AQUATIC ENVIRONMENT TECHNICAL SUPPORTING DOCUMENT FOR THE HOUND CHUTE PROJECT

Submitted To:

ONTARIO POWER GENERATION

Submitted By:

Montreal River EA Consulting Team

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EXECUTIVE SUMMARY

Ontario Power Generation Inc. (OPG) is proposing to redevelop the Hound Chute Generating Station (GS), a run-of-the-river hydroelectric power plant located on the Montreal River in northeastern Ontario. The Hound Chute GS has been in operation for 98 years and is at the end of its designed service life. The existing nameplate capacity of Hound Chute GS is 3.6 megawatts (MW). The proposed undertaking will replace the existing generating facility and when completed, will provide an expected nameplate capacity of 9.5 MW, an increase of approximately 6.0 MW. In order to construct the new powerhouse, the existing powerhouse and associated water conveying and electricity connection facilities will be decommissioned. In addition to building a new generating station all existing civil structures on the site shall be rehabilitated or upgraded including the replacement of the flash boards with an automatic bladder type weir.

The proposed Hound Chute GS redevelopment on the Montreal River is subject to the Class Environmental Assessment for Modifications to Hydroelectric Facilities prepared under the Ontario *Environmental Assessment Act*. This aquatic environmental assessment is being undertaken as part of this Class Environmental Assessment.

During proposed Hound Chute GS construction, potential effects on the aquatic environment may occur due to in-water construction activities, blasting, soil erosion and turbidity generation, accidental spills and waste generation. Based on an assessment of the available baseline information and potential effects, as well as the implementation of recommended mitigative measures, it is concluded that effects during construction will be minimal, localized and short-term.

During proposed Hound Chute GS operation, potential effects on the aquatic environment may occur due to accidental spills. This concern has been primarily addressed through the use of oil-free equipment such as Vacuum breakers and dry type transformers. However, during facility operation, there is still a risk of an accidental spill. If a spill should occur, it will be managed and adverse effects mitigated based on the Spills Emergency Preparedness and Response Plan. Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed hydroelectric power plant will have minimal effects on the aquatic environment.

Environmental protection during construction and operation will be ensured by adherence to the Environmental Management Plan, as well as compliance with regulatory standards and guidelines.

TABLE OF CONTENTS

Page No.

EXECUTIVE SUMMARY ES-1

ACRONYMS AND ABBREVIATIONS AC-1

GLOSSARY G-1

1.0 INTRODUCTION 1-1
- 1.1 Project Description 1-2
- 1.2 Description of the Study Area 1-7
- 1.3 Study Approach 1-8
- 1.4 Structure of Report 1-9

2.0 BASELINE AQUATIC ENVIRONMENTAL 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 Montreal River 2-1
    - 2.1.3.1 Hydrology 2-1
    - 2.1.3.2 Morphology and Bathymetry 2-5
- 2.2 Aquatic Environment Resources 2-5
  - 2.2.1 Water Quality 2-5
  - 2.2.2 Sediments and Sediment Quality 2-7
  - 2.2.3 Aquatic Vegetation 2-9
  - 2.2.4 Plankton 2-9
  - 2.2.5 Benthic Macroinvertebrates 2-10
  - 2.2.6 Fisheries Resources 2-11
    - 2.2.6.1 Fish Habitat and Communities 2-16
  - 2.2.7 Aquatic Avifauna 2-19
  - 2.2.8 Significant Aquatic Wildlife Species 2-21
  - 2.2.9 River Uses 2-21
    - 2.2.9.1 General Recreation 2-21
    - 2.2.9.2 Recreational Boating 2-22
    - 2.2.9.3 Commercial Fishing 2-22
    - 2.2.9.4 Sportfishing 2-23
    - 2.2.9.5 Municipal Water Supply 2-23
    - 2.2.9.6 Hydropower Facilities 2-24
    - 2.2.9.7 Other Uses 2-24

3.0 IMPACT ASSESSMENT AND MITIGATIVE MEASURES 3-1
- 3.1 Surface and Groundwater Hydrology 3-1
- 3.2 Montreal River 3-3
  - 3.2.1 Hydrology 3-3
  - 3.2.2 Water Quality 3-4
  - 3.2.3 Sediments 3-5
  - 3.2.4 Aquatic Vegetation 3-5
  - 3.2.5 Plankton 3-5
  - 3.2.6 Benthic Macroinvertebrates 3-5

3.2.7 Fish Populations 3-6
3.2.8 Fish Habitat 3-10
3.2.9 Aquatic Avifauna 3-15
3.2.10 Water Uses 3-15
3.2.11 Marsh Bay 3-15

4.0 SUMMARY AND CONCLUSIONS 4-1

5.0 REFERENCES 5-1

APPENDIX 1 FISHERIES SURVEY AND IMPACT ASSESSMENT REPORTS

LIST OF TABLES

Page No.

1.1 Existing and Proposed Plant Operational Summary 1-7

2.1 Monthly and Annual Mean Discharges (m^3/s) of the Montreal River 2-2
2.2 Annual Flow Metrics for the Montreal River at Hound Chute, 1972 to 1995 2-5
2.3 Montreal River Water Quality at Latchford 2-6
2.4 Montreal River Sediment Quality Data 2-8
2.5 Benthic Macroinvertebrate Community Composition Downstream of the Hound Chute GS 2-10
2.6 Fish Species Recorded in the Montreal River 2-12
2.7 Fish Species Captured and/or Observed Near the Latchford Dam and the Hound Chute GS 2-13
2.8 Summary of Fish Consumption Advisories, Montreal River at Matachewan 2-15
2.9 Aquatic Avifauna Species Observed in the Temiskaming Area 2-19
2.10 Fishing Seasons in Division 18 Fishery Area 2-23
2.11 Summary of Hydroelectric Facilities and Dam Structures in the Montreal River Watershed 2-25

4.1 Summary of Potential Effects and Recommended Mitigative/Remedial Measures 4-2

LIST OF FIGURES

Page No.

1.1 Hound Chute GS Location 1-1
1.2 Current Facilities, Hound Chute GS 1-3
1.3 Montreal River Watershed and OPG Facilities....................1-4
1.4 Proposed Facilities and Cofferdam Locations, Hound Chute GS 1-5
1.5 Local Study Area....................1-8

2.1 Maximum and Minimum Daily Discharge for the Montreal River 2-3
2.2 Annual Daily Flow Hydrographs from 1972 to 1995 for the Montreal River at Hound Chute....................2-4
2.3 Bathymetry, Substrate and Flow Velocity Features Within the Upstream Portion of the Hound Chute GS Study Area 2-17
2.4 Bathymetry, Substrate and Flow Velocity Features Within the Downstream Portion of the Hound Chute GS Study Area 2-18

3.1 Proposed Redevelopment Works, Water Depths and Other Details Considered in the Fisheries Impact Assessment 3-12

LIST OF PHOTOGRAPHS

Page No.

1.1 Hound Chute GS....................1-2
1.2 Existing Submerged Structure at Low Water Levels, Hound Chute GS Forebay Inlet...1-6

3.1 Downstream View Within the Spill Channel 3-8
3.2 View of Intake Channel, Upstream of the Hound Chute GS 3-13
3.3 View of Hound Chute GS Tailrace 3-13
3.4 View of Upstream Side of Crest Weir at the Upstream End of the Spill Channel.........3-14

ACRONYMS AND ABBREVIATIONS

AP	Acid potential
ARD	Acid rock drainage
B	Breeding
BMP	Best Management Practice
C	Common
CCME	Canadian Council of Ministers of the Environment
CHDI	Canadian Hydro Developers Inc.
Cl.	Class
CLI	Canada Land Inventory
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DBC	Design-Build-Contractor
ECGM	Environmental Construction Guidelines Manual
ER	Environmental Report
et al.	And others
etc.	And so on (et cetera)
F.	Family
GS	Generating station
>	Greater than
HADD	Harmful alteration, disruption or destruction (of fish habitat)
ISQG	Interim sediment quality guideline
LEL	Lowest effect level
LRIA	*Lakes and Rivers Improvement Act*
M	Migrant
ML/ARD	Metal Leaching and Acid Rock Drainage
MNR	Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MOEE	Ontario Ministry of Environment and Energy
N	North
N/A	Not available
NHIC	Natural Heritage Information Centre
NP	Neutralizing potential
O.	Order
OPG	Ontario Power Generation
P.	Phylum
PCBs	Polychlorinated biphenyls
PEL	Probable effect level
PSQG	Provincial Sediment Quality Guideline
PWGSC	Public Works and Government Services Canada
PWQO	Provincial Water Quality Objective
Q2	Second quarter (of the year)
R	Rare

S1	Extremely rare in Ontario; usually fewer than 5 occurrences (in a 10-km by 10-km Mercator square grid)
S1S2	Extremely rare to very rare in Ontario
S2	Very rare in Ontario; usually between 5 to 20 occurrences (in a 10-km by 10-km Mercator square grid)
S2S3	Very rare to uncommon in Ontario
S3	Rare to uncommon in Ontario; usually between 20 to 100 occurrences (in a 10-km by 10-km Mercator square grid)
S4	Common in Ontario; apparently secure, usually more than 100 occurrences (in a 10-km by 10-km Mercator square grid)
S5	Very common in Ontario; demonstrably secure
SAN	Accidental
SARA	*Species at Risk Act*
SENES	SENES Consultants Limited
S.F.	Sub Family
S.O.	Sub Order
SEL	Severe effect level
sp.	One species
SZN	Not of practical conservation concern as there are no clearly definable occurrences
TEL	Threshold effect level
TOC	Total organic carbon
U	Uncommon
V	Very rare
W	West

MEASUREMENT UNITS

°	Degree
GWh	gigawatt-hour
km	Kilometre
km^2	square kilometre
kV	Kilovolt
L/s	litre per second
m	Metre
m^3/s	cubic metre per second
MW	Megawatt
µg/L	microgram per litre
µg/g	microgram per gram
’	Minute
%	Percent
$/m^3$	per square metre
”	Second
y	Year

GLOSSARY

Algae	A group of unrelated simple plant organisms that live in aquatic habitats.
Alkalinity	Measure of a water's capacity to neutralize an acid.
Amphibole	A group of double chained inosilicate minerals whose basic chemical unit is the tetrahedron (SiO_4); they are common rock forming minerals and are found in most igneous and metamorphic rocks.
Annelida	A phylum of invertebrates comprising the segmented worms.
Aquatic macrophytes	Rooted, usually vascular, aquatic plants, such as water lily, cattail, coontail, etc.
Arthropoda	A phylum of invertebrate animals characterized by an outer body layer, the exoskeleton.
Avifauna	Birds.
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.
Bivalva (Pelecypoda)	Clams.
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.).
Capacity Factor	Ratio of the actual energy produced to the maximum energy which could be delivered under continuous operation at maximum rating.
Chironomidae (chironomids)	Midge fly larvae.
Chute	A steeply-inclined natural passageway or constructed pipe or channel which conveys water from a higher to a lower level.
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.
Coleoptera	Beetles (aquatic).
Conductivity	Numerical expression of a water's ability to conduct an electrical current; the conductivity of water is dependent on its ionic concentrations and temperature.
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	Flies.
Drawdown	The magnitude of the change in water surface elevation of a well, reservoir, or other natural body of water, resulting from the withdrawal of water.
Ephemeroptera	Mayfly larvae.
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.
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.
Flash board	A wood plank, steel member or inflatable rubber membrane placed at the top of a spillway to increase the storage capacity of a reservoir.
Forebay	The part of a dam's reservoir that is immediately upstream from the powerhouse.
Freshet	High flows in a stream or river, usually occurring in the spring, caused by snow melt, runoff, heavy rains and/or high inflows.
Genus (plural genera)	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 metamorphic coarse grained igneous rock with the recrystallization of quartz, feldspar, micas and amphiboles into bands.
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.
Headgate (Control Gate)	The gate that controls water flow into a hydroelectric dam.
Headpond	The reservoir from which water is extracted for power generation or spillage.
Hydrograph	A graph describing stream discharge over time.
Igneous	Rocks formed from the solidification of molten magma either beneath (intrusive igneous rock) or at (extrusive igneous rock) the earths' surface.
Insecta	Insects.
Intake	A structure which regulates the flow of water into a water-conveying conduit.
Ion (ionic)	An atom that is either negative or positively charged.
Leachate	Solution containing material (chemicals) leached (removed) from a solid matrix (soil, rock) by an aqueous medium (water, acid).
Lotic	Flowing water, e.g., in streams and rivers.

Magma	Molten rock originating from the earth's interior.
Metamorphic	A rock that forms from the recrystallization of igneous, sedimentary or other metamorphic rocks through pressure increase, temperature use, or chemical alteration.
Metamorphism	A process that produces a change in the chemistry, structure or mineralogic composition of solid rock, usually due to temperature and/or pressure changes.
Mica	Silicate mineral that exhibits a platy crystal structure and perfect cleavage.
Mirex/Photomirex	Although mirex (a cyclodiene insecticide) is no longer produced or used in North America, it is very persistent in the environment and highly resistant to degradation; it is reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity in experimental animals; mirex can be photochemically converted in the environment to photomirex, a suspected gastrointestinal or liver toxicant.
Mollusca	Molluscs (snails and clams).
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	Worms.
Order	A category used in the classification of organisms that consists of one or several similar or closely related families.
Overburden	The soil, rock and other material which lies on top of the underlying mineral or other deposit, e.g., bedrock.
Peaking Facility	A facility that meets peak energy demands which generally occur between 07:00 and 23:00 h on weekdays; the water is drawn from upstream reservoirs during the periods when electricity is generated by these facilities.
Periphyton (Aufwuchs)	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.
Phylum	A major division of the animal kingdom containing classes of animals.
Plankton	Minute organisms that drift or float passively with the current of a waterbody.
Platyhelminthes	A phylum of acoelomate (without a coelum) invertebrates comprising the flatworms, characterized by a flattened unsegmented body.
Polychlorinated Biphenyls	A group of biologically persistent organic compounds containing chlorine, previously used in electrical transformers and capacitors because of their insulating capacity and fire resistance; due to their persistence, they are being phased out and destroyed.
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 turbine blades.

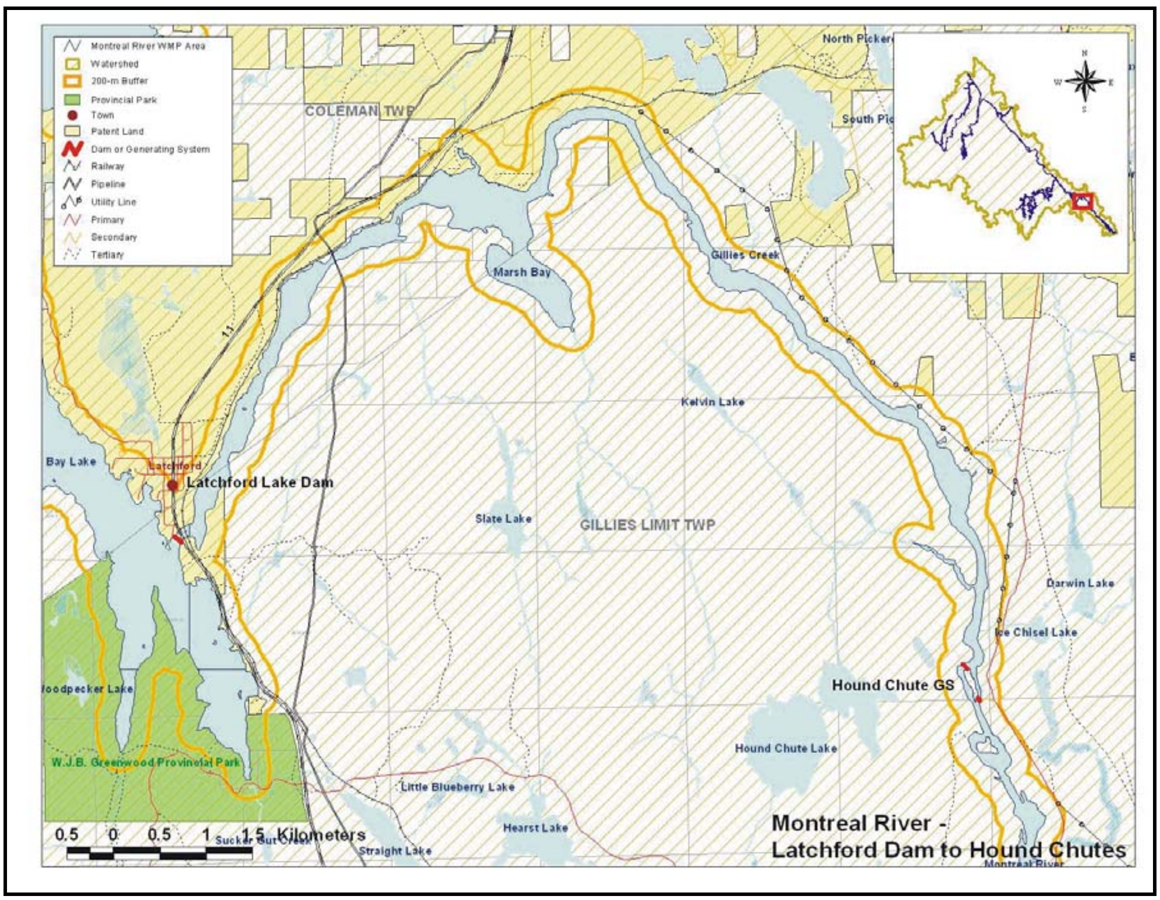
Precambrian	Encompasses the time between the origin of the earth and the appearance of complex forms of life about 600 million years ago, and is believed to be equivalent to as much as 90% of the earth's 405-billion-year history.
Quartz	A mineral: an oxide of silicon which is abundant and widespread occurring as an important constituent in many igneous, sedimentary and metamorphic rocks.
Rotifer	Small, usually microscopic, pseudocoelomate (lacking a true coelum) unsegmented animals, with a ciliated region, the corona, at the anterior end, comprising part of the zooplankton community in waterbodies.
Run-of-the-River	A power plant that has no upstream storage capacity and must pass all flows as they come.
Schist	A medium to coarse grained metamorphic rock with micas generally the dominant minerals in the rock tending to orient themselves in such a way that their thin plates lie essentially parallel to each other, imparting a layered structure to the rock.
Shannon-Wiener 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.
Sill	Horizontal planes of igneous rock that run parallel to the grain of the original rock deposits; they form when magma enters and cools in bedding planes found within the crust.
Simuliidae	Blackfly larvae.
Sluiceway (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).
Special Concern	A species with 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.
Spillway	A passageway, or channel, 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 spillway must be capable of discharging major floods without damaging the dam while maintaining the reservoir level below some predetermined maximum level.
Stoplog	A gate (sometimes made from squared lumber) which can be placed into an opening to shut off or regulate the flow of water.
Tailrace	A channel through which the water flows away from a hydroelectric plant following its discharge from the turbine(s).
Taxon (plural taxa)	
Terrestrial	Belonging, living on or growing in the earth or land.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Total Kjeldahl Nitrogen	Measure of both ammonia and organic nitrogen.
Trichoptera	Caddisfly larvae.
Tricladida	Planarians, an order of Turbellaria.

