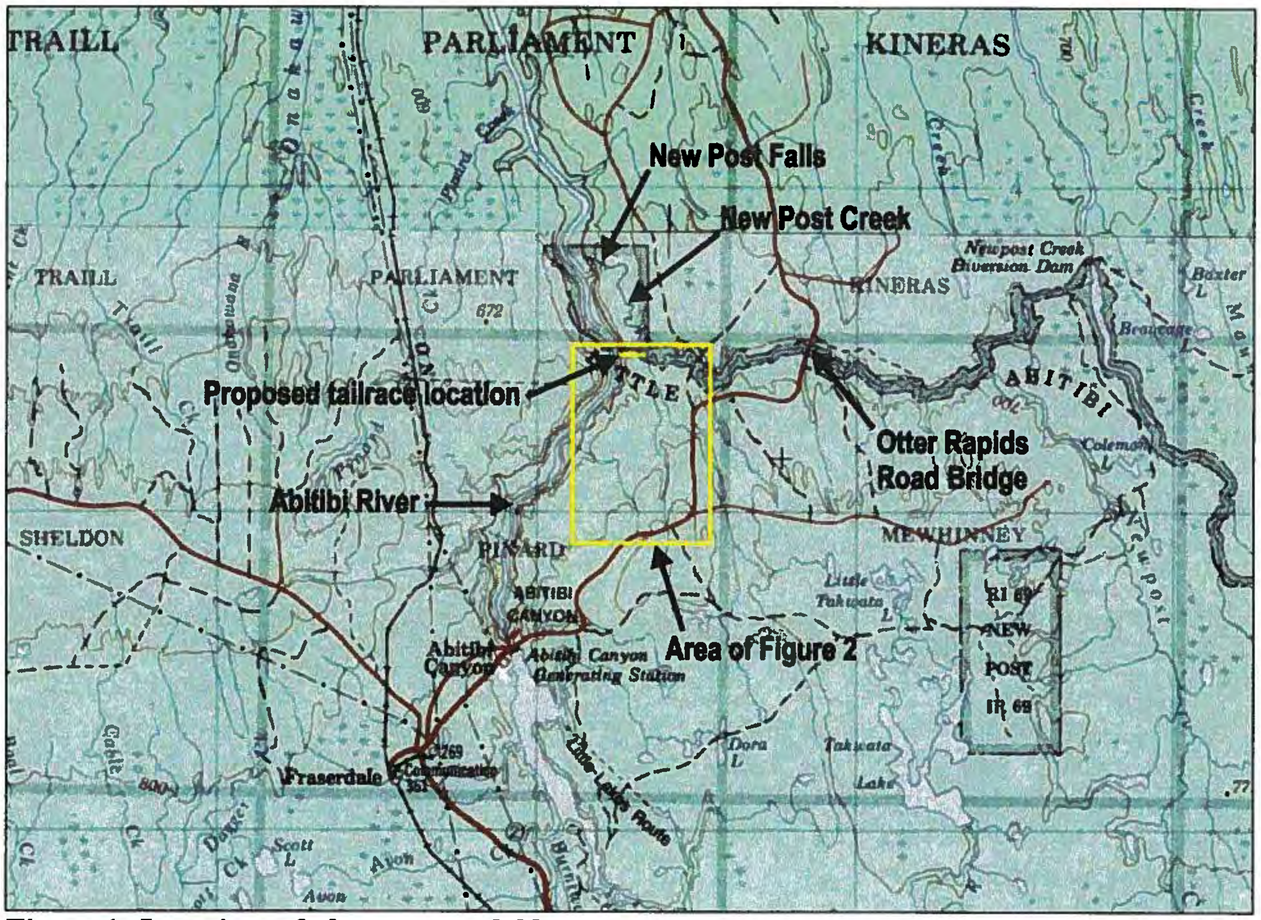



**Figure 1: Location of the proposed New Post Creek GS. The yellow line indicates the approximate location of the proposed penstock that will divert water from New Post Creek to a tailrace on the Abitibi River. The area covered in Figure 2 is shown.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a GS that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfalls located approximately 800 m upstream from its confluence with the Abitibi River. Flow through the powerhouse would enter the Abitibi River approximately 2.8 km upstream from the confluence of New Post Creek and the Abitibi River. An existing forest access road that runs north from the Otter Rapids Road is proposed to be upgraded and extended as the permanent access road for the construction and operation of the GS (Figure 2).

## 3.0 METHODS

All aquatic habitat investigations and fish collections, undertaken along the existing access road, were conducted by C. Portt and Associates staff George Coker and Jim Reid, assisted by TTN member George Ross.

**Habitat Characterization**

Watercourse crossings along the access road were investigated on September 17 and 18, 2011. Habitat was described, and substrate was classed using a modified Wentworth (1922) scale (Table 1). Besides the substrate descriptors used in Table 1, the term "soil" was used to describe substrates that were clearly flooded terrestrial soils

**Table 1: Substrate particle size terms and associated size ranges, modified from Wentworth (1922).**

| Particle size term | Particle size (mm) |
|---|---|
| clay | 0.001 - 0.004 |
| silt | 0.004 - 0.062 |
| sand | 0.062 - 2.0 |
| gravel | 2.0 - 64.0 |
| cobble | 64.0 - 256.0 |
| boulder | > 256 |
| bedrock | na - rock not granulated |

All distance measurements were either determined in the field using a handheld GPS unit, or from orthorectified digital aerial photographs and downloaded field GPS data using Manifold System 8 software. Likewise, the location of all digital photographs and other observations were associated with GPS waypoints imported into Manifold System 8. Watercourse flow was visually estimated, where possible, at locations with simple channel cross sections.

**Fish Community Characterization**

Electrofishing was undertaken using a Halltech 2000 backpack electrofisher. After field identification and enumeration, all fish were released alive at the point of capture. Electrofishing effort is expressed in electro seconds, which is the amount of time that electrical current is discharged into the water. Electrofishing generally targets small fishes in water up to 1 m deep, and is useful in extracting fish from coarse substrate or dense cover. Detailed fish collection reports (FCRs) for all collections have been submitted to the Ontario Ministry of Natural Resources (MNR) Cochrane office.

## 4.0 RESULTS

The results of fish collections are summarized in Table 2, and the fish collection locations are shown in Figure 2. Selected photographs are provided in Appendix A and their locations are described in the Photograph caption. Four watercourse crossings of the access road were identified and assessed, as were two small wetlands.

**Crossing #1**

At Crossing #1, there is a small corrugated steel culvert, that is perched at the downstream end (Photograph 1). Flow in the watercourse was less than 1 litre/s, and a small plunge pool had developed at the downstream end of the culvert (Photograph 1). Substrate is soil or silt (Photographs 2 and 3). Upstream of a point approximately 150 m upstream from the crossing, the watercourse passes through a series of beaver ponds. Approximately 110 m downstream from Crossing #1 the watercourse passes through some more beaver ponds and then into a wetland where it has a poorly defined channel. Ultimately it flows to the Abitibi River, which is approximately 3 km downstream from the road crossing. The aerial photograph does not show a well defined channel. Electrofishing at the crossing found Brook Stickleback (*Culaea inconstans*) and Fathead Minnow (*Pimephales promelas*), which are resilient species that are commonly found in small intermittent watercourses such as this (Figure 2,Table 2: EF-1). This watercourse may, or may not be, intermittent, but based upon the presence of fish it appears that it maintains some surface water on a permanent basis. Habitat is very simple, and, based upon the size and condition of the channel, flow is almost always small.

**Crossing #2**

This is a small culvert that does not appear associated with a defined watercourse channel. There was no water when examined on September 17 and 18, 2011 (Photograph 4). It should not be considered fish habitat.

**Crossing #3**

At Crossing #3, there is a small corrugated steel culvert, that is perched on the downstream end (Photograph 5). Flow in the watercourse was approximately 1 litre/s. Substrate is soil or silt, with some gravel, sand, and cobble (Photographs 6 and 7). The watercourse disappears under tree roots for a short distance (Photograph 8), and is a poorly defined channel in most places. Upstream from the crossing the watercourse passes through a series of beaver ponds. Downstream from Crossing #3 the watercourse occupies a shallow depression, and after 1600 m it empties into the Abitibi River. Based upon the general project arrangement drawings, the lower reaches of this watercourse may be encroached upon by the embankment of the proposed road branch that will service the GS (Figure 2). No fish were captured by electrofishing (Figure 2,Table 2: EF-2). Based upon the lack of fish and the poorly defined nature of the channel, this watercourse may not have water in the vicinity of Crossing #3 during most summers. The watercourse at Crossing #3 should be considered marginal fish habitat, in that it is possible that a few resilient small-bodied fish species may occur upstream of the crossing in a beaver pond, and that individuals of these potential populations may occasionally occur in the vicinity of Crossing #3.

**Wetland #1**

This is a small apparently isolated wetland, approximately 1 ha in size, west of the access road (Figure 2: Wetland #1). This wetland may be due to the poor drainage caused by the existing access road bed. There did not appear to be a culvert associated with this location. Only a relatively small area of standing water occurred along the west side of the roadbed (Photograph 9). Electrofishing was not conducted, but a dipnet was swept numerous times through the dense aquatic vegetation and algae that occurred here (Photograph 9), and no fish were collected or observed (Figure 2, Table 2: DN-1). Wetland #1 is not considered fish habitat.

**Crossing #4**

This is a small culvert that does not appear associated with a defined watercourse channel. There was no water when examined on September 17 and 18, 2011, and little evidence that water occurs here for very long (Photograph 10). It should not be considered fish habitat.

**Wetland #2**

Wetland #2 is where the existing access trail to the proposed intake weir location crosses a small portion of a 2 ha wetland. The portion of trail shown in Photograph 11 is flooded each spring, but dries every summer. No electrofishing was conducted, since it was dry at the time of this examination. No fish have been observed here over the period 2009-2012. Since it is only wet during the spring period, and no fish have been observed here on many occasions, this portion of the wetland is not considered fish habitat.

**Table 2: Electrofishing and dipnetting in the watercourses that cross the proposed access road. Collection site locations are shown in Figure 2.**

| Collection Site (EF=electrofisher; DN=dipnet) | EF-1 | EF-2 | DN-1 |
|---|---|---|---|
| Crossing | Crossing #1 | Crossing #3 | Wetland #1 |
| Date | Sep 17, 2011 | Sep 17, 2011 | Sep 18, 2011 |
| Electroseconds | 131 | 110 | na |
| **Species** | | no catch | no catch |
| Fathead Minnow | 1 | | |
| Brook Stickleback | 6 | | |

## 5.0 CONCLUSIONS

The four watercourses and two wetlands, that are crossed by the proposed GS access road, are all relatively minor systems with simple baitfish communities or with no fish community. The poorest quality examples of these watercourses and wetlands, likely do not provide any fish habitat. There were no sport fishes captured or observed in any of these watercourses and wetlands.

## 6.0 REFERENCES

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. J. Geol. 30: 377-392.

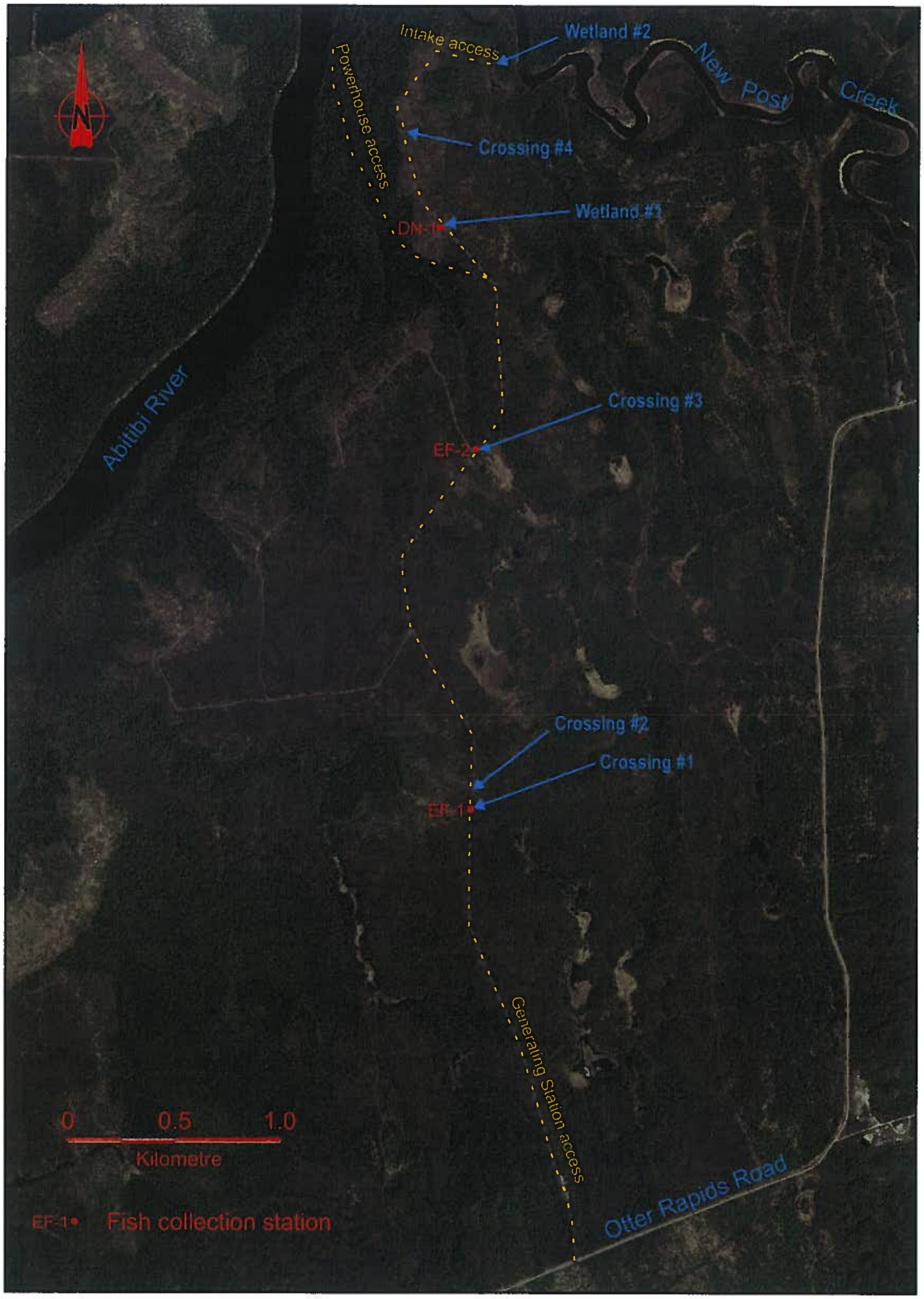



**Figure 2: Watercourse crossing and wetland features assessed, and fish community sampling locations. The dashed yellow line indicates the potential access route to the proposed GS.**

# Appendix A

## Photographs

Photograph 1. The downstream end of the small culvert at Crossing #1. The culvert is perched, and flow was less than 1 litre/s. September 18, 2012.

Photograph 2. Soil or silt channel downstream of the small culvert at Crossing #1. September 18, 2011.

Photograph 3. Soil channel approximately 17 m upstream of Crossing #1. September 18, 2011.

Photograph 4. Downstream end of culvert at Crossing #2. September 18, 2011.

Photograph 5. Downstream end of damaged culvert at Crossing #3. September 18, 2011.

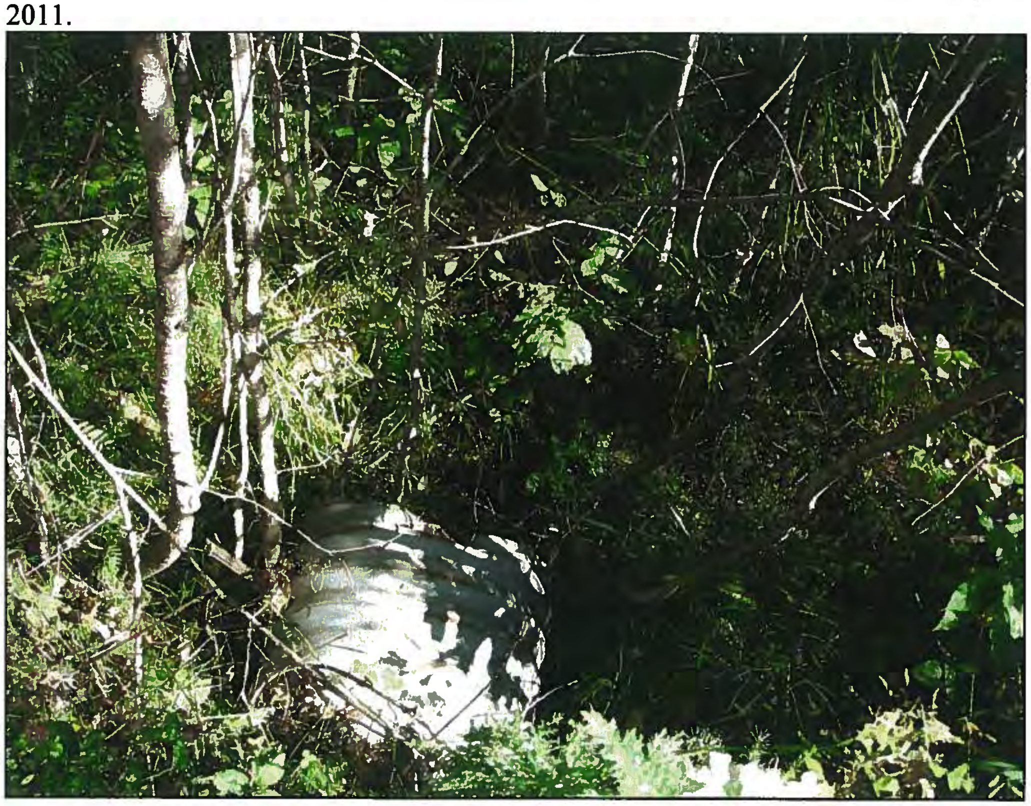
Photograph 6. Approximately 30 m downstream from Crossing #3. September 18, 2011.

Photograph 7. Upstream of Crossing #3. September 18, 2011.

Photograph 8. Downstream from Crossing #3 where the watercourse disappears beneath tree roots. September 18, 2011.

Photograph 9. Small area of open water on the west side of the access road in Wetland #1. September 18, 2011.

Photograph 10. Small culvert at Crossing #4. No defined channel. September 18, 2011.



Photograph 11. Existing access trail to the location of the proposed intake weir at Wetland #2. September 18, 2011.

# NEW POST CREEK HYDROELECTRIC PROJECT
# FISH HABITAT ASSESSMENT OF THE
# PREFERRED TRANSMISSION LINE ROUTE

Report date: **April 16, 2013.**

Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION .......... 1
2.0 BACKGROUND .......... 2
3.0 METHODS .......... 2
4.0 RESULTS .......... 3
5.0 CONCLUSIONS .......... 5
6.0 REFERENCES .......... 6

APPENDIX A Photographs

## 1.0 INTRODUCTION

C. Portt and Associates and SENES Consultants Limited were retained by Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek generating station (GS). The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2011 aquatic habitat and fish community assessment of the preferred transmission line route. The route is approximately 7 km long, and runs generally west from the proposed powerhouse location on the east side of the Abitibi River, to the existing 115 kV Otter Rapids GS transmission line, approximately 13 km north of Fraserdale near the intersection of Road 1 and the Ontario Northland Railway right-of-way to Moosonee.

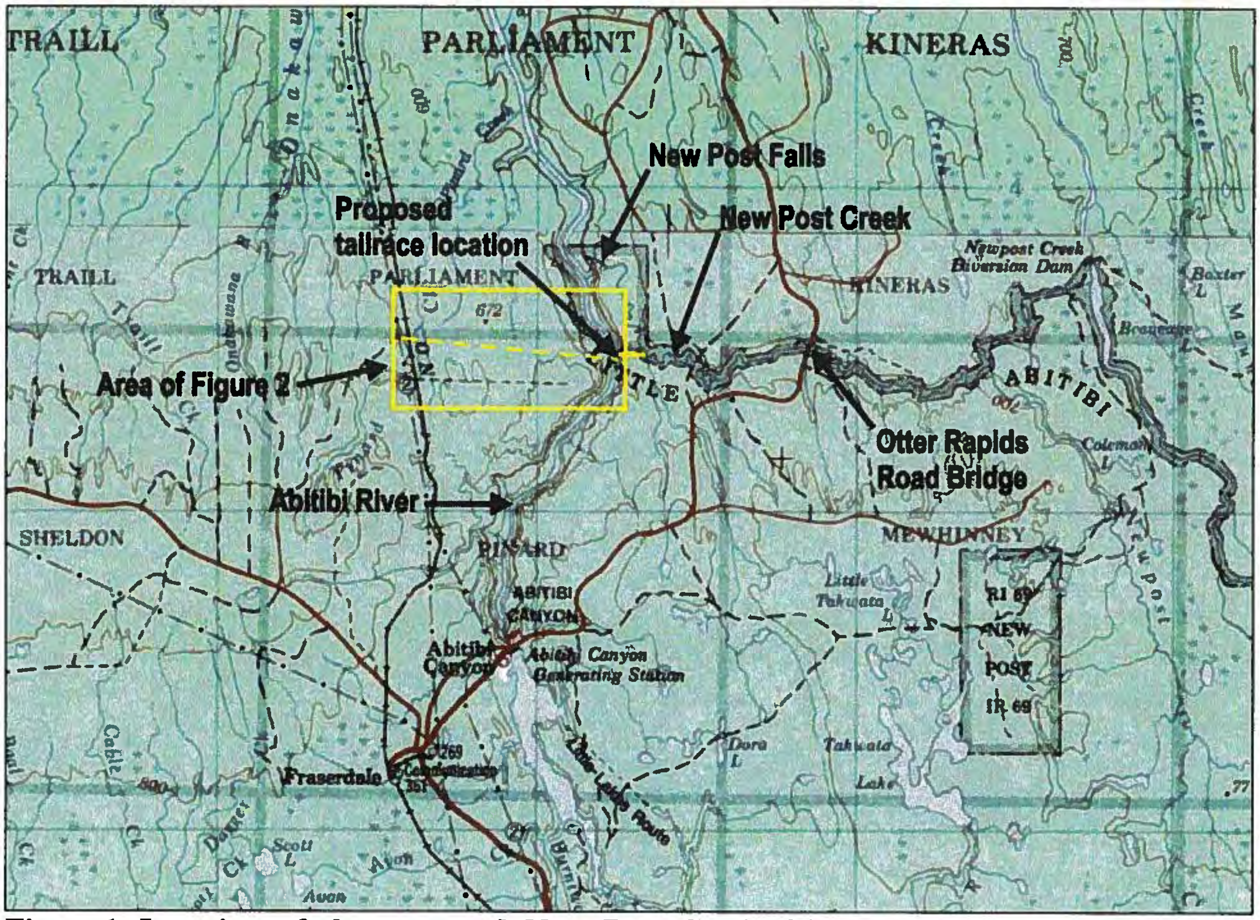



**Figure 1: Location of the proposed New Post Creek GS. The short solid yellow line indicates the approximate location of the proposed penstock that will divert water from New Post Creek to a tailrace on the Abitibi River, and the dashed yellow line indicates the transmission line corridor. The area covered in Figure 2 is shown.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a GS that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfalls located approximately 800 m upstream from its confluence with the Abitibi River. Flow through the powerhouse would enter the Abitibi River approximately 2.8 km upstream from the Abitibi River and New Post Creek confluence. A new transmission line is required to connect the proposed GS with an existing transmission line that brings power south from the Otter Rapids GS (Figure 2).

## 3.0 METHODS

All aquatic habitat investigations and fish collections, undertaken along the proposed transmission line corridor, were conducted by C. Portt and Associates staff George Coker and Jim Reid on September 15, 16, and 18, 2011. Habitat was described, and substrate was classed using a modified Wentworth (1922) scale (Table 1). Besides the substrate descriptors used in Table 1, the term "soil" was used to describe substrates that were clearly flooded terrestrial soils

**Table 1: Substrate particle size terms and associated size ranges, modified from Wentworth (1922).**

| Particle size term | Particle size (mm) |
|---|---|
| clay | 0.001 - 0.004 |
| silt | 0.004 - 0.062 |
| sand | 0.062 - 2.0 |
| gravel | 2.0 - 64.0 |
| cobble | 64.0 - 256.0 |
| boulder | > 256 |
| bedrock | na - rock not granulated |

All distance measurements were either determined in the field using a handheld GPS unit, or from orthorectified digital aerial photographs and downloaded field GPS data using Manifold System 8 software. Likewise, the location of all digital photographs and other observations were associated with GPS waypoints imported into Manifold System 8. Watercourse flow was visually estimated, where possible, at locations with simple channel cross sections.

Electrofishing was undertaken using a Halltech 2000 backpack electrofisher. After field identification and enumeration, all fish were released alive at the point of capture. Electrofishing effort is expressed in electro seconds, which is the amount of time that electrical current is discharged into the water. Electrofishing generally targets small fishes in water up to 1 m deep, and is useful in extracting fish from coarse substrate or dense cover. When warranted by site conditions, a dipnet was sometimes used to sweep dense aquatic macrophytes for hidden fishes. Detailed fish collection reports (FCRs) for all collections have been submitted to the Ontario Ministry of Natural Resources (MNR) Cochrane office.

## 4.0 RESULTS

The results of fish collections are summarized in Table 2, and the fish collection locations are shown in Figure 2. Selected photographs are provided in Appendix A and their locations are shown in Figure 2. It had rained for several days prior to the field investigation, with 17.9 mm of precipitation recorded at Kapuskasing for the period September 11-14, 2011 (www.theweathernetwork.com).

**Crossing #1: Abitibi River**

The Abitibi River in the vicinity of the proposed transmission line crossing is 122 m wide and 10 m deep. Substrates are primarily clay or a mixture of clay and sand, and have some small patches of larger materials such as gravel, cobble and wood debris. The fish community in this part of the Abitibi River is known to be composed of 14 species of large-bodied fish (Table 2 *In* C. Portt and Associates, 2013) dominated by Lake Sturgeon (*Acipenser fulvescens*), Longnose Sucker (*Catostomus catostomus*), Shorthead Redhorse (*Moxostoma macrolepidotum*), Walleye (*Sander vitreus*), Sauger (*Sander canadensis*), Mooneye (*Hiodon tergisus*), Goldeye (*Hiodon alosoides*) and Fallfish (*Semotilus corporalis*). Though no sampling for small-bodied fishes was conducted in the mainstream of the Abitibi River, Slimy Sculpin (*Cottus cognatus*), Spoonhead Sculpin (*Cottus ricei*), Logperch (*Percina caprodes*), Johnny Darter (*Etheostoma nigrum*), Troutperch (*Percopsis omiscomaycus*), Lake Chub (*Couesius plumbeus*), Longnose Dace (*Rhinichthys cataractae*) and possibly others, also likely occur here (Table 3 *In* C. Portt and Associates, 2013). As the transmission line will span the Abitibi River, there will be no effect on fish habitat or the fish community.

**Crossings #2, #3 and #4**

These three crossings are the headwaters of a small tributary of the Abitibi River, with Crossing #3 being approximately 1,334 m upstream of the Abitibi River. The watercourse at Crossing #2 could not be discerned from the surrounding landscape when examined in the field on September 15, 2011, though the aerial photograph, which appears to be taken in the early spring, shows a lighter colouration of vegetation that indicates damper conditions. The watercourse at Crossing #2 is ephemeral, and does not provide direct fish habitat.

The watercourse at Crossing #3 was examined immediately upstream and downstream of the transmission line corridor where culverts cross abandoned logging roads. The upstream culvert was exposed at the road crossing (Photograph 1), and the upstream soil watercourse (swale) was dry with little indication that it is wet for more than short periods of time during spring melt or rainstorms (Photograph 2). The downstream culvert has also been exposed at the road crossing, and the watercourse here is poorly defined with soil and sand substrate (Photograph 3). The watercourse was dry when examined on September 15, 2011, and therefore electrofishing could not be undertaken. The watercourse at Crossing #3 is probably ephemeral, and is not thought to provide direct fish habitat.

The watercourse at Crossing #4 has the most substantial channel of the crossings associated with this tributary, having 1.5 m high banks, and gravel, cobble and sand substrate (Photograph 4). Upstream of Crossing #4 this watercourse has several on-line beaver ponds, but at Crossing #4 it was dry when examined on September 15, 2011. It is possible that simple fish communities may occur in the upstream beaver ponds, as well as downstream in this tributary closer to the Abitibi River, and that some individuals of these potential fish communities may occur at Crossing #4 on a seasonal basis. Therefore, the watercourse at Crossing #4 is considered simple seasonal fish habitat.

**Crossing #5**

Crossing #5 is a 3,900 $m^2$ isolated pond, with no apparent inlet or outlet (Photograph 5). A floating bog shoreline prevented close approach to the water, and therefore this pond could not be electrofished. The water was very clear, but no fish could be observed from shore, during at least 20 minutes of observation. However, a number of aquatic insects were observed. If fish are present in this pond, it is likely a simple community with one or two species of small bodied fish.

**Crossing #6**

Crossing #6 is the upstream end of an undefined watercourse. It is a wet depression that directs flow north within the woods. A defined channel is not apparent in the aerial photographs until approximately 300 m downstream of the north limit of the transmission line corridor. On September 18, 2011, there was no water observed in this watercourse where it crossed a forest access road, 408 m downstream from the northern limit of the transmission line corridor. While the Crossing #6 location is probably seasonally wet, and might have some seasonal pockets of standing water, it should not be considered fish habitat.

**Crossing #7**

Crossing #7 is shown on the aerial photograph as a large (2 ha) beaver pond, most of which is located within the proposed transmission line corridor (Figure 2). However, when examined on September 18, 2011, the beaver dam had failed since the aerial photograph was taken, and the pond was < 10% of its former size, with the dewatered area forming a meadow (Photographs 6 and 7). The meadow was boggy, with Sphagnum Moss and Sedges dominating. Substrate of the pond and meadow is clay along the shore, and peat in the meadow area. Brook stickleback (*Culaea inconstans*) were captured by dipnet in the pond (Table 2; Figure 2: DN-1), and by electrofisher 470 m downstream of the pond in a small pool at the downstream end of the forest access road culvert (Photographs 8 and 9) (Table 2; Figure 2: EF-1). Approximately 2 to 3 litres/s flow was observed in the channel downstream of the beaver dam in a Alder swamp (Photograph 10), which must be assumed to provide habitat for Brook Stickleback, based upon the catch of this species at upstream and downstream locations. Therefore, the pond and associated watercourse at Crossing #7 provide habitat for a single common and resilient species of fish.

## Crossing #8

Crossing #8 is a branch of Pinard Creek that joins with the main creek approximately 413 m north of the north boundary of the transmission line corridor (Figure 2). At Crossing #8 there are two drained online beaver ponds and associated meadows (Photographs 11 and 12). The substrate is soft peat, and dense rooted macrophytes (*Potamogeton* spp.) occur in almost all areas of open water. Electrofishing captured large numbers of Brook Stickleback of various sizes, as well as Northern Redbelly Dace (*Chrosomus eos*) and one Finescale Dace (*Chrosomus neogaeus*) (Figure 2; Table 2: EF-2). Farther upstream, close to the centre of the proposed transmission line corridor and the upstream beaver dam, iron staining in the watercourse indicates that groundwater inputs are occurring (Photograph 13). The watercourse at Crossing #8 is good quality simple habitat, with a simple, but productive, fish community.

## Crossing #9

Crossing #9 is the main branch of Pinard Creek, which flows to the Abitibi River, approximately 10 km downstream of the proposed transmission line corridor (Figure 1). The watercourse at Crossing #9 is a shallow flowing stream, ranging in width from 3.5 to 6 m, with gravel and silt substrate, and clear and cold water (Photographs 14, 15 and 16). Bur-reed (*Sparganium* sp. - floating leafed type) dominated the aquatic plant community, and was found throughout the channel. There is a wide range of water velocities, due to the shallow nature of the channel and the pockets of vegetation and woody debris along the channel edge. Brook Trout (*Salvelinus fontinalis*) were the only fish species captured by electrofishing (Figure 2, Table 2: EF-3). The watercourse at Crossing #9 is good quality cold water fish habitat.

**Table 2: Electrofishing and dip net catch in the waterbodies crossed by the Transmission Line corridor, excluding the Abitibi River. Collection site locations are shown in Figure 2.**

| Collection Site (EF=electrofisher; DN=dipnet) | EF-1 | EF-2 | EF-3 | DN-1 |
|---|---|---|---|---|
| Date | Sep 18, 2011 | Sep 16, 2011 | Sep 16, 2011 | Sep 18, 2012 |
| Electroseconds | unknown | 246 | 446 | na |
| **Species** | | | | |
| Northern Redbelly Dace | | common | | |
| Finescale Dace | | 1 | | |
| Brook Stickleback | 3 | abundant | | abundant |
| Brook Trout | | | 5 | |

# 5.0 CONCLUSIONS

The nine waterbody crossings along the preferred transmission line corridor of the New Post Creek GS, range from a large river with a diverse fish community, through a coldwater trout stream and watercourses with simple baitfish communities, to ephemeral watercourses that do not provide direct fish habitat. Brook Trout occur in Pinard Creek.

## 6.0 REFERENCES

C. Portt and Associates. 2013. New Post Creek Hydroelectric Project: Assessment of Impacts to Fish Habitat in the Abitibi River and New Post Creek. Prepared for SENES Consultants Limited, Richmond Hill, Ontario. 26 p + 3 appendices.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. J. Geol. 30: 377-392.

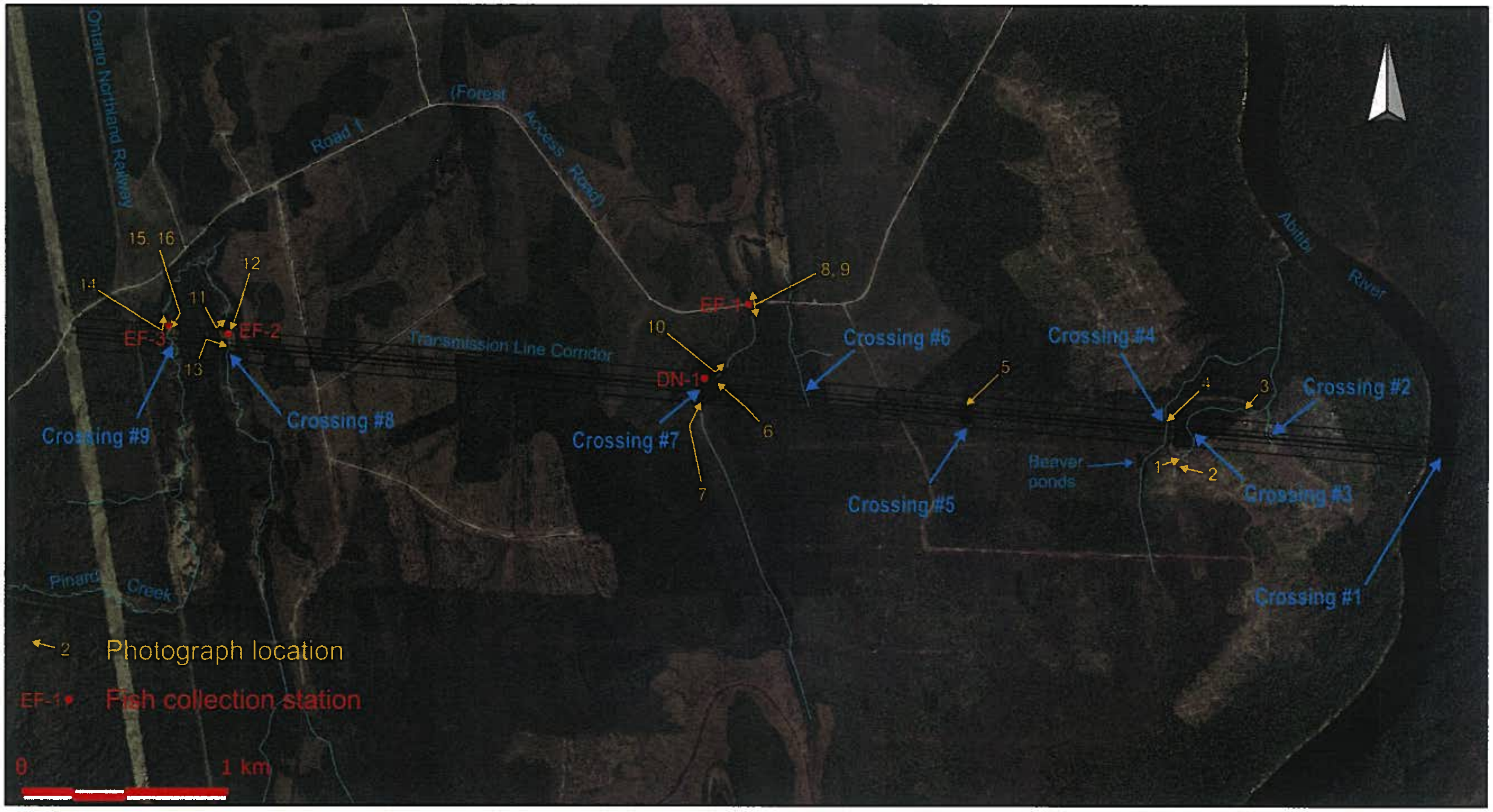



**Figure 2: Transmission Line corridor study area, showing the numbered crossings, fish community sampling locations, and photograph locations. All watercourses crossing the Transmission Line corridor flow in a northward direction.**

# Appendix A

## Photographs

Photograph 1. The exposed upstream culvert at Crossing #3. No flow. September 15, 2011.