Turbellaria	Free-living flatworms.
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.
Weir	A dam in the river to stop and raise the water.
Wing-wall	A flaring vertical wall on either side of a weir.
Zooplankton	That portion of plankton consisting of animals, usually minute crustaceans and other small multicellular and single cellular animals.

1.0 INTRODUCTION

Ontario Power Generation Inc. (OPG) is proposing to redevelop the Hound Chute Generating Station (GS), a run-of-the-river hydroelectric power plant located on the Montreal River in northeastern Ontario (see Figure 1.1). The existing nameplate capacity of Hound Chute GS is 3.6 megawatts (MW). The proposed undertaking will replace the existing generating facility and when completed, will provide an expected nameplate capacity of approximately 9.5 MW, an increase of approximately 6 MW. The proposed Hound Chute GS will be connected to the existing 44-kilovolt (kV) feeder as part of the local distribution system. In order to construct the new powerhouse, the existing powerhouse and associated water conveying and electricity connection facilities will be decommissioned. In addition to building a new generating station, all existing civil structures on the site shall be rehabilitated or upgraded including the replacement of the flash boards with an automatic bladder type weir.

Figure 1.1: Hound Chute GS Location



The new facility will continue to operate under the existing operating regime that has been long established and more recently formalized in the Water Management Plan for the Montreal River (OPG *et al.*, 2004).

In 2000, the Ontario *Lakes and Rivers Improvement Act* (LRIA) was amended to establish the statutory authority of the Ministry of Natural Resources (MNR) to order the preparation of Water Management Plans for operation of waterpower facilities and associated control structures and ensure compliance with the Plans. The intent of the Water Management Plan is to provide certainty and clarity as to how waterpower facilities and control structures are operated with respect to levels and flows so as to balance environmental, social and economic objectives.

The Water Management Plan for the Montreal River system is the result of partnership between OPG, the MNR and Public Works and Government Services Canada (PWGSC) which operate hydroelectric generating facilities as well as flood control and civil structures along the river, as well as First Nations and the general public, which participated in the form of various advisory committees (OPG *et al.*, 2004).

The Water Management Plan was prepared in accordance with the Water Management Planning Guidelines for Waterpower (MNR, 2002). The Water Management Planning Guidelines were approved by the Minister of Natural Resources on 14 May 2002. The LRIA requires compliance by facility operators with the operating regimes established in the Water Management Plan.

1.1 PROJECT DESCRIPTION

Current Facilities

The 3.6-MW Hound Chute GS is located on the Montreal River straddling the townships of Latchford and Coleman in the District of Timiskaming, approximately 10 km southwest of the Town of Cobalt. This 4-unit plant, initially placed in service in 1908, is accessed by Silverfields Road which is maintained by OPG but open to public use. Photograph 1.1 depicts Hound Chute GS.

Photograph 1.1: Hound Chute GS

The Hound Chute GS has a cement-capped rockfill weir and a concrete spillway terminating in abutments at each end. Flash boards are removed each spring prior to the freshet to help mitigate flooding upstream. The dam diverts the river through a 427-m intake canal excavated along the east bank of the river, directly to the headgates (see Figure 1.2). The bottom of the large forebay is 0.3 m deeper than the intake. Two underflow sluices built at the south end of the powerhouse are large enough to take all of the water during very low water flow conditions. At the intake of each turbine chamber, there is a gate 3 m high by 4.6 m wide with a pass and gate lifting apparatus as well as two stoplog checks.

Figure 1.2: Current Facilities, Hound Chute GS

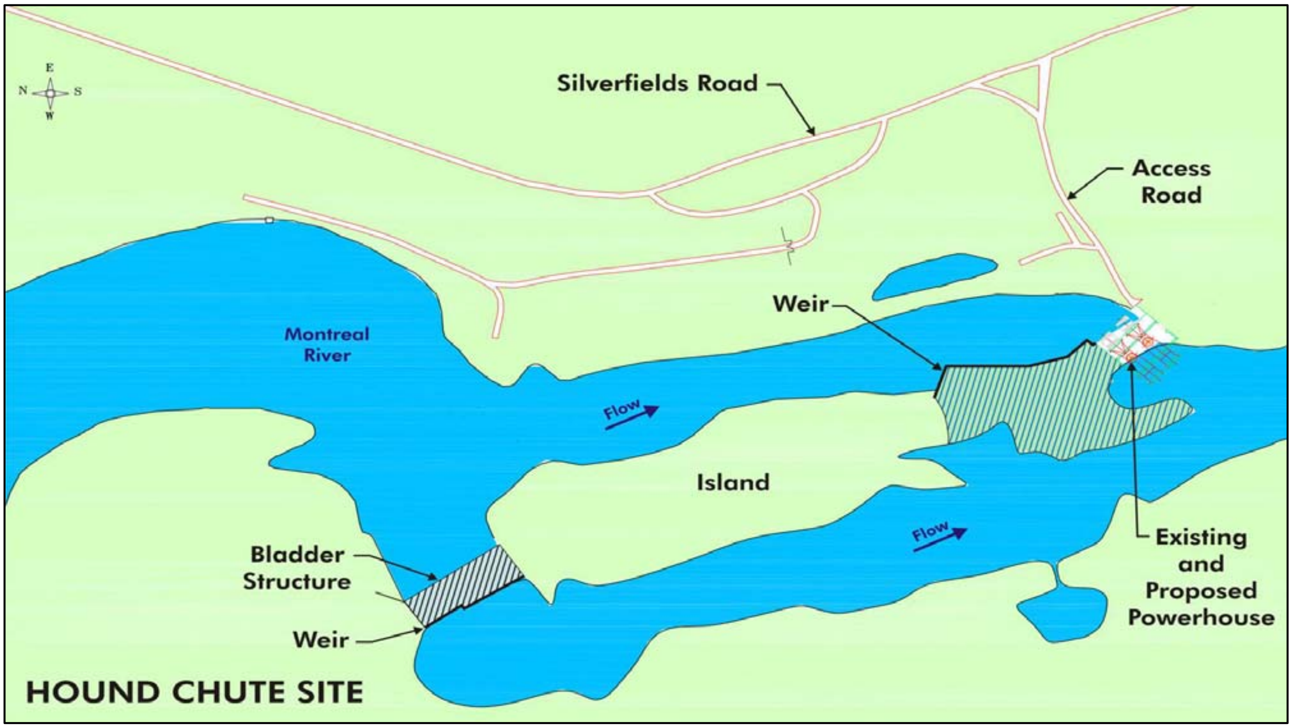
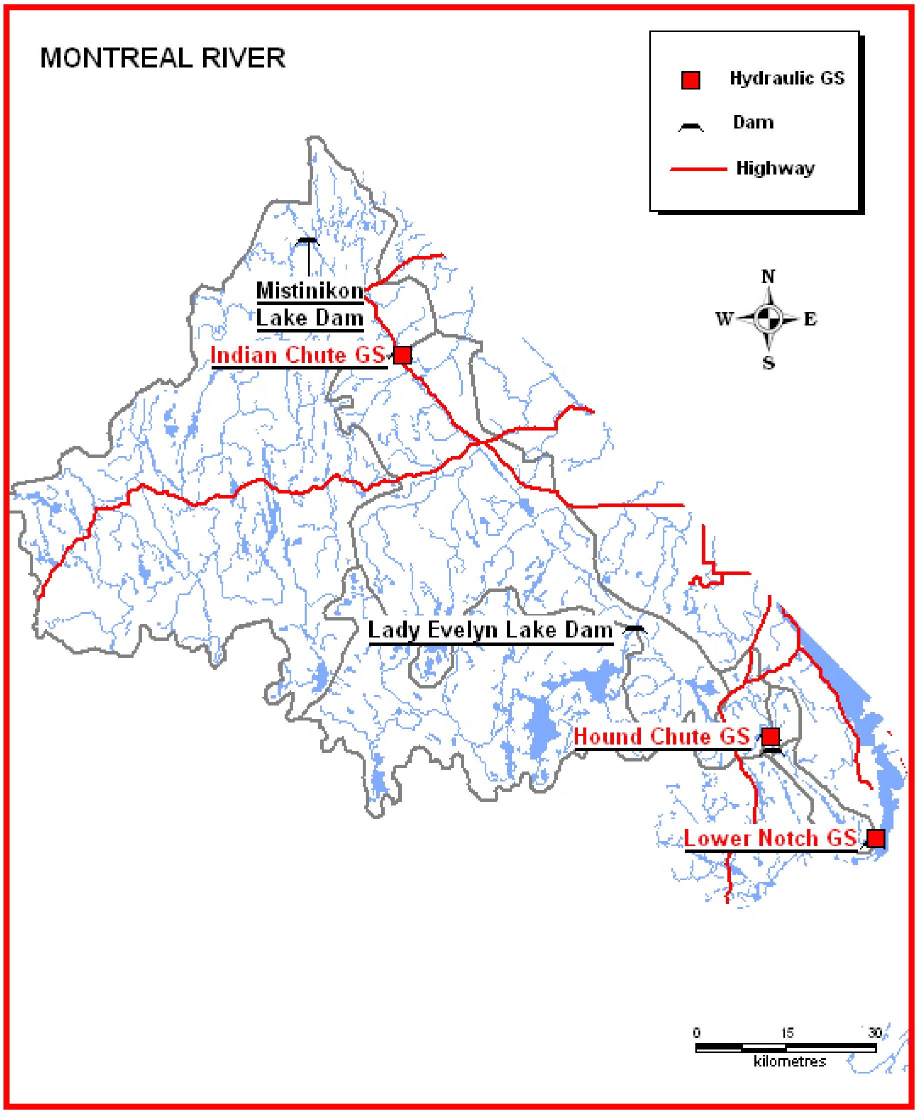


Figure 1.3: Montreal River Watershed and OPG Facilities



Proposed Facilities

The proposed Hound Chute GS is planned to be located on the same footprint as the existing powerhouse and will consist of two units with a total expected nameplate capacity of approximately 9.5 MW. The existing powerhouse will be demolished followed by the construction of the new facility.

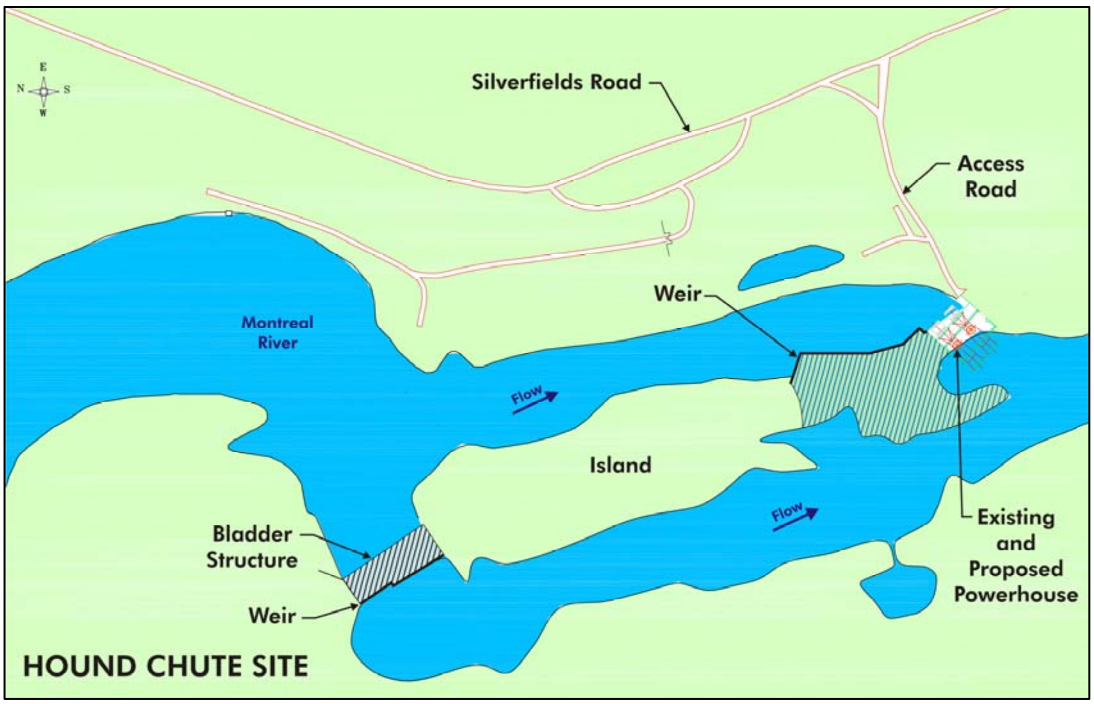
Water would continue to be conveyed from the forebay along the existing canal into a direct intake in the new powerhouse.

A small amount of excavation and slope stabilization will be required for the new powerhouse foundation and underground tailrace canal. Geotechnical studies at the new powerhouse site and the nearshore of the new tailrace outlet location have been undertaken and the rock has low potential for acid generation (Martin, 2006).

A cofferdam is being proposed at the inlet of the forebay for a number of reasons. First, there is an existing submerged structure (remains of a former bridge) located in this area which can be utilized for cofferdam construction. Second, having the cofferdam in this location will allow for equipment and materials to be more easily transported to the island for the planned rehabilitation and modification work on the western channel weir. This will result in less impact to the trees and vegetation on the island. Third, it is recommended that upon construction completion, the cofferdam and submerged structural material be removed resulting in improved flow of water to the powerhouse. This cofferdam would likely be in place for 12 to 14 months and will result in a dewatered area of 13,900 m^2 (1.4 ha).

The cofferdam on the downstream side of the powerhouse is likely to be in place for 12 to 14 months as well and result in an area to be dewatered of approximately 1,000 m^2 (0.1 ha).

Figure 1.4: Proposed Facilities and Cofferdam Locations, Hound Chute GS



The submerged structure is visible at low water levels as indicated in Photograph 1.2.

Photograph 1.2: Existing Submerged Structure at Low Water Levels, Hound Chute GS Forebay Inlet

Refurbishments to the wing wall will be required and can be done in the dry while the powerhouse is being constructed. A new electrical substation will be built. The proposed facility will be connected to the existing 44-kV feeder.

The dam with flash boards on the western channel will also require rehabilitation and modifications. At this point it is not known whether a cofferdam will be required to refurbish this structure or whether this can occur in the wet. The need for this cofferdam will not be certain until a Design-Build-Contractor (DBC) is retained by OPG and this selection will not occur until 2007. While the cofferdam is an uncertainty, it is taken into account in this environmental assessment (EA). If a cofferdam is required it likely will be in place for 3 to 4 months and the Department of Fisheries and Oceans (DFO) will be consulted. Should a cofferdam be required at this location it will be installed at the beginning of construction, with all the water in the river channelled through the forebay and powerhouse, and over the wing-wall weir. Once this dam is refurbished the water in the river will be directed down the western channel while the cofferdam at the forebay neck is built and subsequently the powerhouse constructed.

Table 1.1 provides a summary of the existing and proposed plant operating characteristics. The gross head, i.e., the difference in elevation between the water surface at the intake and tailrace, will remain the same. However, the rated flow through the Hound Chute GS will increase from 57 to 105 m^3/s, decreasing the frequency of spill over the Obermeyer (bladder type) weir from 40% to 20% of the time.

Table 1.1: Existing and Proposed Plant Operational Summary

	Hound Chute GS	
Parameter	Existing	Proposed
Number of Units	4	2
Capacity (MW)	3.6	9.5
Annual Energy Production (GWh)	26.2	50
Gross Head (m)	10.3	10.3
Rated Flow (m^3/s)	57	105
Capacity Factor (%)[1]	74.0	55.0

[1] Ratio of the actual energy produced to the maximum energy which could be delivered under continuous operation at maximum rating.

1.2 DESCRIPTION OF THE STUDY AREA

The Hound Chute GS is located on the Montreal River straddling the townships of Latchford and Coleman in the District of Timiskaming, approximately 10 km southwest of the Town of Cobalt. The location of the site is shown on Figure 1.1.

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.