Photograph 2. Swale channel upstream of culvert that is upstream of Crossing #3. September 15, 2011.

Photograph 3. Watercourse channel approximately 15 m upstream of the downstream culvert at Crossing #3. September 15, 2011.

Photograph 4. Watercourse channel at Crossing #4. Dry with gravel, cobble and sand substrate. September 15, 2011.

Photograph 5. Crossing #5. Isolated pond with no apparent inlet or outlet. September 18, 2011.

Photograph 6. Crossing #7. View from the beaver dam, showing the remaining portion of the beaver pond. September 18, 2011.

Photograph 7. Crossing #7. View northeast along the watercourse that originates upstream and south of the pond. September 18, 2011.

Photograph 8. Downstream view from the forest access road culvert, located 470 m downstream from Crossing #7. Brook Stickleback occur here. September 18, 2011.

Photograph 9. Upstream view from the forest access road culvert, located 470 m downstream from Crossing #7. September 18, 2011.

Photograph 10. Crossing #7. View downstream from the beaver dam into the Alder swamp. Brook Stickleback likely occur here. September 18, 2011.

Photograph 11. Partially drained beaver pond, immediately downstream of Crossing #8. Dense aquatic macrophytes in open water. September 16, 2011.

Photograph 12. Stream through section of drained beaver pond at Crossing #8. Dense aquatic macrophytes in open water. September 16, 2011.

Photograph 13. Stream through section of drained beaver pond at Crossing #8. Iron staining indicates groundwater inputs. September 16, 2011.

Photograph 14. Pinard Creek at Crossing #9. September 16, 2011.

Photograph 15. Pinard Creek at Crossing #9. September 16, 2011.

Photograph 16. Pinard Creek at Crossing #9. September 16, 2011.

# NEW POST CREEK HYDROELECTRIC PROJECT FISH HABITAT ASSESSMENT OF THE PARLIAMENT LOOP ROAD ACCESS

Report date: **April 16, 2013.**

Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION ........ 1
2.0 BACKGROUND ........ 2
3.0 METHODS ........ 2
4.0 RESULTS ........ 3
5.0 CONCLUSIONS ........ 5
6.0 REFERENCES ........ 6

APPENDIX A Photographs

# 1.0 INTRODUCTION

C. Portt and Associates and SENES Consultants Limited were retained by Ontario Power Generation Inc. (OPG) and its partner Coral Rapids Power LP (CRP), a wholly owned company of Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek Generating Station (GS). The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2011 and 2012 aquatic habitat and fish community assessment of a potential temporary construction access route, using the south portion of the Parliament Loop Road, to the proposed intake weir.

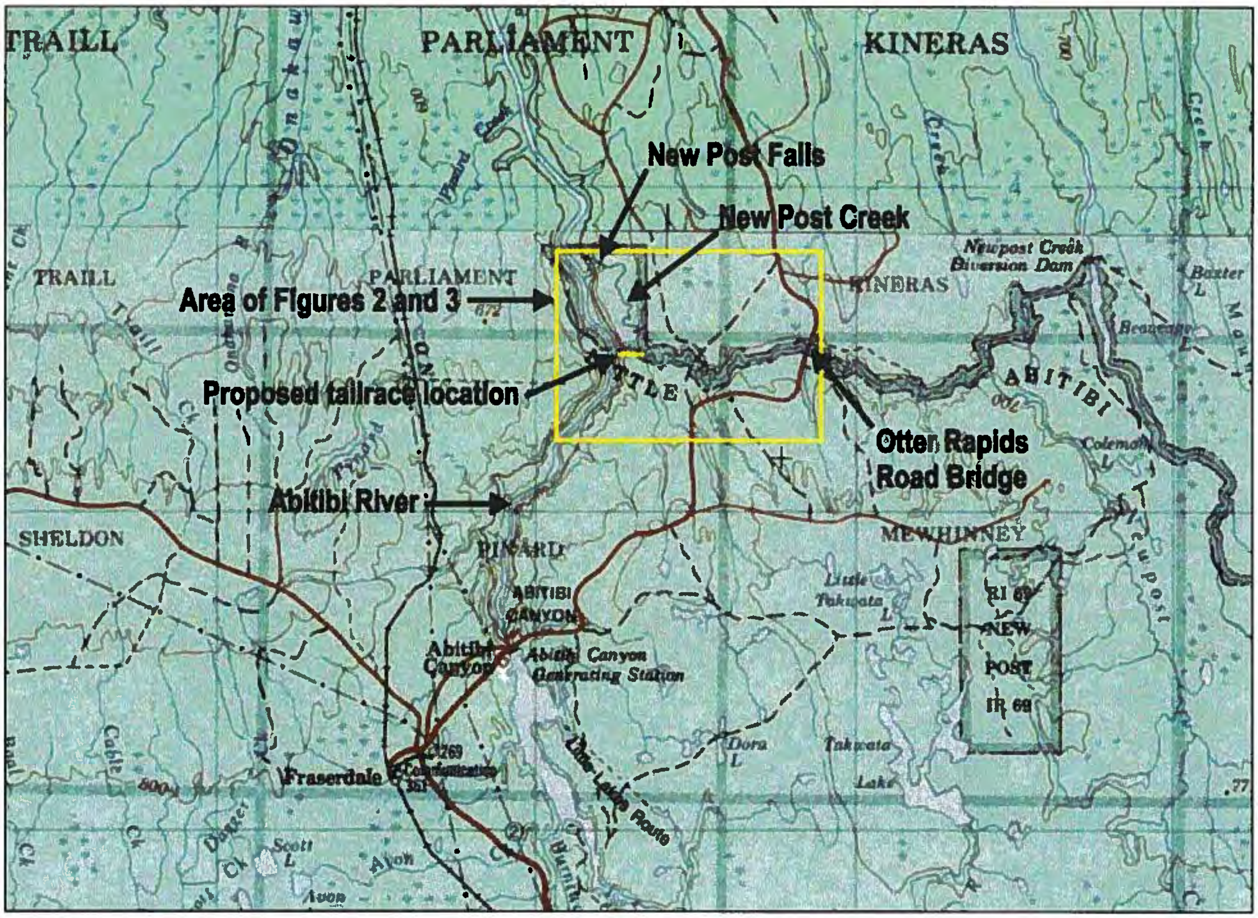



**Figure 1: Location of the proposed New Post Creek GS. The yellow line indicates the approximate location of the proposed penstock that will divert water from New Post Creek to a tailrace on the Abitibi River. The area covered in Figures 2 and 3 is shown.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a GS that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfalls located approximately 800 m upstream from its confluence with the Abitibi River. Flow through the powerhouse would enter the Abitibi River approximately 2.8 km upstream from the Abitibi River and New Post Creek confluence. The south portion of the Parliament Loop Road is proposed as a potential temporary construction access route to the east side of New Post Creek at the proposed intake weir location (Figures 2 and 3).

## 3.0 METHODS

All aquatic habitat investigations and fish collections, undertaken along the south portion of the Parliament Loop Road, were conducted by C. Portt and Associates staff George Coker and Jim Reid, assisted by TTN members George Ross and Kyle Ross in 2011 and 2012.

**Habitat Characterization**

Watercourse crossings along the south portion of the Parliament Loop Road were investigated on September 14, 2011, and September 18, 2012. Habitat was described, and substrate was classed using a modified Wentworth (1922) scale (Table 1). Besides the substrate descriptors used in Table 1, the term "soil" was used to describe substrates that were clearly flooded terrestrial soils

**Table 1: Substrate particle size terms and associated size ranges, modified from Wentworth (1922).**

| Particle size term | Particle size (mm) |
|---|---|
| clay | 0.001 - 0.004 |
| silt | 0.004 - 0.062 |
| sand | 0.062 - 2.0 |
| gravel | 2.0 - 64.0 |
| cobble | 64.0 - 256.0 |
| boulder | > 256 |
| bedrock | na - rock not granulated |

All distance measurements were either determined in the field using a handheld GPS unit, or from orthorectified digital aerial photographs and downloaded field GPS data using Manifold System 8 software. Likewise, the location of all digital photographs and other observations were associated with GPS waypoints imported into Manifold System 8. Watercourse flow was visually estimated, where possible, at locations with simple channel cross sections.

**Fish Community Characterization**

Electrofishing was undertaken using a Halltech 2000 backpack electrofisher. After field identification and enumeration, all fish were released alive at the point of capture. Electrofishing effort is expressed in electro seconds, which is the amount of time that electrical current is discharged into the water. Electrofishing generally targets small fishes in water up to 1 m deep, and is useful in extracting fish from coarse substrate or dense cover. Detailed fish collection reports (FCRs) for all collections have been submitted to the Ontario Ministry of Natural Resources (MNR) Cochrane office.

# 4.0 RESULTS

The results of fish collections are summarized in Table 2, and the fish collection locations shown in Figure 2. Selected photographs are provided in Appendix A and their locations are shown in Figure 3. Ten tributaries were identified as flowing into New Post Creek, upstream of the proposed intake weir, and are described in detail in the report entitled New Post Creek Hydroelectric Project: Assessment of Effects to Fish Habitat in the Abitibi River and New Post Creek (C. Portt and Associates 2013). Some of these tributaries cross the study area along Parliament Loop Road. To maintain consistency between reports, the names assigned to tributaries, as well as the codes assigned to electrofishing locations, in the above report, have been maintained in this report.

**Crossing #1**

Tributary 2 is very small and has a small watershed (Figure 2). Consequently, it does not have a lot of flow, as evidenced by the shallow channel that drops steeply into New Post Creek from the surrounding table lands. It was not flowing but did have some standing water at Crossing #1, approximately 516 m upstream from New Post Creek, after a couple of rainy days when examined on September 18, 2012 (Photograph 1). The aerial photograph does not show a well defined channel, and likely is often dry. No electrofishing was attempted, but this watercourse is unlikely to support fish, due to the lack of water and the steep drop into New Post Creek that may be a barrier to upstream fish movement.

**Crossing #2**

This is a small, poorly defined branch of Tributary 2 (Figure 2). There was no apparent channel upstream of the small culvert at Crossing #2, though there was some standing water among the vegetation on September 18, 2012, due to the steady rain that occurred over the previous couple of days (Photograph 2). This watercourse is unlikely to support fish, and direct fish habitat does not exist at Crossing #2.

**Crossing #3**

Tributary 6 begins in a large wetland approximately 2.8 km upstream from New Post Creek, and flows through a number of beaver ponds between its source and Crossing #3 at Parliament Loop Road, approximately 760 m upstream from New Post Creek (Figure 2). The last 350 m of this watercourse is an old meander loop of the pre-diversion New Post Creek channel, that became isolated when the flows that were diverted from the Little Abitibi River system in 1963 eroded a new course for the creek that bypassed this loop (Figure 2). When examined near its mouth on

September 20, 2011, there was some standing water in the pre-diversion New Post Creek channel (Photograph 3), but very little flow, despite the heavy sustained rainfall of September 19. Substrate is clay, and the riparian vegetation is alder at Photograph 3. The aerial photograph shows that farther upstream in the pre-diversion loop there are larger areas of ponding, that likely retain some water during extended dry periods. At Crossing #3 at Parliament Loop Road, approximately 760 m upstream from New Post Creek, there is a large beaver pond with clay substrate and rooted aquatic plants upstream of the road (Photograph 4). The beaver dam is perched on top of the roadbed (Photograph 5), and the culvert is blocked, forcing the water to flow over the road. Immediately downstream of the beaver dam the small channel has substrate of clay mixed with sand, gravel, and cobble (Photograph 6).

Electrofishing was undertaken near New Post Creek (Figure 2,Table 2: EF-10) and below the beaver dam at Parliament Road (Figure 2, Table 2: EF-11). No fish were captured at EF-10, likely because this portion of channel is dry at times. At EF-11 the Northern Redbelly Dace (*Chrosomus eos*) and Brook Stickleback (*Culaea inconstans*) that were captured are typical of the boggy and beaver pond habitats that occur in this area (Scott and Crossman, 1973).

**Crossing #4**

Crossing #4 is on a poorly defined branch of Tributary 7. On the aerial photograph it appears as a broad swale upstream of Parliament Loop Road (Photographs 7 and 8), and a narrow defined channel downstream of Parliament Loop Road (Photograph 9) that joins the main channel of Tributary 7 approximately 400 m farther downstream. This watercourse crossing was examined on September 14, 2011, and on September 18, 2012, and on both occasions there was less than 1 litre/s of flow after one or two days of sustained rainfall. Electrofishing was not attempted at this location. This watercourse at Crossing #4 probably does not flow during dry periods, and is unlikely to provide direct fish habitat. Tributary 7 was electrofished at three other locations, but no fish were captured (Figure 2, Table 2: EF-12, EF-13, and EF-14).

**Crossing #5**

Crossing #5 is on the main channel of Tributary 7, approximately 1,700 m upstream from New Post Creek. Tributary 7 begins in a large wetland approximately 3 km upstream from New Post Creek, and flows through a number of beaver ponds and marshy areas until a point approximately 850 m upstream from New Post Creek. It drops fairly steeply into New Post Creek at its mouth. There was a large beaver dam perched upon Parliament Loop Road (Photograph 10), with a large beaver pond on the upstream, or north, side of Crossing #5 (Photograph 11). The culvert is blocked, and on September 14, 2011, approximately 4 litres/s was flowing over the roadbed. Immediately downstream of the road there was a small alder swamp (Photograph 12), and approximately 50 m farther downstream the watercourse is a meandering entrenched hard clay channel (Photograph 13) flowing through a meadow (Photograph 14). The substrate within the beaver pond was, predictably, soil, while at all other locations examined within the stream channel the substrate was hard clay. Aquatic habitats on both sides of Parliament Loop Road were electrofished, but no fish were captured (Figure 2, Table 2: EF-13). This tributary was also electrofished farther downstream, but no fish were captured (Figure 2, Table 2: EF-12). However, it is unlikely that a watercourse of this size would be completely fishless, and therefore probably has a simple but sparse fish community in some locations.

**Crossing #6**

Crossing #6 is a branch of Tributary 7 with no defined channel. On the aerial photograph it appears as a broad swale that flows from north to south, with a small culvert, approximately 0.3 m in diameter, beneath Parliament Road. Upstream of the road it was wet boggy soil (Photograph 15), and downstream there was a limited area of standing water (Photograph 16). Similar conditions were apparent on September 14, 2011, and September 18, 2012, as both days were preceded by a period of rain. The standing water downstream of the culvert was electrofished, but no fish were captured (Figure 2, Table 2: EF-14). The terrestrial vegetation downstream of the crossing suggests that it likely goes dry during the summer, and therefore, direct fish habitat probably does not exist at Crossing #6.

**Crossing #7**

Crossing #7 is associated with a poorly defined watercourse, with approximately 1 litre/s flow when examined on September 14, 2011, and less than 1 litre/s flow when examined on September 18, 2012. It is not known if this watercourse discharges to New Post Creek. Upstream of the crossing is a small marsh and a 1 m deep pool of water with soil substrate (Photograph 17). Downstream of the small twin culverts (Photograph 18) there is a diffuse channel with soil substrate. This watercourse was electrofished, but no fish were captured (Figure 2, Table 2: EF-17). Based upon the observed habitat, there may be permanent flow or standing water at Crossing #7. However, since the upstream pool appeared to be the best available location to support fish within this watercourse, and no fish were found, it is likely that fish do not occur here.

**Table 2: Electrofishing in the watercourses that cross Parliament Road.**

| Site (Figure 2) | EF-10 | EF-11 | EF-12 | EF-13 | EF-14 | EF-17 |
|---|---|---|---|---|---|---|
| NPC Tributary | 6 | 6 | 7 | 7 | 7 | unknown |
| Date | Sep 20, 2011 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 | Sep 18, 2012 |
| Electroseconds | 60 | 549 | 206 | 565 | 72 | 223 |
| **Species** | no catch | | no catch | no catch | no catch | no catch |
| Northern Redbelly Dace | | 1 | | | | |
| Brook Stickleback | | 10 | | | | |

# 5.0 CONCLUSIONS

The seven watercourses that cross the portion of the Parliament Loop Road that is being considered as a potential construction access route to the proposed intake weir location, are all relatively minor systems with simple baitfish communities or with no fish community. The smallest of these watercourses likely do not provide any fish habitat. There were no sport fishes captured or observed in any of these watercourses.

## 6.0 REFERENCES

C. Portt and Associates. 2013. New Post Creek Hydroelectric Project: Assessment of Effects to Fish Habitat in the Abitibi River and New Post Creek. Prepared for SENES Consultants Limited, Richmond Hill, Ontario. 26 p + 3 appendices.

Scott, W.B and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 183. Ottawa, Canada. 966 p.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. J. Geol. 30: 377-392.

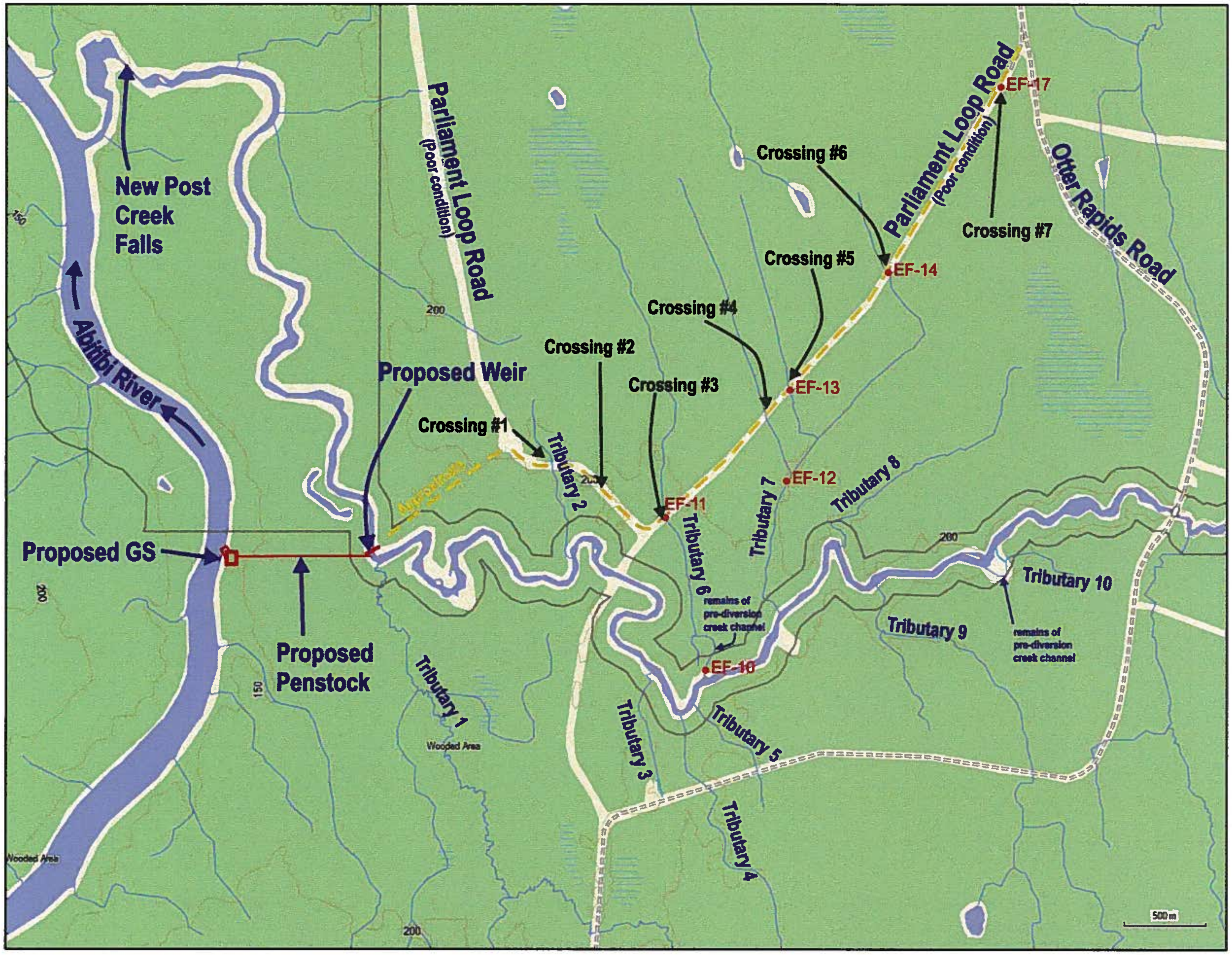



**Figure 2: Fish community sampling locations (EF-10 to EF-14, and EF-17). The dashed yellow line indicates the potential temporary construction access route to the proposed intake weir location.**

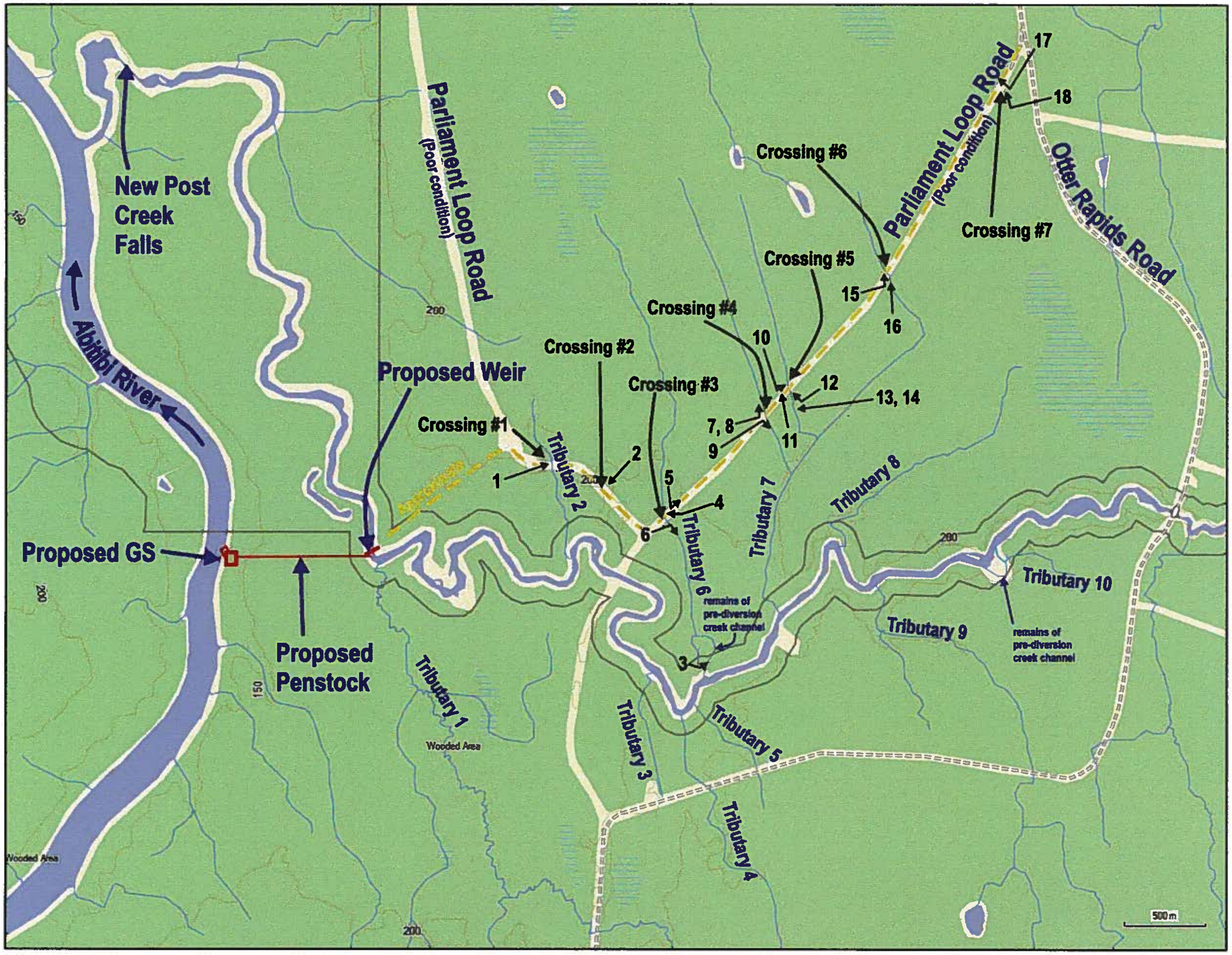



**Figure 3: Locations of selected photographs in the study area. Photographs are provided in Appendix A. The dashed yellow line indicates the potential temporary construction access route to the proposed intake weir location.**

# Appendix A

## Photographs

Photograph 1. The upstream end of the small culvert at Crossing #1 in Tributary 2, 516 m upstream from New Post Creek. September 18, 2012.

Photograph 2. Upstream of the small culvert at Crossing #2 in Tributary 2. September 18, 2012.

Photograph 3. Tributary 6, approximately 35 m upstream from New Post Creek. This is a remnant pre-1963 channel of New Post Creek.

Photograph 4. Large beaver pond, immediately upstream of Crossing #3. September 18, 2012.

Photograph 5. View east from Crossing #3, along Parliament Road, upon which the beaver dam sits. September 18, 2012.

Photograph 6. Tributary 6, approximately 760 m upstream from New Post Creek, in the channel approximately 30 m downstream from Crossing #3. September 14, 2011.

Photograph 7. Upstream view from Crossing #4. September 14, 2011.

Photograph 8. Upstream view from Crossing #4. September 14, 2011.

Photograph 9. Downstream view from Crossing #4. September 14, 2011.

Photograph 10. Beaver dam perched along Parliament Road at Crossing #5. September 14, 2011.

Photograph 11. Beaver pond upstream of Parliament Road at Crossing #5. September 14, 2011.

Photograph 12. Small alder swamp immediately downstream of the blocked Parliament Road culvert at Crossing #5. September 18, 2012.

Photograph 13. View of Tributary 7 channel at the same location as Photograph 14. September 14, 2011.

Photograph 14. Tributary 7, approximately 100 m downstream from Parliament Road Crossing #5. September 14, 2011.

Photograph 15. Boggy swale upstream of Parliament Road at Crossing #6. No apparent channel. September 18, 2012.

Photograph 16. Standing water and terrestrial grasses downstream of Parliament Road. No apparent channel. September 18, 2012.

Photograph 17. Upstream of Crossing #7. Pool of water near the stake is approximately 1 m deep. September 18, 2012.

Photograph 18. Downstream of Crossing #7. Flow disappeared into tangle of tree roots, reappearing at diffuse locations downstream. September 18, 2012.

# NEW POST CREEK
# ABITIBI RIVER
# LAKE STURGEON SPAWNING ASSESSMENT
# 2011 and 2012

Report date: February 25, 2013.
Updated: April 18, 2013.
Prepared for: SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: George Coker and Cam Portt
C. Portt and Associates
56 Waterloo Avenue
Guelph, Ontario
N1H 3H5

TABLE OF CONTENTS

1.0 INTRODUCTION ........ 1
2.0 BACKGROUND ........ 2
3.0 METHODS ........ 4
3.1 Egg Mats ........ 4
3.2 Gillnets ........ 9
3.3 Drift Nets ........ 9
4.0 RESULTS AND DISCUSSION ........ 11
4.1 2011 ........ 11
4.2 2012 ........ 13
5.0 CONCLUSIONS ........ 20
6.0 REFERENCES ........ 21

# 1.0 INTRODUCTION

C. Portt and Associates, as a part of an environmental assessment team lead by SENES Consultants Limited, was retained by Ontario Power Generation Inc. (OPG), who are in partnership with Taykwa Tagamou Nation (TTN), to conduct a fisheries assessment of the proposed New Post Creek generating station (GS). The proposed development is located on the east bank of the Abitibi River, approximately 80 km north of Smooth Rock Falls and 13 km downstream from Abitibi Canyon (Figure 1). This report presents the results of the 2011 and 2012 investigations of Lake Sturgeon (*Acipenser fulvescens*) spawning activity, which are the second and third years of Lake Sturgeon spawning investigations undertaken in support of this project. A smaller scale Lake Sturgeon spawning assessment was undertaken in 2010, but was inconclusive and is briefly summarized in Section 2.0 below.

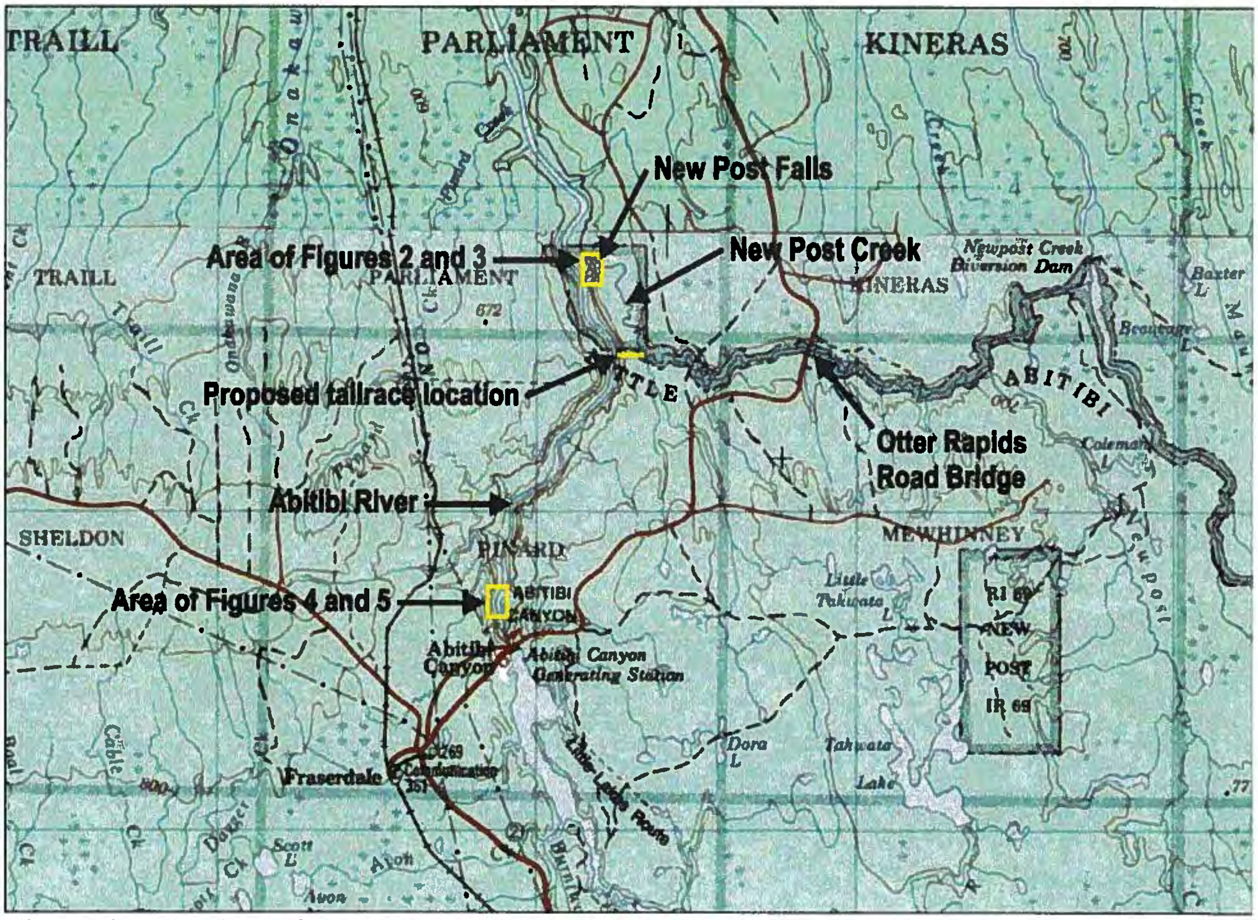



**Figure 1: Location of the proposed New Post Creek GS. The yellow line indicates the approximate proposed location of the penstock that will divert water from New Post Creek to a tailrace on the Abitibi River.**

## 2.0 BACKGROUND

OPG and CRP are proposing to construct a GS that diverts water from New Post Creek to the Abitibi River, bypassing an approximately 5.7 km long section of New Post Creek, that includes a high waterfall located approximately 800 m upstream from its confluence with the Abitibi River (Figure 1). This Lake Sturgeon spawning assessment examined New Post Creek between its confluence with the Abitibi River and the waterfall (Photographs 1 and 2), and the Abitibi River in the vicinity of the rapids that are immediately downstream from Abitibi Canyon.

During years when water temperature rises slowly, Lake Sturgeon typically begin to spawn when the water temperature reaches 11.7ºC (Becker, 1983), with optimal spawning water temperatures of 13 to 18°C (Scott and Crossman, 1973). During years with lower water flow and more rapid temperature rise, spawning may be delayed until temperatures reach 14.5 to 15.0ºC (Becker, 1983). Holm *et al.* (2009) gives the spawning temperature range as 13 to 21ºC. Lake Sturgeon spawn at depths of 0.3 to 4.6 m (Becker, 1983), in areas of swift water or rapids, often at the foot of low falls that prevent further migration (Scott and Crossman, 1973). In the Des Prairies River (Quebec), spawning habitats are covered by a mix of fine- to medium-size gravel to boulders (LaHaye *et al.* 1992). Spawning in the Wolf River (Wisconsin) occurs along the outside of a river bend, especially where the current is upwelling or slowly boiling, and where rocks, boulders, and broken slabs of concrete have been riprapped at a steep angle into the water (Becker, 1983). Male Lake Sturgeon typically mature at around 15 years of age, while females typically mature around 20 years of age, though there is considerable variation across their Canadian range (Scott and Crossman, 1973).

Potential Lake Sturgeon spawning habitat is only found in two locations along the 39 km section of Abitibi River that runs between the tailwater of the Abitibi Canyon GS and the downstream Otter Rapids GS dam. These are the areas of shallow, swiftly flowing, water over coarse substrate that occurs immediately below the rapids at the base of New Post Creek falls (Photographs 1 and 2), and within the rapids immediately downstream of the tailrace of the Abitibi Canyon GS on the Abitibi River.

The 2010 Lake Sturgeon spawning assessment involved spawning observations and gillnetting in New Post Creek, downstream of the waterfalls near its confluence with the Abitibi River. No Lake Sturgeon were observed during a brief field visit on May 20, 2010, when water temperature in New Post Creek was 13.8°C, and in the Abitibi River was 9.2°C. Due to an unusually warm and dry spring, water temperatures increased rapidly and had already reached 22.5°C in New Post Creek, and 14.7°C in the nearby Abitibi River when gillnetting commenced on May 25, 2010, which is above the typical spawning temperature for Lake Sturgeon. Gillnets were set in New Post Creek over the period May 25-27, and nearby in the Abitibi River from May 26 - 27, 2010. A total of 11 Lake Sturgeon, and no other fish species, were captured. Nine of these were captured in New Post Creek, and two were captured in the Abitibi River near the mouth of New Post Creek. All but one of the Lake Sturgeon were 100 cm or more long, and most of the adult Lake Sturgeon appeared to be in post-spawning condition, as they were flacid and one had a small amount of blood coming from its vent. None of the sturgeon examined were ripe (i.e. the gonadal readiness to spawn, demonstrated by the emission of gametes during handling when slight or no pressure is applied to the abdomen).