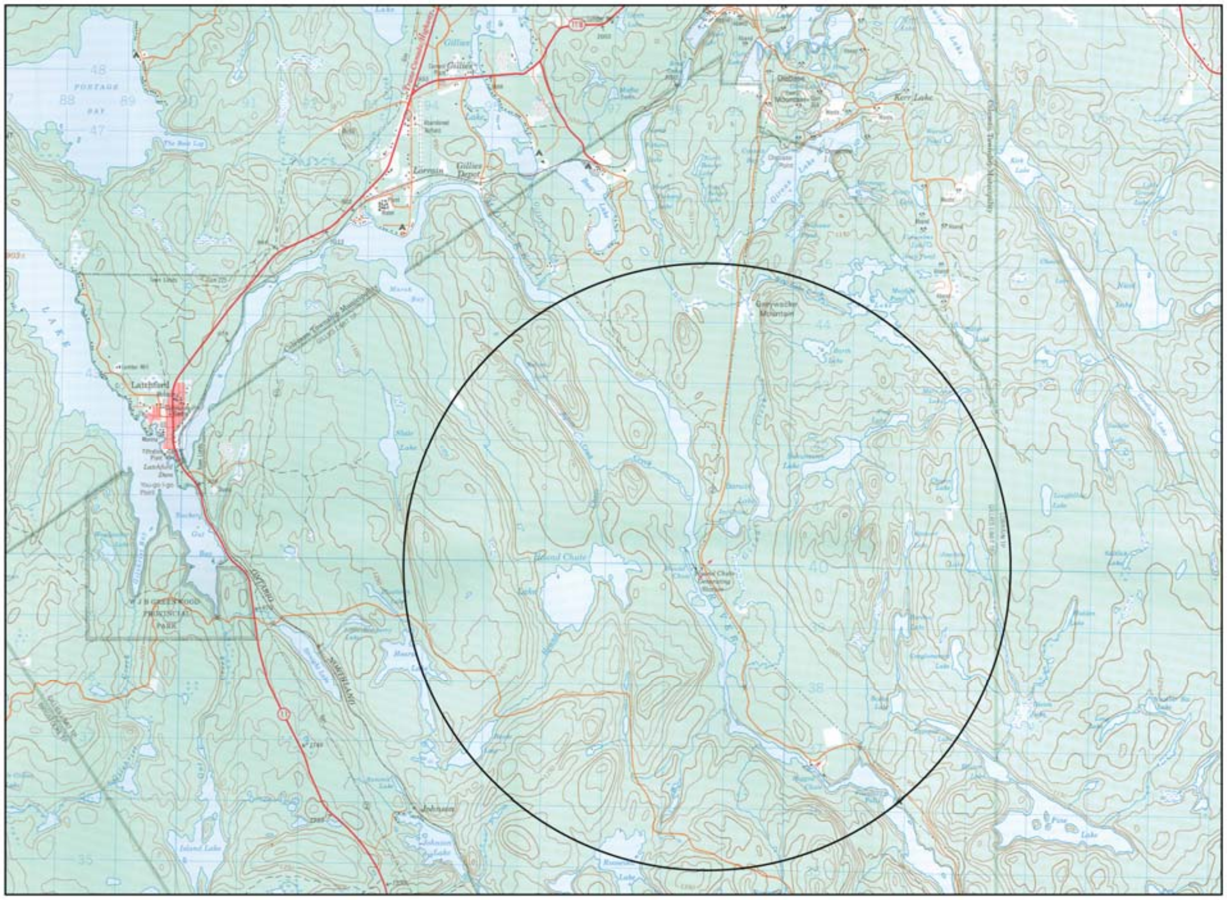
Regional Study Area

The regional setting is generally defined by the Montreal River Drainage Basin (see Figure 1.3) and Lake Timiskaming. The regional setting provides for the baseline description of this drainage basin and the associated general land and water uses affecting the aquatic environment.

Local Study Area

The local study area extends from Bay Lake upstream of Latchford to the Montreal River outlet at Lake Timiskaming (Figure 1.5). 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 water and sediment quality, aquatic biota, as well as specific water uses, e.g., recreational boating, sportfishing, municipal and industrial uses, etc.

Figure 1.5: Local Study Area



Site-Specific Study Area

The site-specific study area encompasses the Montreal River within the Hound Chute GS property (see Figure 1.2) and provides for the environmental baseline description of sediments, aquatic vegetation, benthic macroinvertebrate communities and fisheries resources.

1.3 STUDY APPROACH

The baseline setting for the aquatic environment was prepared based on literature review and personal contacts. Environmental baseline conditions have been recently summarized by OPG *et al.* (2004). This information was augmented and updated by data requested from the MNR and the Ontario Ministry of the Environment (MOE). Moreover, site-specific studies have been undertaken addressing aquatic vegetation, benthic macroinvertebrates and fisheries resources. The fisheries resources study report (Coker and Portt, 2006a) is provided in Appendix 1.

This technical supporting document addresses the aquatic environment to be affected by the construction and operation of the proposed hydroelectric power plant redevelopment. Other technical supporting documents address the terrestrial environment, archaeology, socio-economics, First Nation consultation and public consultation.

1.4 STRUCTURE OF REPORT

This report was prepared by Environment & Energy Limited (EEL) as a Technical Support Document to the Environmental Report (ER) (SENES, 2006) prepared pursuant to the Class Environmental Assessment for Modifications to Hydroelectric Facilities (Ontario Hydro, 1993). The ER provides a description of the proposed undertaking, summarizes the overall baseline environmental setting and anticipated environmental effects, recommends appropriate mitigative measures to minimize or obviate these effects, and describes agency, public and First Nation consultation.

This Supporting Document is organized into four chapters:

- Chapter 1.0 Introduction – provides a description of the project, a description of the study area and the study approach;
- Chapter 2.0 Baseline Aquatic Environment Conditions – describes the baseline aquatic environment conditions in the study area;
- Chapter 3.0 Impact Assessment and Mitigative Measures – details the assessment of aquatic environment effects, presents mitigative measures to minimize or obviate these effects and delineates the net effects;
- Chapter 4.0 Summary and Conclusions – summarizes the potential effects and recommended mitigative/remedial measures.

2.0 BASELINE AQUATIC ENVIRONMENTAL CONDITIONS

2.1 WATER RESOURCES

2.1.1 Site Surface Hydrology

Surface water drainage is downgradient toward the Montreal River (Gartner Lee, 2001).

2.1.2 Groundwater Hydrology

In the area of the Hound Chute GS, 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 watertable may come within 1 m of the surface.

2.1.3 Montreal River

2.1.3.1 Hydrology

The Montreal River occurs within the Ottawa River drainage basin of the Great Lakes-Saint Lawrence Drainage System.

The Montreal River extends approximately 282 km from its headwaters in the Shining Tree area west of Goganda to its confluence with Lake Timiskaming (OPG *et al.*, 2004). The Montreal River and its tributaries drain approximately 7,122 km^2 (see Figure 1.3).

Based on historical hydrological data, greatest streamflow occurs during the spring freshet in April, May and June with the lowest flows occurring generally during the summer (August, September) period (see Table 2.1). Maximum and minimum daily discharges of the Montreal River at Mountain Chutes and the Lower Notch GS located approximately 60 km upstream and 25 km downstream, respectively, of the Hound Chute GS are depicted in Figure 2.1. Extreme maximum and minimum monthly flows at Mountain Chutes were 279 m^3/s in May 1979 and 5.99 m^3/s in March 1968, respectively. Extreme maximum and minimum daily flows at this same location were 517 m^3/s on 28 April 1979 and 2.94 m^3/s on 02 September 1976, respectively. For the Lower Notch GS, extreme maximum and minimum monthly flows were 407 m^3/s in May 1979 and 10.4 m^3/s in September 1992, respectively. Extreme maximum daily flow at this same location was 589 m^3/s on 01 May 1979. No data were available for extreme minimum daily flow.

Annual daily flow hydrographs from 1972 to 1995 for the Montreal River at Hound Chute are depicted in Figure 2.2. Annual flow metrics based on the 23 years of data for Hound Chute are presented in Table 2.2

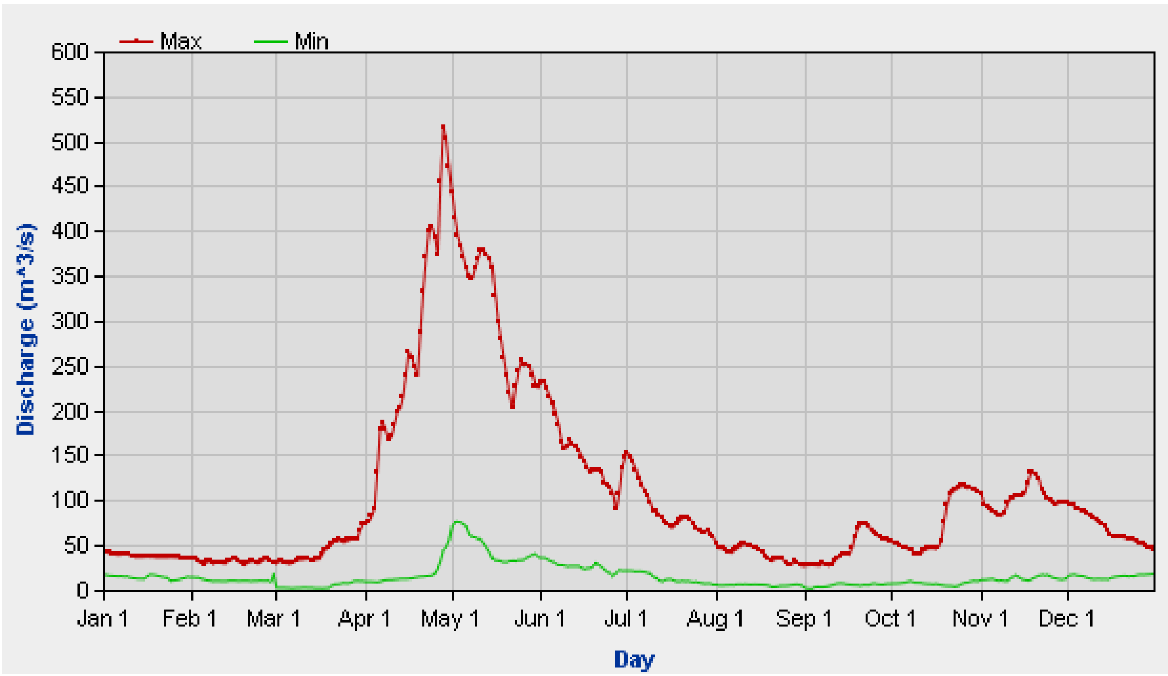
Table 2.1: Monthly and Annual Mean Discharges (M^3/S) of the Montreal River[1]

Location	Period of Record	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mountain Chutes[2]	1968 – 1995	25.7	22.2	22.5	88.7	152	72.2	35.7	20.3	18.9	31.6	41.2	34.2	47.5
Lower Notch GS[3]	1972 – 1994	69.3	70.4	60.9	119	187	96.3	50.3	35.0	31.6	51.4	67.6	67.8	75.6

1 Source: http://www.wsc.ec.gc.ca/staflo/index_e.cfm?cname=flow_monthly.cfm
2 Location: 47°38'21"N; 80°11'28"W; drainage area of 4,300 km^2.
3 Location: 47°8'15"N; 79°27'15"W; drainage area of 6,600 km^2.

Figure 2.1: Maximum and Minimum Daily Discharge for the Montreal River

MOUNTAIN CHUTES (O2 JD009)



LOWER NOTCH GENERATING STATION (02JD010)

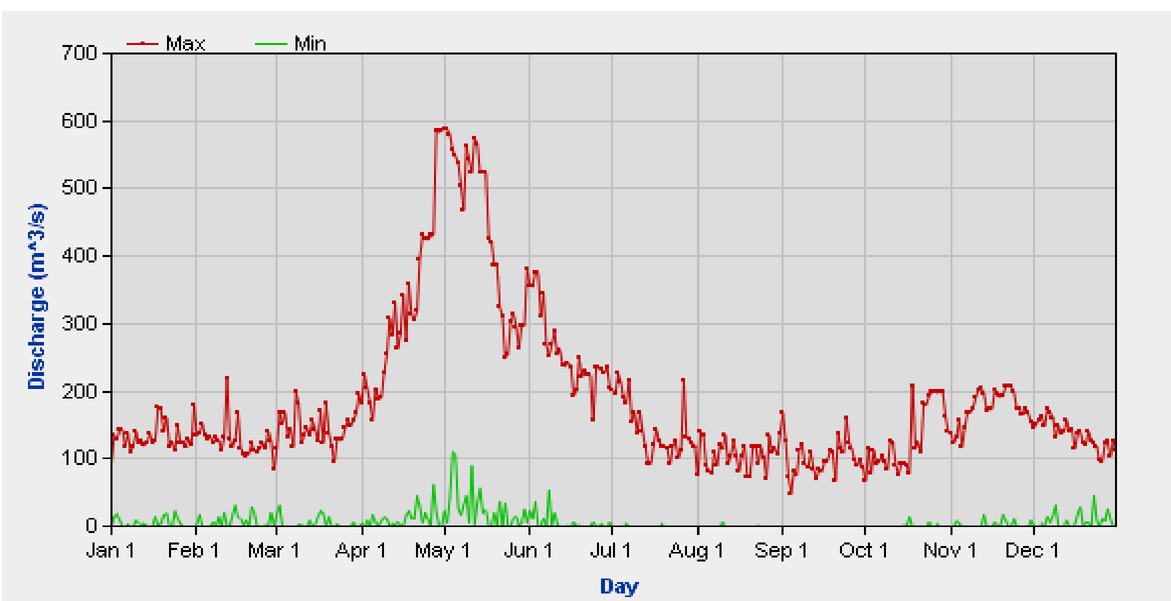


Figure 2.2: Annual Daily Flow Hydrographs from 1972 to 1995 for the Montreal River at Hound Chute

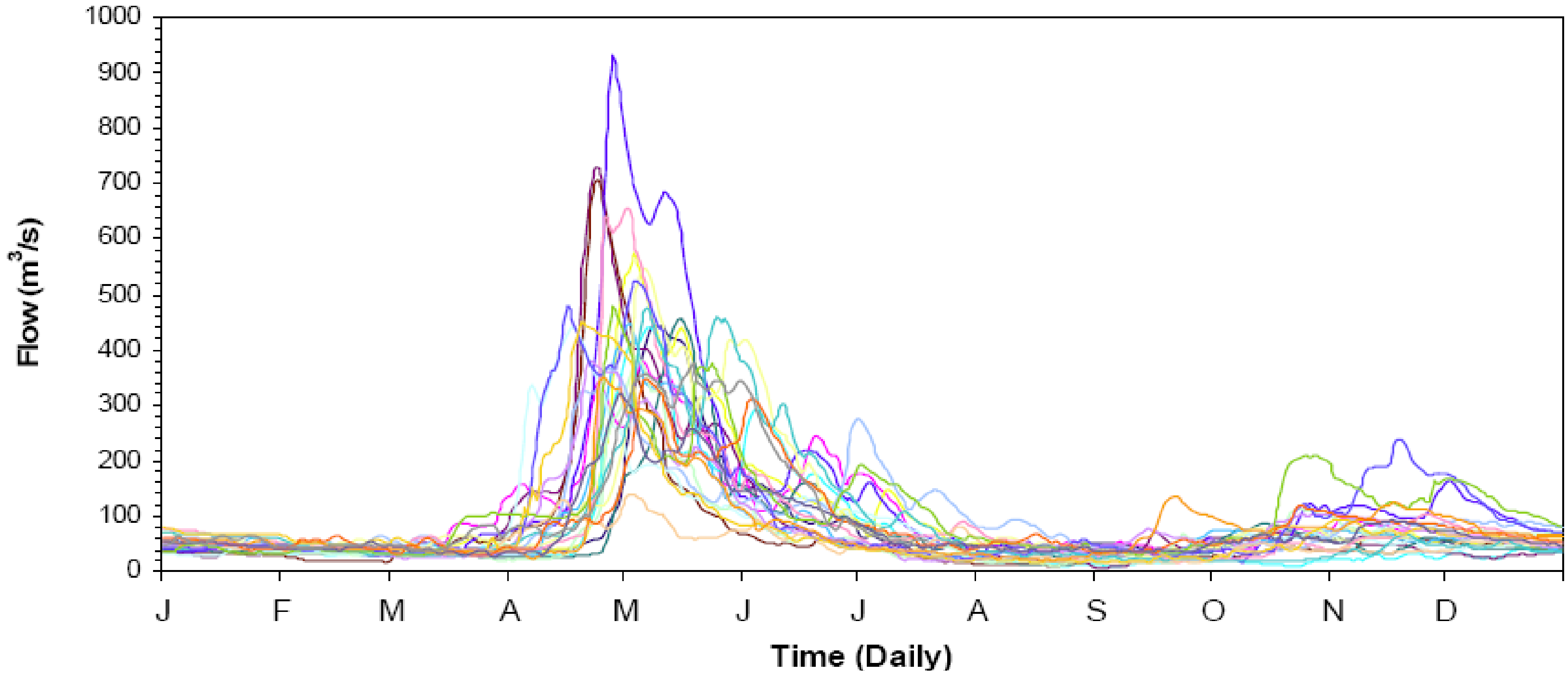


Table 2.2: Annual Flow Metrics for the Montreal River at Hound Chute, 1972 To 1995[1]

Descriptive Metric	Value
Drainage Area (km^2)	6,362
Mean Annual Flow (m^3/s)	86.3
20% Time Exceeded Flow (m^3/s)	104.0
Median Flow (m^3/s)	50.9
80% Time Exceeded Flow (m^3/s)	34.7
Month of Maximum Median Flow	May
Month of Minimum Median Flow	September

1 Source: Metcalfe *et al.* (2003).

As indicated in Section 1.1, upstream storage for the Hound Chute GS is provided by the Lady Evelyn Dam operated by OPG on the Lady Evelyn River, as well as the Bay Lake Dam operated by PWGSC in Latchford (except during the navigational season).

The Ottawa River Regulation Planning Board and PWGSC control Lake Timiskaming water levels. The lower and upper limits are 175.26 and 179.56 m, respectively. There is a navigation lower limit from 15 May to 15 October of 178.65 m.

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 characteristics of watercourses in the area are directly related to the underlying geology and the effects of glaciation on the landscape. In this area where the Precambrian Shield dominates, the lakes tend to be elongated, reflecting the direction of glacial ice movement, with deep basins and moderately to steeply sloping shores. Rivers in the Shield area have moderate gradients and channels that are narrow and well-defined.

The morphology and bathymetry of the Montreal River upstream and downstream is provided in Section 2.2.6.1.

2.2 AQUATIC ENVIRONMENT RESOURCES

2.2.1 Water Quality

Based on its good water quality, the Montreal River is the source of the Latchford potable water supply. Table 2.3 presents water quality data for the Montreal River at Highway No. 11 in Latchford. The mean concentrations of all applicable parameters were below their respective Provincial Water Quality Objectives (PWQOs) with the exception of aluminum (however, it is unlikely that the aluminum analyses were based on clay-free samples as required for comparison with the interim PWQO). In addition, the mean concentrations of total phosphorus were above the Provincial Water Quality Guideline of 0.03 mg/L to eliminate excessive plant growth in rivers and streams.

Table 2.3: Montreal River Water Quality at Latchford[1]

	Concentration (mg/L unless otherwise indicated)												
	1992			1993			1994			1995			
Parameter	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	PWQO[2]
Dissolved Oxygen	8.9(6)[3]	3.5	16.0	8.0(8)	7.0	9.0	9.0(9)	7.0	10.0	9.1(7)	5.0	11.0	see below[4]
Alkalinity	29.9(8)	15.1	59.6	24.5(8)	15.5	35.0	28(9)	16	41	25(8)	16	33	-
Conductivity(umhos/cm)	122(8)	65	243	97(8)	60	217	99(9)	62	139	83(8)	53	121	-
Hardness	44(8)	22	69	34(8)	23	50	38(9)	28	46	35(8)	24	48	-
pH (units)	7.2(8)	6.8	7.5	7.2(8)	6.9	7.6	7.3(9)	6.5	7.7	7.3(8)	7.0	7.5	6.5-8.5
Particulate (Non-filterable) Residue	6(8)	<1	15	4(8)	<1	15	5(9)	<1	15	7(8)	<1	40	-
Total Reactive Ammonia	<0.05(8)	<0.01	0.3	0.05(8)	<0.01	0.3	<0.02(9)	<0.01	<0.05	<0.02(8)	<0.01	0.059	-
Unfiltered Reactive Nitrite	-	-	-	-	-	-	-	-	-	<0.005(6)	<0.002	0.009	-
Unfiltered Reactive Nitrate	-	-	-	-	-	-	-	-	-	0.680(6)	0.129	1.435	-
Filtered Total Reactive Nitrates	1.28(8)	0.08	4.20	0.81(8)	0.10	3.20	1.04(9)	0.12	2.31	0.64(8)	0.13	1.44	-
Total Kjeldahl Nitrogen	0.72(8)	0.35	1.42	1.12(8)	0.30	6.10	0.58(9)	0.30	1.17	0.63(8)	0.23	2.17	-
Reactive Phosphate	-	-	-	-	-	-	-	-	-	0.012(6)	<0.003	0.034	-
Total Phosphorus	0.186(8)	0.017	0.56	0.088(8)	0.009	0.440	0.115(9)	0.010	0.320	0.182(8)	0.010	1.156	0.03[5]
Sulphate	11.3(8)	7.23	17.5	9.37(8)	6.55	16.6	8.88(9)	6.50	12.0	8.71(8)	5.94	11.3	-
Calcium	-	-	-	-	-	-	-	-	-	14.9(7)	7.9	40.0	-
Magnesium	-	-	-	-	-	-	-	-	-	2.5(7)	1.9	3.2	-
Aluminum (µg/L)	-	-	-	-	-	-	-	-	-	179(7)	55	620	75[6,7]
Cadmium (µg/L)	-	-	-	-	-	-	-	-	-	<0.26(7)	<0.2	<0.4	0.2
Chromium (µg/L)	-	-	-	-	-	-	-	-	-	1.3(8)	<0.2	2.8	100
Cobalt (µg/L)	-	-	-	-	-	-	-	-	-	<0.5(8)	<0.5	<0.5	0.6
Copper (µg/L)	3.2(8)	<0.7	6.6	2.1(8)	<1.0	6.7	2.5(9)	<1.2	4.8	3.2(7)	<1.4	10.0	5
Iron (µg/L)	168(8)	85	310	132(8)	97	230	145(9)	77	270	174(7)	72	510	300
Lead (µg/L)	<2.0(8)	<2.0	<2.0	<2.2(8)	<2.0	<3.0	<2.2(9)	<2.0	<3.0	<2.0(7)	<2.0	<2.0	10
Manganese (µg/L)	-	-	-	-	-	-	-	-	-	20(6)	11	28	-
Molybdenum (µg/L)	-	-	-	-	-	-	-	-	-	<0.27(6)	<0.20	<0.55	10[7]
Nickel (µg/L)	<1.1(8)	<1.0	<1.8	<1.1(8)	<1.0	<2.0	<1.0(9)	<1.0	<1.0	<1.0(7)	<1.0	<1.0	25
Zinc (µg/L)	<4.7(8)	<1.4	9.3	<3.4(8)	<2.0	9.4	<4.2(9)	<1.0	16.0	<4.9(7)	<1.0	20.0	30

1 Source: S. Sunderani, MOE, 2006, pers. comm.
2 PWQO = Provincial Water Quality Objective (MOEE, 1994).
3 Number in brackets is the number of samples analyzed.
4 For warmwater biota: 7 mg/L at 0°C, 6 mg/L at 5°C, 5 mg/L at 10°C and 15°C, 4 mg/L at 20°C and 25°C.
5 Provincial Water Quality Guideline (MOEE, 1994).
6 At pH >6.5 to 9.0, the Interim PWQO is 75 µg/L based on total aluminum measured in clay-free samples.
7 Interim PWQO.

In-situ water quality measurements were taken during the fisheries and benthic macroinvertebrate survey undertaken in June 2006 with the following findings: water temperature (21.6°C); dissolved oxygen (D.O.) (8.7 mg/L); oxygen saturation (99%); and pH (7.8). The D.O. concentration and oxygen saturation levels were well above the PWQO for the protection of coldwater (i.e., 5 mg/L D.O. and 57% saturation at 20°C) and warmwater (i.e., 4 mg/L D.O. and 47% saturation at 20°C) biota. The pH is within the PWQO range of 6.5 to 8.5 to protect aquatic life.

Based on a Phase I Environmental Site Assessment of the Hound Chute GS property, Gartner Lee (2001) reported that water from the floor trench system in the powerhouse may contain oil; however, this water is pumped through an oil-water separator prior to being discharged to the tailrace.

Based on a MOE concern regarding the potential for leaching of naturally occurring arsenic from exposed surfaces of rock fractured by blasting at a proposed pipeline crossing of the Montreal River, analysis of total arsenic was undertaken of a rock sample collected approximately 3 km downstream of Latchford Dam and 12 km upstream of the Hound Chute GS (Fitchko, 1991). In addition, this rock was fragmented for leachate arsenic analysis using the MOE Regulation 309 leachate extraction procedure. The arsenic concentration of 1 μg/g in the bedrock sample was typical of metamorphic rock (schists and gneisses). Onishi and Sandell (1955) reported that arsenic was likely lost in the end-stages of regional metamorphism. Based on the MOE Regulation 309 leachate extraction procedure, the arsenic concentration in the fragmented rock leachate was <5 μg/L, almost two orders of magnitude below the Provincial Water Quality Objective (PWQO) of 100 μg/L (MOEE, 1994a) and well below the Ontario Drinking Water Objective of 25 μg/L (MOEE, 1994b).

During federal agency consultation, Environment Canada expressed a concern regarding acid generation potential of rock blasted during the proposed Hound Chute GS redevelopment. As indicated in Section 1.1, bedrock on the Hound Chute GS property has low acid generation potential (Martin, 2006). Based on modified acid base accounting analyses, all rock samples tested had a low potential for acid rock drainage (ARD). Acid potential (AP) is calculated from sulphide sulphur content. The sulphide sulphur levels ranged from 0.07 to 0.12%. A sulphide sulphur level of less than 0.3% is used as a draft guideline by Price (1997) as having low potential for ARD, unless the rock has elevated metal levels and/or the levels of neutralizing potential (NP) are low. The NP/AP ratio is commonly used to assess the potential for ARD. Based on this ratio, the rock samples had negligible to low potential for ARD.

2.2.2 Sediments and Sediment Quality

Sediments in the Montreal River can be expected to be predominantly silt and clay, particularly in the in-stream lakes and slower moving sections of the river. Sediment type immediately upstream and downstream of the Hound Chute GS is relatively coarse (see Section 2.2.6.1).

Prior to constructing the proposed natural gas pipeline crossing of the Montreal River, sediment sampling was also undertaken in 1991 for sediment quality analysis due to the recent spill of Matachewan tailings upstream (Fitchko, 1991). Sediment samples were obtained from both nearshore sides of the Montreal River along the pipeline right-of-way frontage. The samples, consisting of fine to medium gravel with sand and a minor clay/silt component, were composited into one sample for analysis. Although a boat and motor were available, offshore sampling was not possible due to the strong currents and irregular river bed. Furthermore, subsurface probing (sampling) with a soil auger was not possible due to the coarse (stoney) nature of the surficial substrate.

The sediment quality data for the composite sample are presented in Table 2.4. The concentrations of arsenic, chromium, copper, iron and nickel were above their respective Provincial Sediment Quality Guidelines (PSQGs) "lowest effect level" (LEL) and/or the federal interim sediment quality guidelines (ISQGs), but well below the PSQG "severe effect level" (SEL) and the federal "probable effect level" (PEL). The PSQG LEL and federal ISQG represent threshold contaminant concentrations at which actual ecotoxic effects to the most sensitive species of the benthic macroinvertebrate community become apparent assuming that they are naturally present. Moreover, it is recognized that metal concentrations may be naturally high, particularly in areas of mineralized ore. Overall, sediment quality at this location on the Montreal River can be considered to be good.

Table 2.4: Montreal River Sediment Quality Data[1]

	Concentration (g/g unless otherwise indicated)				
	Montreal River	PSQG[2]		Canadian Sediment Quality Guideline[5]	
	Sediment	LEL[3]	SEL[4]	ISQG[6]	PEL[7]
% Gravel	24.9	-	-	-	-
% Sand	60.4	-	-	-	-
% Silt	12.8	-	-	-	-
% Clay	1.9	-	-	-	-
Volatile Solids (%)	1.0	-	-	-	-
Total Kjeldahl Nitrogen	355	550	4,800	-	-
Ammonia-Nitrogen	1.57	-	-	-	-
Total Phosphorus	520	600	2,000	-	-
Cyanide	<0.05	-	-	-	-
Oil and Grease	136	1,500[8]	-	-	-
Arsenic	6[9]	6	33	5.9	17.0
Cadmium	<0.5	0.6	10	0.6	3.5
Chromium	68	26	110	37.3	90.0
Cobalt	19	50[8]	-	-	-
Copper	27	16	110	35.7	197
Iron	35,000	20,000	40,000	-	-
Lead	14	31	250	35.0	91.3
Mercury	<0.1	0.2	2	0.17	0.486
Molybdenum	<1	-	-	-	-
Nickel	43	16	75	-	-
Selenium	<1	-	-	-	-
Silver	<0.5	0.5[8]	-	-	-
Zinc	54	120	820	123	315
Total PCBs	<0.05	-[10]	-[10]	0.0341	0.277

1 Source: Fitchko (1991).

[2] PSQG = Provincial Sediment Quality Guideline (Persaud *et al.*, 1992).

[3] LEL = lowest effect level (µg/g dry weight sediment), defined as the concentration at which actual ecotoxic effects to the benthic macroinvertebrate community becomes apparent. It is derived using field-based data on the co-occurrence of sediment concentrations and benthic species. The LEL is calculated for the benthic community as the estimated sediment concentration at which 10% of benthic species would be affected. This is a conservative value in that it reflects a potential adverse effect on the most sensitive benthic species assuming that they are naturally present.

[4] SEL = severe effect level (µg/g dry weight sediment) represents contaminant concentrations that could potentially eliminate most benthic organisms. It is derived using field-based data on the co-occurrence of sediment concentrations and benthic species. The SEL is calculated for the benthic community as the estimated concentration at which 90% of benthic species would be affected.

[5] CCME (1999, 2001).

[6] ISQG = interim sediment quality guideline (µg/g dry weight sediment) based on the "threshold effect level" (TEL) which represents the concentration below which adverse biological effects rarely occur, i.e., fewer than 25% adverse effects occur below the TEL.

[7] PEL = probable effect level (µg/g dry weight sediment) defines the concentration above which adverse effects are expected to occur frequently, i.e., more than 50% adverse effects occur above the PEL.

[8] Parameter carried over from the Open Water Disposal Guidelines (Persaud *et al.*, 1992) for uncontaminated sediments.

[9] Bold numbers are above their respective LEL and/or ISQG.

[10] The determination of PSQGs for organic parameters is based on actual total organic carbon (TOC) concentrations in the sediments. TOC was not analyzed for the Montreal River sediment sample.

2.2.3 Aquatic Vegetation

Coker and Portt (2006a) observed no aquatic macrophytes and a general lack of epiphytic growth on the substrate in the Montreal River near the Hound Chute GS.

Examination of the Natural Heritage Information Centre (NHIC, 2006) database indicated no significant aquatic vegetation species have been recorded within a 5-km radius of the Hound Chute GS. Similarly, based on the *Species at Risk Act* (SARA) Schedule 1 Species at Risk Web Mapping Application (Environment Canada, CWS, 2004) database, no aquatic vegetation species at risk have documented occurrences overlapping the local study area.

2.2.4 Plankton

There are two algal communities in most lotic 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).

Data on plankton communities in the Montreal River were not available.

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 from 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.

The benthic macroinvertebrate community downstream of the Hound Chute GS was characterized by 32 taxa with a total density of 6,079 organisms per m^2 (Table 2.5). The Shannon-Wiener diversity index value was 3.68 indicative of unpolluted conditions (good water quality). There were no dominant major taxa, with bivalvids (clams) and coleopterans (aquatic beetles), comprising 26.6 and 26.1% of the benthic community, respectively. The aquatic beetle, *Stenelmus*, and the clam, *Cyclocalyx* (*Pisidium*), were the most common genera representing 25.0 and 22.9% of the benthic community, respectively. Other common taxa were midgefly larvae (18.6%) represented by 12 chironomid genera, nematodes (8.5%) and trichopterans (caddisfly nymphs) (8.0%).

Table 2.5: Benthic Macroinvertebrate Community Composition Downstream of the Hound Chute GS[1]

Taxon	Density/m^2
P. Nematoda	518
P. Platyhelminthes	
Cl. Turbellaria	
O. Tricladida	388
P. Annelida	
Cl. Oligochaeta	
F. Lumbriculidae	
Lumbriculus variegatus	97
P. Arthropoda	
Cl. Insecta	
O. Coleoptera	
F. Elmidae	
Optioservus larvae	65
Stenelmis larvae	1,521
O. Ephemeroptera	
F. Baetidae	
Acentrella parvula	32
Procloeon	32
F. Heptageniidae	
Leucrocuta	32
Stenonema	32
O. Odonata	
S.O. Anisoptera	
F. Gomphidae	
Hagenius	32
O. Trichoptera	
F. Hydropsychidae	
Hydropsyche	32
H. alternans	356

Taxon	Density/m²
Macrostemum	32
F. Lepidostomatidae	
Lepidostoma	32
F. Leptoceridae	
Oecetis	32
O. Diptera	
F. Ceratopogonidae	
Bezzia	65
F. Chironomidae	
S.F. Chironominae	
Microtendipes	65
Polypedilum halterale	32
P. scalaenum	32
Tanytarsus	194
Tribelos	32
S.F. Orthocladiinae	
Cricotopus	97
Cricotopus/Orthocladius	32
Psectrocladius	32
S.F. Tanypodinae	
Ablabesmyia	162
Djalmabatista	162
Helopelopia	129
Thienemannimyia complex	162
F. Simuliidae	32
P. Mollusca	
Cl. Bivalva (Pelecypoda)	
F. Sphaeriidae	
Cyclocalyx (Pisidium)	1,392
Sphaerium (Musculium)	194
S. striatinum	32
S. simile	
TOTAL NUMBER OF ORGANISMS	6,079
TOTAL NUMBER OF TAXA	32
SHANNON-WIENER DIVERSITY INDEX	3.68

1 Based on a composite of triplicate samples collected with a T-sampler in June 2006.

2.2.6 Fisheries Resources

The Montreal River and associated reservoir lakes provide coolwater fish habitat. The primary fish species are walleye, northern pike, smallmouth bass, yellow perch, lake whitefish and white sucker (OPG *et al.*, 2004). Walleye are present throughout the river system and are extremely important to the local tourism economy as the most sought after species in the recreational fishery.

Table 2.6 presents the 29 species recorded in the Montreal River watershed. Of these, 14 species have been recorded near the Latchford Dam (Dillon, 1999), whereas six species were recorded during the June 2006 survey of fish habitat and communities near the Hound Chute GS (Coker and Portt, 2006a) (see Table 2.7).

Table 2.6: Fish Species Recorded in the Montreal River[1]

Common Name	Scientific Name	Status
Brassy minnow	*Hybognathus hankinsoni*	N/A[2]
Common shiner	*Luxilus cornutus*	River resident
Golden shiner	*Notemigonus crysoleucas*	N/A
Emerald shiner	*Notropis atherinoides*	River resident
Blacknose shiner	*N. heterolepsis*	River resident
Spottail shiner	*N. hudsonius*	River resident
Mimic shiner	*N. volucellus*	River resident
Northern redbelly dace	*Phoxinus eos*	Tributaries, occasional resident
Finescale dace	*P. neogaeus*	Tributaries, occasional resident
Bluntnose minnow	*Pimephales notatus*	River resident
Fathead minnow	*P. promelas*	N/A
Longnose dace	*Rhinichthys cataractae*	River resident
White sucker	*C. commersoni*	River resident
Redhorse sucker	*Moxostoma* sp.	River resident
Northern pike	*Esox lucius*	River resident
Cisco (lake herring)	*Coregonus artedi*	River resident
Lake whitefish	*C. clupeaformis*	River resident
Brook trout	*Salvelinus fontinalis*	Tributaries, occasional resident
Burbot	*Lota lota*	River resident
Brook stickleback	*Culaea inconstans*	Tributaries, occasional resident
Mottled sculpin	*Cottus bairdi*	River resident
Rock bass	*Ambloplites rupestris*	River resident
Pumpkinseed	*Lepomis gibbosus*	River resident
Smallmouth bass	*Micropterus dolomieu*	River resident
Yellow perch	*Perca flavescens*	River resident
Walleye	*Sander vitreus*	River resident
Iowa darter	*Etheostoma exile*	River resident
Johnny darter	*E. nigrum*	River resident
Logperch	*Percina caprodes*	River resident

1 Source: Based on 1973 MNR and 1999 Royal Ontario Museum data (Dillon, 1999); OPG *et al.* (2004).
2 N/A = not available.