**Photograph 1: View of New Post Creek falls and the rapids. June 13, 2012. Photograph locations are shown in Figures 2 and 3.**

**Photograph 2: View downstream towards the Abitibi River from the same location as Photograph 1, showing the base of the rapids and the wide portion of New Post Creek that narrows in the distance prior to curving out of view to the right to join the Abitibi River. Photograph locations are shown in Figures 2 and 3. June 13, 2012.**

## 3.0 METHODS

Field investigations for this project were conducted by C. Portt & Associates staff George Coker and Jim Reid, as well as TTN members George Ross, Kevin Ross and Kyle Ross, over the periods May 20 to June 6, 2011, and May 11 to 23 and May 30 to June 14, 2012. Additional field observations of water temperature in the Abitibi River and New Post Creek during May of both years were provided by OPG staff to aid in determining the timing for the field investigations. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to locate and identify key features, and record sampling gear and digital photograph locations. Water temperature was determined each day using a Hanna Instruments Checktemp® thermometer, rated accurate to 0.3C°, and checked regularly against a crushed ice/water mixture and a high quality mercury thermometer. Continuous water temperature data were collected at 15 minute intervals at a depth of approximately 2 m in both the New Post Creek and the Abitibi River study areas during 2012 using Onset Hobo® WaterTemp Pro v2 loggers that have an accuracy of ±0.2°C. The continuous water temperature data were used to calculate cumulative thermal units (CTUs), based on the methods of Keppinger (1988), which were used to determine the period of drift net deployment. Water clarity was measured using a Secchi disk.

### 3.1 Egg Mats

In 2011, twenty egg collection mats were deployed from May 22 to June 5 over a range of flow velocities, water depths and substrates considered suitable for Lake Sturgeon spawning downstream of the New Post Creek falls (Figure 2). Each mat consisted of a flat plastic container with a snap-on lid, approximately 25 cm wide × 38 cm long × 10 cm deep. The container was filled with gravel to provide weight, wrapped in hog hair filter material which was held in place by bungee cords, and deployed with an attached line and buoy to facilitate retrieval.

In 2012, forty egg collection mats of slightly different construction were deployed from May 11 to May 22 over a range of flow velocities, water depths and substrates considered suitable for Lake Sturgeon spawning downstream of the New Post Creek falls (Figure 3). Each mat consisted of a flat piece of steel plate, approximately 25 cm wide × 38 cm long × 2 cm thick. The steel plate was wrapped in hog hair filter material which was held in place by steel clips, and deployed with an attached line and buoy to facilitate retrieval.

Upon retrieval each mat was placed in a shallow plastic tub, where the hog hair filter material was carefully examined for captured eggs. Then the hog hair filter material was removed from the mat base and thoroughly rinsed in river water in the plastic tub, to dislodge any potentially hidden eggs, and the wash was poured through a 0.5 mm mesh geological sieve to find any dislodged eggs. The egg mats were then redeployed at the same or different locations, depending on any changes in flow and water level conditions. In 2011 and 2012 the egg collection mats were deployed and retrieved 4 times over the period of deployment, with the interval varying between 1 and 6 days depending upon water temperature and local sturgeon activity as determined by gillnet catch.

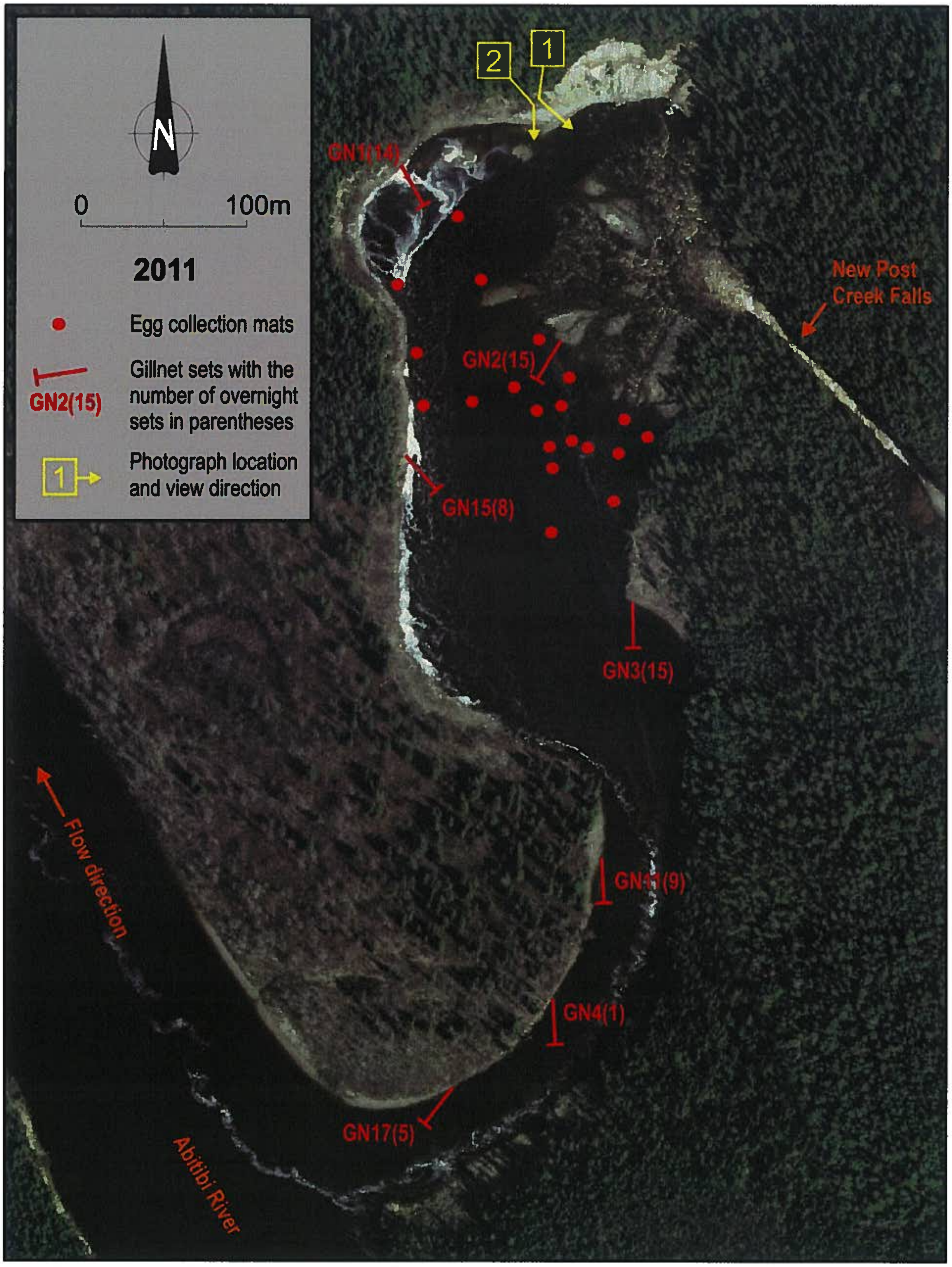



**Figure 2:** **Location of egg collection mats and gillnets in New Post Creek. May, 2011.**

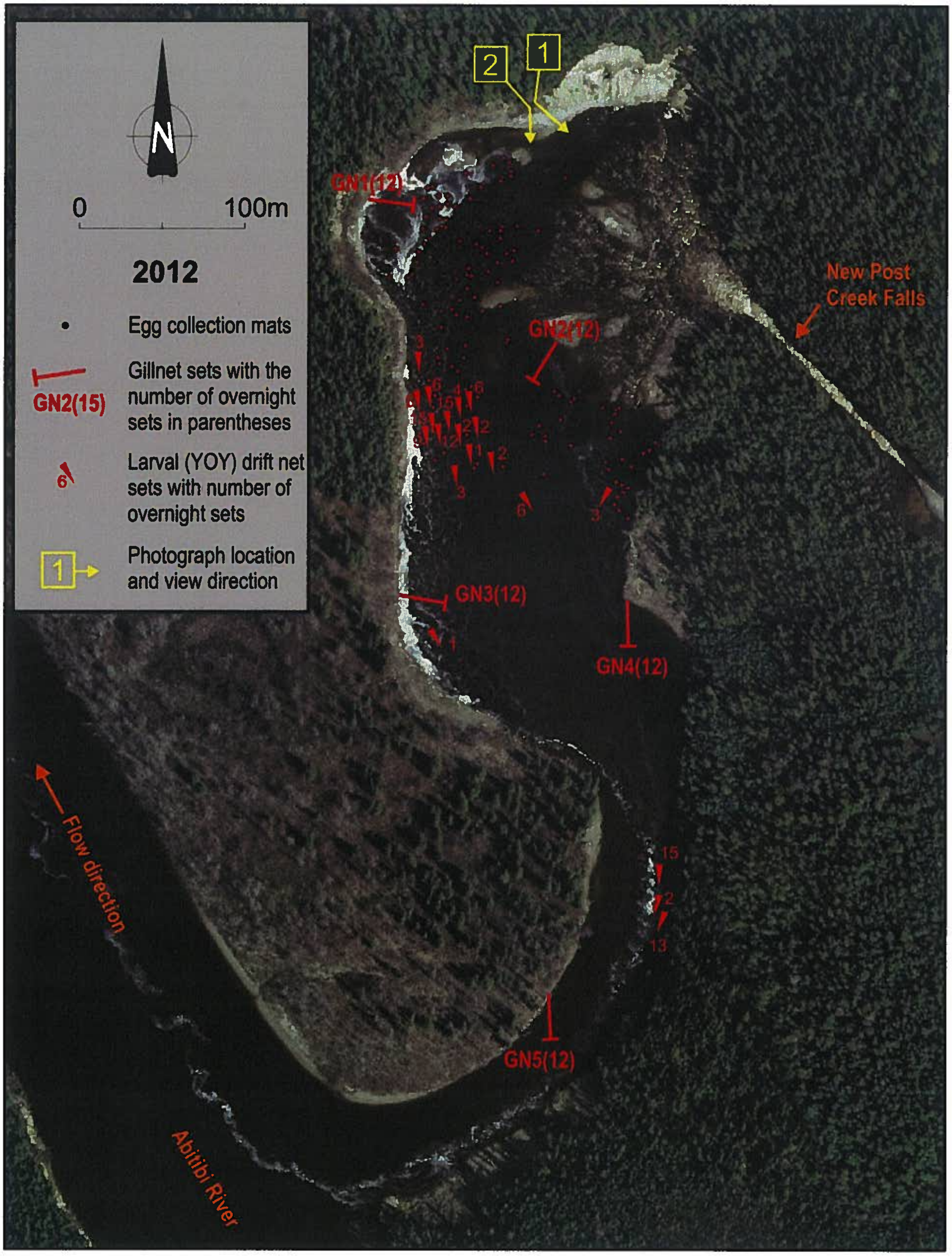



**Figure 3: Location of egg collection mats, gillnets, and drift nets in New Post Creek. May and June, 2012.**

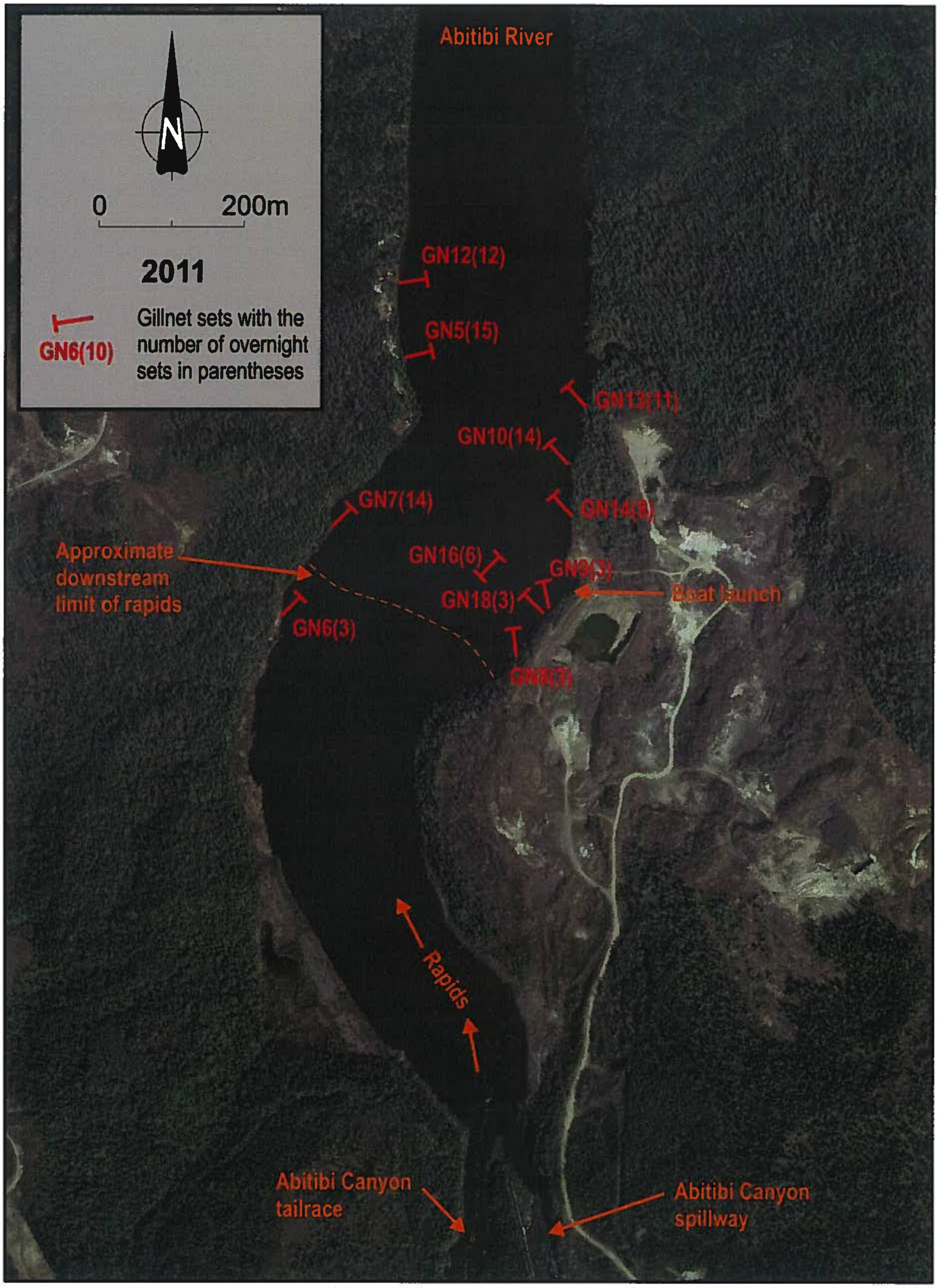



**Figure 4:** **Location of gillnets near Abitibi Canyon. May, 2011.**

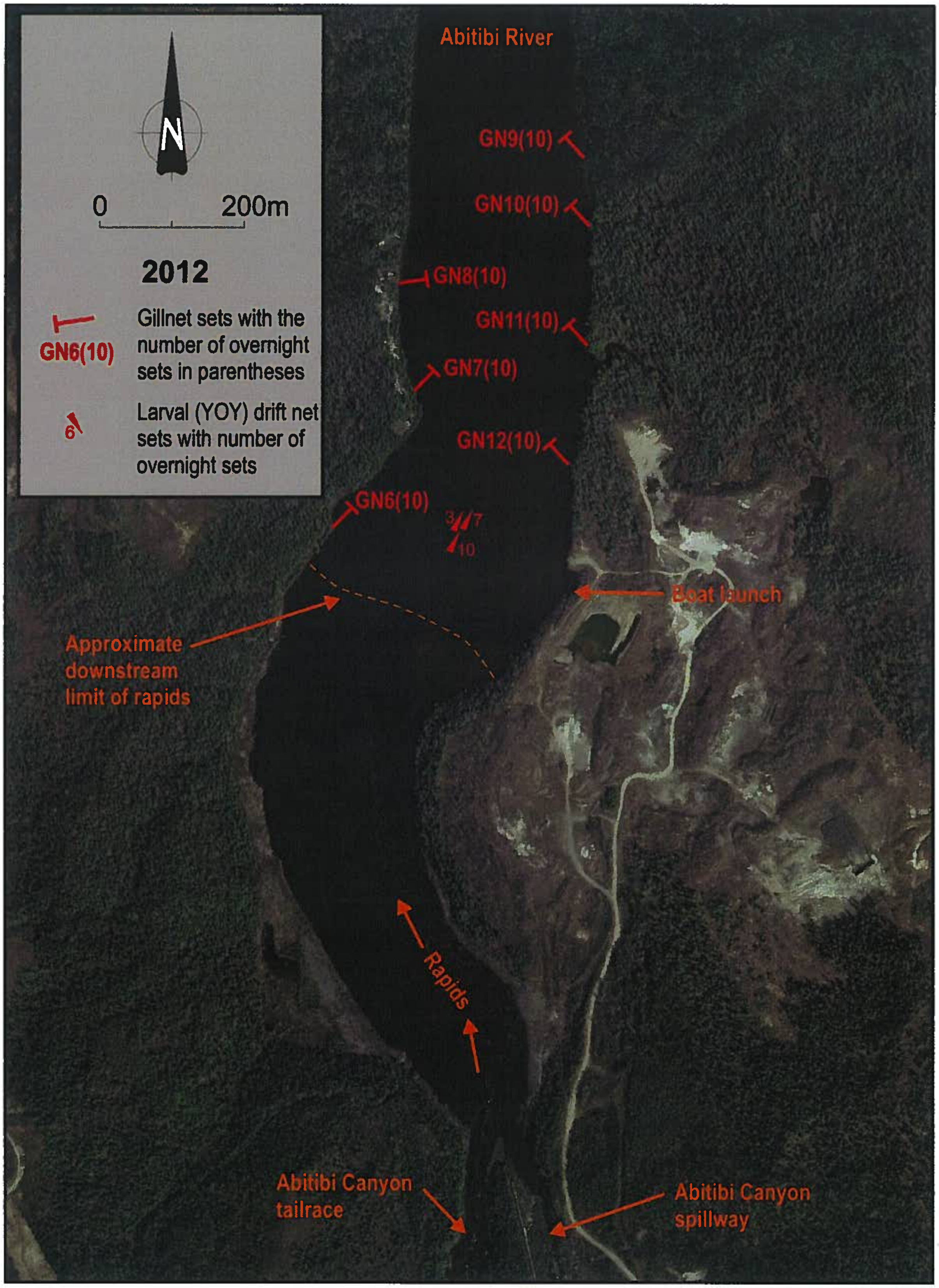



**Figure 5: Location of gillnets and drift nets near Abitibi Canyon. May and June, 2012.**

## 3.2 Gillnets

Gillnets were set for Lake Sturgeon in New Post Creek downstream from the falls, and in the Abitibi River immediately below the rapids that are downstream of Abitibi Canyon, from May 20 to June 6, 2011 (Figures 2 and 4), and from May 11 to May 23, 2012 (Figures 3 and 5). Each gillnet was 25 m long and 2.13 m deep, and composed of four 6.2 m long panels of 8 inch (20.32 cm), 9 inch (22.86 cm), 10 inch (25.40 cm) and 12 inch (30.48 cm) multifilament nylon mesh. Gillnets were retrieved and reset each day. Gillnets were usually set with one end attached to shore and the offshore end anchored and buoyed for retrieval. In one case during 2011 nets were set in midstream below Abitibi Canyon, with an anchor and buoy at each end. The GPS coordinates of each end of each gillnet set was recorded, as was water depth at the offshore end, or at both ends for the midstream sets. In 2011, 67 overnight gillnet sets were conducted in New Post Creek, downstream of the waterfalls (Figure 2), and 92 overnight sets were conducted below Abitibi Canyon in the Abitibi River (Figure 4). In 2012, 60 overnight gillnet sets were conducted in New Post Creek, downstream of the waterfalls (Figure 3), and 70 overnight sets were conducted below Abitibi Canyon in the Abitibi River (Figure 5).

Each Lake Sturgeon captured was placed in a mesh cradle and weighed to the nearest 10 grams using a Salter Brecknell ElectroSamson™ hanging scale. While remaining in the mesh cradle, its total and fork lengths were measured to the nearest centimetre using a tape measure, and it was evaluated for injuries and spawning condition. The gillnet mesh size in which it was captured was also recorded. A small hole was made with a hand-held paper punch in the membrane between the rays of the pelvic fin each time a Lake Sturgeon was captured. Holes were made in the left pelvic fin of sturgeon captured in New Post Creek, and holes were made in the right pelvic fin of individuals captured in the Abitibi River below Abitibi Canyon. These marks were used to determine if any of the captured fish moved between the two study sites, as well as how many times an individual fish had been captured. Lake Sturgeon that were previously captured were not weighed or measured, to minimize handling stress. Other fish species captured were recorded, but not examined in any way. All fish were released alive at the point of capture, and all Lake Sturgeon appeared to be vigorous when released.

## 3.3 Drift Nets

Drift nets to collect young-of-the-year (YOY) Lake Sturgeon drifting downstream were deployed from May 30 to June 14, 2012. Initially, 10 nets were set below the rapids downstream of New Post falls (Figure 3), but 2 nets were subsequently moved to the Abitibi River below Abitibi Canyon (Figure 5). Those two nets were also deployed for 2 nights farther upstream in New Post Creek. In all, 126 overnight driftnet sets were conducted in New Post Creek downstream of the falls, 20 were conducted in the Abitibi River, and 4 were conducted in upper New Post Creek. The upper New Post Creek driftnet sets were deployed to confirm that coregonid (i.e. Salmonidae: *Coregonus* spp.) YOY captured in the drift nets below New Post Creek falls, were coming from upstream areas.

Each drift net consisted of a stainless steel D-frame, 76 cm wide and 53 cm high, to which a cone of 1.6 mm mesh, 3.6 m long and tapering to a 11.4 cm diameter opening, was attached. A detachable collection container with filtering holes covered by 1000 µm mesh was attached to the small end of the mesh cone. A bridle was attached to the front of the D-frame and this in turn was attached with rope to anchors placed approximately 5 m upstream. All of the drift net sets were overnight sets. The coordinates of the net locations were determined using GPS. Each net was assigned a number, and the location, date, and time of each net set and lift were recorded. The water depth immediately in the front of the net, at the mid-point across the opening, was determined to the nearest 0.1 m. Drift nets were always set in areas with sufficient current to maintain the mesh cone in an open and expanded condition.

During retrieval, each drift net was lifted from front to back, rinsing the mesh so that retained material was moved into the collection container at the end of the mesh cone. The mesh near the collection container was examined for YOY sturgeon, which can become trapped with their snouts sticking through the mesh. The collection container was then removed and the collected material was emptied into a bucket. Any material remaining in the collection container or the back of the mesh cone was rinsed into the bucket with river water. After the collected material was removed, the net was rubbed and agitated with the collection container off to dislodge any attached biofilm that could impair flow through the mesh. The collection container was then reattached and the net was reset.

Occasionally, larger fish were captured in the drift nets. These were identified to species and released. The drift nets retained varying amounts of benthic invertebrates, algae, woody debris, and other detritus. Subsamples of the retained material were placed in white plastic trays. Each subsample was carefully examined, by eye, agitating the debris, sometimes with added water, and teasing it apart with forceps to expose YOY fishes, which were collected into vials. The subsample was examined until no additional fishes were observed and it could be reasonably concluded that no more were present. Then the algae and debris in that subsample were discarded, a new subsample of the retained material was placed in the tray, and the sorting process began again. This process was repeated until all of the material retained in the net had been examined. All YOY fish were preserved in 5% buffered formalin, and the catch from each net was preserved separately. Keys from several sources, including Auer (1982), Becker (1983), Holm et al (2009) and Scott and Crossman (1973), were used to identify the preserved specimens to the lowest practical level. The identification of some of the species collected was confirmed by Erling Holm, Assistant Curator of Fishes, Department of Natural History, Royal Ontario Museum.

It is not known if Lake Sturgeon spawn in New Post Creek. The probable spawning period for Lake Sturgeon was estimated based upon New Post Creek water temperature, sturgeon capture in gillnets, and the timing and associated water temperature of Lake Sturgeon spawning in the nearby Abitibi River, downstream of Abitibi Canyon. Then, to ensure that the drift nets were deployed for the period that YOY Lake Sturgeon would be drifting from potential spawning sites, Cumulative Thermal Units (CTU), calculated according to Keppinger (1988), were used to estimate the start and end dates for drift net sets. The thermal units for each day were calculated by subtracting 5.8 from the mean daily water temperature, and the CTUs were calculated by summing the daily thermal units after spawning was assumed to have occurred. Based on several years of spawning observations in the Kakabeka River, at Thunder Bay, it had been suggested by M. Friday (MNR biologist) for another project where sturgeon spawning was not known to occur, that the CTUs be calculated based on the following assumptions:

- the first spawning would have occurred after either the first two consecutive days when the maximum water temperature was 13°C or higher, or
- after the first two consecutive days that the mean water temperature was 13°C or higher.

The rate of embryo development and length of time between Lake Sturgeon spawning and YOY drift is related to water temperature, with development occurring more rapidly and drift occurring sooner after spawning in warm years (Keppinger, 1988; Smith and King, 2005). The results of studies conducted from 2004-2010 on the Kaministiquai River at Kakabeka were summarized by Friday (2012). He reported that the CTUs between the first spawning and the beginning of YOY drift ranged from 131 to 163 (mean=150), and the CTUs between the first spawning and the end of larval drift from that spawning ranged from 263 to 352 (mean=306). Smith and King (2005) reported a mean CTU of 151 between the first spawning and the beginning of larval drift in the Black River in northern Michigan.

# 4.0 RESULTS AND DISCUSSION

## 4.1 2011

Table 1 summarizes the gillnet catch results and water temperature data over the period of gillnet and egg mat deployment in 2011. Gillnets were set at a total of seven locations in New Post Creek (Figure 2), with each location being fished from 1 to 15 overnight sets, for a total of 67 overnight sets from May 20 to June 6, 2011 (Appendix A: Table A1). A total of 13 Lake Sturgeon were captured in New Post Creek, with only one of these a recaptured fish, and none were ripe (Table 1). Below Abitibi Canyon, gillnets were set at a total of eleven locations (Figure 4), with each location being fished from 1 to 15 overnight sets, for a total of 92 overnight sets from May 20 to June 6, 2011 (Appendix A: Table A1). A total of 30 Lake Sturgeon were captured below Abitibi Canyon, and 12 of these were recaptured fish, and 8 were ripe males (Table 1). None of the Lake Sturgeon captured and marked in either of these two areas, were recaptured in the other area during the gillnetting period. Detailed gillnet catch data is provided in Appendix A: Table A2. The weather was slow to warm in the spring of 2011, resulting in fluctuating temperatures and a relatively small overall temperature rise of approximately 1°C in New Post Creek, and approximately 3.5°C in the Abitibi River during the period of field work (Figure 6).

No Lake Sturgeon eggs were collected in the egg mats that were deployed in New Post Creek from May 22 to June 5, 2011 (Figure 2). A number of amber coloured eggs, approximately 3 mm in diameter, were recovered from the egg mats when they were initially set, but the number of these eggs declined over the deployment period. Based upon their colour and size, and the season and habitat, these eggs were probably from suckers (Catostomidae). Lake Sturgeon eggs are also about 3 mm in diameter, but are black in colour (Becker, 1983).

**Table 1: Summary of the 2011 gillnet catch information.**

| Date | New Post Creek - 5 nets/night | | | Abitibi Canyon - 7 nets/night | | |
|---|---|---|---|---|---|---|
| 2011 | Water temp. (°C)[1] | Number of Lake Sturgeon captured (number of recaptures)[2] | Lake Sturgeon spawning condition | Water temp. (°C)[1] | Number of Lake Sturgeon captured (number of recaptures)[2] | Lake Sturgeon spawning condition |
| May 21 | 12.2 | 1 | - | 10.7 | 1 | - |
| May 22 | 11.5 | 0 | - | 10.8 | 3 | - |
| May 23 | 12.5 | 0 | - | 11.0 | 0 | - |
| May 24 | 9.5 | 1 | - | 10.3 | 1 | - |
| May 25 | 8.2 | 0 | - | 10.3 | 1 | - |
| May 26 | 8.4 | 0 (nets removed) | - | 10.3 | 1 (nets removed) | - |
| May 27 | - | - | - | - | - | - |
| May 28 | 10.4 | - (nets reset) | - | 11.1 | - nets reset | - |
| May 29 | 11.5 | 1 | - | 11.8 | 0 | - |
| May 30 | 12.5 | 0 | - | 12.0 | 1 | - |
| May 31 | 12.9 | 0 | - | 12.5 | 9(2) | 7 ripe males[4] |
| June 1 | 14.4 | 0 | - | 12.7 | 3(3) | 1 ripe male |
| June 2 | 13.5 | 4(1) | 2 post-spawning[3] | 12.7 | 3(2) | 1 post-spawning |
| June 3 | 13.4 | 1 | 1 post-spawning | 13.0 | 2(2) | - |
| June 4 | 12.8 | 2 | 1 post-spawning | 13.1 | 3(3) | - |
| June 5 | 12.9 | 3 | 3 post-spawning | 13.0 | 0 | - |
| June 6 | 13.3 | 0 | - | 14.1 | 2 | 1 post-spawning |

[1]Surface water temperature determined with a hand-held digital thermometer.
[2]Total number of Lake Sturgeon captured. The number in parentheses indicates recaptures of fish captured previously in 2011.
[3]Sturgeon not releasing gametes, and with loose and flattened mid-ventral area, indicating that it had finished spawning.
[4]Indicates sex of sturgeon that was releasing gametes.

Very few fish were captured in gillnets over the first 8 days of field work (Table 1), indicating that few Lake Sturgeon were moving about in the approaches to the potential spawning areas in New Post Creek and the Abitibi River. On the 9th day of field work (May 31) the number of Lake Sturgeon below Abitibi Canyon suddenly spiked to 9 individuals, 7 of which were ripe males, indicating that the spawning run had begun. The temperature in the Abitibi River on May 31 was 12.5°C, which is consistent with the temperature reported for the onset of Lake Sturgeon spawning in the literature (Becker, 1983; Holm *et al.*, 2009; Scott and Crossman, 1973; Stewart and Watkinson, 2004). No corresponding increase in Lake Sturgeon catch, or appearance of ripe fish, occurred in New Post Creek. The spawning run below Abitibi Canyon appeared to be brief, with ripe fish captured for only two days, and the number of Lake Sturgeon captured declining after the initial spike in number that was observed on May 31. Although water temperatures were suitable for spawning in New Post Creek, only after the spawning period appeared to end below Abitibi Canyon did sturgeon begin to occur in greater numbers in New Post Creek, and none of these fish were ripe and most were in post-spawning condition (flacid), suggesting that spawning did not occur in New Post Creek in 2011.

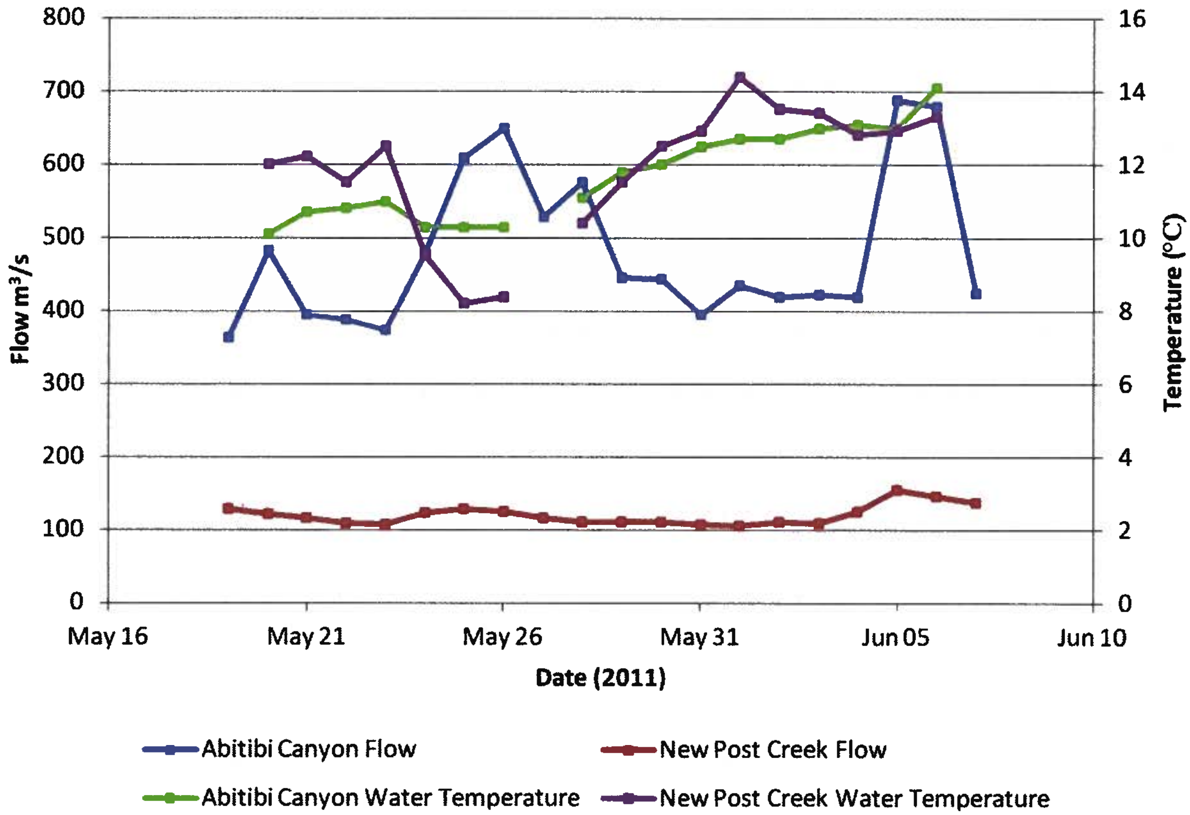



**Figure 6: Flow and measured daily water temperature within the study areas during 2011.**

## 4.2 2012

Table 2 summarizes the gillnet catch results and water temperature data over the period of gillnet and egg mat deployment in 2012, and Figure 7 shows river flow and temperature during the study period. Gillnets were set at five locations in New Post Creek (Figure 3), with each location being fished for 12 overnight sets, for a total of 60 overnight sets from May 11 to May 23, 2012 (Appendix A: Table A3). A total of 15 Lake Sturgeon were captured in New Post Creek. None of these were recaptures of fish caught in 2012, however, 5 fish had been captured in 2011, and 3 of these had been captured below Abitibi Canyon. Below Abitibi Canyon, gillnets were set at a total of seven locations (Figure 5), with each location being fished for 10 overnight sets, for a total of 70 overnight sets from May 13 to May 23, 2012 (Appendix A: Table A3). A total of 32 Lake Sturgeon were captured below Abitibi Canyon, with 5 of these being recaptures of fish marked in 2012, and 2 being recaptures of fish captured in 2011 below Abitibi Canyon. None of the Lake Sturgeon captured and marked in either of these two areas in 2012, were recaptured in the other area during the gillnetting period. Detailed gillnet catch data is provided in Appendix A: Table A4.

No Lake Sturgeon eggs were collected in the egg mats that were deployed within the potential spawning area in New Post Creek from May 11 to May 22, 2012 (Figure 3). As in 2011, a number of eggs were recovered from the egg mats, but based upon their amber colour, 3 mm size, and the timing, these were likely Catostomid (sucker) eggs.

**Table 2: Summary of the 2012 gillnet catch information.**

| Date | New Post Creek - 5 nets/night | | | Abitibi Canyon - 7 nets/night | | |
|---|---|---|---|---|---|---|
| 2012 | Water temp. (°C)[1] | Number of Lake Sturgeon captured (number of recaptures)[2] | Lake Sturgeon spawning condition | Water temp. (°C)[1] | Number of Lake Sturgeon captured (number of recaptures)[2] | Lake Sturgeon spawning condition |
| May 12 | 11.2 | 5 | - | 8.2* | no nets set | - |
| May 13 | 12.0 | 4 | - | 9.3 | no nets set | - |
| May 14 | 12.7 | 0 | - | 9.3 | 2 | - |
| May 15 | 12.6* | 5 | - | 10.1* | 0 | - |
| May 16 | 12.1 | 1 | - | 9.8* | 1 | - |
| May 17 | 11.5 | 0 | - | 9.9 | 1 | - |
| May 18 | 11.7 | 0 | - | 10.3 | 2 | - |
| May 19 | 12.5 | 0 | - | 10.2 | 9 | 6 ripe males[3], 1 post-spawning[4] |
| May 20 | 14.2 | 0 | - | 11.1 | 8(2) | 5 ripe males, 3 ripe females |
| May 21 | 14.8 | 0 | - | 11.2 | 4(2) | 1 ripe female |
| May 22 | 14.5 | 0 | - | 11.6 | 5(1) | 2 ripe males, 1 post-spawning |
| May 23 | 14.1 | 0 | - | 12.3 | 0 | - |

[1]Average water temperature using logged readings at 15 minute intervals over a 24 hour period.
*Average water temperature based upon a partial daily set of logged water temperatures. Due to changes in river water level, the logger was exposed to air for a portion of the day.
[2]Total number of Lake Sturgeon captured, and the number of these that were recaptures in parentheses.
[3]Indicates sex of sturgeon that was releasing gametes.
[4]Sturgeon not releasing gametes, and with loose and flattened mid-ventral area, indicating that it had finished spawning.

In 2012, all 15 Lake Sturgeon that were captured by gillnet in New Post Creek were caught in the first five days of netting (Table 2). None of the 15 were ripe or in post-spawning condition. No Lake Sturgeon were captured in New Post Creek over the remaining seven days of gillnetting. Similar to 2011, in 2012 there initially were relatively few Lake Sturgeon captured in the Abitibi River below Abitibi Canyon (compare Tables 1 and 2). Catches increased on May 19 below Abitibi Canyon, coincident with the first capture of ripe sturgeon. Ripe sturgeon were also captured on May 20, 21 and 22, below Abitibi Canyon, but catches declined over this period and no Lake Sturgeon were captured on May 23.

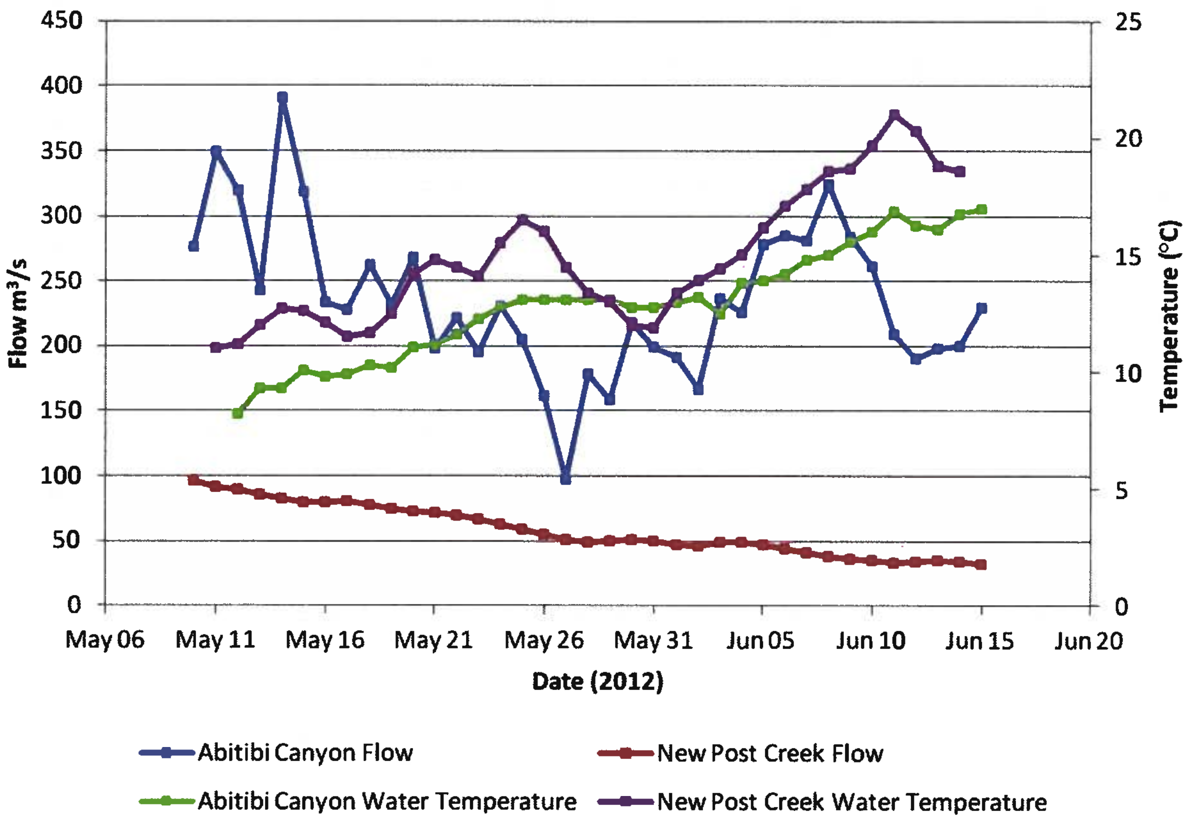



**Figure 7: Flow and mean daily water temperature within the study areas during 2012.**

The drift net catches are summarized in Table 3, and the detailed catch is provided in Appendix A: Table A5. Lake Sturgeon were not captured in the 8 drift nets set daily in New Post Creek downstream of the falls. The New Post Creek drift net catches were dominated by YOY coregonids (Salmonidae: *Coregonus* spp.), YOY sucker (Catostomidae) and YOY sculpin (Cottidae), with small numbers of YOY Burbot (*Lota lota*), YOY Walleye or YOY Sauger (*Sander* sp.), YOY Yellow Perch (*Perca flavescens*) and YOY Northern Pike (*Esox lucius*). In addition to the YOY fishes, a small number of juvenile or adult Trout-perch (*Percopsis omiscomaycus*), Northern Redbelly Dace (*Chrosomus eos*), Spottail Shiner (*Notropis hudsonius*), Logperch (*Percina caprodes*), Johnny Darter (*Etheostoma nigrum*), Brook Stickleback (*Culaea inconstans*), and Brown Bullhead (*Ameiurus nebulosus*) were captured (Appendix A: Table A5). Of those specimens identified as coregonids, the majority were identified as Cisco (*Coregonus artedi*), while the remaining portion could not be identified to species because of their smaller size or poor specimen condition. It is likely that these unidentified coregonids are also Cisco. All coregonids captured in the drift nets in New Post Creek were dead and decomposing. As coregonid spawning had not been observed, and was not thought to occur, below New Post Creek falls, and given the deteriorated condition of these specimens, it was suspected that they were coming from farther upstream.

**Table 3: Summary of the 2012 drift net catch of young-of-the-year fishes.**

| | New Post Creek below falls | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 drift nets | | 8 drift nets | | | | | | | | | | | | |
| Lift date[1] | May 31 | June 1 | June 2 | June 3 | June 4 | June 5 | June 6 | June 7 | June 8 | June 9 | June 10 | June 11 | June 12 | June 13 | June 14 |
| Whitefishes (Salmonidae: *Coregonus* spp.)[2] | 9 | 18 | 23 | 12 | 32 | 25 | 12 | 2 | 4 | 8 | 6 | 31 | 12 | 8 | 7 |
| Suckers (Catostomidae) | 5 | 19 | 103 | 26 | 7 | 2 | 2 | 1 | 4 | 2 | 7 | 5 | 9 | 4 | 5 |
| Sculpins (*Cottus* sp.) | | 1 | 32 | 6 | 8 | 4 | 2 | 2 | 1 | 2 | | 11 | | | |
| Burbot (*Lota lota*) | 1 | | | | | 1 | | | | | | | | | |
| Yellow Perch (*Perca flavescens*) | | | | | | | | | | | | | | 3 | |
| Walleye or Sauger (*Sander* sp.)[3] | | | | | | | | | | | | | 1 | | 1 |
| Northern Pike (*Esox lucius*) | | | | | | | | | | | | | 1 | | |
| | | | | | | | | | | | | | | | |
| | New Post Creek at Otter Rapids Road bridge - 2 drift nets | | | | | | | | | | | | | | |
| Lift date | na | na | na | na | na | na | na | na | June 8 | na | na | na | June 12 | na | na |
| Whitefishes (Salmonidae: *Coregonus* spp.)[2] | | | | | | | | | 8 | | | | 12 | | |
| Suckers (Catostomidae) | | | | | | | | | | | | | 54 | | |
| Sculpins (*Cottus* sp.) | | | | | | | | | | | | | 3 | | |
| Burbot (*Lota lota*) | | | | | | | | | | | | | 2 | | |
| Northern Pike (*Esox lucius*) | | | | | | | | | | | | | 1 | | |
| | | | | | | | | | | | | | | | |
| | Abitibi River below Abitibi Canyon - 2 drift nets | | | | | | | | | | | | | | |
| Lift date | na | na | na | June 3 | June 4 | June 5 | June 6 | June 7 | na | June 9 | June 10 | June 11 | na | June 13 | June 14 |
| Suckers (Catostomidae) | | | | | | | | | | | | | | | 1 |
| Walleye or Sauger (*Sander* sp.)[3] | | | | | | | | | | 1 | | | | | |
| Northern Pike (*Esox lucius*) | | | | | | | | | | | 1 | | | | |
| Lake Sturgeon (*Acipenser fulvescens*) | | | | | 2[4] | 1[4] | | | | | | | | 1 | 9 |
| | | | | | | | | | | | | | | | |

na = Not applicable. No drift nets were set for these dates.
[1]Drift net sets are overnight for approximately 24 hours. The date provided is the end date.
[2]This represents all fish that were identified as Cisco (*Coregonus artedi*), plus those identified only as *Coregonus* sp. due to their small size or poor specimen condition.
[3]Walleye and Sander specimens of small size could not be differentiated.
[4]Pre-emergent Lake Sturgeon embryos.

To investigate the possibility that the coregonid YOY captured below the falls in New Post Creek originated from farther upstream, two drift nets were set for approximately 24 hours on June 7-8, and again on June 11-12, at the Otter Rapids Road bridge in New Post Creek (Figure 1), approximately 16 km upstream of the falls. Coregonid YOY, in a similar deteriorated condition, were also captured at that location (Table 3). It is speculated that these coregonids originated from the Little Abitibi River upstream of the existing New Post Creek Diversion Dam (Figure 1). Young-of-the-year sucker, YOY sculpin, YOY Burbot, and YOY Northern Pike were also captured in these drift net sets (Table 3), indicating that some portion of the drift net catch below the falls may be fish that had been transported from upstream in New Post Creek. Besides these YOY fishes, a few juvenile or adult fish were also captured in New Post Creek at the Otter Rapids Road bridge, including Northern Redbelly Dace, Lake Chub (*Couesius plumbeus*), Longnose Dace (*Rhinichthys cataractae*), Spottail Shiner, Blacknose Shiner (*Notropis heterolepis*), and Fallfish (*Semotilus corporalis*) (Appendix A: Table A5).

The two drift nets set in the Abitibi River downstream of Abitibi Canyon, caught 3 pre-emergent Lake Sturgeon embryos (June 4 and 5 lifts) (Table 3). These three Lake Sturgeon embryos, which were not yet at the stage where downstream drift normally occurs, were kept alive in jars of river water until they were sufficiently developed to be positively identified as sturgeon. On June 13, one YOY Lake Sturgeon was captured in the drift nets below Abitibi Canyon, and on June 14 nine YOY Lake Sturgeon were captured, indicating that the normal emergence from the substrate and drift had commenced. Only a few other YOY fishes were captured in these two drift nets (Table 3). The juvenile or adult fishes captured included Mooneye (*Hiodon tergisus*), Trout-Perch, and Emerald Shiner (*Notropis atherinoides*) (Appendix A: Table A5).

Table 4 presents the mean water temperature and the calculated CTUs in relation to the primary field work activities and observations. The time from when spawning is thought to have occurred to the detection of the first drifting Lake Sturgeon YOY at Abitibi Canyon was 25 days, which is the maximum observed by Friday in the Kaministiquia River (years 2004 – 2010; mean= 17 days; Friday, 2012). The CTU value when the first drifting YOY were captured was 200.8. This is greater than what has been observed in the Kaministiquia River over the period 2004-2010, where the average CTUs at the beginning of Lake Sturgeon drift was 150.3 (range=131 – 163; Friday, 2012). Similarly, Smith and King (2005) reported average days and Cumulative Thermal Units to drift from initial spawning in the Black River, Michigan, to be 17.3 and 151.2, respectively, for 2000-2002. It is possible that drift began prior to the first YOY captures in this study, as the level of effort downstream from Abitibi Canyon was quite low, relative to the size of the river and no driftnets were set at that location on June 11-12.

**Table 4: Temperature and Cumulative Thermal Unit information relative to field events.**

| New Post Creek | | | | | Abitibi Canyon | | |
|---|---|---|---|---|---|---|---|
| Date (2012) | [1]Mean Daily Water temp. (°C) | [2]Cumulative Thermal Units from May 11 | [2]Cumulative Thermal Units from May 16 | Event | [1]Mean Daily Water temp. (°C) | [2]Cumulative Thermal Units from spawning | Event |
| May 11 | 11.0* | 5.2 | - | Start gillnets | 8.6* | | |
| May 12 | 11.2 | 10.6 | - | | 8.2* | | |
| May 13 | 12.0 | 16.8 | - | | 9.5 | | Start gillnets |
| May 14 | 12.7 | 23.7 | - | [3]no catch | 9.5 | - | |
| May 15 | 12.6* | 30.5 | - | | 10.1* | - | [3]no catch |
| May 16 | 12.1 | 36.8 | 6.3 | | 9.8* | - | no catch |
| May 17 | 11.5 | 42.5 | 12.0 | no catch | 9.9 | - | |
| May 18 | 11.7 | 48.4 | 17.9 | no catch | 10.3 | - | |
| May 19 | 12.5 | 55.1 | 24.6 | no catch | 10.2 | 4.4 | ripe/partially spent males caught |
| May 20 | 14.2 | 63.5 | 33.0 | no catch | 11.1 | 9.7 | ripe/partially spent male/females caught |
| May 21 | 14.8 | 72.5 | 42.0 | no catch | 11.2 | 15.1 | ripe/partially spent female caught |
| May 22 | 14.5 | 81.2 | 50.7 | no catch | 11.6 | 20.9 | ripe/partially spent males caught |
| May 23 | 14.1 | 89.5 | 59.0 | End gillnets | 12.3 | 27.4 | End gillnets |
| May 24 | 15.5 | 99.2 | 68.7 | | 12.8 | 34.4 | |
| May 25 | 16.5* | 109.9 | 79.4 | | 13.1* | 41.7 | |
| May 26 | 16.0** | 120.1 | 89.6 | | 13.1** | 49.0 | |
| May 27 | 14.5* | 128.8 | 98.3 | | 13.1* | 56.3 | |
| May 28 | 13.4 | 136.4 | 105.9 | | 13.1 | 63.6 | |
| May 29 | 13.0 | 143.6 | 113.1 | | 13.1 | 70.9 | |
| May 30 | 12.0 | 149.8 | 119.3 | Start driftnets | 12.8 | 77.9 | |
| May 31 | 11.9 | 155.9 | 125.4 | | 12.8* | 84.9 | |
| June 1 | 13.4 | 163.5 | 133.0 | | 13.0** | 92.1 | |
| June 2 | 13.9 | 171.6 | 141.1 | | 13.2 | 99.5 | Start driftnets |
| June 3 | 14.4 | 180.2 | 149.7 | | 12.5 | 106.2 | |
| June 4 | 15.0 | 189.4 | 158.9 | | 13.8 | 114.2 | |
| June 5 | 16.2 | 199.8 | 169.3 | | 13.9 | 122.3 | |
| June 6 | 17.1 | 211.1 | 180.6 | | 14.2 | 130.7 | |
| June 7 | 17.8 | 223.1 | 192.6 | | 14.8 | 139.7 | no driftnets set |
| June 8 | 18.6 | 235.9 | 205.4 | | 15.0 | 148.9 | no driftnets lifted |
| June 9 | 18.7 | 248.8 | 218.3 | | 15.6 | 158.7 | |
| June 10 | 19.7 | 262.7 | 232.2 | | 16.0 | 168.9 | |
| June 11 | 21.0 | 277.9 | 247.4 | | 16.9* | 180.0 | no driftnets set |
| June 12 | 20.3 | 292.4 | 261.9 | | 16.3 | 190.5 | no driftnets lifted |
| June 13 | 18.8 | 305.4 | 274.9 | | 16.1 | 200.8 | First YOY captured |
| June 14 | 18.6* | 318.2 | 287.7 | End driftnets | 16.8 | 211.8 | End driftnets |

[1]Average water temperature using logged readings at 15 minute intervals over a 24 hour period.
[2]Daily average water temperature minus 5.8, summed from assumed or observed spawning date.
[3]`No catch` indicates that no Lake Sturgeon were captured.
*Average water temperature based upon a partial daily set of logged water temperatures.
**Water temperature estimated from adjoining dates.

To evaluate the adequacy of the drift netting in New Post Creek it was assumed, based on the water temperature that spawning apparently occurred at in the Abitibi River, that if Lake Sturgeon did spawn in New Post Creek, spawning could have begun as early as May 10. Based on this assumption, drift netting began 20 days after the start of potential spawning, when 150 CTUs were reached, and continued for 15 days, when 318 CTUs were reached. The last capture of a Lake Sturgeon in New Post Creek was in the overnight gillnet sets of May 15-16, and therefore it was assumed that if spawning had occurred there it would have ended on May 15. Based on this assumption, drift netting began 15 days after spawning would have ended, when 119 CTUs were attained, and ended 15 days later when 288 CTUs were attained. Based on the observations of sturgeon drift in the Kaministiquia River near Thunder Bay, Ontario (Table 5), and given the assumed potential spawning dates, the drift netting in New Post Creek thoroughly sampled the period when drift would have been expected to have occurred. This is supported by the fact that drifting sturgeon were captured on June 13 and 14 in the Abitibi River, which had lower water temperatures and, consequently, where both spawning and drift would be expected to occur later. It should also be noted that the level of effort was greater in New Post Creek, with eight drift nets covering a relatively small potential spawning area, compared to two drift nets covering a much larger potential spawning area below Abitibi Canyon.

**Table 5: Cumulative thermal units (CTUs) from the estimated dates of first and second spawnings, to the start and end of YOY drift from that spawning, and the duration of drift, in the Kaministiquia River from 2004 through 2010. Only one spawning event is thought to have occurred in 2006 and 2008 (Source: Friday, 2012).**

| First spawning event | | | |
|---|---|---|---|
| Year | CTUs from estimated spawning date to start of drift | CTUs from estimated spawning date to end of drift | Duration of drift (days) |
| 2004 | 146 | 299 | 19 |
| 2005 | 154 | 266 | 12 |
| 2006 | 131 | 332 | 16 |
| 2007 | 163 | 263 | 7 |
| 2008 | 159 | 352 | 18 |
| 2009 | 152 | 352 | 19 |
| 2010 | 147 | 276 | 21 |
| Mean | 150 | 306 | 16 |
| **Second spawning event** | | | |
| Year | CTUs from estimated spawning date to start of drift | CTUs from estimated spawning date to end of drift | Duration of drift (days) |
| 2004 | 173 | 289 | 8 |
| 2005 | 204 | 291 | 7 |
| 2007 | 170 | 249 | 5 |
| 2009 | 177 | 280 | ~10 |
| 2010 | 142 | 277 | 10 |
| Mean | 173 | 277 | ~8 |

## 5.0 CONCLUSIONS

During the early spring of 2011 and 2012, adult Lake Sturgeon were captured in New Post Creek, but no ripe individuals were captured there and it appears that Lake Sturgeon moved out of the creek to the Abitibi River prior to the commencement of spawning below Abitibi Canyon. Ripe Lake Sturgeon were captured below Abitibi Canyon in 2011 and 2012. A few days after the spawning run finished below Abitibi Canyon in 2011, Lake Sturgeon were captured once again in New Post Creek. Some of these were in post-spawning condition (flacid, spent). Lake Sturgeon were not observed to return post-spawning to New Post Creek in 2012, but netting only continued for 4 days after spawning below Abitibi Canyon was initiated.

Egg mats deployed in New Post Creek during the spawning period in 2011 and 2012 did not collect any Lake Sturgeon eggs. Egg mats were not deployed below Abitibi Canyon.

Eight drift nets were continuously deployed in New Post Creek over the estimated drift period for Lake Sturgeon in 2012, but no YOY sturgeon were captured. Two drift nets deployed in the Abitibi River below Abitibi Canyon in 2012, over most of the same period, captured YOY Lake Sturgeon on the last two days of drift netting.

The studies have demonstrated that Lake Sturgeon spawn in the Abitibi River below Abitibi Canyon. All of the results to date support the conclusion that Lake Sturgeon do not spawn in New Post Creek.

## 6.0 REFERENCES

Auer, N.A. 1982. Identification of Larval Fishes of the Great Lakes Basin with Emphasis on the Lake Michigan Drainage. Great Lakes Fishery Commission Special publication 82-3, December 1982.

Becker, G.C. 1983. Fishes of Wisconsin. Univ. of Wisconsin Press. Madison, Wisconsin. 1052 p.

Friday, M.J. 2012. The migratory and reproductive response of spawning lake sturgeon to controlled flows over Kakabeka Falls on the Kaministiquia River, 2010. Ont. Min. Natur. Resour., Northwest Sci. & Info., NWSI Tech. Rpt. TR-146. 35 pp. + append. DRAFT

Holm, E., N.E. Mandrak, and M.E. Burridge. 2009. The ROM field guide to freshwater fishes of Ontario. Royal Ontario Museum, Toronto. 462 p.

Kempinger, J. J., 1988: 11th Annual Larval Fish Conference on Spawning and early life history of lake sturgeon in the Lake Winnebago System, Wisconsin. Am. Fish. Soc. Symp. 5, 110–122.

LaHaye, M., A. Branchaud, M. Gendron, R. Verdon and R. Fortin. 1992. Reproduction, early life history, and characteristics of the spawning grounds of the lake sturgeon (*Acipenser fulvescens*) in Des Praires and L'Assomption rivers near Montréal, Quebec. Canadian Journal of Zoology 70: 1681-1689.

Scott, W. B., and E. J. Crossman. 1973, "Freshwater fishes of Canada", Bull. Fish. Res. Bd. Can. 184, 966 p.

Smith, K.M., and D.K. King. 2005. Dynamics and extent of larval lake sturgeon *Acipenser fulvescens* drift in the Upper Black River, Michigan. J. Appl. Ichthyol. 21: 161–168.

Stewart, K.W., and D.A. Watkinson. 2004. The freshwater fishes of Manitoba. University of Manitoba Press, Winnipeg. 276 pp.

# APPENDIX B

## Benthic Macroinvertebrate Taxa
## Recorded in the Abitibi River (Fiset, 1995)

## APPENDIX B: BENTHIC MACROINVERTEBRATE TAXA RECORDED IN THE ABITIBI RIVER[1]

| Taxon |
| --- |
| **P. COELENTERATA** |
| **O. Hydroida** |
| **F. Hydridae** |
| *Hydra* |
| **P. NEMATODA** |
| **P. ANNELIDA** |
| **Cl. Oligochaeta** |
| **F. Tubificidae** |
| **Cl. Hirudinea** |
| **F. Hirudinidae** |
| **F. Glossiphoniidae** |
| **P. ARTHROPODA** |
| **Cl. Malacostraca** |
| **O. Amphipoda** |
| **F. Gammaridae** |
| **O. Decapoda** |
| **F. Cambaridae** |
| **O. Mysidacea** |
| *Mysis relicta* |
| **Cl. Insecta** |
| **O. Coleoptera** |
| **F. Elmidae** |
| *Stenelmis* |
| **O. Ephemeroptera** |
| **F. Baetidae** |
| *Acentrella* |
| **F. Ephemerellidae** |
| *Dannella* |
| *Serratella* |
| **F. Ephemeridae** |
| *Hexagenia* |
| **F. Heptageniidae** |
| *Heptagenia* |
| *Stenacron* |
| *Stenonema* |
| **F. Leptophlebiidae** |
| *Habrophlebiodes* |
| *Paraleptophlebia* |
| **O. Hemiptera** |
| **F. Corixidae** |
| *Cymatia* |
| **F. Veliidae** |

| Taxon |
| --- |
| **O. Megaloptera** |
| **O. Plecoptera** |
| **F. Perlidae** |
| *Beloneuria* |
| **F. Perlodidae** |
| *Isoperla* |
| **O. Trichoptera** |
| **F. Hydropsychidae** |
| *Hydropsyche* |
| **F. Limnephilidae** |
| *(?) Chyranda* |
| *Hydatophylax argus* |
| **F. Polycentropodidae** |
| *Polycentropus* |
| **F. Psychomyiidae** |
| **F. Rhyacophilidae** |
| *Rhyacophila* |
| **O. Diptera** |
| **F. Ceratopogonidae** |
| *Probezzia* |
| **F. Chaoboridae** |
| *Chaoborus* |
| **F. Culicidae** |
| **F. Chironomidae** |
| **S.F. Chironominae** |
| *Cryptochironomus* |
| *Micropsectra* |
| *Microtendipes* |
| *Paratendipes* |
| *Phaenopsectra* |
| *Rheotanytarsus* |
| **S.F. Orthocladiinae** |
| *Cricotopus* |
| *Eukiefferiella* |
| *Nanocladius* |
| *Paracladius* |
| *Psectrocladius* |
| **S.F. Tanypodinae** |
| *Apsectrotanypus* |
| **F. Musidae** |
| **F. Simuliidae** |
| **F. Tabanidae** |
| **F. Tipulidae** |
| *Antocha* |
| *Tipula* |
| **P. MOLLUSCA** |
| **Cl. Gastropoda** |
| **F. Ancylidae** |

| Taxon |
| --- |
| *Ferrissia rivularis* |
| **F. Hydrobiidae** |
| *Amnicola limosa* |
| *Marstonia decepta* |
| **F. Lymnaeidae** |
| **F. Physidae** |
| *Physa* |
| *P. gyrina* |
| **F. Planorbidae** |
| *Gyraulus deflectus* |
| Cl. Bivalva (Pelecypoda) |
| **F. Sphaeriidae** |
| *Pisidium* |
| *Sphaerium* |

[1]Source: Fiset (1995).

# APPENDIX C

## Aquatic Assessment of Proposed Minimum Flows in New Post Creek (Coker and Portt, 2012e)

# AQUATIC ASSESSMENT

# OF

# PROPOSED MINIMUM FLOWS IN NEW POST CREEK

**July 5, 2012**
**Revised July 10, 2012**

**Updated title April 22, 2013.**

## 1.0 Introduction/Background

CRP/OPG met with MNR/Ontario Parks and DFO in Sudbury on October 20th to initiate discussions with respect to the anticipated minimum flow requirements for the New Post Creek Project. At this meeting, it was agreed that a 2D Habitat Suitability model would be used to assess habitat in New Post Creek, downstream of the waterfalls to the Abitibi River, at various flow conditions to assess potential post-development minimum flows. Based on feedback from the regulatory team, KGS constructed a 2D model and a data acquisition (Field Program) was undertaken in Nov 2011 which included bathymetry, substrate, and flow/velocity/water level metering. KGS developed and calibrated the 2D hydraulic model to simulate a range of flows including Spring IFNs; Winter / Summer / Fall IFNs.

Results from the modeling exercise were presented to MNR/Ontario Parks/ DFO and MOE on April 11, 2012 at a meeting where the proposed minimum flow of 10cms for May and June; 3cms for July, August and September and 1 cms for October to April were proposed and discussed in terms of implications to the aquatic environment.

This document summarizes the information presented in April. It also includes preliminary results from the May/June 2012 fieldwork that further investigated sturgeon spawning as discussed at the April 2012 meeting. The report below describes the methodology used and then provides the biological assessment of the 3 flow scenarios, and provides the rational as to why CRP/OPG believes that the proposed flows presented at the meeting are defensible.

Consideration has been given to the economic challenges facing the project when developing the recommendations. To this end KGS has calculated the expected reduction in energy resulting from the increase of 1 cms flow for the three periods proposed. This information is included here to provide additional context, however CRP/OPG recognize that a separate discussion on the economic implications of the proposed flows will take place. The reduced GWh impacts are noted in the report for each proposed period (Spring, Summer and Winter). Note that the proposed New Post Creek Project is expected to produce 122 GWh annually (25MW).

## 2.0 Hydraulic Model of New Post Creek downstream from the falls

As part of the definition and assessment of the Instream Flow Needs (IFN) for the proposed New Post Creek hydroelectric development, KGS Group provided support to SENES with the modeling and quantification of fish habitat downstream of the New Post Creek falls, between the falls and the confluence with the Abitibi River.

A 2-dimensional hydraulic model of the area of interest was developed by KGS Group to assess the hydraulic conditions downstream of the falls on the New Post Creek. The hydraulic model results were used in a Habitat Suitability (HSI) model to simulate and quantify fish habitat over a range of potential instream flows. The HSI model developed by KGS Group for this study is a Microsoft Excel based program, which computes the wetted and suitable areas based on the specific suitability parameters provided to KGS Group by SENES for key life stages of target fish species.

SENES selected the spawning period for Walleye and Lake Sturgeon as key life stage and target fish species for this study. Potential IFN's were assessed with the models for the period of May and June (spawning period) and from July to April.

## 2.1 Methods

2-Dimensional model

The University of Alberta's software River2D was used for this analysis. River2D is a two dimensional depth averaged finite element model that has been customized for and commonly used in fish habitat studies. The selected flow conditions were simulated under steady-state conditions. No ice cover was considered in the modeling and the hydraulic assessment of winter IFN's.

Model Extent

The model domain encompasses the area of the New Post Creek located downstream of the falls, between the foot of the falls and the confluence with the Abitibi River, as shown on Figure 1.

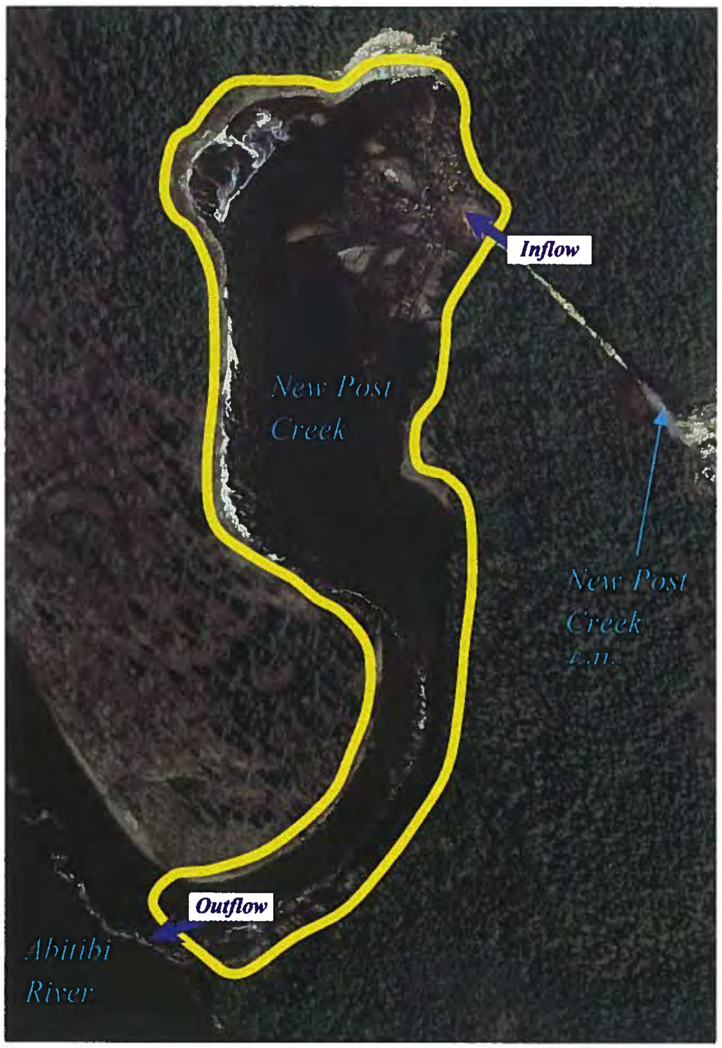



**Figure 1: Extent of 2-Dimensional hydraulic model**

Mesh Configuration

River2D uses a computational mesh constituted of triangular elements for the calculations. The mesh configuration for this particular model was optimized for resolution and computational time. It is constituted of triangular cells with edge lengths as follows:

- 1 metre, in the rapids area downstream of the falls, and

- 4 metres, from the bottom of the rapids to the confluence with the Abitibi River

Boundary Conditions

The boundary conditions applied to the hydraulic model consisted of a constant inflow source at the foot of the falls and a static water level at the confluence with the Abitibi River.

The downstream water levels were specifically defined for the IFN periods that were analyzed. The two periods that the IFN's were simulated and assessed for are the following:

- May to June, which corresponds to the spawning period of the target fish species
- July to April, to represent the conditions for the remainder of the year

For each period, a downstream water level was defined based on the daily average water levels reported at the Otter Rapids Generating Station.

Digital Elevation Model

A digital elevation model (DEM) was prepared for the hydraulic model from a combination of the following sources of topographic information:

- Bathymetric and topographic data surveyed by KGS Group on November 4, 2011
- LiDAR data flown in 2007

In those areas where no bathymetric, topographic or LiDAR information was available, assumptions were made using preliminary simulations of the hydraulic model and observations at site from SENES and KGS Group.

Calibration

The flow distribution and general hydraulics were compared with actual conditions observed on site or documented with air photos, for flows of 13.5 $m^3/s$, 22 $m^3/s$ and 26 $m^3/s$, as estimated from the Water Survey of Canada gauge #04ME005.

A calibration run was also prepared to represent the conditions observed on the date of the survey (November 4, 2011, Q=26 $m^3/s$). The surveyed water levels were compared to the simulated ones at the same location, as shown in Figure 2. The roughness over the model domain was adjusted as required. Once the model was calibrated, all simulated water levels were within 8cm of the surveyed water levels. Considering the accuracy inherent to 2D models and to the survey, this difference is considered acceptable and suggests that the model is adequately calibrated.