TABLE 2.7: Fish Species Captured and/or Observed Near the Latchford Dam and Hound Chute GS

Common Name	Scientific Name	Near Latchford Dam[1]	Near Hound Chute GS[2]
Spottail shiner	*Notropis hudsonius*	X	
Mimic shiner	*N. volucellus*	X	X
Bluntnose minnow	*Pimephales promelas*		X
Longnose dace	*Rhinichthys cataractae*		X
White sucker	*Catostomus commersoni*	X	
Northern pike	*Esox lucius*	X	
Lake whitefish	*Coregonus clupeaformis*	X	
Burbot	*Lota lota*	X	
Nine-spine stickleback	*Pungitius pungitius*	X	
Mottled sculpin	*Cottus bairdi*	X	X
Rock bass	*Ambloplites rupestris*	X	
Smallmouth bass	*Micropterus dolomieu*	X	X
Yellow perch	*Perca flavescens*	X	
Walleye	*Sander vitreus*	X	X
Johnny darter	*Etheostoma nigrum*	X	
Logperch	*Percina caprodes*	X	

1 Source: Dillon(1999).
2 Source: Coker and Portt (2006a).

The ninespine stickleback collected by Dillon (1999) had not been previously recorded in the 1973 MNR and 1999 Royal Ontario Museum databases.

The fish community in the vicinity of the Hound Chute GS appears to be relatively simple and numerically sparse (Coker and Portt, 2006a). Only six species were observed by underwater video and/or captured by electrofishing (see Table 2.7). The clear water, lack of aquatic macrophytes and general lack of epiphytic growth on the substrate are indicative of relatively low productivity conditions.

There is an important walleye spawning area located below the dam at Latchford. In the spring, a minimum flow is maintained from the east side of the dam to ensure that the walleye spawning bed downstream is covered by water (OPG *et al.*, 2004).

Important northern pike spawning and nursery habitat is present in Marsh Bay located on the Montreal River between Latchford Dam and the Hound Chute GS.

To improve bass spawning habitat upstream, flashboards at the Hound Chute GS are installed prior to 01 June or after 30 June, or if the elevation drops to the sill level of 272.95 m during June (OPG *et al.*, 2004). A minimum flow of 10 m^3/s is maintained during flashboard installation to enable continued operation of the Ragged Chute GS located approximately 4 km downstream.

There are four hydroelectric generating stations on the Montreal River system as well as four control dams (OPG *et al.*, 2004). These barriers impede upstream movement of many fish species. The downstream movement of species and mixing of stocks likely continues despite in-stream development.

The river sections from the Latchford Dam to 30 m downstream of the Ontario Northland Transportation Commission bridge in Latchford, as well as 150 m upstream and downstream from the concrete abutments at Fountain Falls located approximately 5.5 km and 1.5 km downstream of the Hound Chute GS and Ragged Chute GS, respectively, have been designated as Fish Sanctuaries by the MNR. For these two sanctuaries, fishing for any species is prohibited form 15 April to the Friday before the third Saturday in May (MNR, 2005).

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. Mercury is the major contaminant of fish in inland waters of the province. A summary of the most recent fish consumption advisories for the Montreal River in the Township of Matachewan approximately 95 km upstream of Latchford is provided in Table 2.8. The maximum recommended number of meals of sport fish per month is eight for the general population (MOE, 2005). Since young children and developing fetuses are affected by contaminants at lower concentrations than the general population, children under 15 and women of child-bearing age are advised to consume fish only in the eight and four meals per month categories. Top predators, such as northern pike and walleye, usually have the highest mercury concentrations. Smaller, younger fish and fish that are not top predators, such as panfish and yellow perch, have lower contaminant concentrations.

Table 2.8: Summary of Fish Consumption Advisories, Montreal River at Matachewan[1]

	Fish Length (cm)												
Fish Species	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	>75
White sucker[4]						8[2](8)[3]	8(4)	8(4)					
Northern pike[5]					8(8)	8(4)	8(4)	4(0)	4(0)	4(0)	4(0)	4(0)	0(0)
Lake whitefish[4]				8(8)	8(8)	8(8)	8(8)	8(8)	8(8)	8(4)			
Rock bass[4]	8(4)	4(0)											
Smallmouth bass[4]		8(4)	8(4)	8(4)	8(0)	4(0)	2(0)						
Yellow perch[4]	8(8)	8(8)											
Walleye[5]	8(4)	8(4)	8(0)	4(0)	4(0)	4(0)	2(0)	2(0)	2(0)	0(0)	0(0)	0(0)	

1 Source: MOE (2005).
2 Number of meals of that size fish that can be consumed each month by the general population.
3 Bracketed number of meals of that size fish that is advised for consumption by women of child-bearing age and children under 15.
4+ Based on mercury and other metals.
5 Based on mercury, other metals, PCBs, mirex/photomirex and pesticides.

2.2.6.1 Fish Habitat and Communities

The Montreal River in the vicinity of the Hound Chute GS provides a variety of riverine habitats, with varying flow velocities and water depths (Coker and Portt, 2006a). Substrate type is relatively coarse. Large boulders, steep inclines, large woody debris and an old bridge remnant provide good habitat structure. Depth contours, flow patterns and substrate types are presented in Figures 2.3 and 2.4.

Much of the aquatic habitat downstream of the Hound Chute GS (including the spillway channel) is fairly shallow, with the exception of a plunge pool immediately downstream of the falls at the upstream end of the spillway channel and at the excavated tailrace. Most of the aquatic habitat upstream of the Hound Chute GS is deeper. Based on the difference in average depths, flow velocity is generally higher downstream of the generating station. Flow velocity generally increases with flow discharge. However, as OPG maximizes flow through the Hound Chute GS, the headrace channel and spillway channel will show less and more variation in flow velocity, respectively. The spillway channel has very high flow velocities during the spring freshet, but is essentially a quiet backwater area during the summer. Most of the substrate is dominated by cobble, boulder and gravel in various proportions. Bedrock is exposed within the two falls, as well as in a portion of the headrace channel. Large woody debris is present at a few locations, generally where the water is deepest. The remains of an old bridge, consisting of rock-filled wood cribs and weathered concrete piers, are located at the upstream end of the headrace channel.

As indicated in Section 2.2.6, fish diversity and abundance are low in the area of the Hound Chute GS likely due to the low productivity conditions.

No walleye spawning was observed upstream and downstream of the Hound Chute GS on 30 April and 04 May 2006, when many walleye were observed spawning on both nights at the Latchford Dam. Despite the lack of observed walleye spawning activities near the Hound Chute GS, possibly low numbers of walleye and white sucker utilize the riffles near the generating station to spawn. These riffles differ throughout in water depth, flow velocity and substrate size, and therefore, the location of the optimal combination of these parameters that are required for spawning will vary with discharge conditions through the powerhouse and the spill channel. During the spawning surveys, most of the riffles in the vicinity of the Hound Chute GS had flow velocities that were too high for walleye spawning. However, spawning conditions may be suitable on other occasions when lower river discharge rates occur. It is possible the walleye spawning occurs further downstream where substrate and low velocities are suitable.

The lack of observed walleye spawning during the spring 2006 survey may also reflect the limited and generally poor spawning habitat that was accessible for viewing or low walleye abundance in the reach of the Montreal River between Hound Chute GS and the dam at Ragged Chute, approximately 4.2 km downstream.

The small fish species captured during the 2006 survey (see Table 2.7) likely reside year-round, taking advantage of local areas with suitable spawning conditions.

Figure 2.3: Bathymetry, Substrate and Flow Velocity Features Within the Upstream Portion of the Hound Chute GS Study Area

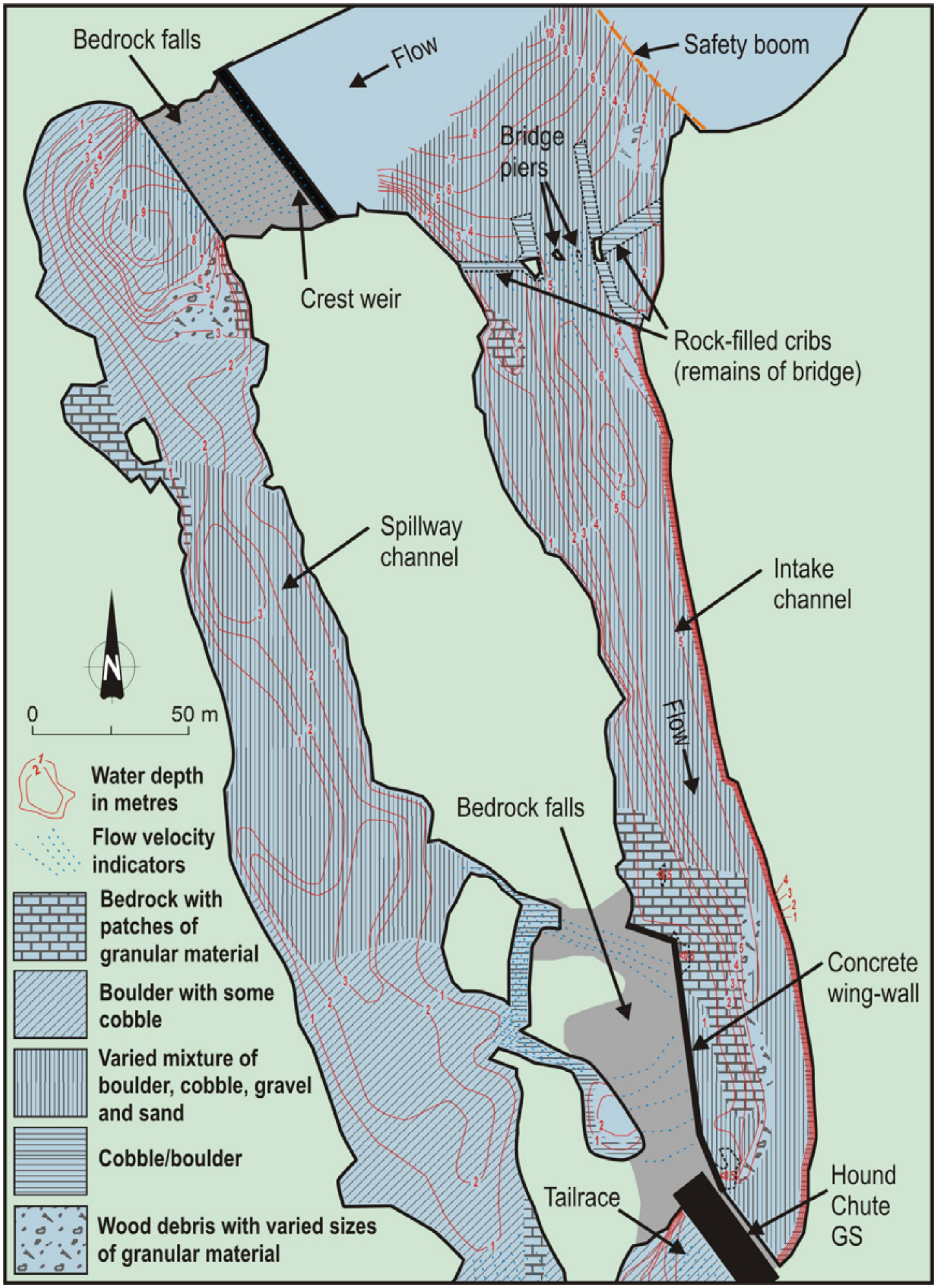
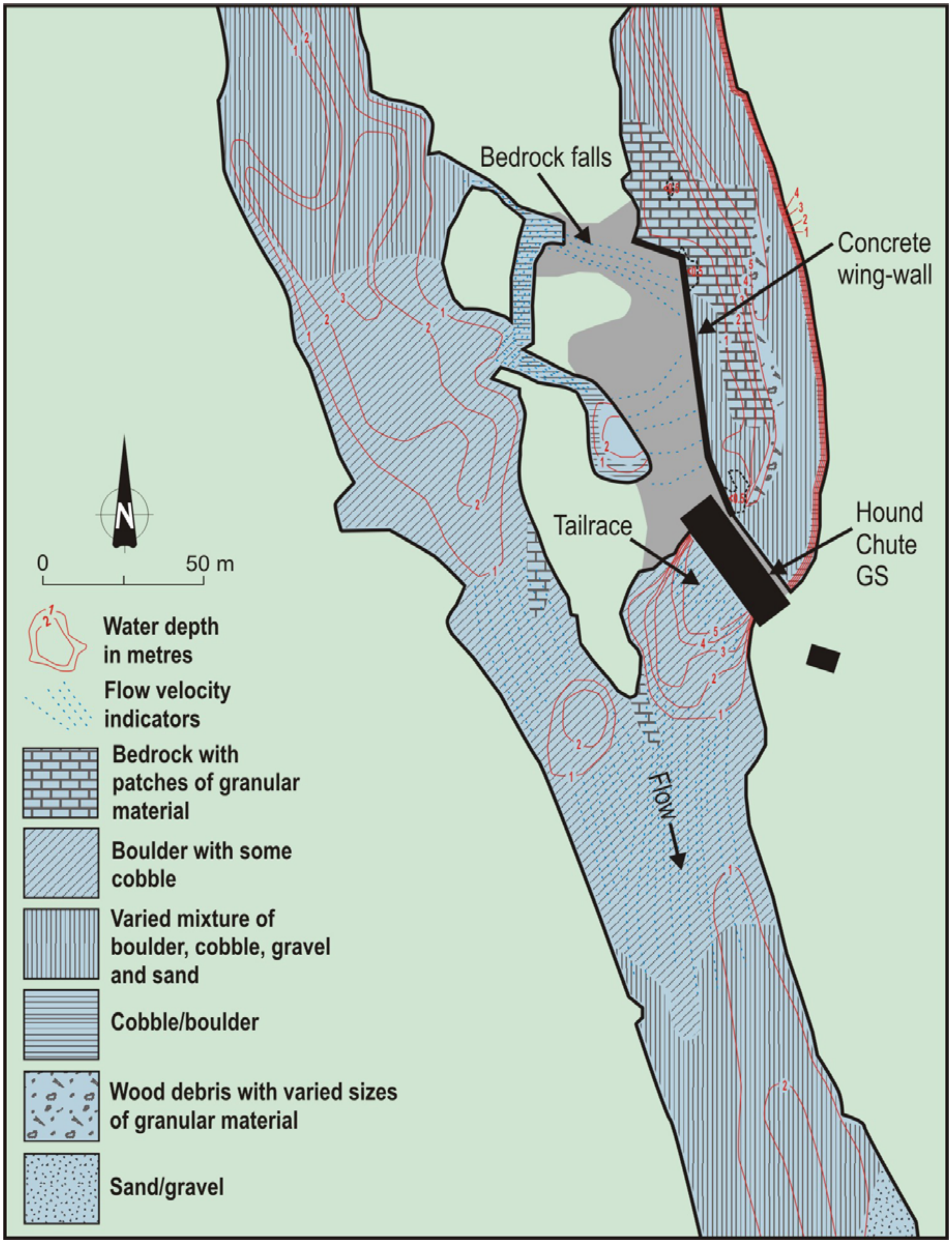


Figure 2.4: Bathymetry, Substrate and Flow Velocity Features Within the Downstream Portion of the Hound Chute GS Study Area



2.2.7 Aquatic Avifauna

Table 2.9 lists the abundance and status of aquatic avifauna species recorded in the Temiskaming area. Of the 36 species that have been recorded as breeding in the Temiskaming area, 16 are designated by the NHIC (2006) as S5, i.e., very common in Ontario and demonstrably secure; 17 are S4, i.e., common in Ontario and apparently secure; one is S3, i.e., rare to uncommon in Ontario; and two are S2, i.e., very rare in Ontario.