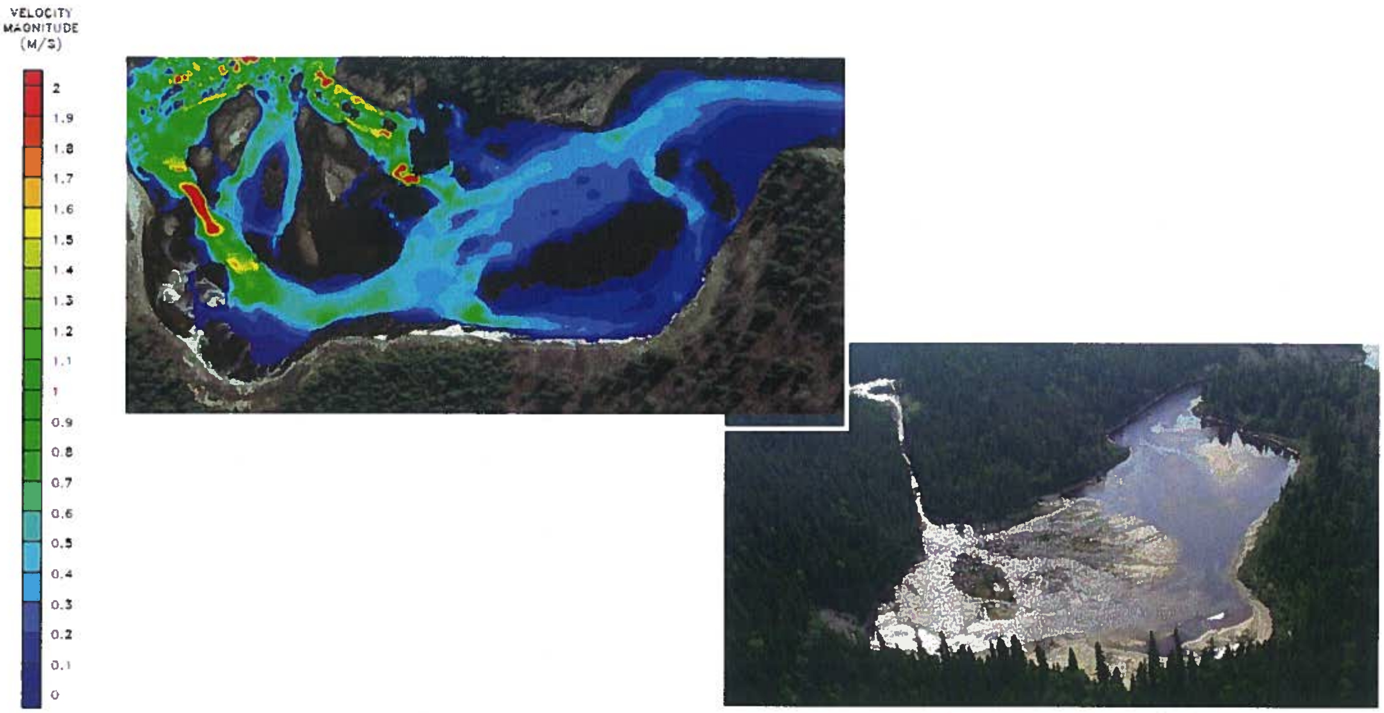



**Figure 2: Comparison of observed vs. simulated flows (August 30, 2010, Q=13.5 $m^3/s$)**

<u>Spawning Habitat Parameters</u>

For the model to provide the location and area of potential Walleye and Lake Sturgeon spawning habitat in lower New Post Creek, the environmental parameters necessary for spawning were determined. For both Walleye and Lake Sturgeon, these parameters were selected from a wide range of literature sources (see report Section 5: References). Parameter selection for Walleye was based upon this writer's experience in observing Walleye spawning at many locations in Ontario, and for Lake Sturgeon it was based upon advice from MNR biologists.

**Walleye**

A common source of habitat suitability information for Walleye has traditionally been the USFWS publication <u>McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984, "Habitat suitability information: walleye", U.S. Dept. Int. Fish Wildl. Serv., FWS/OBS-82/10.56.</u> which provides an index of suitability for the various spawning habitat parameters, where 0 is least suitable, and 1 is most suitable.

The spawning habitat parameters obtained from this publication are:

(1) Rubble/gravel substrates were assumed to be excellent for spawning walleye, and is supported by numerous published sources.
(2) Spawning velocity suitability is shown to rise rapidly once velocity exceeds approximately 1 foot/s (0.3 m/s), attains a suitability index value of >0.8 between 2.25 and 3.25 feet/s (0.69-0.99 m/s), and drops very quickly to a suitability index value of 0 at approximately 3.6 feet/s (1.1 m/s). This relationship was generated by a frequency analysis of unpublished field data collected from the Yellowstone River in Montana, below an intake diversion from April and May, 1977, where a total of 230 eggs were collected along 4 transects on a gravel bar.
(3) Spawning depth suitability is shown to rise rapidly from a suitability index value of 0 at approximately 1 foot (0.3 m) deep, attains a suitability index value of >0.8 between approximately 2.2 – 5.4 feet (0.67-1.65 m) deep, and drops rapidly to a suitability index value of 0 at approximately 6.5 feet (2 m) deep. This relationship was generated from unpublished

information collected from four stations on the Missouri River in South Dakota, Nebraska, and Iowa, over the period March 29 – November 4, 1976.

In our experience in Ontario, Walleye make greater use of shallower water at slower water velocities than suggested by McMahon *et al.* (1984). A more recent field study detailing Walleye spawning habitat in the Sandusky River, Ohio, characterized Walleye spawning habitats that were more typical of those observed by us in Ontario, and developed a HSI curve for velocity and provided a scatterplot of egg deposition at depth (Gillenwater *et al.* 2006).

Gillenwater *et al.* (2006) collected Walleye eggs by a surber sampler from 6 random locations each day for 3 days per week (weather and flow conditions permitting) within a 200 m long spawning area, over the entire spawning period (March 26-April 30, 2004), for a total of 75 samples. Depth and velocity was determined at each sampling location. All maximum egg densities occurred within flow velocities of 0.3 and 0.95 m/s, which was considered to have a suitability of >0.8. Egg density at average depth appeared high even in shallow water, but began to drop off at about 0.8 m deep and was zero at 1.2 m deep.

In consideration of the above, and after examining all the listed sources of published Walleye spawning information, Walleye spawning substrate, using the Wentworth (1922) size classes, was determined to be coarse gravel with cobble and/or boulder, based mainly upon McMahon *et al.* (1984), Scott and Crossman (1973), and Holm *et al.* (2009). The optimal depth range for spawning Walleye was determined to be 0.2 to 0.8 m deep, with marginal spawning depths 0.1-0.2 m and 0.8-2 m, mostly taken from Gillenwater *et al.* (2006), except that the maximum depth of 2 m was taken from McMahon *et al.* (1984) because Gillenwater *et al.* (2006) did not appear to include deeper habitats in their study area. The flow velocity for Walleye spawning was considered to be optimal at 0.3 to 0.95 m/s, and marginal at 0.1-0.3 m/s and 0.95-1.2 m/s, and was also mostly taken from Gillenwater *et al.* (2006), except that the minimum velocity of 0 m/s given in Gillenwater *et al.* (2006) was modified to 0.1 m/s, to avoid classifying all still water as marginal walleye spawning habitat.

**Sturgeon**

Lake sturgeon spawn at depths of 0.3-4.6 m in areas of swift water (Scott and Crossman, 1973; Becker, 1983), usually along the outside bends of river banks, especially where the current is upwelling or slowly boiling, sometimes where rocks and boulders occur at a steep angle into the water (Becker, 1983). Broken slabs of concrete have also been used (Becker, 1983). In a Michigan River, Chiotti *et al* (2008) characterized two spawning locations where spawning events were documented and eggs collected. The substrate composition at spawning sites consisted of high proportions (80%) of cobble (64-256 mm) and pebble (16-64 mm) combined, with cobble making up 34-44% of the substrate. Depth at spawning sites was 1.5–3.0 m, average water velocity was 0.34-1.32 m/s, and near-substrate water velocity was 0.08–1.26 m/s. Both locations were on the outside of a bend. In examining two spawning areas near Montreal, La Haye *et al* (1992) found that lake sturgeon used a wide variety of hard substrates for spawning, from fine to coarse gravel to cobbles and boulders, but no eggs were found on homogenous substrates of sand and silt, fractured bedrock, or unfractured bedrock. Dumont *et al.* (2011) studied lake sturgeon spawning below the Riviere-des-Prairies Generating Station on the Des Prairies near Montreal, Quebec, over the period 1995-1999, and found that locations with the highest egg deposition had average velocities of 0.51 to 1.42 m/s, and average depths of 1.00 to 2.78 m. Over all locations where any egg deposition occurred, average velocity ranged from 0.18 to 1.42 m/s, and average depth ranged from 0.75 to 5.50 m. The dominant substrates recorded by Dumont *et al.* (2011) were rock (65-256 mm) and gravel (3-65 mm). Golder Associates (2011) measured velocity and depth at sturgeon spawning locations in the Groundhog River in May 2011. Velocity ranged from 0.09 m/s to 0.55 m/s, with a mean velocity of 0.15 m/s, and depth ranged from 0.3 m to 0.82 m, with a mean depth of 0.62 m.

Based upon the above information, as well as discussions and input from MNR (Chris Chenier and Charles Hendry), the following spawning habitat parameters were established for Lake Sturgeon. Spawning substrates (in the classifications of the modified KGS maps) is coarse gravel with cobble and/or boulder. Lake Sturgeon spawning depth ranges from 0.75 to 5.5 m, and spawning velocity ranges from 0.09 to 1.5 m/s.

### 2.2 Model Results

A large number of model runs were executed, using streamflows ranging from 1 cms to 144 cms. The results of these model runs were provided to MOE, MNR, Ontario Parks and DFO prior to the April 11, 2012 meeting. The graphs in the following report sections were generated using the model output of suitable habitat area. Key maps of modeled instream conditions of velocity and depth, as well as habitat suitability, are also included in the following report sections to illustrate specific themes.

## 3.0 Assessment of Proposed Minimum Flows in New Post Creek

CRP/OPG proposes minimum flows of 10 cms over the spring (May-June) spawning period, 3 cms during the summer (July-September) period, and 1 cms during the remainder of the year. These minimum flows balance the maintenance of ecological function and project economics, within a system created artificially by a watercourse diversion. The following assessment of the potential effect of minimum flow on aquatic habitat is based upon:

- Results of field work that was undertaken to generally characterize habitat and answer specific questions associated with valued ecosystem components.
- Hydraulic modeling of habitat conditions.
- Life history of the fish community.
- Expert opinion.

### 3.1 Minimum Flows: Spring Spawning Period

The assessment of minimum flow for spring spawning fishes in New post Creek is primarily concerned with Walleye and Lake Sturgeon spawning downstream of the falls. The model results for Walleye and Lake Sturgeon spawning habitat suitability at 30 cms and 10 cms is presented in Figures 3 to 10.

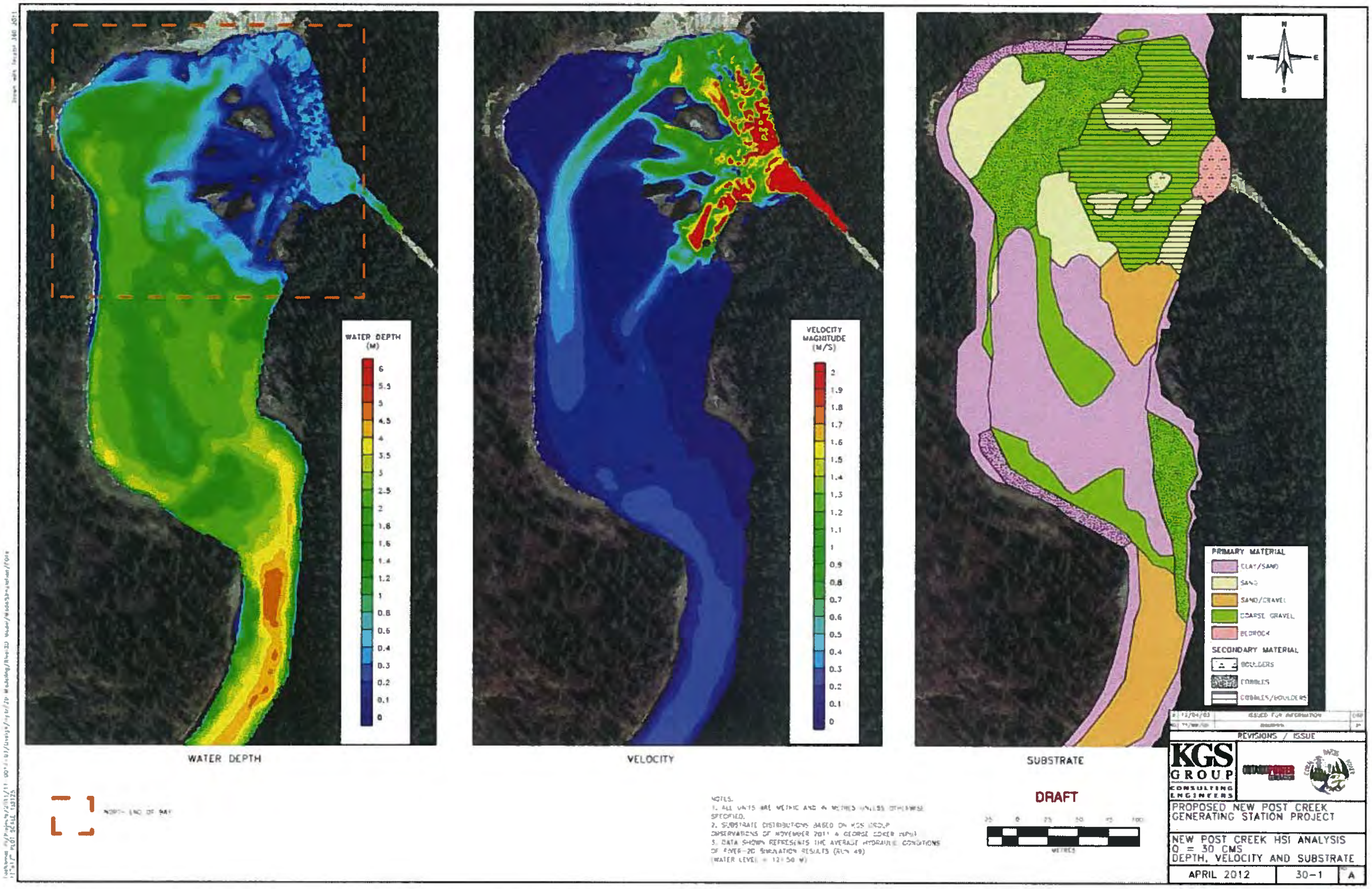



**Figure 3: Habitat parameters of water depth and water velocity at 30 cms, and substrate, which are of primary importance when defining potential walleye and lake sturgeon spawning habitat.**

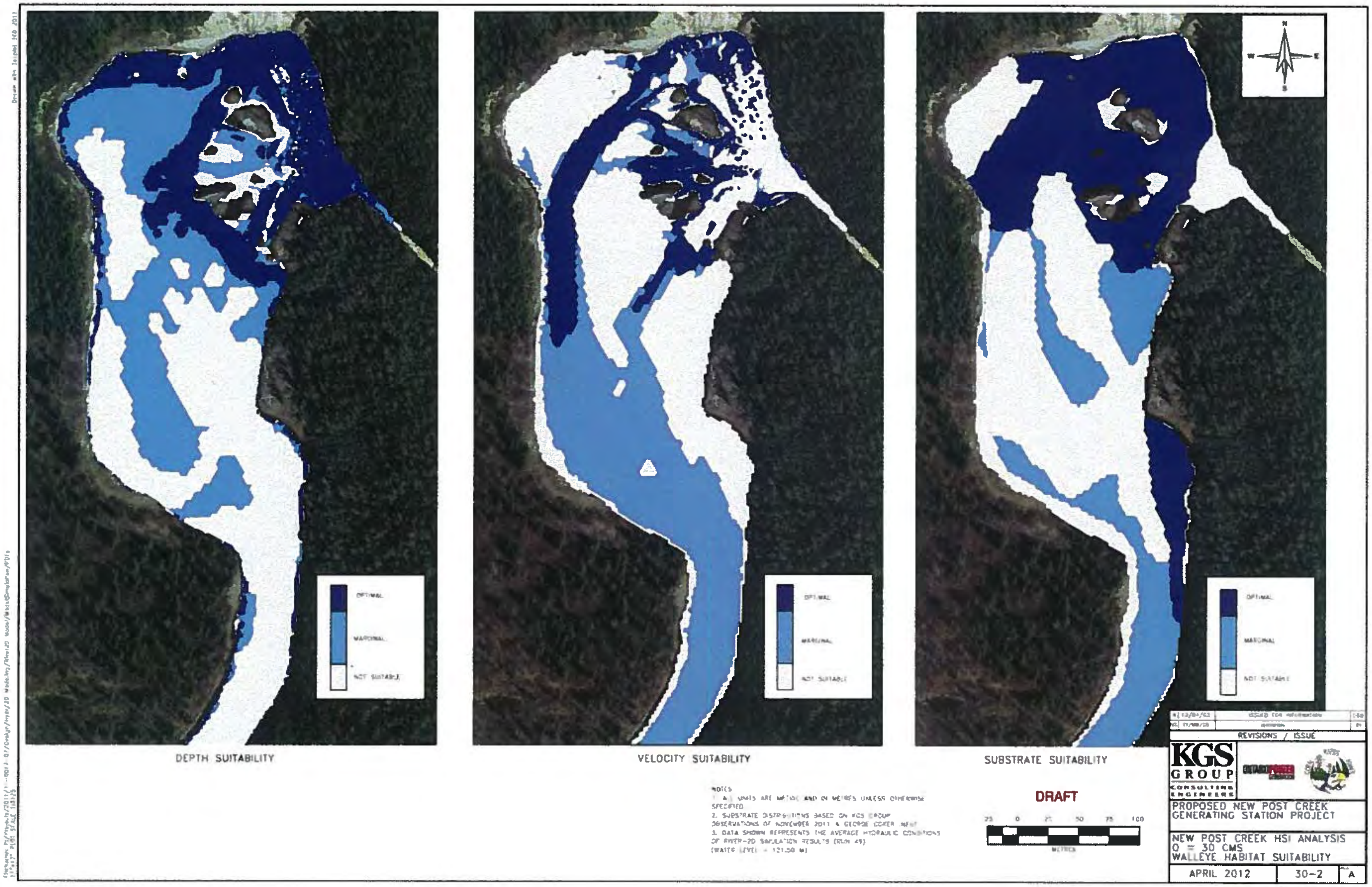



**Figure 4: The spatial extent at 30 cms of suitable water depth, water velocity, and substrate type required by Walleye for spawning. Optimal and marginal ranges were defined for each parameter.**

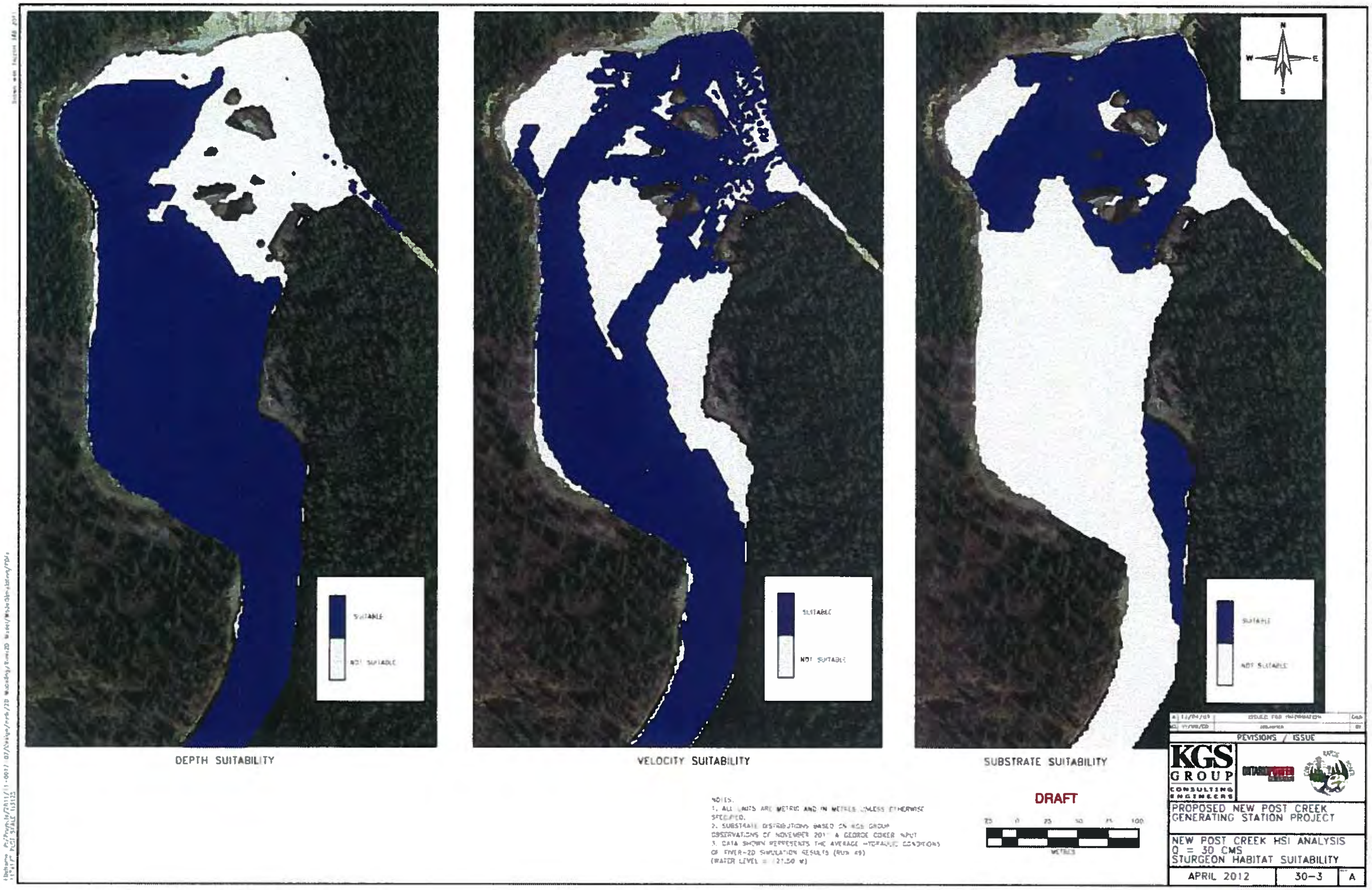



**Figure 5: The spatial extent at 30 cms of suitable water depth, water velocity, and substrate type required by Lake Sturgeon for spawning. Optimal and marginal ranges were not defined.**

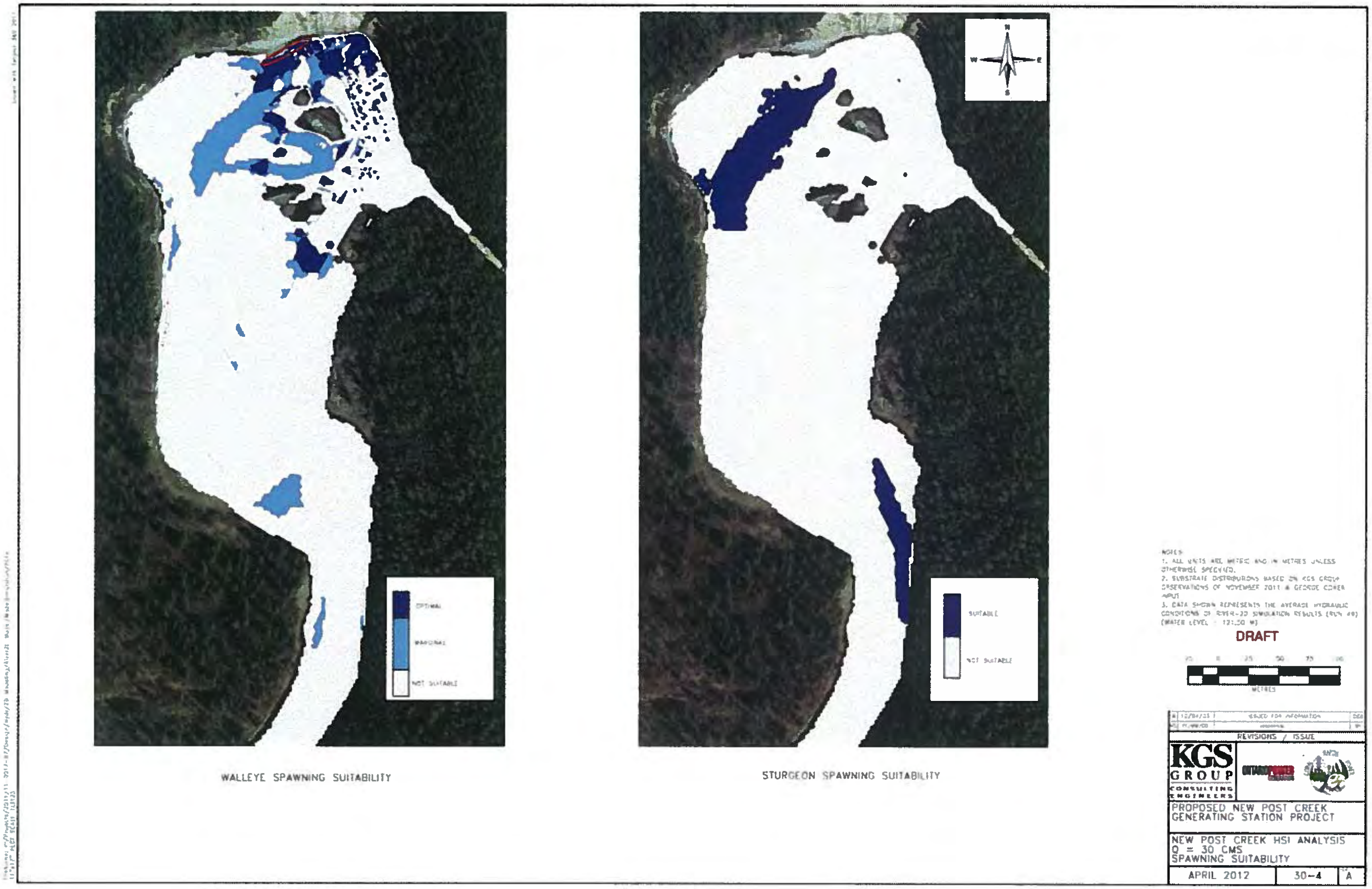



**Figure 6: The spatial extent at 30 cms of potential Walleye and Lake Sturgeon spawning habitat, where suitable flow velocities, water depths, and substrate types overlap. Optimal and marginal spawning habitats are delineated for Walleye. The small red ellipse at the top end of the Walleye spawning suitability map shows the location of Walleye observed at night during the 2010 spawning run.**

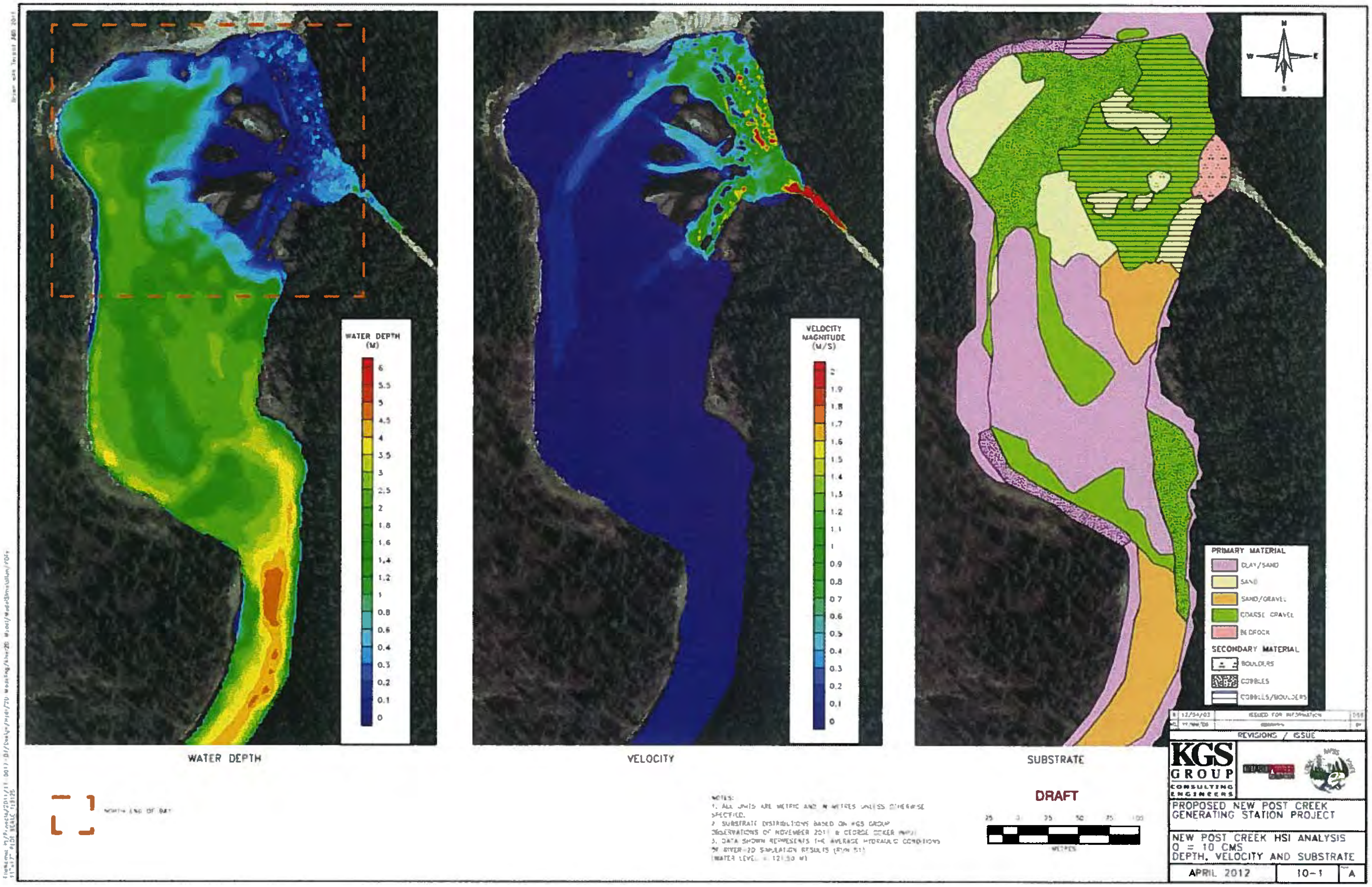



**Figure 7: Habitat parameters of water depth and water velocity at 10 cms, and substrate, which are of primary importance when defining potential walleye and lake sturgeon spawning habitat.**

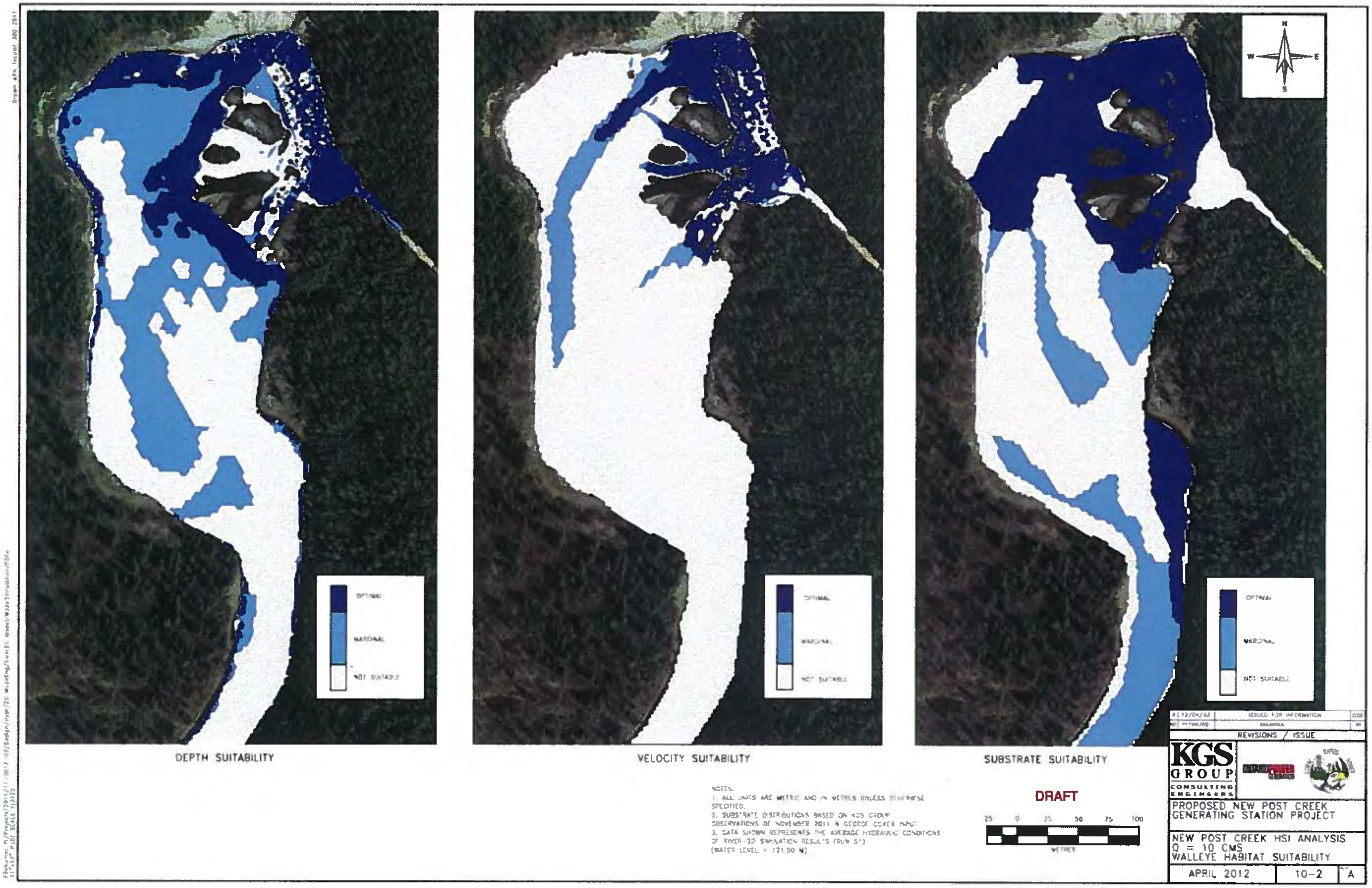



**Figure 8: The spatial extent at 10 cms of suitable water depth, water velocity, and substrate type required by Walleye for spawning. Optimal and marginal ranges were defined for each parameter.**

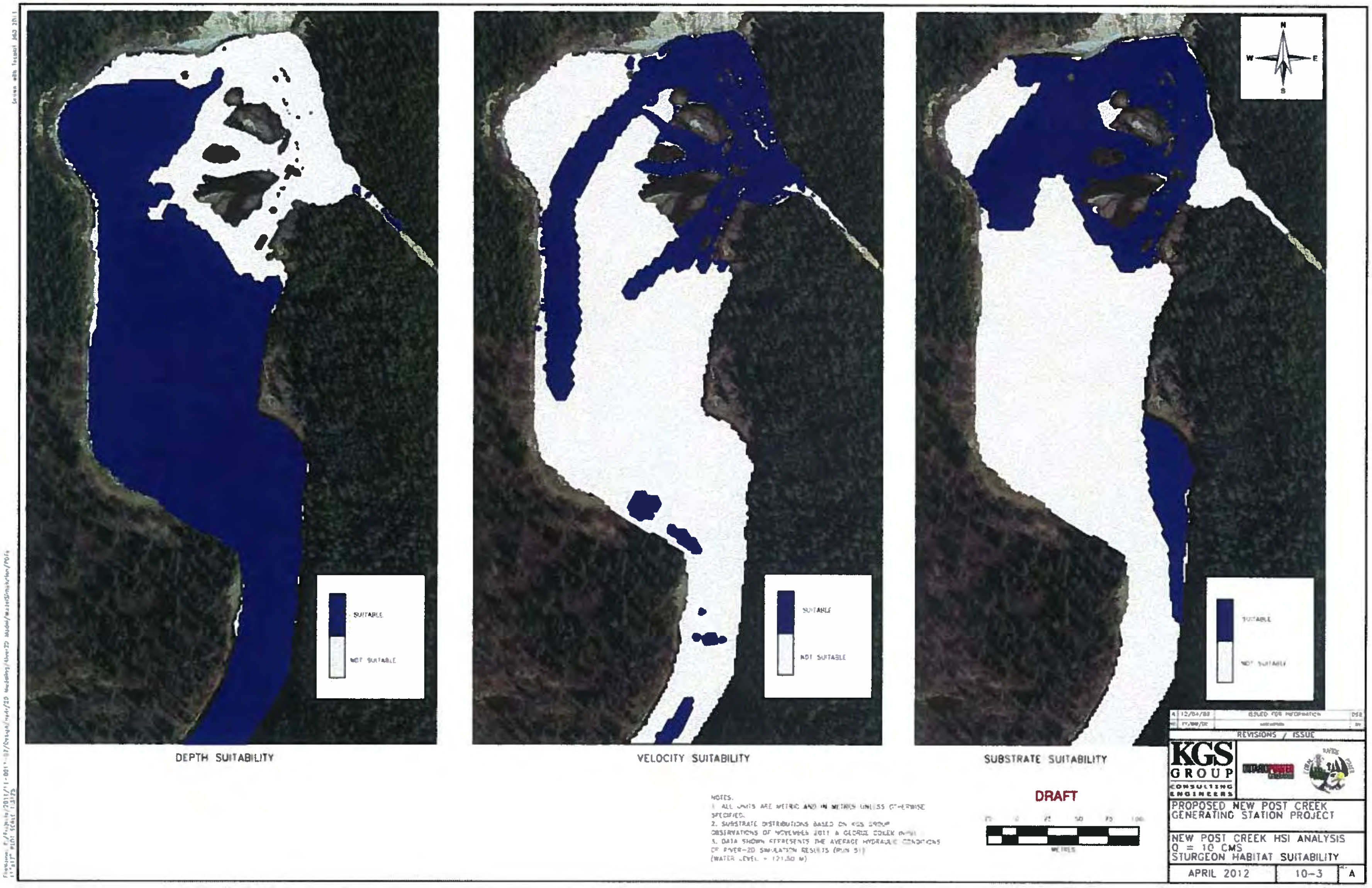



**Figure 9: The spatial extent at 10 cms of suitable water depth, water velocity, and substrate type required by Lake Sturgeon for spawning. Optimal and marginal ranges were not defined.**

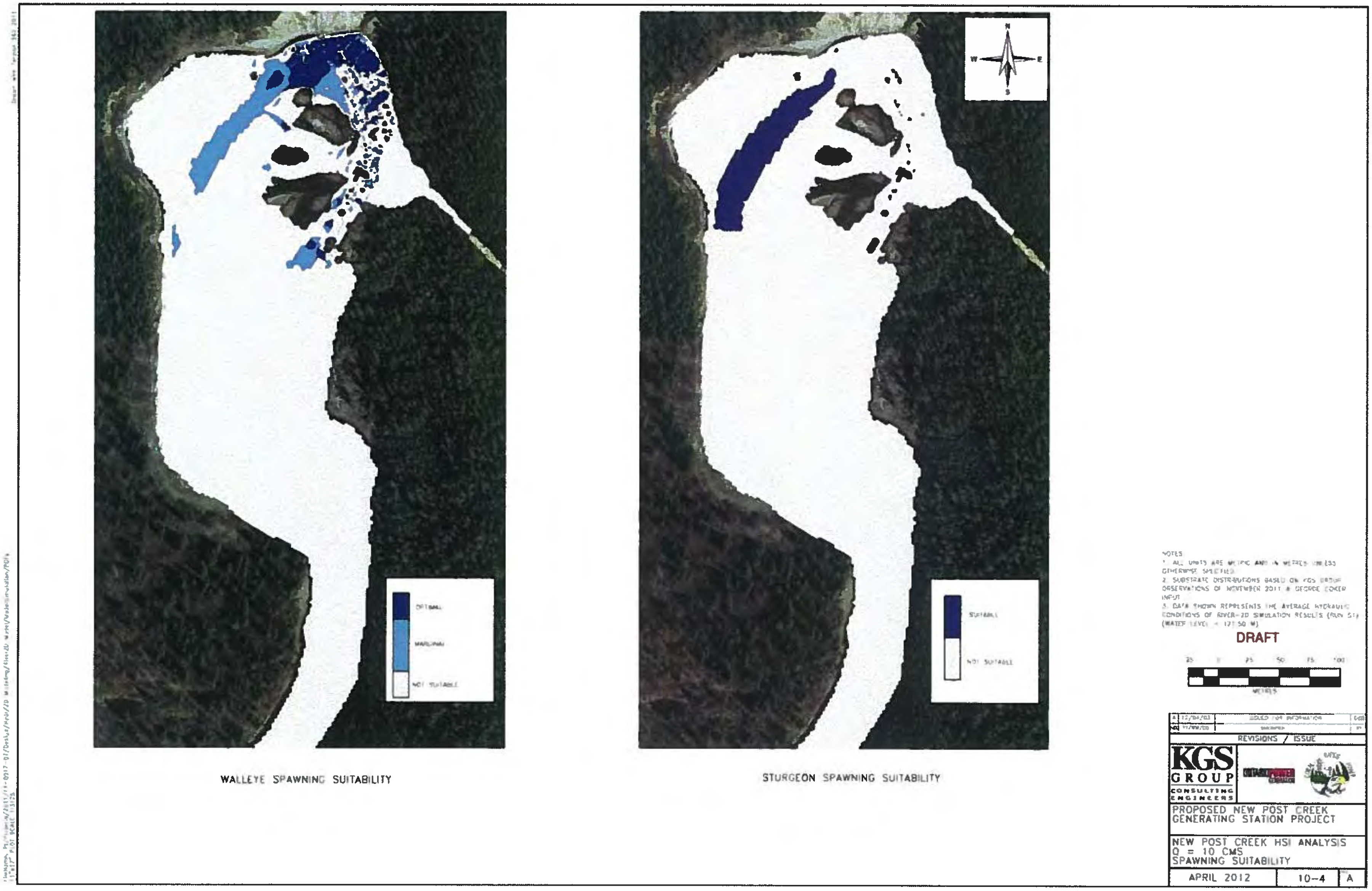



**Figure 10: The spatial extent at 10 cms of potential Walleye and Lake Sturgeon spawning habitat, where suitable flow velocities, water depths, and substrate types overlap. Optimal and marginal spawning habitats are delineated for Walleye.**

Walleye – Analysis of Results

The presence of Walleye in spawning condition in New Post Creek, downstream from the waterfalls, has been confirmed each of the three years that a Walleye spawning assessment was undertaken. In all three years, gillnets were set for a few hours during the day to capture males and females in spawning condition, when water temperatures were within the typical range at which Walleye spawn. Overnight gillnet sets were not attempted to avoid killing large numbers of spawning fish. Nighttime observations using a powerful light (1.5 million candlepower) were also undertaken each year to confirm that Walleye were spawning here, but were largely ineffective due to the turbidity and turbulence of the water. New Post Creek flows during these nighttime observations were 212-221 cms in 2009, 34 cms in 2010, and 189 cms in 2011. Only in 2010 were a few Walleye observed at night close to shore in typical spawning habitats, due to the lower flows that year which resulted in slightly clearer and less turbulent water. Figure 6 shows the location of the observed Walleye in 2010.

Besides the two example habitat model runs provided above, the results of additional optimal Walleye spawning habitat model runs at a range of flows are graphed in Figure 11.

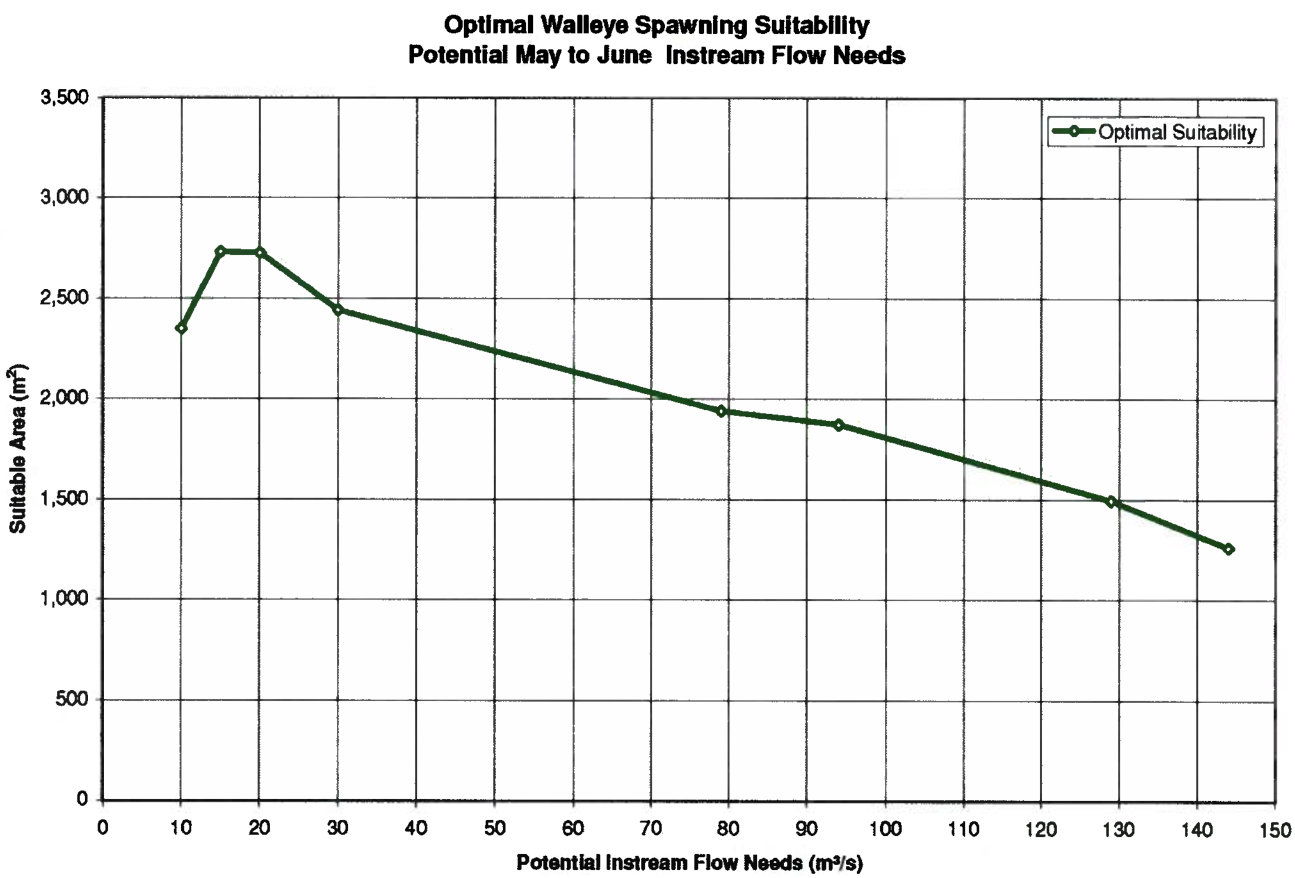



**Figure 11: Graph of potential optimal Walleye spawning habitat area versus flow.**

The area of potential optimal Walleye spawning habitat is highest at flows of 10 – 30 cms, compared to reduced areas of potential optimal spawning habitat at flows >80 cms that typically occur during the spring spawning period of Walleye. As shown in Figure 12, historic New Post Creek flows during the spring spawning period are historically much higher than the optimal spawning flows. With the proposed generating station reducing flows by up to ~50 cms, the likelihood of flows landing in a more optimal zone for spawning increase significantly.

The relationship of suitable spawning habitat to flow in any river will approximately follow a bell-shaped distribution, with its exact shape and the position of the peak determined by the morphology of the channel. In the case of habitat below the falls in New Post Creek, a limited area of suitable depth for walleye spawning becomes increasingly unavailable as riverflow and flow velocity increase, whereas in rivers where suitable depth is widespread, the area of suitable spawning habitat may remain high or increase as riverflow increases towards the capacity of the channel. Therefore, for New Post Creek, the potential Walleye spawning habitat area is greater at riverflows that are considerably less than what occurs during the typical period of Walleye spawning, and so the projected overall decrease in flow that will occur below the falls (i.e. 50 cms) as a result of the proposed project, will provide more optimal Walleye spawning habitat compared to today.

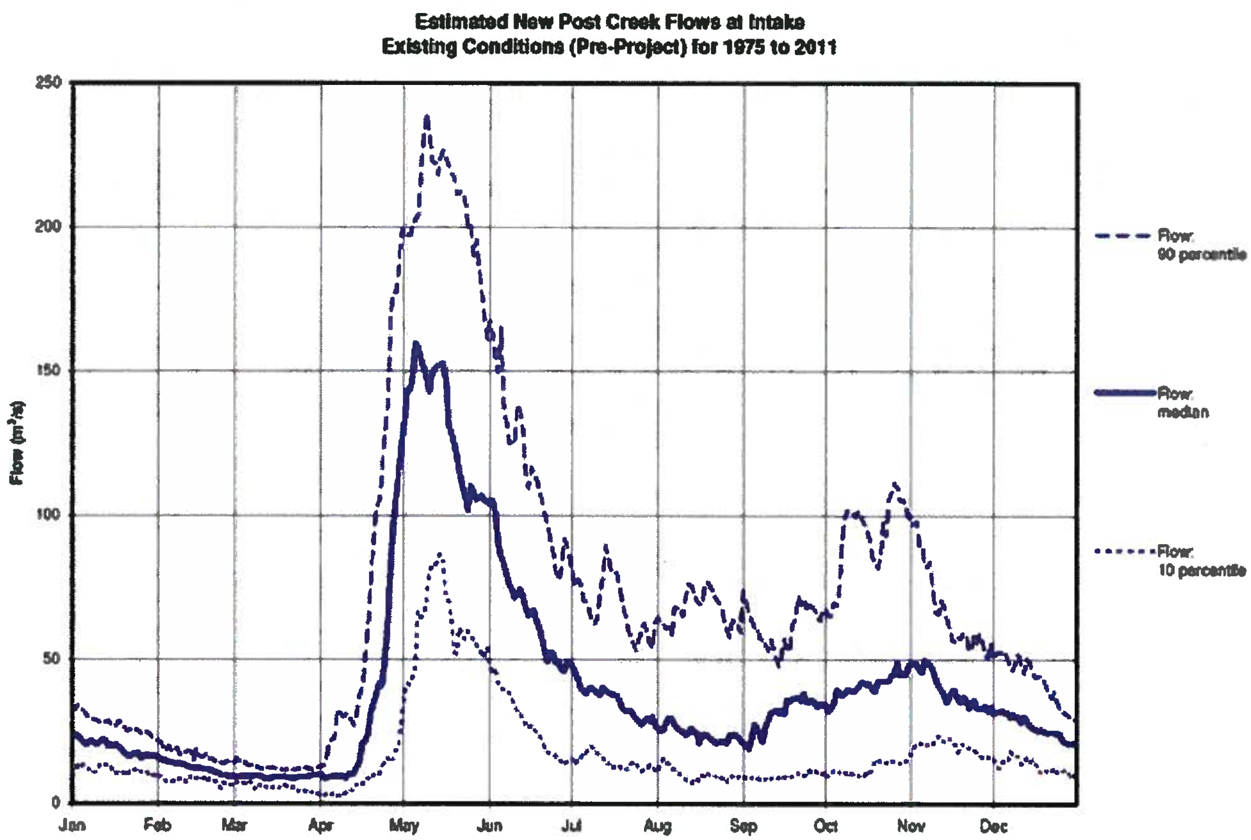



**Figure 12: Median New Post Creek flows.**

While the peak suitability occurs between approximately 15-20 cms (Figure 11), flows cannot be controlled within a small band at this site and it is unlikely that this flow range would actually be provided regularly. As there is limited difference in area of optimal Walleye spawning habitat between flows just above and below this range, but there is significant energy implications, the recommended 10 cms provides the upside of including the peak range while not limiting the project viability.

In terms of energy impact, current data estimates that for every 1 cms increase in minimum flow during this period will result in a loss of annual energy production of 0.25 GWh.

The recommended minimum flow of 10 cms will provide a greater area of optimal Walleye spawning habitat than what occurs under typical spring flows at present, and will not unnecessarily have an excessive negative impact upon the viability of the hydroelectric project.

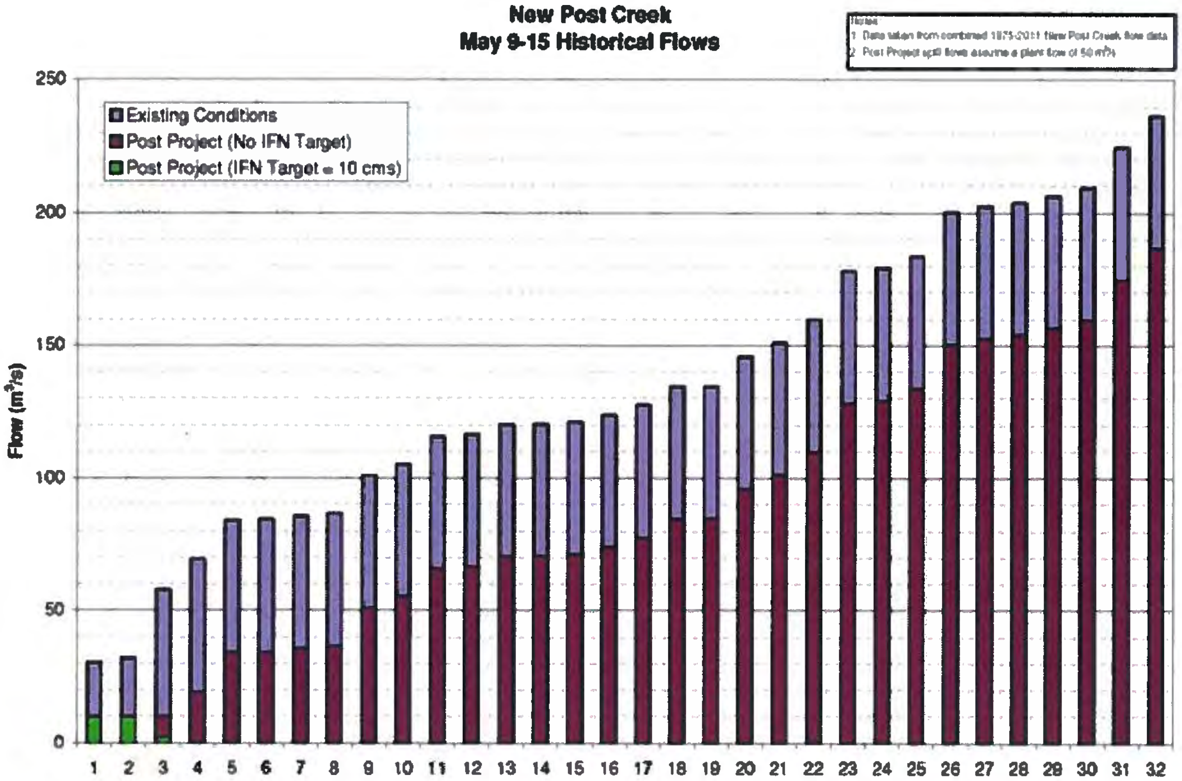



**Figure 13: Histogram of historical flows in New Post Creek, ranked in order of least to most, during the typical start of Walleye spawning in early May. The blue bar portions represent the effect of diverting 50 cms of flow through the proposed generating station, so that a reduced flow passes down New Post Creek and over the falls (red). Only during three years out of 32 would the flow in New Post Creek be low enough to require some curtailing of plant flow to provide the proposed spring minimum flow of 10 cms (green).**

Figure 13 further illustrates that reducing flows downstream of the falls by the proposed plant flow of 50 cms, will potentially increase the amount of optimal spawning habitat. For example, under the present flow regime there are only 2 years out of 32 in which total flows are below 50 cms, which provides significantly more potential optimal spawning habitat, as illustrated in Figure 11. The number of years with flows below 50 cms increases to 8 out of 32 during the post-development period. **Therefore, an overall reduction in flow by 50 cms will provide a greater amount of potential optimal Walleye spawning habitat. Even during the limited number of years when the minimum flow will occur, the amount of potential Walleye spawning habitat will be greater than what now occurs under typical spring flows.**

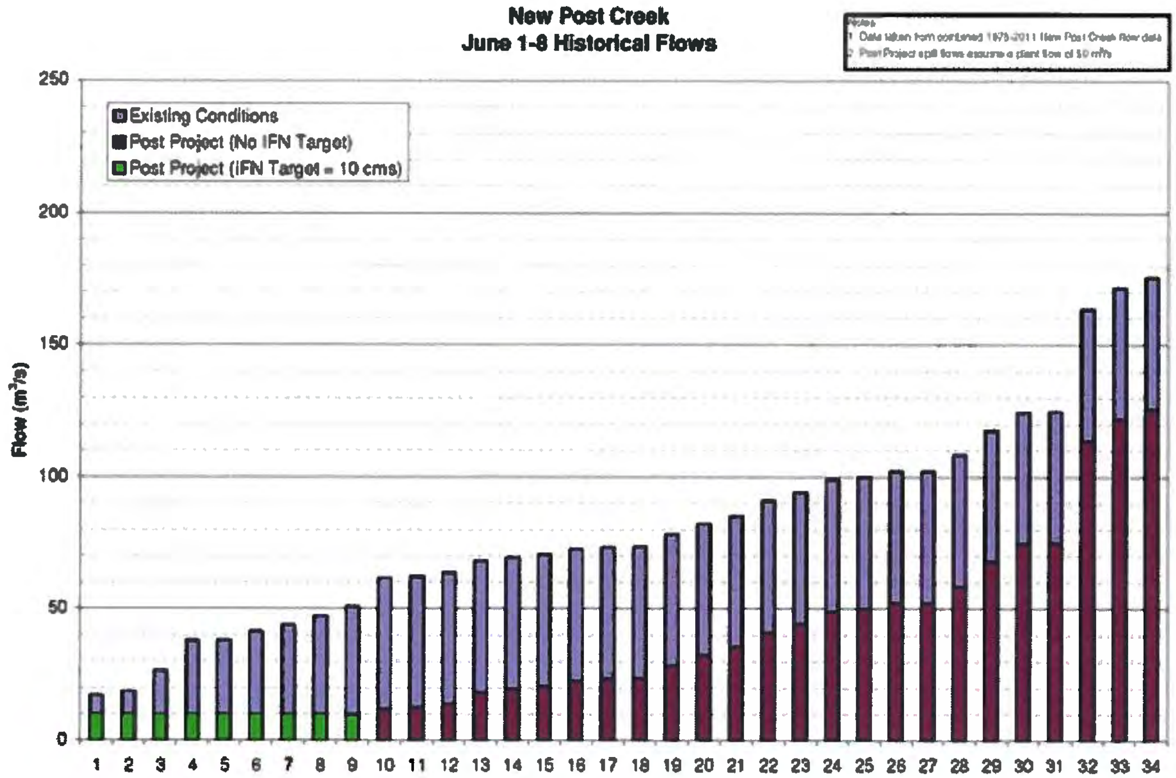



**Figure 14: Histogram of historical flows in New Post Creek, ranked in order of least to most, during the typical end of Walleye fry emergence in early June. As in Figure 13, the blue bar portions represent the effect of diverting 50 cms of flow through the proposed generating station, so that a reduced flow passes down New Post Creek and over the falls (red). Only during 9 years out of 32 would the flow in New Post Creek be low enough to require some curtailing of plant flow to provide the proposed spring minimum flow of 10 cms (green).**

As is usual, flow tends to lessen as the late spring and summer seasons progress, resulting in an increased likelihood that flow through the generating station will need to be curtailed further. Figure 14 shows the historical flows, split into the three flow allotments as was done in Figure 13, during the typical end of the Walleye fry emergence in the first week of June. Despite the proposed 50 cms of flow diverted through the generating station, there is enough flow to maintain flows greater than the minimum target flow during 25 out of 34 years, and only during 9 of 34 years would the flow be low enough to require some curtailing of plant flow to provide the proposed spring minimum flow of 10 cms. As noted above, this scenario will also provide a greater area of potential optimal Walleye spawning habitat than what occurs under existing conditions.

Finally, another fact that is apparent upon examination of the above histograms (Figures 13 and 14) is that the range of flow will be somewhat compressed by removing 50 cms from any flow passing over the falls, but maintaining a minimum flow of 10 cms. This will reduce the range of flow reduction that typically occurs over the Walleye spawning period, and therefore reduce the potential for Walleye eggs becoming stranded when flows drop during the incubation period.

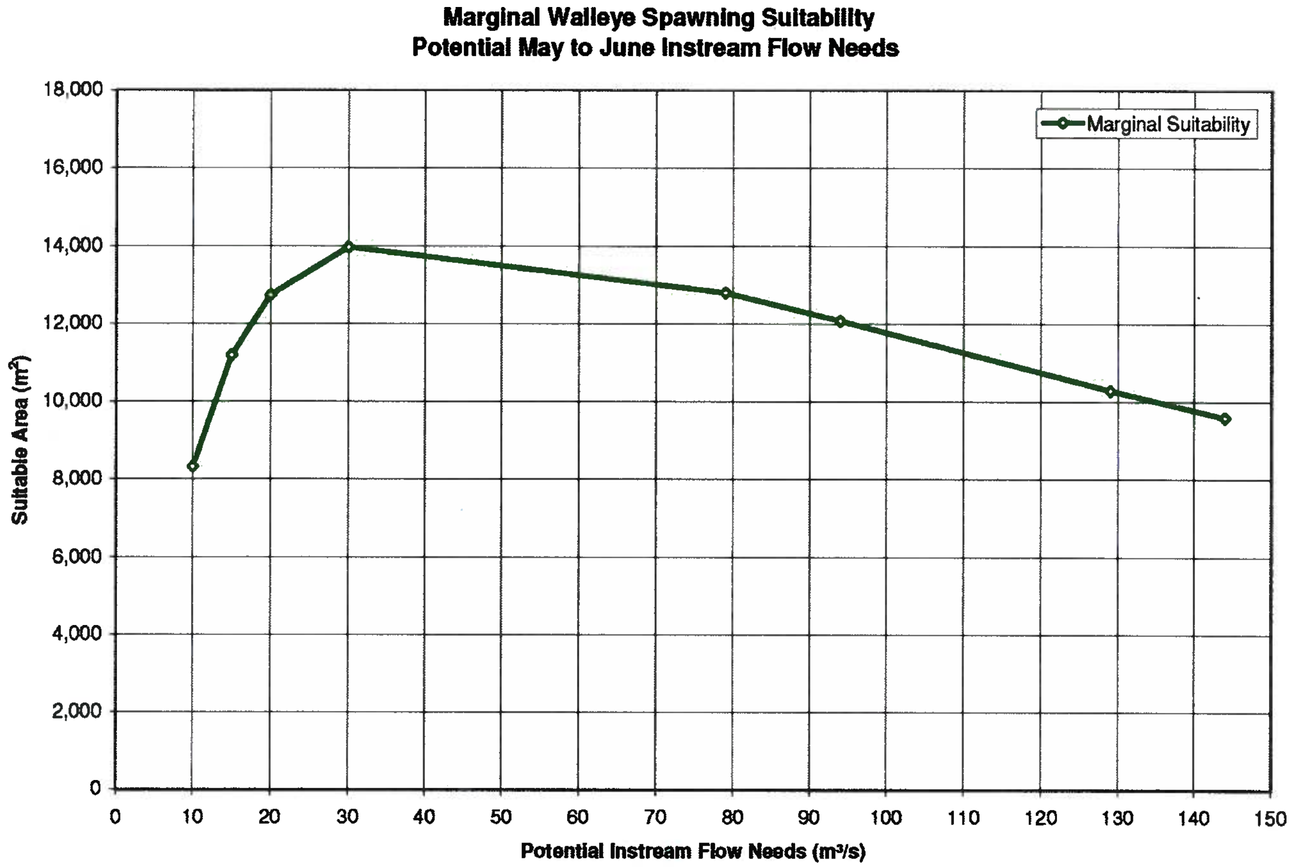



**Figure 15: Graph of potential marginal Walleye spawning habitat area versus flow.**

Marginal Walleye spawning habitat follows a similar pattern to optimal spawning habitat, but peaks at 30 cms instead of 15-20 cms. Regardless, the general reduction of flow will result in a greater amount of marginal potential Walleye spawning habitat being available most years. Only those few years when the minimum flow of 10 cms is provided might there be slightly less marginal Walleye spawning habitat than would occur during a typical year. However, **Walleye will not use marginal habitat if there is optimal habitat available for spawning, which there is in this situation**.

### Walleye Summary

- Amount of good Walleye spawning habitat is greatest at flows of 10-30 cms.
- Removing the proposed GS flow of 50 cms from the river flow passing over the falls will increase the amount of Walleye spawning habitat during most years.
- Proposed minimum flow of 10 cms will provide more good quality Walleye spawning habitat than typical spring flows.
- Proposed minimum flow of 10 cms will be required approximately 1 in 10 years during the spawning period, rising to about 1 in 4 years by the end of the fry dispersal period. Therefore, the maintenance of a target minimum flow will reduce the range of flows that typically occur during walleye spawning, potentially improving embryo survival.
- Proposed minimum flow of 10 cms will minimize the energy impact to the project while maintaining quality Walleye spawning conditions. Each cms addition during this period will result in a loss of 0.25 GWh of generation.

Lake Sturgeon – Analysis of Results

Besides the two example habitat model runs provided in Figures 3 to 10, the results of additional Lake Sturgeon spawning habitat model runs at a range of flows are graphed in Figure 16. The area of potential Lake Sturgeon spawning habitat appears to increase less with flow when flows exceed 30 cms. As mentioned above, the relationship of suitable spawning habitat to flow in any river will approximately follow a bell-shaped distribution, with its exact shape and the position of the peak determined by the morphology of the channel. In the case of habitat below the falls in New Post Creek, the entire area is within the range of depth for Lake Sturgeon spawning habitat, and so potential Lake Sturgeon spawning habitat area will tend to increase with flow until velocity becomes too fast. The area of suitable substrate, however, is limited, and is the reason the graph of potential Lake Sturgeon spawning habitat area vs. flow essentially levels-off above 80 cms. Therefore, for New Post Creek, potential Lake Sturgeon spawning habitat area is maximized at typical spring flows.

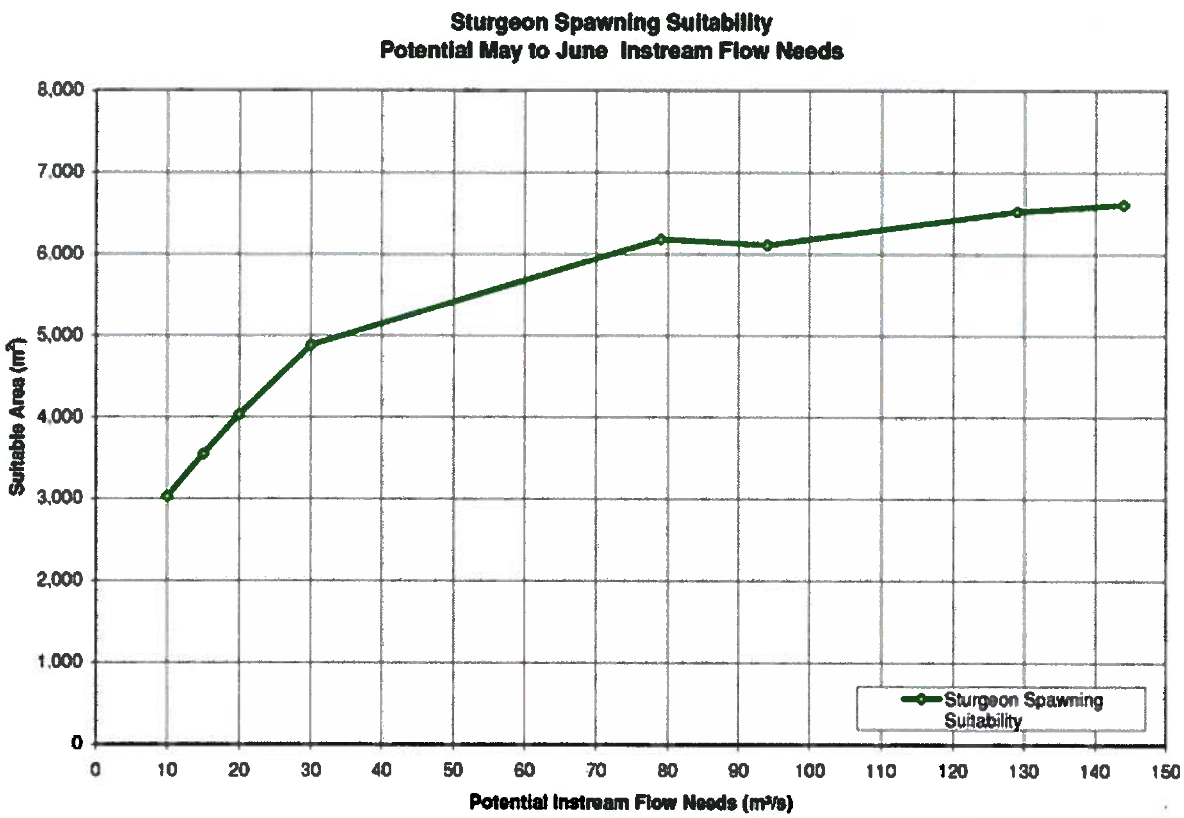



**Figure 16: Graph of potential Lake Sturgeon spawning habitat area versus flow.**

The Lake Sturgeon population in this area is likely not limited by the area of potential spawning habitat below New Post Creek falls, due to the large area of potential spawning habitat provided at a minimum flow of 10 cms, combined with the apparently low numbers of Lake Sturgeon in this area. However, as presented below, field work to investigate Lake Sturgeon spawning at New post Creek indicates that they do not spawn in New Post Creek.

**Lake Sturgeon Field Work in 2011 and 2012**

The timing of the Lake Sturgeon netting and egg mat deployment in 2011 and 2012 was determined by temperature monitoring undertaken by OPG staff leading up to the start of field work prior to the typical spawning temperature of Lake Sturgeon (13°C). Netting for adult Lake Sturgeon and egg mat deployment ended in five days in 2011, and in two days in 2012, after the last capture of a Lake Sturgeon in spawning condition occurred below Abitibi Canyon. The start of Lake Sturgeon larvae drift was determined using data from the studies undertaken by M.J. Friday (Upper Great Lakes Management Unit, Lake Superior, MNR) which found that the first drift of Lake Sturgeon larvae occurs approximately 150 Cumulative Thermal Units after the first spawning event. Using data from a temperature logger deployed in New Post Creek that recorded water temperature at 15 minute intervals, the time of potential first larval drift in New Post Creek was calculated from the date that New Post Creek water temperature reached the Abitibi River water temperature at which Lake Sturgeon were observed in spawning condition below Abitibi Canyon (11.3°C). Drift netting began one day prior to this date. Drift netting in New Post Creek for larval Lake Sturgeon continued until larval drift was observed below Abitibi Canyon, where spawning would have occurred later and the time to larval drift was anticipated to take longer due to cooler water during the incubation period, thus ensuring that drift netting in New Post Creek was not terminated too soon.

Egg collection mats are heavy steel plates covered in hogs hair filter material, that are deployed on the substrate of the potential spawning site, which hold fish eggs that contact them. Egg mats were retrieved and reset every 2 or 3 days. **No eggs were collected or observed in New post Creek using 20 mats in 2011 and 40 mats in 2012.**

The gillnets were 25 m long, with large mesh specifically sized to capture sturgeon. Gillnets were retrieved and reset each day. In 2011, 67 overnight sets in New Post Creek, downstream of the waterfalls, captured 12 sturgeon, one of which was a recapture. In 2011, 92 overnight sets below Abitibi Canyon in the Abitibi River captured 39 sturgeon, 12 of which were recaptures. In 2012, 60 overnight sets in New Post Creek, downstream of the waterfalls, captured 15 sturgeon, none of which were recaptures. In 2012, 70 overnight sets below Abitibi Canyon in the Abitibi River captured 31 sturgeon, 5 of which were recaptures. **No Lake Sturgeon in spawning condition have been captured in New Post Creek**, but sturgeon in spawning condition have been captured both years below Abitibi Canyon.