Table 2.9: Aquatic Avifauna Species Observed in the Temiskaming Area[1]

Common Name	*Scientific Name*	Abundance[2]	Status[3]	Provincial Status[4]
Loons	*Gavidae*			
Red-throated loon	*Gavia stellata*	R	M	S1S2
Pacific (Arctic) loon	*G. pacifica*	R	M	S3
Common loon	*G. immer*	C	B	S4
Grebes	*Podicepididae*			
Pied-billed grebe	*Podilymbus podiceps*	C	B	S4
Horned grebe	*Podiceps auritus*	R	-	S1
Red-necked grebe	*P. grisegena*	R	-	S3
Eared grebe	*P. nigricollis*	V	-	SZN
Shearwaters and Fulmars	*Procellariidae*			
Northern fulmar	*Fulmarus glacialis*	V	-	SAN
Cormorants	*Phalacrocoracidae*			
Double-crested cormorant	*Phalacrocorax auritus*	R	M	S4
Herons and Bitterns	*Ardeidae*			
American bittern	*Botaurus lentiginosus*	C	B	S4
Least bittern[5]	*Ixobrychus exilis*	V	-	S3
Great blue heron	*Ardea herodias*	C	B	S5
Swans, Geese and Ducks	*Anatidae*			
Whistling (Tundra) swan	*Cygnus columbianus*	U	M	S3
Snow goose	*Chen caerulescens*	C	M	S4
Brant goose	*Branta bernicla*	C	M	SZN
Canada goose	*B. canadensis*	C	M	S5
Wood duck	*Aix sponsa*	C	B	S5
Green-winged teal	*Anas crecca*	C	B	S4
American black duck	*A. rubripes*	C	B	S5
Mallard	*A. platyrhynchos*	C	B	S5
Northern pintail	*A. acuta*	C	M	S5
Blue-winged teal	*A. discors*	C	B	S5
Northern shoveler	*A. clypeata*	U	B	S5
Gadwall	*A. strepera*	R	B	S4
American wigeon (Baldpate)	*A. americana*	C	B	S4
Canvasback	*Aythya valisineria*	U	M	S1
Redhead	*A. americana*	R	M	S2
Ring-necked duck	*A. collaris*	C	B	S5
Greater scaup	*A. marila*	U	B	S2

Common Name	*Scientific Name*	Abundance[2]	Status[3]	Provincial Status[4]
Lesser scaup	*A. affinis*	C	B	S4
Oldsquaw	*Clangula hyemalis*	C	M	S2S3
White-winged scoter	*Melanitta fusca*	C	M	S1S2
Common goldeneye	*Bucephala clangula*	C	B	S5
Barrow's goldeneye	*B. islandica*	R	M	SZN
Bufflehead	*B. albeola*	C	M	S3
Hooded merganser	*Lophodytes culcullatus*	C	B	S5
Common merganser	*Mergus merganser*	C	B	S5
Red-breasted merganser	*M. serrator*	C	B	S4
Ruddy duck	*Oxyura jamaicensis*	U	B	S2
Rails, Gallinales and Coots	*Rallidae*			
American coot	*Fulica americana*	C	B	S4
Sora	*Porzana carolina*	C	B	S4
Cranes	*Gruidae*			
Sandhill crane	*Grus canadensis*	R	B	S4
Plovers	*Charadriidae*			
Semipalmated plover	*Charadrius semipalmatus*	C	B	S4
Killdeer	*C. vociferous*	C	B	S5
Sandpipers and Phalaropes	*Scolopacidae*			
Greater yellowlegs	*Tringa melanoleuca*	C	M	S4
Lesser yellowlegs	*T. flavipes*	C	M	S4
Solitary sandpiper	*T. solitaria*	U	B	S4
Spotted sandpiper	*Actitis macularia*	C	B	S5
Upland sandpiper	*Bartramia longicauda*	R	B	S4
Hudsonian godwit	*Limosa haemastica*	V	M	S2S3
Ruddy turnstone	*Arenaria interpres*	R	M	SZN
Least sandpiper	*Calidris minutilla*	C	B	S4
Dunlin	*C. alpina*	C	M	SZN
Common snipe	*Gallinago gallinago*	C	B	S5
American woodcock	*Scolopax minor*	C	B	S5
Wilson's phalarope	*Phalaropus tricolor*	R	M	S3
Gulls and Terns	*Laridae*			
Bonaparte's gull	*Larus philadelphia*	C	B	S4
Ring-billed gull	*L. delawarensis*	C	B	S5
Herring gull	*L. argentatus*	C	B	S5
Great black-backed gull	*L. marinus*	R	M	S2
Common tern	*Sterna hirundo*	C	B	S4
Arctic tern	*S. paradisaea*	R	-	S2S3
Black tern[6]	*Chlidonias niger*	R	B	S3

1 Source: Temiskaming Field Naturalists (1994).
2 Abundance: C = common, U = uncommon, R = rare, V = very rare.
3 Status: B = breeding, M = migrant.
4 Source: NHIC (2006); S5 = very common in Ontario, demonstrably secure; S4 = common in Ontario, apparently secure; S3 = rare to uncommon in Ontario; S2S3 = very rare to uncommon in Ontario; S2 = very rare in Ontario; S1S2 = extremely rare to very rare in Ontario; S1 = extremely rare in Ontario; SZN = not of practical conservation concern as there are no clearly definable occurrences; SAN = accidental.
5 Designated as a threatened species by COSEWIC (2006), as well as by COSSARO (MNR, 2006) but not listed in regulation under the *Endangered Species Act*.
6 Designated as a species of special concern by COSSARO (MNR, 2006) but not listed in regulation under the *Endangered Species Act*.

All waterfowl species, including shorebirds, in the area are migratory. This area lies within the overlap between the Mississippi and Atlantic flyways. Migratory bird habitats of most concern are wetlands and open water areas throughout the region, which provide suitable feeding and/or roosting habitat, and allow relatively large accumulations of waterfowl as they prepare to begin or resume their migratory flights. Common migrating and breeding ducks in this area include mallard, American black duck, wood duck, ring-necked duck, American wigeon, blue-winged teal, common goldeneye, hooded merganser and common merganser.

The Canada Land Inventory (CLI, 1970) has classified the section of the Montreal River between Gillies Depot, located approximately 7 km upstream of the Hound Chute GS and Lake Timiskaming, as Class 6 with severe limitations to waterfowl production due to adverse topography and fast water flow. Upstream of Gillies Depot to the Lady Evelyn River outlet, the Montreal River is also categorized as Class 6 with severe limitations due to adverse topography and fluctuating water levels. The surrounding inshore upland areas have been classified as Class 7 with such severe limitations due to adverse topography that almost no waterfowl are produced.

2.2.8 Significant Aquatic Wildlife Species

A number of aquatic avian species have been designated with special status under federal and/or provincial legislation. Federally, species at risk are recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2006) and are protected under the *Species At Risk Act*, whereas provincially they are recognized by the Committee on the Status of Species at Risk in Ontario (COSSARO) under the Ontario *Endangered Species Act* and the Species at Risk in Ontario List (MNR, 2006). Species listed in regulation as endangered are afforded protection under the *Endangered Species Act*. The Provincial Policy Statement (OMMAH, 2005) provides protection of significant habitat of species listed by COSSARO (MNR, 2006) as endangered (not in regulation) or threatened. No protection is currently afforded to provincially designated species of special concern.

Of the aquatic species listed in Tables 2.6, 2.7 and 2.9, the least bittern is considered to be threatened by COSEWIC (2006). The least bittern and black tern have been designated as threatened and of special concern, respectively, by COSSARO but are not listed in regulation under the Ontario *Endangered Species Act* (MNR, 2006). COSEWIC (2006) does not consider black tern to be at risk.

Based on examination of the SARA Schedule 1 Species at Risk Web Mapping Application (Environment Canada, CWS, 2004) and NHIC (2006) databases, neither species has been recorded within a 5-km radius of the Hound Chute GS.

2.2.9 River Uses

2.2.9.1 General Recreation

The CLI (1974) categorizes both shorelands at the Hound Chute GS location as Class 4 with moderate capability for outdoor recreation. These shorelands provide access for canoe tripping; opportunities for angling or viewing sportfish; and/or a vantage point or area which offers a superior view. These shorelands also exhibit variety in land and water relationships which enhances opportunities for general outdoor recreation such as hiking and nature study or for aesthetic appreciation of the area. Downstream of the Hound Chute GS to the river outlet, the shorelands are also categorized at Class 4. In addition to the same recreational opportunities afforded at the Hound Chute GS location, some of these shorelands are suited to family or other recreation lodging use. At the Montreal River outlet, the shorelands are categorized as Class 3 with moderately high capability for outdoor recreation. In addition to the same recreational opportunities afforded by the shorelands upstream, there is an area exhibiting major, permanent, non-urban, man-made structures of recreational interest. Upstream of the Hound Chute GS location, the shorelands are categorized as Class 3 and 4, as well as Class 5 with moderately low capability for outdoor recreation. In addition to the same recreational opportunities provided by the shorelands downstream, some of these shorelands afford viewing of falls or rapids; provide access to water suitable for popular forms of family boating; are capable of supporting family beach activities; are suited to organized camping; and/or afford opportunity for viewing of wetland wildlife.

Further inland, the lands are categorized as Class 4 and 5, as well as Class 6 with low capability for outdoor recreation. The Class 6 lands exhibit variety in land and water relationships which enhances opportunities for general outdoor recreation; provide access to water affording opportunity for angling or viewing sportfish; and afford opportunities for viewing upland wildlife. In addition to the same recreational opportunities provided by the Class 6 lands, the Class 4 and 5 lands provide opportunities for downhill skiing and viewing of wetland wildlife.

There are a number of resorts and lodges in the Latchford area. For example, Red Pine Wilderness Lodge, Island 10 Fishing Retreat, Ellen Island Camp and Lady Evelyn Camp located on Lady Evelyn Lake about 25 km west of the Hound Chute GS provide opportunities for fishing, boating, canoeing and hiking. Anima-Nipissing Adventures and Breechwood Lodge on Lake Anima Nipissing about 14 km west of the Hound Chute GS, provide similar recreational opportunities. Anima-Nipissing Adventures also provide trips up the Montreal River by freighter canoe. Marsh Bay Resort, located on the Montreal River about 10 km upstream of the Hound Chute GS, provides opportunities for fishing, canoeing, camping, hiking, hunting, cross-country skiing and snowmobiling.

2.2.9.2 Recreational Boating

Boating and canoeing occur on the Montreal River upstream and downstream of the Hound Chute GS. The shallow depth of the Montreal River at some locations during certain times of the year, as well as the presence of dams and rapids, prevent larger craft from using the river for long distance navigation. The upper Montreal River is a designated canoe route, extending 64 km from Edith Lake downstream to Matachewan (MNR, 1991). This route can be extended downstream for another 20 km to Elk Lake. However, the river section upstream and downstream of the Hound Chute GS is also utilized by canoeists as evidenced by the well-used portage and campsite just upstream of the safety boom.

The “Pioneer Route” for boaters extends from the head of Lake Timiskaming at Notre Dame du Nord and New Liskeard to the Town of Témiscaming, approximately 125 km down the Ottawa River. The route’s name reflects the many thousands of settlers who from 1882 (before the advent of railways) travelled the waterway to access agricultural lands on the Quebec shore and those of the Little Clay Belt on the Ontario side.

2.2.9.3 Commercial Fishing

There are no commercial fishing operations on the Montreal River system.

Commercial baitfishing activities are common in the New Latchford/Cobalt area. The MNR North Bay District office controls and issues baitfishing licences. Baitfish consists of shiners, chubs, suckers and dace and are usually caught during the summer months.

2.2.9.4 Sportfishing

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 Montreal River.

Latchford occurs within the MNR Division 18 fishing area, with specific fishing seasons (Table 2.10) and catch limits.

As indicated in Section 2.2.6, there are two fish sanctuaries within the local study area: one downstream of the Latchford Dam, the other upstream and downstream of Fountain Falls. Sportfishing in the two sanctuaries is prohibited form 15 April to the Friday before the third Saturday in May (MNR, 2005).

Table 2.10: Fishing Seasons in Division 18 Fishery Area[1]

Species	Open Season
Northern pike	Open all year except 24 December
Lake whitefish	Open all year except 24 December
Brook trout	01 January to 15 September
Smallmouth bass	Last Saturday of June to 30 November
Yellow perch	Open all year
Walleye	01 January to 14 April and third Saturday in May to 31 December

[1] Source: MNR (2005); for sportfish species present in the Montreal River.

2.2.9.5 Municipal Water Supply

The Town of Latchford and the Refinery Townsite, with approximately a dozen permanent homes located about 4 km northeast of Latchford, rely on the Montreal River for their potable water supply. The Latchford water treatment plant was upgraded in 2004 to improve water quality for 143 households. The project included the installation of two new package filter plants, modification of the raw water pumping facilities and addition of duplex chemical dosing and sodium hypochlorite disinfection with storage and spill containment.

2.2.9.6 Hydropower Facilities

There are four hydroelectric generating stations and five dams in the Montreal River watershed. Table 2.11 provides a summary description of the operations of these hydroelectric facilities and dam structures.

As indicated in Table 2.11, the forebay at the Hound Chute GS is held between 273.87 and 274.10 m from the time the flash boards are installed after freshet until the end of Thanksgiving weekend for recreational purposes associated with the Marsh Bay Resort location about 10 km upstream (OPG *et al.*, 2004).

2.2.9.7 Other Uses

There are a number of cottages on the river between Latchford and the Hound Chute GS.

Table 2.11: Summary of Hydroelectric Facilities and Dam Structures in the Montreal River Watershed[1]

Facility/Dam	Owner/ Operator	Comments
Duncan Lake Dam	MNR/OPG	Duncan Lake Dam is located upstream of the point where Wapus Creek drains into the West Montreal River. This dam controls Duncan Lake and Pigeon Lake flows into the West Montreal River. The water is regulated to 3.14 m for recreation, navigation and fisheries. The sluice can be pulled to mitigate high water level as a result of exceptional rains. Logs are removed for the winter operation to supply additional water for power production. These logs are replaced in early to mid-June.
Mistinikon Lake Dam	OPG	The Mistinikon Lake Dam is situated on the Montreal River at the outlet of Mistinikon Lake approximately 14.5 km northwest of the Township of Matachewan urban centre. The dam controls Mistinikon Lake flow into the Montreal River approximately 38 km upstream of the Indian Chute GS. Water level is maintained between 319.0 and 319.70 m from Victoria Day to Thanksgiving Day weekend for recreational and navigational purposes. There is an agreement that when walleye spawning begins, the water level is held or allowed to rise and not drop to prevent exposing the eggs.
Gowganda Lake Dam	MNR	Gowganda Lake Dam is located in the community of Gowganda. It controls Gowganda Lake flow into Burk Lake, which flows into the Montreal River below Mistinikon Lake. The water level is regulated to 1.96 m (with reference to the top of the sill) for recreation and navigation.
Indian Chute GS	OPG	The Indian Chute GS (3 MW), a run-of-the-river facility, is located on the Montreal River approximately 16 km northwest of the community of Elk Lake. It is operated by remote control from Porcupine TS. The water level is maintained between 295.17 and 295.50 m from Victoria Day until Thanksgiving weekend for recreational and navigational purposes. In the event of a dry year, the water level is maintained above 295.17 m during the walleye spawning period in the spring. This water level allows walleye to access the Sidney Creek spawning bed located above Indian Chute GS.

Facility/Dam	Owner/ Operator	Comments
Lady Evelyn Lake Dam	OPG	The Lady Evelyn Lake Dam is located on the Lady Evelyn River, approximately 0.4 km upstream from its confluence with the Montreal River. This dam controls Lady Evelyn Lake flow into the Montreal River above Bay Lake. In accordance with a 1982 agreement with camp operators, storage between 289.30 and 289.51 m may be used only if spill is occurring downstream. This is to minimize spill losses downstream and to help mitigate erosion on the lake. When the snow course taken on 15 February shows water content to be less than normal, the drawdown is halted at 286.0 m to ensure filling of the lake by 01 June. The water level is maintained between 288.90 and 289.30 m from 01 June to Thanksgiving Day weekend for recreational and navigational purposes.
Latchford Dam	PWGSC	Latchford Dam, located in the Town of Latchford, is on the Montreal River approximately 15 km upstream of the Hound Chute GS. The dam controls Bay Lake water level on the Montreal River. The water level is maintained between 276.96 and 277.15 m from mid-May until Thanksgiving Day weekend. In the spring, a minimum flow must be maintained from the east side of the dam to ensure that the walleye spawning bed downstream is covered with water. A drawdown of 25 cm is initiated 01 November with the remaining drawdown of 1.40 m delayed until 01 March with a gradual drawdown until April to protect beaver, muskrat and other wildlife.
Hound Chute GS	OPG	The Hound Chute GS is operated by remote control from Porcupine TS. Flash boards are removed each spring prior to freshet to help mitigate flooding upstream. The forebay is held between 273.87 and 274.10 m from the time the flash boards are installed until Thanksgiving Day weekend on a best-effort basis for navigation and recreational purposes at Marsh Bay Resort located 10 km upstream. In high flow years, the top of the operating range of 274.16 m may be exceeded due to limited discharge capabilities at the station.
Ragged Chute GS	OPG/CHDI[2]	The Ragged Chute GS (3 MW), a run-of-the-river power plant, is located approximately 4.8 km downstream of the Hound Chute GS. There are no operating constraints for this facility.
Lower Notch GS	OPG	The Lower Notch GS, which is located at the mouth of the Montreal River at Lake Timiskaming, is one of the largest peaking facilities (280 MW) in Ontario. It is operated by remote control from the Dymond TS in New Liskeard. There are no operating constraints for this facility.

[1] Source: OPG *et al.* (2004).
[2] CHDI = Canadian Hydro Developers Inc.

3.0 IMPACT ASSESSMENT AND MITIGATIVE MEASURES

The available environmental baseline information and site-specific aquatic vegetation, benthic macroinvertebrate and fisheries survey findings provided the basis for an assessment of potential construction and operational impacts on the aquatic environment, e.g., due to cofferdam installation/removal, dewatering, blasting/rock fragment excavation, soil erosion and turbidity generation, etc.

Recommended mitigative measures for project effects on the aquatic environment are based on standard environmental construction guidelines, relevant government guidelines for proposed hydroelectric power plant development, as well as government agency and other organization consultation.

The significance of potential impacts was based on their magnitude, duration and extent after the implementation of recommended mitigative measures.

3.1 SURFACE AND GROUNDWATER HYDROLOGY

The proposed Hound Chute GS is planned to be located on the same footprint as the existing powerhouse. The existing powerhouse will be demolished followed by the construction of the new facility. The concrete base of the existing powerhouse extends to depths of approximately 11 to 17 m (Hatch Acres, 2006). This fair to very poor quality concrete base will be removed prior to construction of the new powerhouse foundation. A small amount of excavation and slope stabilization will be required for the new powerhouse foundation and underground tailrace canal. Two or three cofferdams will be required for powerhouse construction and weir refurbishment. Areas will be cleared of vegetation for construction material laydown and assembly.

Till and gully erosion caused by channelized overland flow can be a major source of soil erosion during construction. 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. In general, the following guidelines will be applied in development of the Erosion and Sediment Control Plan:

- fitting of proposed works to the terrain;
- 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;
- implementation of erosion control measures, e.g., rip rap berms underlain by filler 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
- revegetation of disturbed areas by seeding and/or planting following construction as soon as seasonal conditions permit.

As indicated in the Terrestrial Environment Supporting Document, a site-specific Erosion and Sediment Control Plan, addressing the area around the powerhouse and its ancillary infrastructure, as well as the construction laydown and assembly areas, will be prepared and implemented during construction. The site-specific Erosion and Sediment Control Plan will be part of a broader Environmental Management Plan for the redevelopment project.

For any new temporary crossings of drainage ditches, standard construction procedures will be followed involving crossing design (culvert or ford), installation and maintenance. For new crossings, a permit must be obtained from the MNR.

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

At the Hound Chute GS redevelopment site, blasting may be required to demolish the existing powerhouse and its foundation.

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 the 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 *Canadian 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. As indicated in Section 3.2.7, all blasting operations should adhere to DFO guidelines (Wright and Hopky, 1998) and blasting engineer recommendations.

Blasting could have a potential effect on groundwater quality and flow in the immediate vicinity of the blasting operations (Fitchko *et al.*, 1998). 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. 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.

Wells providing potable or other service groundwater within 100 m of blasting activities should be identified and sampled for water quality and level prior to and after blasting to confirm no effects on groundwater resources.

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

3.2 MONTREAL RIVER

As indicated in Section 1.1, a cofferdam is proposed at the inlet of the forebay to take advantage of an existing submerged structure. Upon construction completion, the cofferdam and submerged structural material (remains of an antecedent bridge) be knocked down and distributed along the bottom of the forebay resulting in improved flow of water to the powerhouse. This cofferdam would likely be in place for 12 to 14 months and will result in a dewatered area of 13,900 m^2 (1.4 ha).

The cofferdam on the downstream side of the powerhouse is likely to be in place for 12 to 14 months as well and result in an area to be dewatered of approximately 1,000 m^2 (0.1 ha).

Refurbishments to the wing wall will be required and can be done in the dry while the powerhouse is being constructed.

The dam with flash boards on the western channel will also require refurbishment. At this point it is not known whether a cofferdam will be required to refurbish this structure or whether this can occur in the wet. The need for this cofferdam will not be certain until a Design-Build-Contractor (DBC) is retained by OPG and this selection will not occur until Q2 2007. If a cofferdam is required it likely will be installed at the beginning of construction and be in place for 3 to 4 months, channelling all the water in the river through the forebay and powerhouse, and over the wing wall weir. Once this dam is refurbished the water in the river will be directed down the western channel while the cofferdam at the forebay neck is built and subsequently the powerhouse constructed.

The temporary 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 site. The work will also involve dewatering to the area downstream of the cofferdam and as necessary the placement of erosion control structures.

Blasting of bedrock will be required within the dewatered zones adjacent to the proposed powerhouse with the rock fragments removed by backhoe. The DFO has developed a number of guidelines 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 destruction of fish and/or harmful alteration, disruption or destruction (HADD) of fish habitat (see Section 3.2.7)

3.2.1 Hydrology

As indicated in Section 3.2, during the periods when no flow is diverted through the generating station, all flow in the Montreal River will be passed over the weirs. As a result, the hydrology of the river will not be affected downstream of the generating station during construction.

As indicated in Section 1.0, the generating station has operated as a run-of-the-river plant and will continue to do so. The new facility, with the automatically controlled inflatable weir as well as significantly increased discharge capacity, will enable a reduction of water level fluctuations and provide improved control of water levels and flows. The facility will continue to operate under the Water Management Plan Operating Regime.

3.2.2 Water Quality

During the construction period, water quality of the Montreal River may by affected by soil erosion and turbidity generation, in-water construction activities, accidental spills and waste material dispersion.

As indicated in Section 3.1, a site-specific Erosion and Sediment Control Plan will be prepared and implemented during construction.

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

The potential effects of in-water construction activities, such as cofferdam construction, on water quality in the Montreal River will be minimized by using clean rock fill, the placement of rock fill over similar coarse substrate and judicious selection of the discharge location and water pressure during dewatering.

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 plastic sheets bermed around the edges, and use of suitable hydrocarbon absorbent material for cleanup and approved landfill or other disposal. Any spills with the potential to create an impact to the environment should be reported to the MOE as required by provincial spills legislation. Interim sanitary waste collection and availability of treatment facilities should be arranged for the duration of the construction period. All construction waste and wastewater should be disposed of in accordance with regulatory requirements.

A Hazardous Materials Management Plan, Waste Management Plan and Spills Emergency Preparedness and Response Plan will be developed for the redevelopment project 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 water quality in the Montreal River.

During weir refurbishment, 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 prior to temporary cofferdam removal. All trash and other solid debris should also be collected for appropriate disposal.

As indicated in Section 2.2.1, sampling and analysis of bedrock at the proposed redevelopment site determined that it has low acid generation potential (Martin, 2006). As the acid generation potential is low, no mitigative measures are recommended.

Overall, the effects of generating station construction on Montreal River water quality are expected to be localized, temporary and negligible.

3.2.3 Sediments

As indicated in Section 2.2.2, bottom substrate in the Montreal River in the vicinity of the Hound Chute GS consists predominantly of coarse material, e.g., sand, gravel, cobble, boulder and/or bedrock. After construction, substrate type and quality will be similar to that currently in place. The potential use of fragmented rock generated by blasting activities for fish habitat enhancement and/or use for nearshore/shoreline erosion protection will be discussed with DFO. Otherwise, the excess rock will be removed form the dewatered areas behind the temporary cofferdams for suitable upland disposal.

As the new facility will continue to operate under the existing Water Management Plan Operating Regime (OPG *et al.*, 2004), no alternation of sediment type or quality is anticipated.

3.2.4 Aquatic Vegetation

As indicated in Section 2.2.3, no aquatic vegetation was observed by Coker and Portt (2006a) near the Hound Chute GS.

3.2.5 Plankton

Plankton populations will not be affected by construction or operation of the hydroelectric facility. Any plankton confined behind the cofferdams will be returned to the river during dewatering.

3.2.6 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. As indicated in Section 2.2, the substrate in the areas to be excavated consists primarily of boulder, cobble, gravel and/or sand over bedrock, or bedrock. The placement of rock fill over this type of similar substrate will minimize any 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 dam refurbishment, the placement of rockfill may also 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 of the redevelopment nearshore areas will result in localized destruction of the 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).

As the proposed hydroelectric facilities will continue to operate under the existing Water Management Plan Operating Regime (OPG *et al.,* 2004), no effect on benthic macroinvertebrate communities is anticipated.

3.2.7 Fish Populations

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. Sections 3.2.7 and 3.2.8 present the recommended mitigation measures to be implemented for the proposed Hound Chute GS redevelopment to meet regulatory requirements.

<u>During Construction</u>

The area within the temporary cofferdams will be dewatered to facilitate intake reconstruction, tailrace excavation and dam refurbishment. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. Fish within the area to be dewatered will be collected by electrofishing during drawdown and released to the river. The temporary unavailability of this habitat during the excavation period will have negligible effect on the local fish populations.

Temporary cofferdam installation could disrupt fish spawning activities and impact on the early life stages of fish, e.g., eggs and fry. However, installation and removal of the temporary cofferdams will occur outside of the timing restriction for in-water construction to protect the fish spawning and egg incubation period for warmwater and coolwater fisheries of 01 April to 30 June.

Blasting of bedrock will be required in the nearshore areas to be excavated. No blasting will be conducted in the water. 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. 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.

During powerhouse construction when no flow is being diverted through the GS, all flow in the Montreal River will be passing over the crest weir and through the spill channel (Figure 3.1). During the refurbishment of the crest weir all flow in the Montreal River will be passing through the intake channel, and then either through the GS and/or over the wing-wall (Figure 3.1).

Diverting all flow temporarily through the spill channel will not likely result in increased erosion (Coker and Portt, 2006b). The average annual flow at Hound Chute is 86.3 m^3/s, with 5-y and 20-y return flows of 406 m^3/s and 522 m^3/s, respectively (OPG *et al*., 2004). Despite these periodically high flow rates, there was no evidence of past erosion, which may be due, in part, to the bedrock/boulder shores of the spill channel that are densely covered with woody vegetation (Photograph 3.1). Since water management within the Montreal River will not change between pre- and post-construction, flows upstream and downstream of the spill channel will not be affected. Walleye spawning observations in 2006 did not identify the spill channel as a significant spawning area for walleye or suckers, and no other critical or important habitats are present that may be impacted by this temporary change in spill channel flow regime. The temporary change in spill channel flow regime is not expected to have a negative effect upon the resident fish community within the spill channel.

Photograph 3.1: Downstream View Within the Spill Channel.

Diverting all flow through the intake channel during the refurbishment of the crest weir will not likely result in increased erosion (Coker and Portt, 2006b). Work on the crest weir will be short term and can be accommodated during the period of low flow.

The following mitigation measures were recommended by Coker and Portt (2006b):

- In-water construction activities should be timed to avoid the spawning and incubation period of spring spawning fishes such as walleye, suckers and smallmouth bass, which typically excludes in-water work from 01 April to 30 June;

- If all water is being diverted through the spill channel at the time of the walleye and sucker spawning period, all water should continue to be diverted through the spill channel until the end of the hatch (15 June);

- 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;

- 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, including sediment removal from water pumped from within cofferdam enclosures;

- Blasting should adhere to the DFO guidelines (Wright and Hopky, 1998) and blasting engineer recommendations; and

- All materials and equipment used for the purpose of site preparation and 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.

<u>During Operation</u>

The redeveloped Hound Chute GS will remain a run-of-the-river hydroelectric plant, and therefore redevelopment will not change the flow regime of the Montreal River or the management of water levels in the upstream reservoir between Hound Chute and Latchford Dam. However, the proposed GS will have a greater flow capacity and therefore will alter the distribution of flow volume between the GS and the 400-m long spill channel (Figure 3.1). Presently, water is spilled through the spill channel or over the wing-wall when flows exceed the 57 m^3/s capacity of the GS, which occurs approximately 40% of the time (OPG *et al*., 2004). The redeveloped Hound Chute GS will have a rated flow of 104 m^3/s which will decrease the frequency of water spilled through the spill channel or over the wing-wall to approximately 20% of the time. When the GS is capable of taking all river flow, a very small amount of leakage occurs through the crest weir and the wing-wall, but essentially the spill channel becomes a quiet backwater. This is not expected to change as a result of redevelopment (Coker and Portt, 2006b).

Downstream of where the tailrace joins with the spill channel, flow velocity and volume will not differ between pre- and post-redevelopment. However, the adjusted location and discharge direction will result in some minor changes in flow velocity pattern in the immediate vicinity of the tailrace. Flow velocity entering the GS intake and exiting the tailrace will not differ significantly between pre- and post-development. However, the flow velocity in the intake channel, upstream of the proposed excavated area (Figure 3.1), will almost double from a maximum of approximately 0.9 m/s to a maximum of approximately 1.6 m/s between pre- and post- construction when the GS is operating at capacity and there is no flow over the wing-wall (F. Vitez, Gestion Conseil SCP, 2006, pers. comm.). The maximum flow velocity in the vicinity of the old bridge structure will not change significantly between pre- and post-construction, since the old bridge structure is presently restricting the channel cross-section to approximately half its potential. Post-construction flow velocity will remain similar to pre-construction velocity when the structure is demolished and the flow volume of the GS is doubled. The estimated area where post-construction flow velocity will be greater than pre-construction flow velocity is shown in Figure 3.1 (Coker and Portt, 2006b).

The existing flow regime within the spill channel due to leakage at the crest weir and the wing-wall is ≤ 1 m^3/s for approximately 60% of the time. Post-development flows of ≤ 1 m^3/s within the spill channel will occur approximately 80% of the time, with most flows in excess of this occurring between April and June (OPG *et al*., 2004). This will likely have a negligible effect upon the productivity within the spill channel; however, it is possible that this may have a slightly positive effect. The flow velocity in the spill channel appeared high for walleye spawning during the spring of 2006, and so a reduction in post-construction flows may improve the conditions for walleye spawning. Post-construction, the quiet backwater that the spill channel becomes during low flow will not be disturbed as often by periodic spill events. This change is not expected to affect fish productive capacity (Coker and Portt, 2006b).

The post-construction doubling of flow velocities within a portion of the intake channel (Figure 3.1) will likely have some effect upon the fish community composition within the affected area. However, given that the area affected is small and the existing habitat in that area is not critical and based on the underwater video not heavily utilized, increased flow velocities will not have a significant or measurable impact on fish productivity (Coker and Portt, 2006b).

Based on the impact assessment and provided that the recommended mitigation measures are implemented, Coker and Portt (2006b) concluded that the redevelopment of the Hound Chute site and the subsequent operation of the new and enlarged GS will not have a significant or measurable impact upon the composition or production of the Montreal River fish community. Overall, as the new facility will continue to operate under the existing Water Management Plan Operating Regime (OPG *et al.*, 2004), there will be no effects on fish populations.

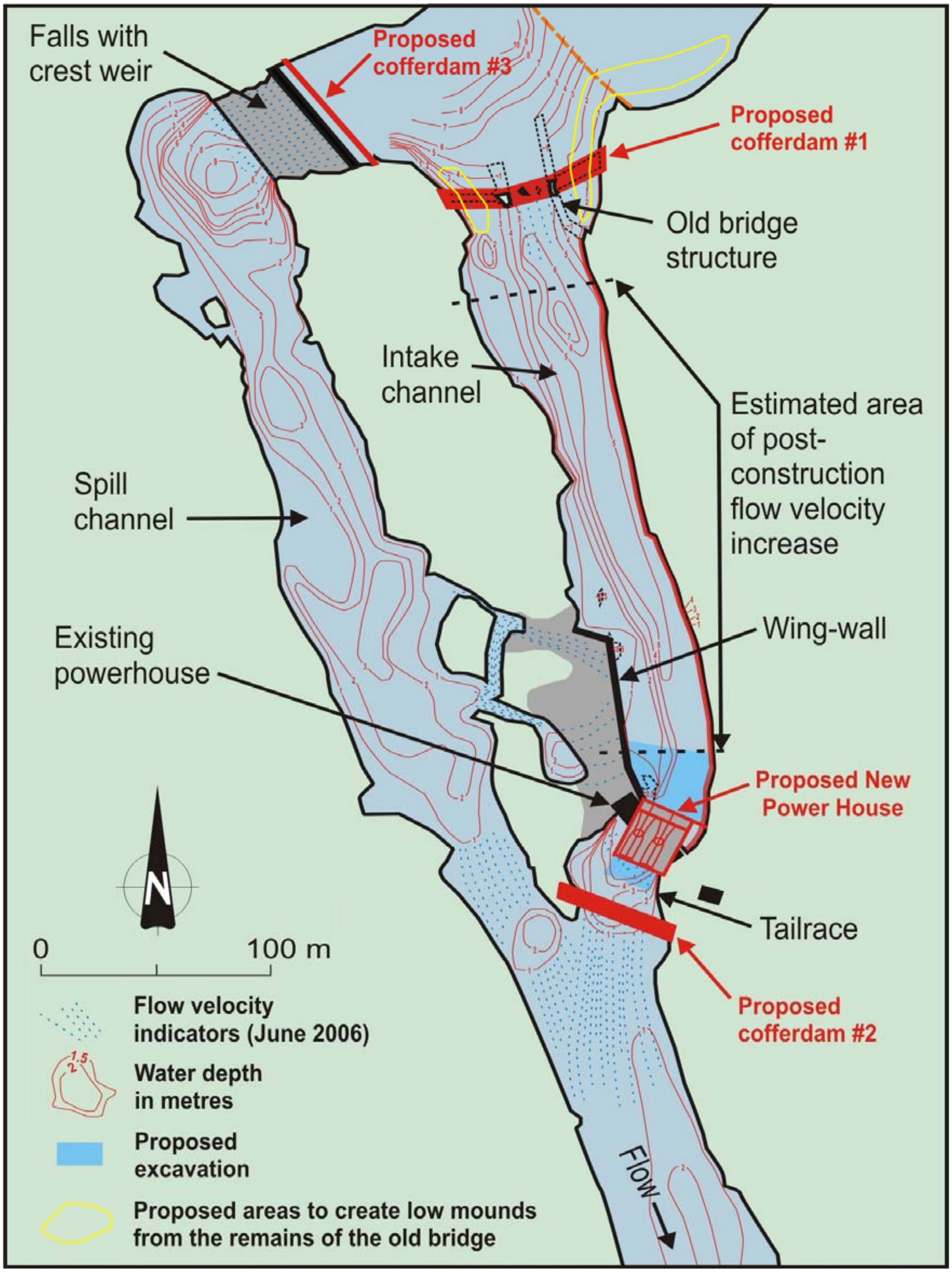
3.2.8 Fish Habitat

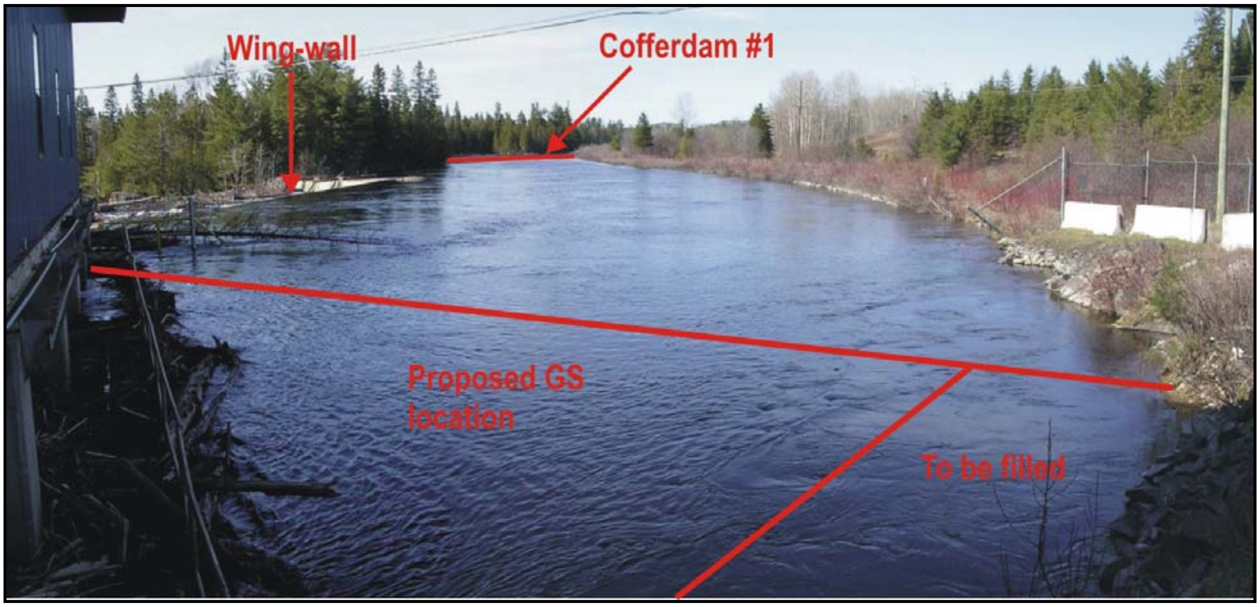
The existing Hound Chute GS will be completely demolished and the proposed GS will be built upon the footprint of the existing GS. The general configuration of the proposed GS will remain the same as the existing GS, with water from the intake channel directly entering short penstocks contained within the powerhouse, passing through the turbines and draft tubes, and then discharging via the tailrace. The proposed GS will be longer and rotated approximately 28° counter-clockwise from the existing GS, which extends the proposed facility into the intake channel (Figure 3.1; Photograph 3.2) and tailrace (Photograph 3.3), resulting in a permanent loss of approximately 262 m^2 (0.026 ha) of habitat in the intake channel, and 111 m^2 (0.011 ha) of habitat in the tailrace. The intake and the tailrace of the proposed facility will occupy similar locations and have almost the same orientation as the existing facility; however, they will be deepened to accommodate the larger plant flows (F. Vitez, Gestion Conseil SCP, 2006, pers. comm.). Intake and tailrace excavation will extend approximately 34 m upstream and 10 m downstream of the GS, respectively. To facilitate flow through the intake channel, the remains of the old rock-filled crib and concrete bridge that is located within the upstream end of the intake channel (Figure 3.2; Photograph 1.2) will be demolished, and the material will be used to create additional habitat structure nearby.