Drift nets are long conical nets with a "D" shaped mouth, that are set in flow downstream from the potential spawning sites at capture fry that emerge from the substrate at the end of their incubation period and then drift downstream. A bridle connected to an anchor keeps the net stationary in an area of flowing water, with the mouth open to the flow and the flat part of the "D" mouth contacting the substrate. Any material and organisms drifting downstream will enter the net mouth and become concentrated in the removable end of the conical net. Initially, 10 nets were set in 2012 below the rapids downstream of New Post falls, but 2 were subsequently moved to the Abitibi River below Abitibi Canyon and were also deployed for 2 nights upstream in New Post Creek. Drift nets were retrieved and reset each day. In all, 126 overnight driftnet sets occurred in New Post Creek downstream of the falls, 20 occurred in the Abitibi River, and 4 occurred in upper New Post Creek. The upper New Post Creek driftnet sets were deployed to confirm that Lake Whitefish fry captured below New Post Creek falls in 2012 were in fact coming from upstream areas. **No larval Lake Sturgeon were captured in New Post Creek**, but in the Abitibi River one was captured on June 13, and nine were captured on June 14, 2012, below Abitibi Canyon, downstream of the spawning area for those Lake Sturgeon in spawning condition that were observed here 26 days earlier.

**Results of the 2011 Lake Sturgeon Investigations**

Figure 17 shows the gillnet set locations, as well as the locations of the 20 egg mats, used in New Post Creek in 2011. Gillnets and egg mats were deployed for 17 days (May 20 – June 6, 2011), ending 5 days after the last Lake Sturgeon in spawning condition was caught below Abitibi Canyon. The gillnet catch is provided in Table 1. The egg mats did not collect any Lake Sturgeon eggs.

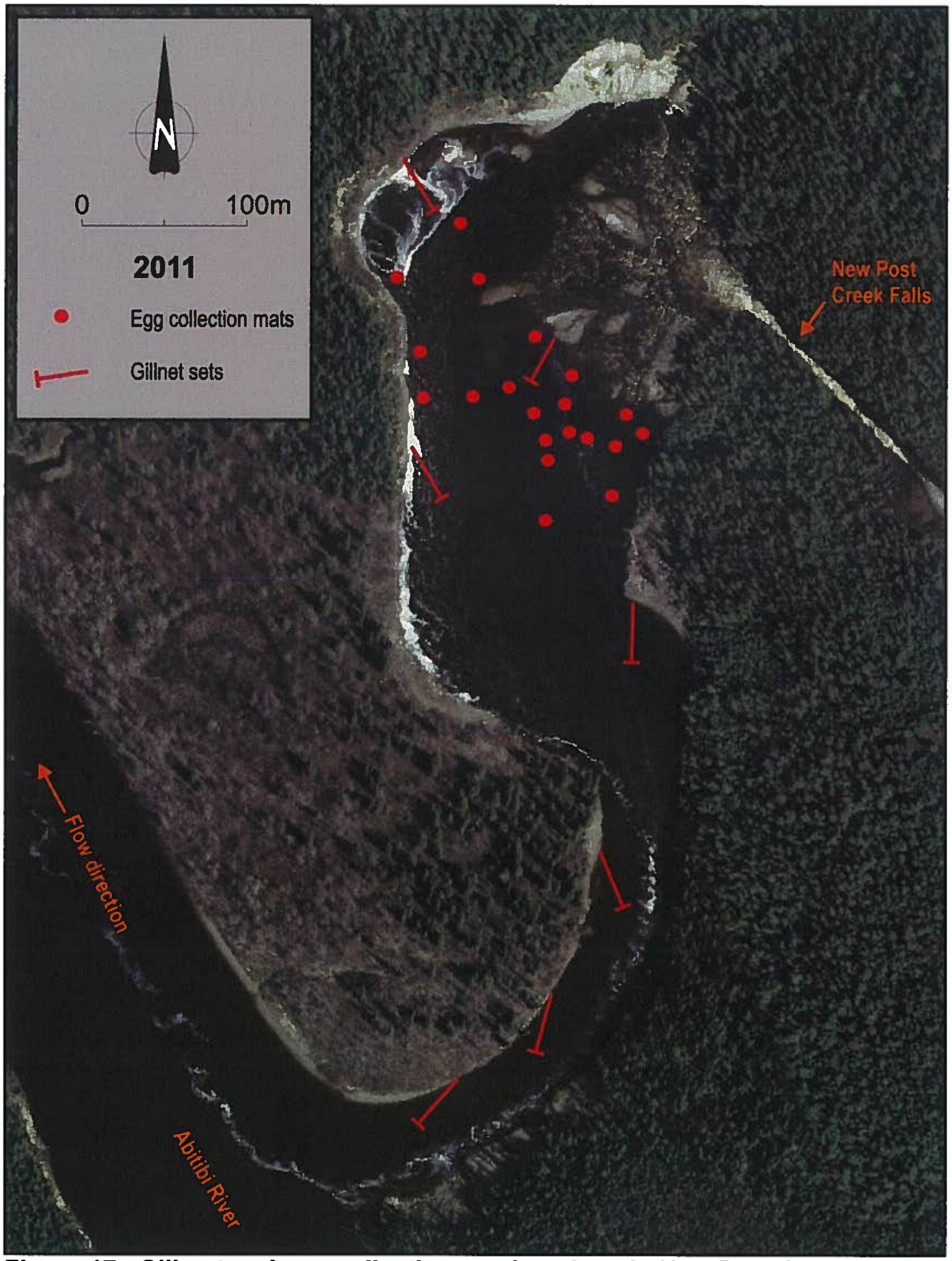



**Figure 17: Gill net and egg collection mat locations in New Post Creek in 2011.**

**Table 1: Summary of the 2011 gillnet catch information.**

| Date | New Post Creek – 5 nets/night | | | Abitibi Canyon - 7 nets/night | | |
|---|---|---|---|---|---|---|
| 2011 | Number of sturgeon captured | Sturgeon condition | Water temp. (C) | Number of sturgeon captured | Sturgeon condition | Water temp. (C) |
| May 21 | 1 | - | 12.2 | 1 | - | 10.7 |
| May 22 | 0 | - | 11.5 | 0 | - | 10.8 |
| May 23 | 0 | - | 12.5 | 0 | - | 11.0 |
| May 24 | 1 | - | 9.5 | 1 | - | 10.3 |
| May 25 | 0 | - | 8.2 | 1 | - | 10.3 |
| May 26 | 0 | - | 8.4 | 1 | - | 10.3 |
| May 29 | 0 | - | 11.5 | 0 | - | 11.8 |
| May 30 | 0 | - | 12.5 | 1 | - | 12.0 |
| May 31 | 0 | - | 12.9 | 11 | 5 Sp. Cond., 2 flacid | 12.5 |
| June 1 | 0 | - | 14.4 | 6 | 1 Sp. Cond. | 12.7 |
| June 2 | 5 | 2 flacid | 13.5 | 5 | 1 flacid | 12.7 |
| June 3 | 1 | 1 flacid | 13.4 | 4 | - | 13.0 |
| June 4 | 2 | 1 flacid | 12.8 | 6 | - | 13.1 |
| June 5 | 3 | 3 flacid | 12.9 | 0 | - | 13.0 |
| June 6 | 0 | - | 13.3 | 2 | 1 flacid | 14.1 |

In 2011 very few fish were captured over the first 8 days of field work. On the 9th day (May 31) of field work the number of fish below Abitibi Canyon suddenly spiked to 11 individuals, 5 of which were males in spawning condition, indicating that the spawning run had begun. None were captured that day in NPC. Only after the spawning period appeared to end below Abitibi Canyon did sturgeon begin to occur in greater numbers in New Post Creek, but many of these were finished spawning, and the rest were not in spawning condition, suggesting that spawning had not occurred in New Post Creek in 2011, which is supported by the lack of Lake Sturgeon eggs collected by the egg mats.

**Results of the 2012 Lake Sturgeon Investigations**

The gear set locations in New Post Creek for 2012 are shown in Figure 18. Gillnets and egg mats were deployed for 13 days (May 11 – May 23, 2012), ending 2 days after the last Lake Sturgeon in spawning condition was caught below Abitibi Canyon. Drift nets were then deployed for 16 days (May 30 – June 14) to capture sturgeon fry emerging from the spawning areas, ending when Lake Sturgeon larvae were captured below Abitibi Canyon. The egg mat collection locations in Figure 18 represent all the locations where egg mats were deployed, as some had to be moved due to changing flow and water level conditions. Forty egg mats were set initially, but some were lost and 34 egg mats were retrieved on the last day. Drift nets were retrieved and reset each day, but sometimes were relocated because of changes to flow and depth conditions, or simply to try a different location. The drift net locations in Figure 18 are accompanied by the number of overnight sets at that location.

The 2012 gillnet catch is provided in Table 2. Though the eggs of suckers were collected by the egg mats, no Lake Sturgeon eggs were found. No larval Lake Sturgeon were captured in New Post Creek.

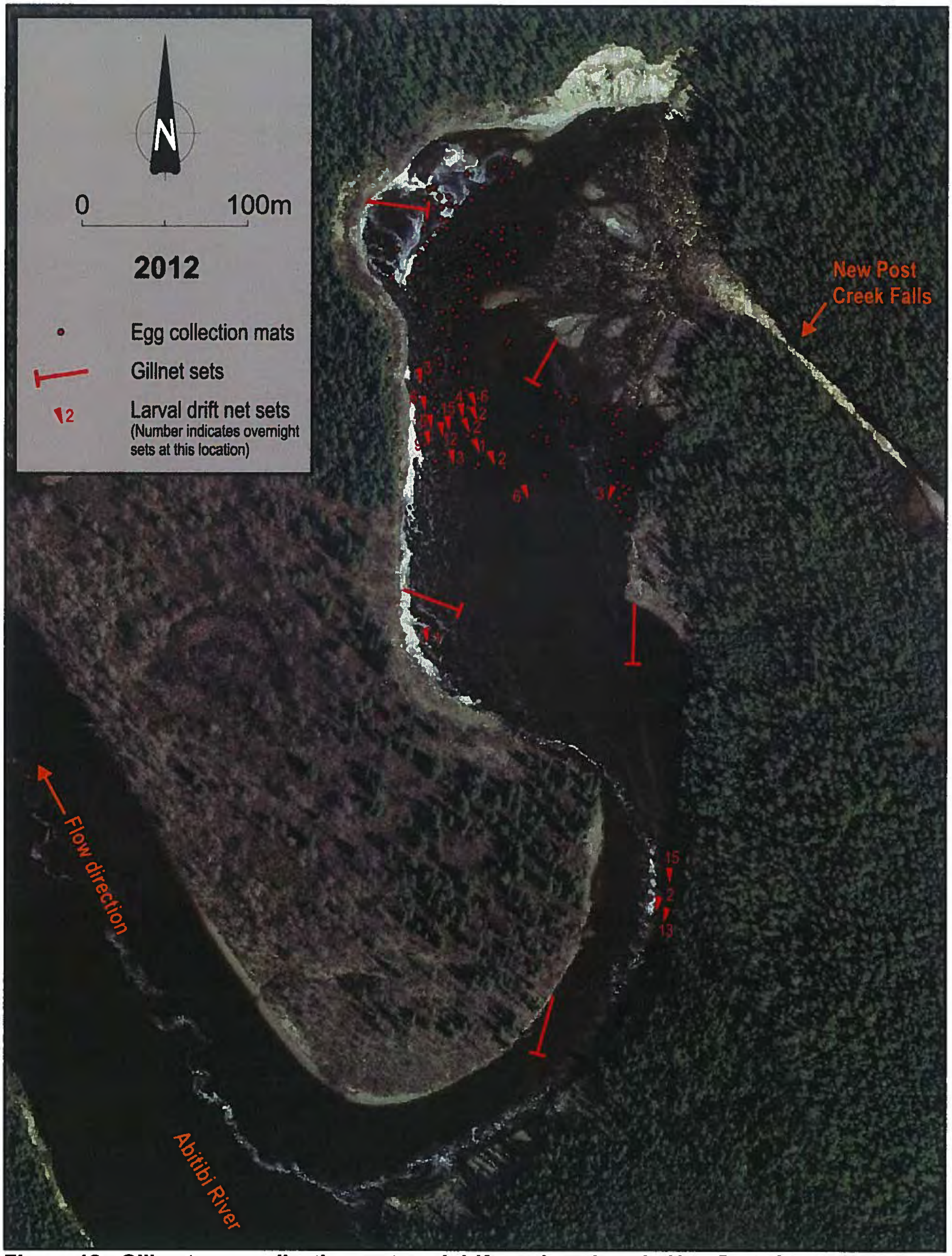



**Figure 18: Gill net, egg collection mat, and drift net locations in New Post Creek in 2012.**

**Table 2: Summary of the 2012 gillnet catch information.**

| Date | New Post Creek – 5 nets/night | | | Abitibi Canyon - 7 nets/night | | |
|---|---|---|---|---|---|---|
| 2012 | Number of sturgeon captured | Sturgeon condition | Water temp. (C) | Number of sturgeon captured | Sturgeon condition | Water temp. (C) |
| May 12 | 5 | - | 11.2 | | no nets set | |
| May 13 | 4 | - | 12.0 | | no nets set | 9.3 |
| May 14 | 0 | - | 12.7 | 2 | - | 9.3 |
| May 15 | 4 | - | 12.6 | 0 | - | 10.1 |
| May 16 | 1 | - | 12.1 | 0 | - | 9.8 |
| May 17 | 0 | - | 11.5 | 1 | - | 9.9 |
| May 18 | 0 | - | 11.7 | 2 | - | 10.3 |
| May 19 | 0 | - | 12.5 | 9 | 6 Sp. Cond. 1 flacid | 10.2 |
| May 20 | 0 | - | 14.2 | 8 | 8 Sp. Cond. | 11.1 |
| May 21 | 0 | - | 14.8 | 4 | 1 Sp. Cond. | 11.2 |
| May 22 | 0 | - | 14.5 | 5 | 2 Sp. Cond., 2 flacid | 11.6 |
| May 23 | 0 | - | 14.1 | 0 | - | 12.3 |

In 2012, all 14 Lake Sturgeon that were captured by gillnet in New Post Creek were caught in the first five days of field work. None of the 14 were in spawning condition or were flacid, indicating that these fish had not spawned yet this year. No Lake Sturgeon were captured in New Post Creek over the remaining 7 days of gillnetting, which was the same period of time that the run of spawning Lake Sturgeon was initiated and completed below Abitibi Canyon in the Abitibi River. Similar to observations in 2011, in 2012 there initially were few fish captured below Abitibi Canyon, but an initial spike in fish occurred on May 19, the majority of which were in spawning condition, signaling the start of Lake Sturgeon spawning in the Abitibi River. The 2012 gillnet survey found no evidence of spawning Lake Sturgeon in New Post Creek below the falls.

The drift nets at New Post Creek caught a few larval fishes, the most common being sucker (Catostomidae). Sculpin (Cottidae) were also quite common. Small numbers of larvae Burbot (*Lota lota*) and Yellow Perch (*Perca flavescens*) were also captured, as well as some specimens that were not part of the larval drift, such as Whitefish (Coregonidae), Trout-Perch (*Percopsis omiscomaycus*), Brook Stickleback (*Culaea inconstans*), and Northern Redbelly Dace (*Phoxinus eos*). Based upon the decomposed condition of most of the Whitefish fry, as well as the fact that dead and decomposing Whitefish fry were also captured in the drift nets set approximately 16 km upstream of the falls in New Post Creek, it is speculated that the Whitefish originated upstream of the New Post Creek diversion dam. No larval Lake Sturgeon were captured in New Post Creek. However, the two drift nets set in the Abitibi River downstream of Abitibi Canyon, caught 1 larval Lake Sturgeon on June 13, and 9 larval Lake Sturgeon on June 14, 2012. The drift net results also support our belief that Lake Sturgeon do not spawn in New Post Creek.

**Lake Sturgeon Summary**

- No Lake Sturgeon eggs were collected by egg collection mats set in New Post Creek over the spawning period in 2011 and 2012.
- No Lake Sturgeon were captured by gillnet in spawning condition in New Post Creek in 2011 and 2012.
- Lake Sturgeon were captured in spawning condition at Abitibi Canyon in 2011 and 2012, following the same pattern both years of an initial spike in the numbers of fish and a corresponding onset of sturgeon in spawning condition, followed by a decrease in catch and fish in spawning condition over the following few days.
- No larval Lake Sturgeon were captured in 8 drift nets set below the falls and rapids in New Post Creek in 2012, but larval Lake Sturgeon were captured in 2 drift nets set below Abitibi Canyon.
- There is no evidence of Lake Sturgeon spawning in New Post Creek.
- If Sturgeon were spawning in the area, 10 cms may be adequate due to the area of suitable habitat, combined with the low numbers of Sturgeon in the area.

Other Spring Spawning Fishes

- It is not believed that minimum flow, timed for Walleye spawning and incubation will have a detrimental effect upon other spring spawning species, and therefore 10 cms is also sufficient for these other spring spawning fish.
- Longnose Suckers spawn at about the same time as Walleye, and generally use the same habitats, since they are often observed together during nighttime observations.
- White Sucker usually spawn immediately following Walleye, and can utilize a broader range of spawning habitats than Walleye.
- Shorthead Redhorse suckers may start to spawn immediately following Walleye, but over a wider range of temperature and probably in slower water velocities and somewhat deeper water in large rivers. None have been caught in New Post Creek during short-term gillnet sets to confirm Walleye spawning in 2009, 2010 and 2011.

Assessment of Proposed 10 cms Spring Minimum Flow ( May and June)

- Minimum flow of 10 cms during the appropriate period will be sufficient to maintain Walleye spawning, incubation, and fry dispersal.
    - Based on the graph of optimal Walleye spawning habitat vs. flow the amount of good Walleye spawning habitat is greatest at 15-20 cms, but 10 and 30 cms also provide more spawning habitat than what would be available at the higher flows of a typical spring. Therefore, by reducing typical spring flows, and providing a minimum flow of 10 cms, the amount of good spawning habitat for Walleye will increase post development.
- The minimum flow represents a targeted minimum flow and is not expected to be required every year. Minimum flow of 10 cms will be required approximately 1 in 10 years during the typical Walleye spawning period, rising to about 1 in 4 years by the end of the typical Walleye fry dispersal period.
- Minimum flow will not be required for Lake Sturgeon.
    - The 2011 and 2012 field program results indicate that Lake Sturgeon do not spawn in New Post Creek.
- The Walleye minimum flow will also be adequate for other spring spawning fish species.

- 10 cms provides sufficient minimum fish flows while not jeopardizing the viablility of the project.
- Based on the estimate from KGS, an increase of 1 cms in minimum flow during the spring spawning season (May and June) will reduce energy production by approximately 0.25 GWh annually.

### 3.2 Minimum Flows: Summer Period (July – September)

The proposed summer minimum flow of 3 cms will be provided to maintain ecological function from the end of the spring minimum flow period, to the end of September, during the more active phase of fish and invertebrates. This will maintain fish and invertebrate production in New Post Creek. This value has been recommended through consideration of the significant energy production impact of each 1 cms during this period to energy production. Current estimates indicate that an increase in minimum flow of 1 cms during this period results in an annual loss of 1 GWh.

Upper New Post Creek Fish Collections

In 2009, 2 gillnets set for one night, plus electrofishing on one occasion, found no fish. Subsequently, collections in 2010 and 2011 captured the following species.

- May 26, 2010. 2 Gillnets, each 53 m long, for 1 overnight set downstream of the proposed intake.
  - 1 small Longnose Sucker (decomposed)
- May 27, 2010. Backpack electrofisher at 1 location (496s).
  - 3 juvenile Burbot, 1 Sculpin
- September 18-20, 2011. 4 RIN Gillnets, each 50 m long, for 2 overnight sets upstream of the proposed intake.
  - 8 White Suckers, 1 Longnose Sucker, 1 Burbot
- September 20, 2011. Backpack electrofisher at 2 locations (110 m of shoreline for 757s, and 91 m of shoreline for 456s).
  - 1 White Sucker YOY, 3 sculpins, 1 Longnose Dace, 1 Johnny Darter
- November 2, 2011. Backpack electrofisher at 1 location (200 m of shoreline for 990s).
  - 1 Longnose Sucker juvenile, 1 Pearl Dace.

Based upon these collections it appears that New Post Creek, upstream of the falls, has a relatively sparse fish community. This is supported by anecdotal information provided by TTN members, who do not consider this section of New Post Creek a place to fish.

Upper New post Creek Aquatic Habitat

- New Post Creek in the vicinity of the proposed intake weir and downstream to falls is essentially flatwater, with 3 water level control points that will maintain upstream water levels. The sections between the control points are deep enough to easily navigate with a boat and outboard motor.
- At the WSC gauge, the difference in water level at 8.86 cms (179.22 m) and 26 cms (179.77 m) is 0.55 m.
- At the WSC gauge, the difference in water level at 26 cms and 80.46 cms (180.87 m) is 1.1 m, while immediately upstream of the falls at these flows the difference was approximately 0.8 m.

- Habitat observations conducted at the 8.86 cms flow suggests that, due to channel morphology, the majority of the aquatic habitat will remain wetted under the proposed 3 cms minimum summer flow.

The above points indicate that reducing the flow to 3 cms from 10 cms will not result in a substantial reduction in habitat area.

The following series of photographs, from the proposed weir location and moving downstream to the falls, illustrate the habitat morphology through this area, as well as the effect of the three water control points to maintain water levels even at very low flow.

**Photograph 1: Downstream view from the proposed Intake Weir location.**

The proposed weir is located over a bedrock outcrop that controls upstream water levels for a significant distance. Photograph 1 is the view downstream of the proposed weir location, showing the relatively deep, flat-water, section of river, with a maximum depth of approximately 6 m, that extends for 1.1 km downstream to the next bedrock outcrop control point.

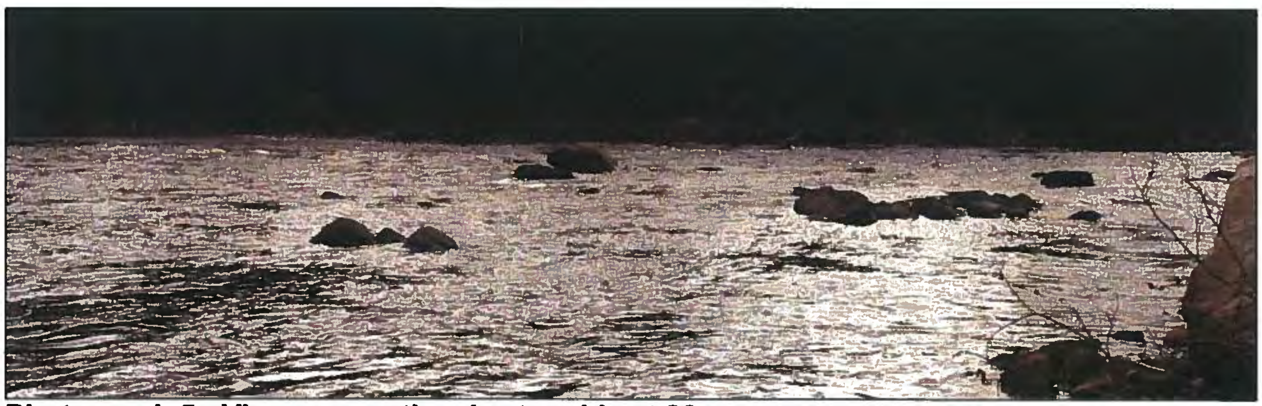
**Photograph 2: Upstream view from the bedrock outcrop located 1.1 km downstream from the proposed weir, at a flow of 11 cms.**

Photograph 2 shows the bedrock outcrop control point in the foreground, and illustrates the flatwater conditions upstream from this bedrock outcrop, as well as the fact that even if flow in New Post Creek were stopped entirely, the upstream habitats would not be dewatered because the outcrop would not allow the upstream water level to drop more than approximately 0.5 m. Photograph 3 is a view downstream from the same location, showing the flatwater conditions that continue downstream to the next control point.

**Photograph 3: Downstream view from the bedrock outcrop located 1.1 km downstream from the proposed weir, at a flow of 11 cms.**

The next water level control point is a short set of low rapids that is 2 km downstream from the proposed weir location. Photograph 4 shows the rapids from upstream, and Photograph 5 is a view across the rapids. The photographs show the rapids at a flow of 26 cms, and though the rapids are fairly uniform in depth across the river, some of it would likely be dewatered at flows of 3 cms.

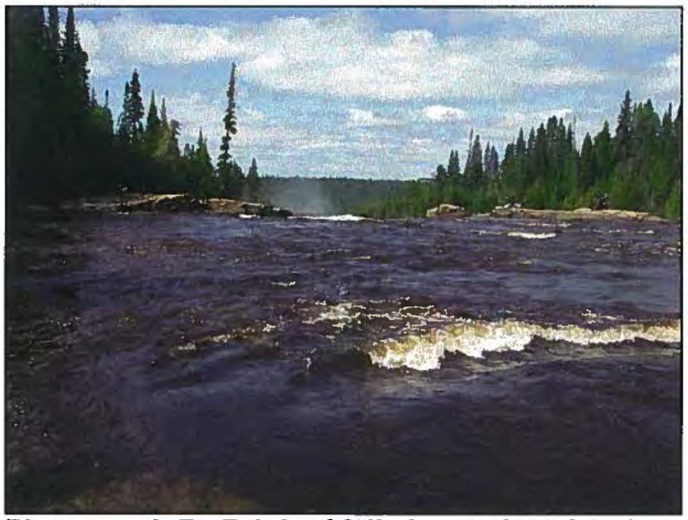
**Photograph 4: Downstream view of short rapids at 26 cms.**



**Photograph 5: View across the short rapids at 26 cms.**

Downstream of the rapids shown in the Photographs 4 and 5, New Post Creek is relatively flat, with some quite deep sections in the upstream portion of this reach, as well as some long sections that are shallower but uniform in depth, to the brink of falls that is 4.4 km downstream of the proposed weir.

**Photograph 6: View of New Post Creek approximately half way between the short rapids and the brink of the falls.**



**Photograph 7: Brink of falls located 4.4 km downstream of the proposed weir location.**

**Photograph 8: Upstream view from the brink of the falls, located 4.4 km downstream of the proposed weir location.**

Photograph 8 shows the flatwater conditions upstream of the falls.

To summarize, the above series of photos illustrate the general flat nature of New Post Creek between the proposed weir and the falls, and how much of the habitat will remain wetted under the recommended minimum flow conditions.

Assessment of Proposed 3 cms Summer Minimum Flow on New Post Creek upstream of the falls to the proposed intake weir location

- Flow is assumed to be sufficient to maintain summer ecological function, based on:
    - Majority of wetted habitat will be maintained, though some very minor losses will occur along shoreline of flatwater sections, with somewhat greater losses of area at the localized flow control points discussed above.
    - Aquatic habitats will remain productive, though lower water levels throughout and the generally lower flow velocities may result in shifts in invertebrate and fish communities.
- Given the sparse nature of the fish community and the existing barrier of the waterfalls that prevents fish from moving upstream to utilize these habitats, any impacts upon the local fish community will have little significance, and broader impacts to downstream and upstream fish communities will be insignificant.
- The seasonal losses of habitat area downstream of the proposed intake weir, due to the imposed minimum summer flow, will probably be more than offset by the area of habitat gained due to the higher water levels that will be maintained upstream of the proposed intake weir.
- Each 1 cms increase in minimum flow is expected to result in an annual decrease of 1 GWh of energy production.

Lower New Post Creek Fish Collections.

The results of electrofishing within wadeable aquatic habitats downstream of the New Post Creek falls are provided in Table 3. This is probably a fairly typical assemblage of fish species for shallow water and the rapids in this area, given the location and adjacent habitats, however, the sparse nature of the fish community is also illustrated.

**Table 3: Results of electrofishing in New Post Creek, downstream of the falls. The date and effort in electroseconds is provided.**

| Species | August 24, 2009 1482 s | May 25, 2010 649 s | May 27, 2010 496 s | September 17, 2011 1678 s |
|---|---|---|---|---|
| Walleye (juvenile) | 1 | 2 | | |
| Shorthead redhorse | | 2 | | |
| Longnose sucker (juvenile) | | | | 1 |
| White sucker (YOY) | 1 | | | |
| Yellow perch (YOY) | 1 | | | |
| Sculpin (Mottled/Slimy) | 4 | | 1 | |
| Spoonhead sculpin | | | | 1 |
| Logperch | 11 | 10 | | 2 |
| Johnny darter | 1 | | | |
| Troutperch | | 1 | | |
| Lake chub | 6 | 5 | | |
| Longnose dace | 1 | 3 | | 13 |
| Burbot (juvenile) | | | 3 | |

**Figure 19: Aerial photograph of New Post Creek below falls. August 30, 2010. Flow = 13.7 cms.**

The habitat in lower New Post Creek, downstream of the waterfalls, is illustrated in Figure 19. After passing over the falls and through the narrow canyon chute (from the top of the photo, or from the east), flow passes over the alluvial fan via three main routes. Most of the flow passes along the north side and then down the west side (solid line), with the remaining flow split between two other routes (dashed lines). Most of the fish collected with backpack electrofisher in the previous table were collected from the wadeable sections of the solid line channel, and from the upper dashed line channel. The habitats along the lower 75% of the solid line are where the main spawning area occurs for Walleye, suckers, and other large spring spawning species. As illustrated in Figures 20 to 22, as flow decreases, less flow follows the dashed line channels (shown in Figure 19), until a point is reached at approximately 3 cms when almost all flow passes down the solid line channel (Figure 22). Though 3 cms would clearly be a reduction in habitat area from what would be maintained under normal low flows (compare with Figure 12), habitat quality would not decrease appreciably within the primary channel (solid line channel in aerial photo), because as flow is reduced it is initially at the expense of the two minor channels (dashed line channels in the aerial photo), therefore maintaining adequate depth in the primary channel to support existing habitat functions. Therefore, though habitat area is decreased, and therefore assumed to represent a loss in productivity, the habitat components found in this area at higher flows of 5 or 10 cms, are still present at a flow of 3 cms. Since the proposed 3 cms minimum flow will occur during the summer period, the resultant habitat changes are considered a local impact rather than something that impacts the broader aquatic community in the adjacent habitats of New Post Creek and the Abitibi River. An opportunity to compensate for the loss of riffle habitat may exist in the tailrace of the proposed GS.

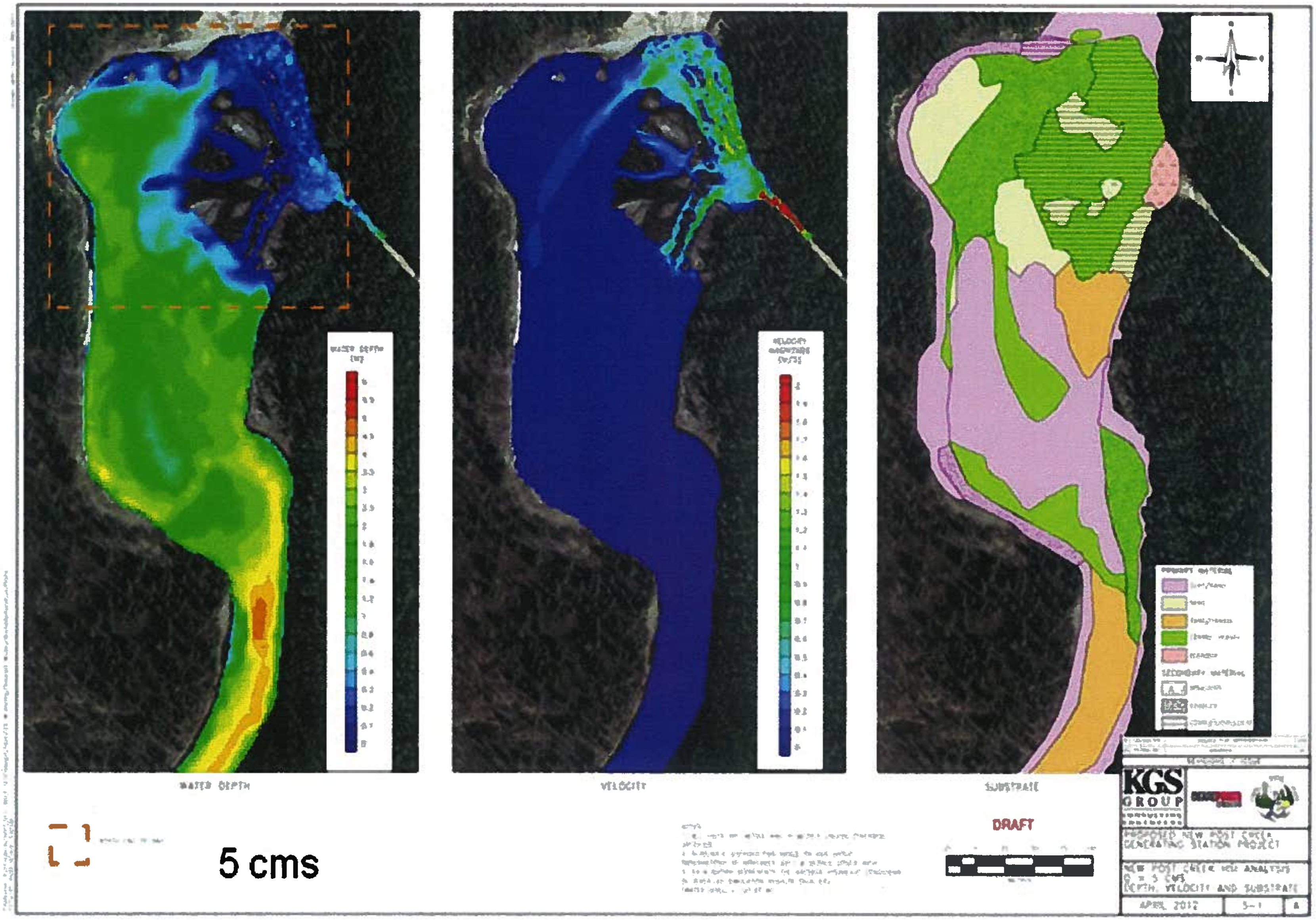



**Figure 20: Habitat parameters of water depth and water velocity at 5 cms, and substrate.**

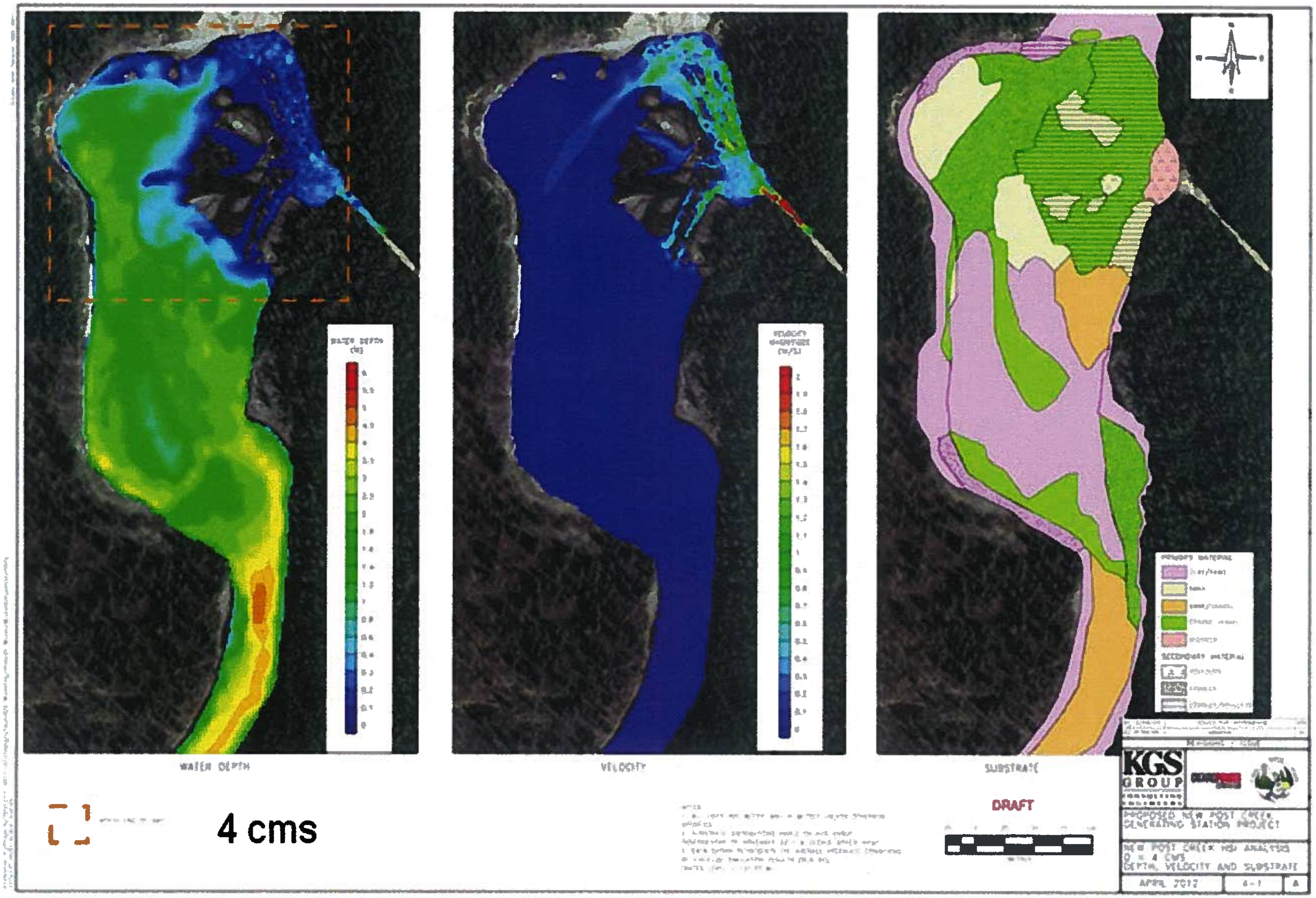



**Figure 21: Habitat parameters of water depth and water velocity at 4 cms, and substrate.**

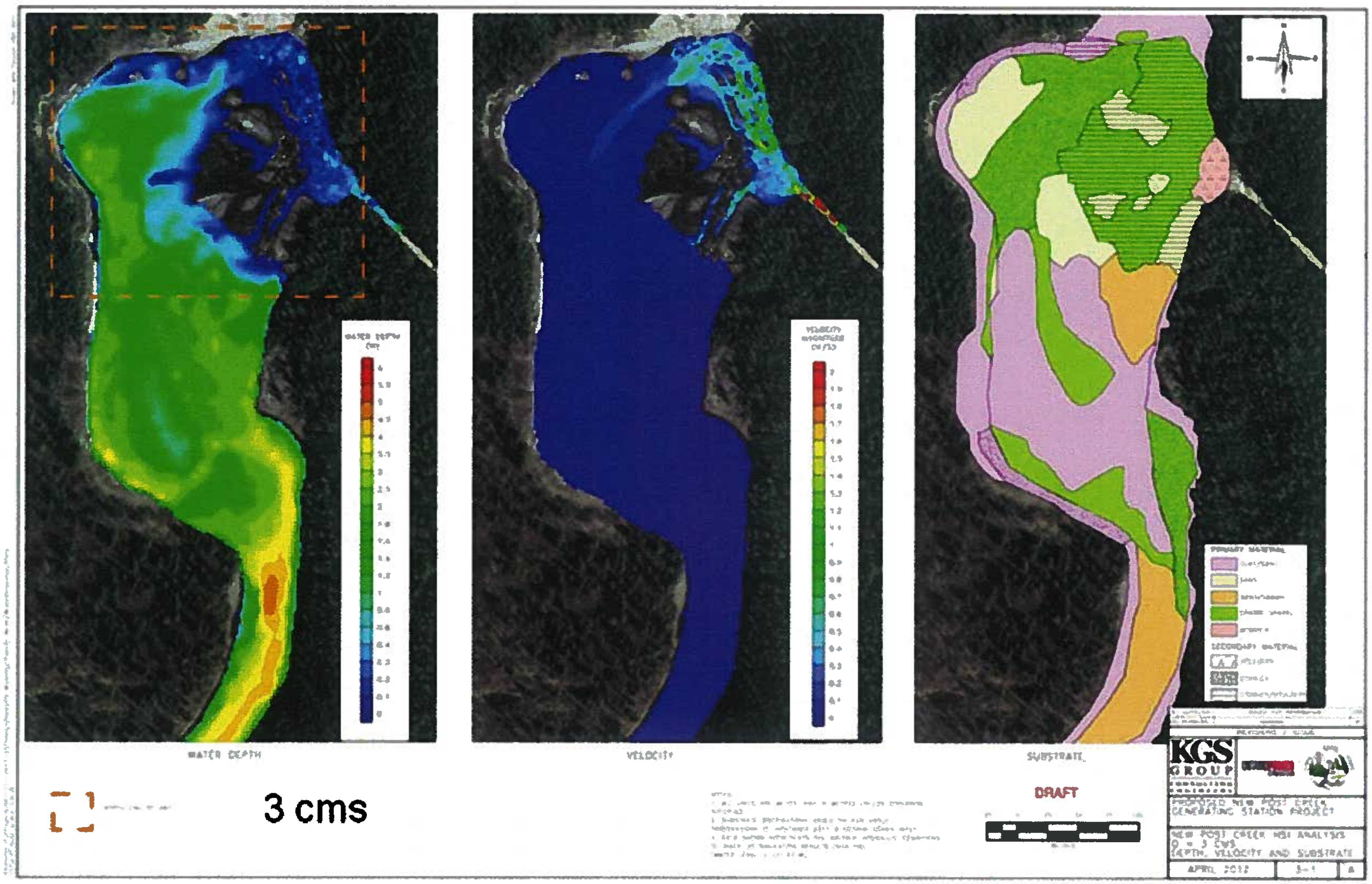



**Figure 22: Habitat parameters of water depth and water velocity at 3 cms, and substrate.**

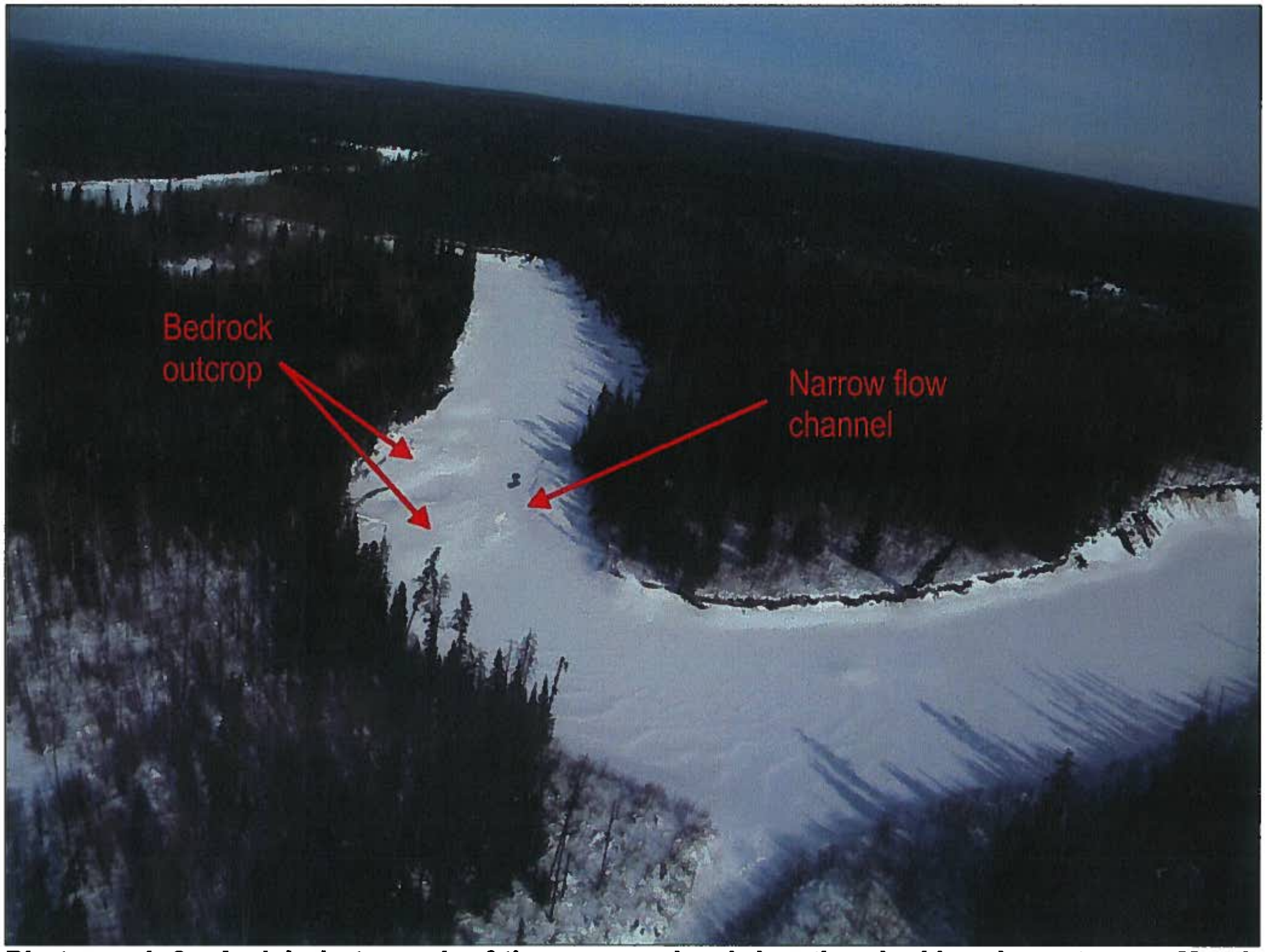
The 4 cms (Figure 21) and 3 cms (Figure 22) modeling results shows correspondingly less wetted area along the channels corresponding to the dashed line channels of the above aerial photograph (Figure 19), though there is little difference in wetted area, depth, and water velocity of the north channel that corresponds to the solid line channel of the aerial photograph.

Assessment of 3 cms Summer Minimum Flow, downstream of the falls to the Abitibi River

- Rapids contribute benthic invertebrate production as food to the local fish community.
- Presently a relatively diverse community of fish inhabit the alluvial fan rapids and adjacent shallows, but at fairly low densities.
- Based upon the previous points, during the summer the rapids are important locally, but likely do not contribute much beyond the lower New Post Creek area, except as a foraging area for fish from the Abitibi River that may enter the lower creek for that purpose. However, gillnetting in the Abitibi River and lower New Post Creek over 4 days in early September, 2011, found no evidence of elevated numbers of fish in lower New Post Creek, as compared to the Abitibi River, suggesting that fish do not concentrate there during the summer.
- The projected reduction in area of rapids habitat at the proposed 3 cms minimum flow, will probably result in a reduction in local invertebrate productivity, but it is not known if this will also translate into a reduction in local fish productivity, given the existing low fish densities observed in the creek itself. As mentioned in the previous point, there is no evidence that fish from the Abitibi River congregate in lower New Post Creek outside of the spring spawning period.
- Habitat quality does not appear to decrease appreciably within the primary channel (solid line channel in Figure 19), because as flow is reduced it is initially at the expense of the two minor channels (dashed line channels in Figure 19).
- The tailrace area of the proposed GS will provide flowing-water habitats with coarse substrates that do not currently exist, providing some compensation for the loss of such habitat in lower New Post Creek.
- Based on an estimate by KGS, an increase of 1 cms in minimum flow during the summer season (July to September) will reduce the energy production by approximately 1 GWh annually.

### 3.3 Minimum Flows: Winter Period (October – April)

The following series of photographs illustrate the winter low flow conditions in New Post Creek from the proposed weir location downstream to the falls and its confluence with the Abitibi River, as well as the flat nature of the watercourse upstream of the falls and the effect of the three water level control points to maintain upstream water levels. The flow determined at the WSC gauge was 7.9 cms at the time these photos were taken. These provide further evidence that substantial habitat areas can be maintained even under winter low flow conditions. Based on the following, a minimum flow of 1 cms is assumed to be adequate to maintain basic ecological function during the winter period.



**Photograph 9: Aerial photograph of the proposed weir location, looking downstream. March 4, 2012.**

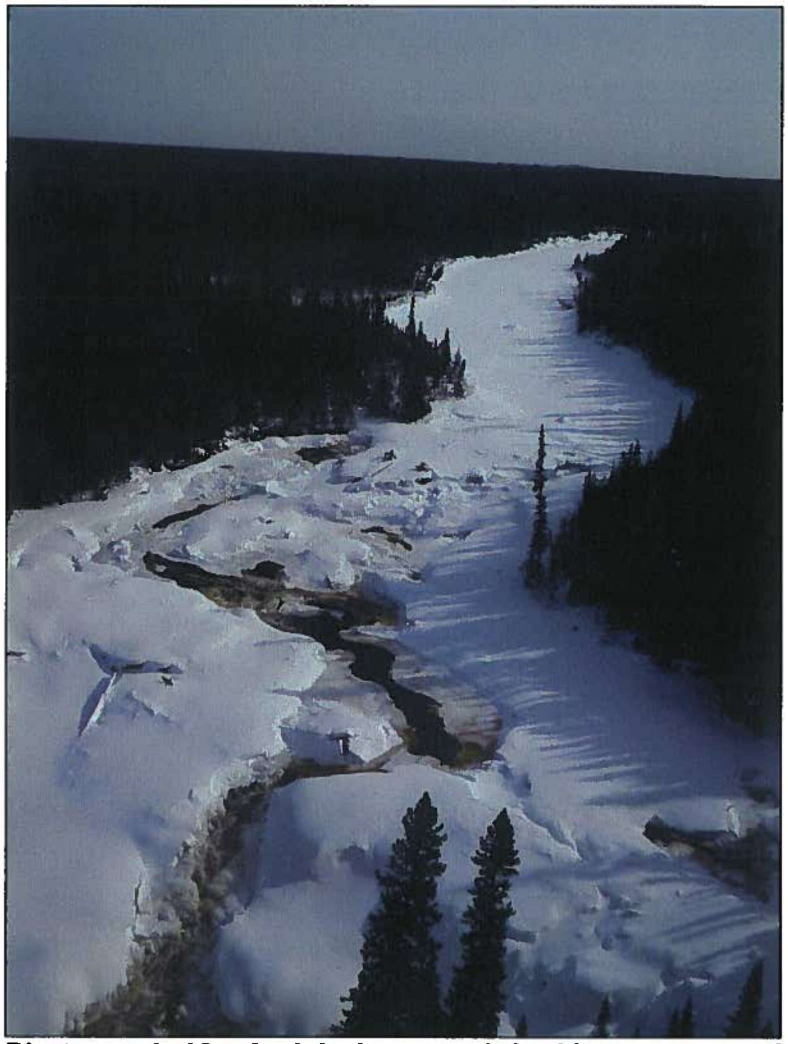
Photograph 9 is of the proposed weir location on New Post Creek. A dark spot on the ice can be seen where the reduced winter flow is concentrated in a narrow channel by the bedrock outcrop of the proposed weir site. Upstream and downstream of the bedrock outcrop, the channel is broad and wetted, as indicated by the smooth ice cover. As discussed as part of the summer low flow presentation, the bedrock outcrop at the proposed weir location is one of the control points in this section of New Post Creek that controls water levels and maintains wetted habitat area upstream. Downstream from the weir location the wetted habitat area is maintained by the bedrock outcrop shown in Photograph 10.

**Photograph 10: Aerial photograph of the bedrock outcrop control point that is located 1.1 km downstream of the proposed weir location. Upstream view. March 4, 2012.**

Photograph 10 is of the bedrock outcrop control point that is located 1.1 km downstream of the proposed weir location. Like the previous photograph, open water can be seen where the reduced winter flow is concentrated in a narrow channel by the bedrock outcrop. Upstream and downstream of this bedrock outcrop, the channel is broad and wetted, as indicated by the smooth ice cover. Downstream from this control point the wetted habitat area is maintained by the short set of rapids shown in Photograph 11.


**Photograph 11: Aerial photograph of the short rapids control point that is located 2.0 km downstream of the proposed weir location. Downstream view. March 4, 2012.**

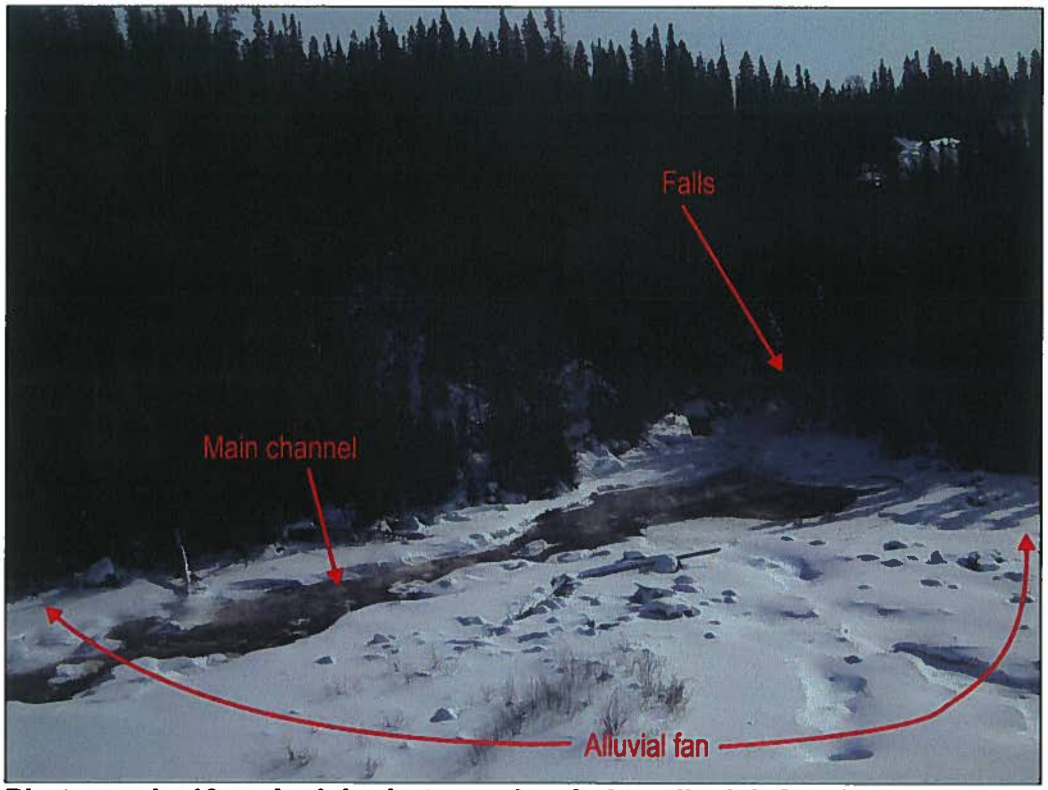
Photograph 11 shows the short rapids control point that is located 2 km downstream of the proposed weir location. Downstream of these rapids the channel is broad and wetted, as indicated by the smooth ice cover. Downstream from this control point the wetted habitat area is maintained by the next control point at the brink of the falls.



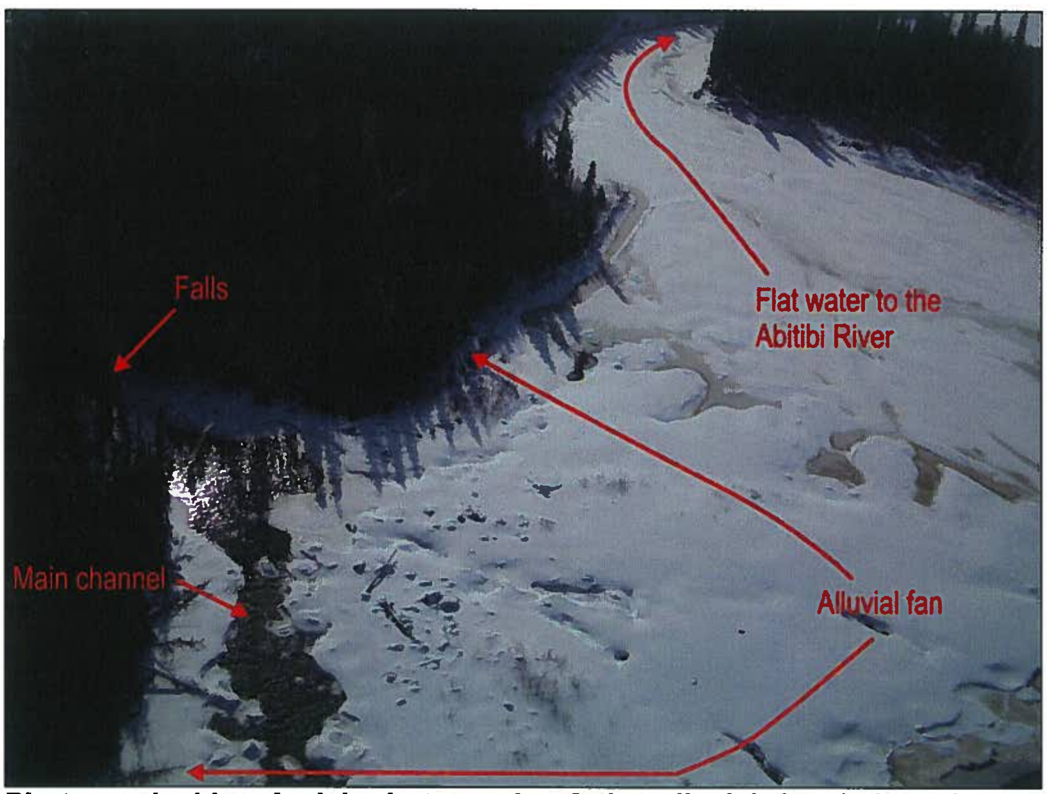
**Photograph 12: Aerial photograph looking upstream from the brink of falls, which is located 4.4 km downstream of the proposed weir location. March 4, 2012.**

Photograph 12 shows the upstream view from the brink of the falls that is located 4.4 km downstream of the proposed weir location. Upstream of this control point the channel is broad and wetted, as indicated by the smooth ice cover.

Photographs 13 and 14 illustrate the typical winter low flow conditions in New Post Creek downstream of the falls. The flow determined at the WSC gauge was 7.9 cms at the time these photos were taken. They show the main channel open, since that is where most of the flow goes. The rest of the alluvial fan is covered in ice, though there is some evidence of flowing water, at least occasionally, in the remaining two channels. These provide evidence that the main flow channel through the alluvial fan is the only substantial portion of riffle habitat that exists below the falls under typical winter low flow conditions, and that other portions of the alluvial fan likely do not contribute much habitat or benthic invertebrate production during the winter.



**Photograph 13: Aerial photograph of the alluvial fan below the New Post Creek falls. Upstream view, March 4, 2012.**



**Photograph 14: Aerial photograph of the alluvial fan below the New Post Creek falls. Downstream view, March 4, 2012.**

A flow of 1 cms would restrict flow below the falls to the main channel (see Figures 23 and 24), which would become somewhat narrower and shallower than shown in Photographs 13 and 14. However, the same habitat types will remain available, but more restricted in area. If the switch from 3 cms to 1 cms occurs at the end of September as proposed, the resident fish and invertebrates can move into their over-wintering positions prior to becoming relatively inactive at low temperatures, but after the reduction in minimum flow to 1 cms, and avoid the mortality that may occur if flow was reduced after they took up their winter locations. Benthic invertebrate drift would likely continue but at a reduced amount, though it is likely utilized by fish much less during the winter, and probably is not limiting to the fish community. Therefore, though the switch from 3 cms to 1 cms at the end of September may result is some minor shift in aquatic community composition, as well as minor changes in ecological functioning, these changes would likely be largely confined to the affected section of New Post Creek, and likely would not result in a significant impairment to offsite ecological contributions.

In terms of energy production, the winter months represent a key period due to typically low water flows. It is currently estimated that an increase in minimum flow of 1 cms will result in an annual reduction in energy production of 2.4 GWh (~2% of total energy).

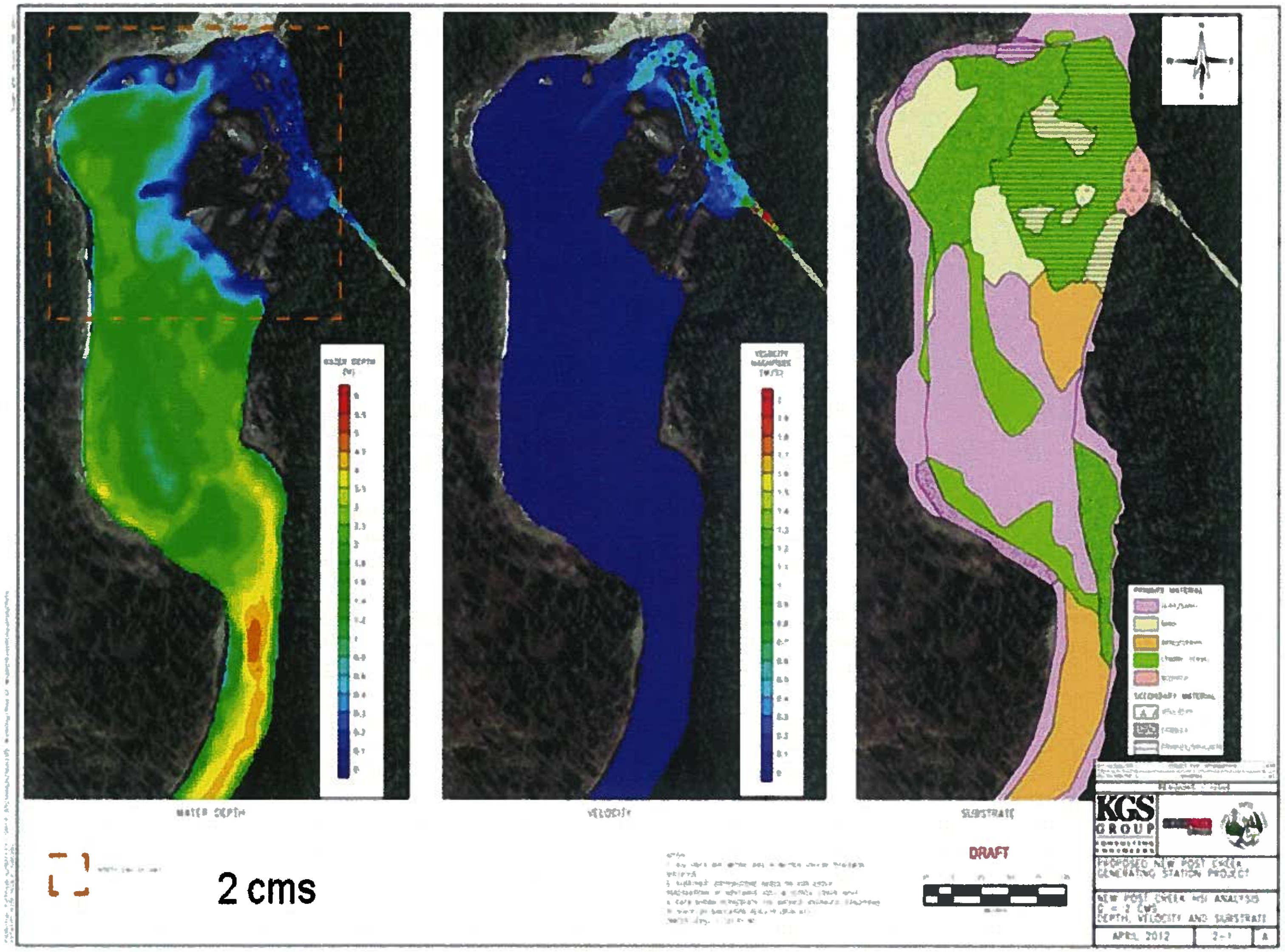



**Figure 23: Habitat parameters of water depth and water velocity at 2 cms, and substrate.**

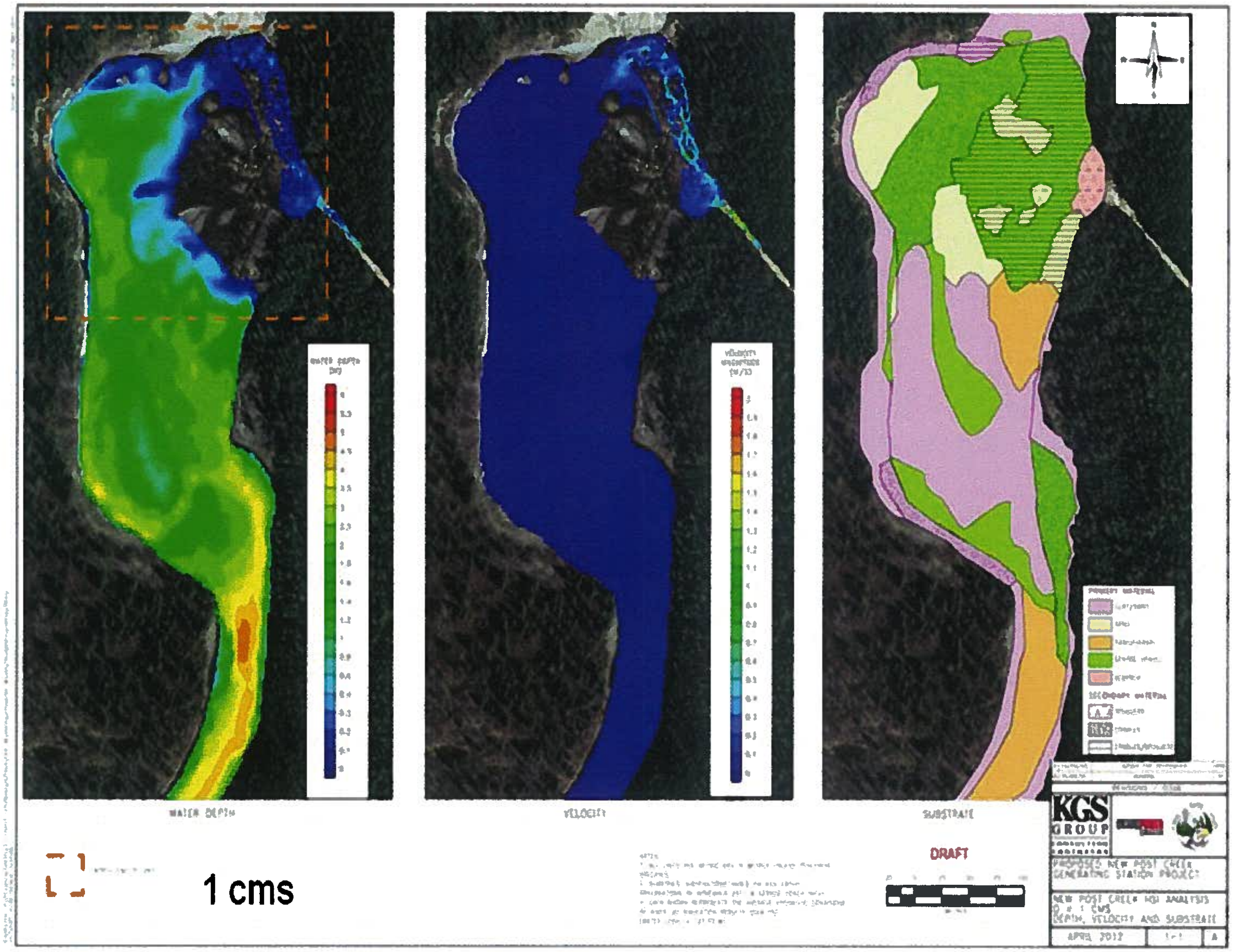



**Figure 24: Habitat parameters of water depth and water velocity at 1 cms, and substrate.**

Assessment of 1 cms Winter Minimum Flow

- Winter minimum flow of 1 cms is assumed to be adequate to maintain ecological function, based upon:
    - Water temperatures will be at or close to zero, and most fish and invertebrates will be in a state of minimal activity.
    - Majority of wetted habitat upstream of the falls will be maintained, though some minor losses will occur along shoreline of flatwater sections, with somewhat greater losses of area at the small and localized flow control points discussed above.
    - Aquatic habitats upstream of the falls will remain productive, though lower water levels and the lower flow velocities will likely result in shifts in the invertebrate and fish communities.
    - Majority of wetted habitat area downstream of the falls will be maintained, because water level downstream of the alluvial fan is controlled by the Abitibi River. Though riffle habitats of similar quality will be maintained in the alluvial fan, they will be reduced in area.
- Given the sparse nature of the fish community and the low winter activity of most fish and invertebrates in New Post Creek and adjacent habitats, any impacts upon the local fish community will have little significance, and broader impacts to downstream and upstream fish communities will be insignificant.
- Transition from 3 cms summer flow to 1 cms winter flow should occur at the end of September when fish and invertebrates are still active, so no further dewatering of habitat will occur after they take up their over-wintering positions.
- Based on the estimate by KGS, an increase of 1 cms in minimum flow during the winter season (October to April) will reduce the energy production by approximately 2.4 GWh annually.

## 4.0 Conclusions

While this summary document has primarily focused on the ecological implications of various minimum flow scenarios, additional impacts to energy production has also been included for context. Balancing the ecological and energy production impacts on minimum flow, CRP/OPG team recommends the following:

- 10 cms minimum flow during the Walleye spawning and incubation period will be adequate to protect the spring spawning fishes below New Post Creek Falls. Spawning fishes below New Post Creek falls contribute to the wider fish community of the adjacent Abitibi River. It is expected that the provision of this minimum flow will only be required occasionally.
- 3 cms minimum flow during the summer will maintain habitats in New Post Creek, but in a somewhat altered and/or reduced area from what occurs now. While this will likely have an insignificant impact upon the wider fish community upstream and downstream, because most of the impacted area is isolated from off-site habitats and fish from the Abitibi River do not appear to congregate in lower New Post Creek outside of the spring spawning period, habitat compensation may be required for the reduced habitat area of the rapids downstream of New Post Creek Falls.
- 1 cms minimum flow during the winter will maintain basic habitats during this time of minimal productivity.

## 5.0 References

Becker, G.C. 1983. Fishes of Wisconsin. Univ. of Wisconsin Press. Madison, Wisconsin. 1052 pp.

Chiotti, J.A., J.M. Holtgren, N.A. Auer, and S.A. Ogren. 2008. Lake sturgeon spawning habitat in the Big Manistee River, Michigan. North American Journal of Fisheries Management 28: 1009-1019.

Dick, T.A, R.R. Campbell, N.E. Mandrak, B. Cudmore, J.D. Reist, J. Rice, P. Bentzen, and P. Dumont. 2006. Update COSEWIC status report on the lake sturgeon *Acipenser fulvescens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 107 pp.

Dumont, P., J. D'Amours, S. Thibodeau, N. Dubuc, R. Verdon, S. Garceau, P. Bilodeau, Y. Mailhot, and R. Fortin. 2011. Effects of the development of a newly created spawning ground in the Des Prairies River (Quebec, Canada) on the reproductive success of lake sturgeon (*Acipenser fulvescens*). Journal of Applied Ichthyology 27: 394-404.

Gillenwater, D., T. Granata, and U. Zika. 2006. GIS-based modeling of spawning habitat suitability for walleye in the Sandusky River, Ohio, and implications for dam removal and river restoration. Ecological Engineering, 28: 311-323.

Golder Associates. 2011. Groundhog River Lake Sturgeon 2011 Monitoring Study. Prepared for Xstrata Nickel, 85 RR8 Strathcona Complex – 3rd Floor, Onaping, Ontario, by Golder Associates Ltd., 1010 Lorne Street, Sudbury, Ont., P3C 4R9. Report Number 11-1197-0004. 26 p + 1 appendix.

Holm, E., N.E. Mandrak, and M.E. Burridge. 2009. The ROM field guide to freshwater fishes of Ontario. Royal Ontario Museum, Toronto. 462 p.

La Haye, M., A. Branchaud, M. Gendron, R. Verdon and R. Fortin. 1992. Reproduction, early life history, and characteristics of the spawning grounds of the lake sturgeon (*Acipenser fulvescens*) in Des Prairies and L'Assomption rivers near Montreal, Quebec. Canadian Journal of Zoology 70: 1681-1689.

McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984, "Habitat suitability information: walleye", U.S. Dept. Int. Fish Wildl. Serv., FWS/OBS-82/10.56.

Scott, W.B and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 183. Ottawa, Canada. 966 pp.