The areas being altered or covered are not thought to be critical habitats, and likely have substrates of exposed bedrock or exposed bedrock overlain with a relatively thin layer of coarse granular material (Coker and Portt, 2006b). After construction, the excavated areas will be mitigated with the addition of coarse granular material, which will restore these areas to their current condition, only deeper. The old rock-filled crib and concrete bridge structure provides some habitat structure in its present form, and may enhance local habitats in its post-construction form as low rubble and log piles on the river bottom near the upstream end of the intake channel and in the shallow area to the east of the intake channel (Figure 3.1).

Temporary impacts to fish habitat will occur due to the placement of cofferdams and the dewatering of habitat within those cofferdams. A cofferdam (#1) is required at the upstream end of the intake channel to dewater approximately 13,900 m^2 (1.39 ha) of the Montreal River between the GS and cofferdam (Photograph 3.2; Figure 3.1). Cofferdam #1 will be a rock structure built upon the remains of an old bridge that is composed of rock-filled wooden cribs and concrete (Photograph 1.2; Figure 3.1). This old bridge will be demolished and its material redistributed as low piles upon the bottom when the cofferdam is removed. A cofferdam (#2) is also required at the tailrace to dewater approximately 1,000 m^2 (0.1 ha) of river, which is presently the existing tailrace (Photograph 3.3; Figure 3.1), to allow construction of the new tailrace configuration. Cofferdam #2 will be a rock structure positioned at a shallow location downstream of the tailrace, and is expected to be in place for 12 to 14 months (Figure 3.1). A cofferdam (#3) may be required at the upstream side of the existing spillway crest weir (Photograph 3.4) to allow the refurbishment of the dam. At this time it is not known if Cofferdam #3 will be required, but if it is it will likely be made of wood and attached to the top of an existing submerged cofferdam, located immediately upstream of the crest weir (F. Vitez, Gestion Conseil SCP, 2006, pers. comm.). Cofferdam #3 is expected to be in place for 3 to 4 months.

Figure 3.1: Proposed Redevelopment Works, Water Depths and Other Details Considered in the Fisheries Impact Assessment. (Note that the blue velocity indicators show areas where the water surface is broken, and denote faster water when close together, and slower water when more widely spaced.)





Photograph 3.2: View of Intake Channel, Upstream of the Hound Chute GS. (Note: red line shows approximate upstream location of proposed GS and area to be filled, as well as Cofferdam #1.)

Photograph 3.3: View of the Hound Chute GS Tailrace. (Note: red line shows approximate downstream location of proposed GS.)

Photograph 3.4: View of Upstream Side of the Crest Weir at the Upstream End of the Spill Channel.

The areas that will be temporarily dewatered do not constitute critical or important habitat (Coker and Portt, 2006b). Some have historically been impacted by the construction and operation of the existing Hound Chute GS. Although the area between cofferdam #1 and the GS is relatively large (1.4 ha), it does not contain any critical habitats and represents only 0.46% of the area between Hound Chute and the upstream Latchford Dam, or 12.5% of the aquatic habitat area within 1 km upstream of the existing GS. This area was also sparsely inhabited by fish, as indicated by the underwater video observations conducted on 28 June 2006 (see Section 2.2.6.1). These areas are not thought to be critical for any life stages of any of the species present, and the fact that they will be temporarily unavailable is not expected to have any significant or measurable impact on the overall fish production of the system, or even within a kilometre of the Hound Chute GS.

Provided that the following recommended mitigation measure, in addition to those listed in Section 3.2.7, is implemented, the net effect to fisheries production from direct habitat alterations will be negligible (Coker and Portt, 2006b):

- The floor of the new tailrace and any area of the existing riverbed that is re-contoured to expose bedrock should be covered by a layer of cobble-sized material to provide better habitat.

In summary, no critical fish habitat, such as walleye, sucker or smallmouth bass spawning habitat, will be directly altered. The areas that will be directly altered are mostly manmade habitats, i.e., the intake structure and the adjacent substrate for approximately 34 m upstream; the tailrace and the adjacent substrate for approximately 10 m downstream; and the submerged remains of the old bridge structure. These locations will continue to provide similar habitats post-construction.

The locations of the cofferdams and the dewatered areas will be temporarily unavailable as fish habitat, and will be completely reinstated post-construction. Although they do contain fish, the fact that they will be temporarily unavailable is not expected to have a significant impact on the productive capacity of the system.

3.2.9 Aquatic Avifauna

A number of aquatic avian species likely use the Montreal River from the Latchford Dam to downstream of the Hound Chute GS as breeding, staging, stopover and/or feeding habitat.

CLI (1970) mapping for waterfowl production indicates that the Montreal River between Gillies Depot, located approximately 7 km upstream of the Hound Chute GS and Lake Timiskaming, is categorized as Class 6 with severe limitations due to adverse topography and fast water flow.

Although two aquatic avian species at risk have been recorded in the Timiskaming area, i.e., least bittern and black tern, there are no records of these species within a 5-km radius of the Hound Chute GS (Environment Canada, CWS, 2004; NHIC, 2006).

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. Most bird species habituate rapidly 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. 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.

During operation, noise will be generated from the proposed generating station. This steady noise from the proposed GS will be similar to that of the existing facility and not elicit an adverse reaction from nearby habituated aquatic wildlife.

3.2.10 Water Uses

During construction and operation of the proposed generating facility, there will be no impact on recreational activities on the Montreal River. The water levels of the river upstream will be maintained as per the approved operating regime identified in the Water Management Plan (OPG *et al.*, 2004). Therefore, there will be no negative impact on recreational boating or canoeing.

3.2.11 Marsh Bay

During the development of the Montreal River System Water Management Plan, a group of property owners located in the Marsh Bay area upstream of the Hound Chute GS raised a variety of socio-economic and environmental concerns to the MNR and OPG (OPG *et al.*, 2004). These individuals own properties along the river and their properties are susceptible to fluctuating water levels. Specifically, the concerns of the residents included:

- fluctuating water levels at their properties owing to the use of flash boards at Hound Chute GS;
- maximum water levels during a flood event;
- property rights; and
- risks to the natural environment from fluctuating water levels.

OPG initiated a number of studies in order to better understand the extent of the flooding and impacts on individual properties. These additional studies included improved bathymetric data for the riverbed; topographic surveying of the properties and buildings of owners to 0.5-m contours; and modelling of the abrupt water level fluctuations during the operation of the flash boards.

Presently, manually operated flash boards are used to assist in the control of the water levels. In the event that there is fluctuation in water levels, OPG has to dispatch personnel to then manually install or remove the flash boards.

In order to address the concerns of the property owners, OPG is proposing to replace the existing flash boards with an inflatable Obermeyer weir as part of the redevelopment of the existing Hound Chute GS. The inflatable weir, which would be automatically controlled, would allow OPG to more tightly control the water levels upstream of Hound Chute GS and thereby reduce the fluctuating water levels throughout the year, but particularly in the spring. On a reasonable effort basis, OPG will operate Hound Chute GS in order to maintain the water level towards the upper end of the Montreal River System Water Management Plan summer operating regime (at Hound Chute), year round. The redevelopment will also include plans for OPG to increase the discharge capacity of the generating station by approximately 150 m^3/s (100 m^3/s from the weir and 50 m^3/s from the additional station capacity) and thereby have additional capacity to reduce the potential for flooding of properties upstream of Hound Chute GS.

The operation of the Obermeyer weir will:

- eliminate the need to drop the water level in order to remove and install flash boards;
- provide for automatic water level operation within the discharge capacity of generating station and weir;
- result in a major reduction in water level fluctuation compared to that experienced in the past;
- lower the likelihood of exposing spring spawning and/or nursery areas (northern pike and walleye);
- lower the likelihood of exposing early summer spawning and/or nursery areas (smallmouth bass);
- lessen the effects of water level fluctuations on amphibian (frog) spawn and waterfowl (loon) nesting; and
- provide consistent water levels throughout the year.

Overall, the property owners at Marsh Bay will experience much more consistent water levels than what they have previously experienced. The concerns of the Marsh Bay residents are historic concerns associated with the location of these properties and the operations at Hound Chute GS. The proposed undertaking at Hound Chute GS represents a unique opportunity to address these concerns and improve the existing situation.

4.0 SUMMARY AND CONCLUSIONS

This technical supporting document provides an aquatic environmental baseline, the potential environmental effects of the proposed Hound Chute GS on the aquatic environment and the recommended mitigative measures to minimize these effects.

During proposed generating station construction, potential impacts on the aquatic environment may occur due to in-water construction activities, blasting, soil erosion and turbidity generation, and accidental spills. Based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigative measures, SENES concludes that effects during construction will be minimal, localized and short-term.

During proposed generating station operation, potential impacts on the aquatic environment may occur due to accidental spills. Based on assessment of the baseline information and potential effects, SENES concludes that the operation of the proposed Hound Chute GS will have negligible effects on the aquatic environment.

Environmental protection during proposed generating stations 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 Environmental Management Plan ensures that environmental protection will be achieved by describing government agency requirements, OPG policy, project commitments and recommended mitigative 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.

Table 4.1 summarizes potential construction and operation effects, the recommended mitigative/remedial measures to minimize or obviate these impacts and the net effects.

Table 4.1: Summary of Potential Effects and Recommended Mitigative/Remedial Measures

Effect/Activity	Recommended Mitigative/Remedial Measure	Net Effect
Construction		
Soil erosion	• Adherence to Erosion and Sediment Control Plan.	Negligible effect
Incidental spills of oil, gasoline and other liquids during construction	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect
Hazardous Materials/ Waste	• Adherence to Hazardous Materials Management Plan and Waste Management Plan. • Waste disposal in accordance with regulatory requirements.	Negligible effect
Blasting	• Adherence to DFO guidelines (Wright and Hopky, 1998) and blasting engineer recommendations.	Negligible effect
In-water construction activities	• Use of clean rock fill for cofferdam. • Placement of rock fill over similar coarse substrate. • Judicious selection of discharge location and water pressure during dewatering. • Adherence to in-water construction timing restriction. • Confined upland disposal of dredged material. • Provision of cobble-sized material on the floor of the new tailrace area of the proposed Hound Chute GS.	Negligible effect
Operation		
Incidental spills of oil, gasoline and other liquids during operation	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect

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APPENDIX 1

FISHERIES SURVEY AND IMPACT ASSESSMENT REPORTS

HOUND CHUTE GS
MONTREAL RIVER
HABITAT AND FISH COMMUNITY ASSESSMENT
2006

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Report date: DRAFT November, 2006

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 METHODS 1
3.0 RESULTS 2
3.1 Overview of study area 2
3.2 Background fish community information 4
3.3 Electrofishing catches and video observations 4
3.4 Existing habitat 5
3.5 Walleye spawning 5
4.0 DISCUSSION 8
4.1 Fish community 8
4.2 Fish habitat 8
5.0 SUMMARY 9
6.0 REFERENCES 10

1.0 INTRODUCTION

C. Portt and Associates was retained, as part of the SENES Consultants Limited project team, by Ontario Power Generation (OPG), to conduct a habitat and fish community assessment at the Hound Chute Generating Station (GS), located approximately 10 km south of Cobalt, Ontario (Figure 1). This report presents the results of the 2006 investigation of aquatic habitat and the fish community in the vicinity of the Hound Chute GS.

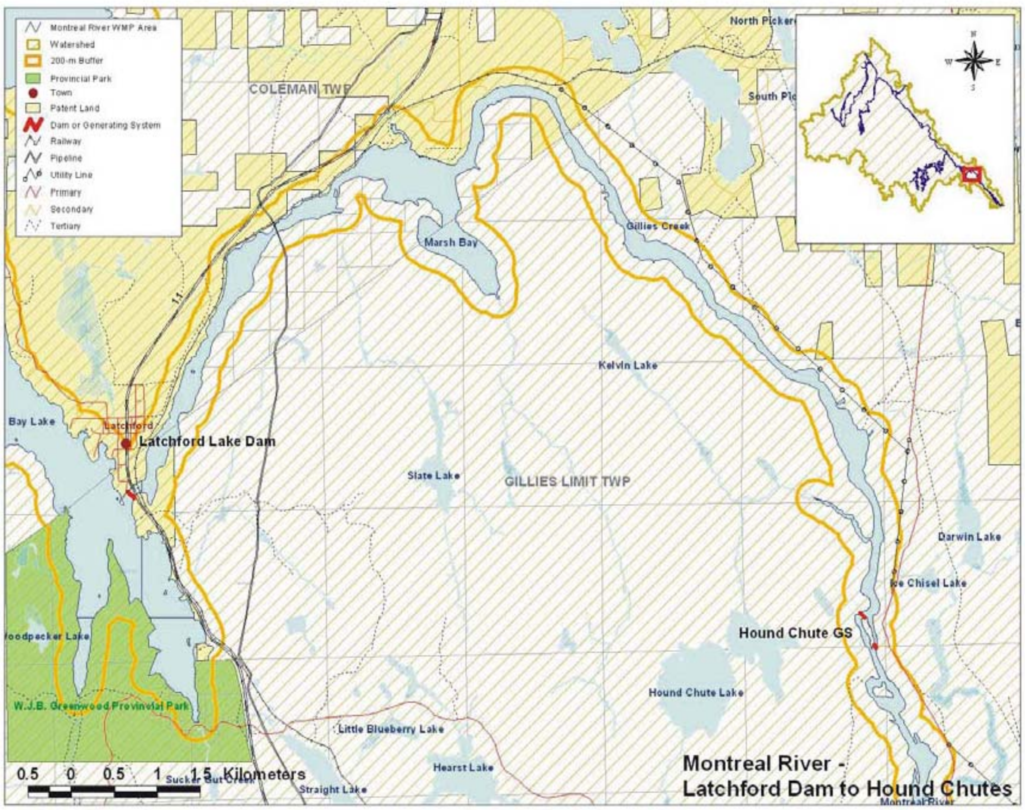

Figure 1: Location of the Hound Chute GS on the Montreal River. Inset shows Montreal River watershed. Map courtesy of OPG.

2.0 METHODS

The North Bay office of the Ministry of Natural Resources was contacted to obtain background fisheries data for the Hound Chute study area.

A walleye (*Sander vitreus*) spawning assessment was conducted by C. Portt and Associates staff (G. Coker, J. Reid) on April 30 and May 4, 2006. The Montreal River in the vicinity of the

Hound Chute GS was examined during daylight hours in order to identify safety hazards, access routes, and potential walleye spawning habitat. Spawning observations were conducted after nightfall on April 30 and May 4. A powerful spotlight was used to search for walleye, which were 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. A Garmin GPS 12 Global Positioning System (GPS) unit was used to locate and identify key features. Digital photographs were taken of all locations examined.

An assessment of habitat was conducted by C. Portt and Associates staff (G. Coker, C. Portt, J. Reid, Rebecca Dolson) on June 19, 20 and 28, 2006. A Garmin GPS 12 Global Positioning System (GPS) unit was used in conjunction with direct observations and measurement in shallow areas, and an electronic hydro-acoustic depth sounder and an underwater video system in deeper areas, to map water depths and substrate type within the study area. Granular substrates were classed as boulder (>256 mm), cobble (64 - 256 mm), gravel (2 - 64 mm), and sand (0.0625 mm – 2 mm) (Wentworth, 1922), based on visual and tactile assessments. Water velocities were estimated visually. Digital photographs were taken at strategic geo-referenced locations to further characterize habitat.

Fish were collected by electrofishing in wadeable areas on June 20, 2006, using a Halltech Model HT 2000 backpack electrofisher. The underwater video system also provided for fish observations.

3.0 RESULTS

3.1 Overview of study area

The Hound Chute GS was completed in 1910-1911 and was designed to generate 3.6 megawatts (MW) of power with 4 turbines. The head is 10.3 m, and the flow capacity of the plant is 57 m^3/s. Water flows from the upstream intake channel (Figure 2; Appendix A: Photograph 1) directly into penstocks contained within the powerhouse, and discharges back to the Montreal River from the downstream side of the powerhouse. The GS bypasses a falls with a concrete crest weir at the top, with flashboards along its crest (Figure 2; Appendix A: Photograph 2), and a section of spill channel approximately 400 m long that ranges from approximately 31 to 65 m in width (Figure 2; Appendix A: Photograph 3). Adjacent to the GS is a low concrete weir (wing-wall), which can spill excess water over a bedrock cliff into the downstream end of the spill channel (Figure 2; Appendix A: Photograph 4). The tailrace is more than 5 m deep where it exits the draft tubes, and then quickly rises to join the typical downstream river depth of approximately 1 m (Figure 2; Appendix A: Photograph 5). Downstream of the confluence of the spill channel and the tailrace, the river is approximately 1 to 2 m deep and approximately 55 to 75 m wide (Figure 2; Appendix A: Photograph 6), and 300 m downstream of the tailrace the river splits around a large island. Water is spilled over the weirs when the river exceeds the plant capacity, which is about 74% of the time (OPG, 2005).

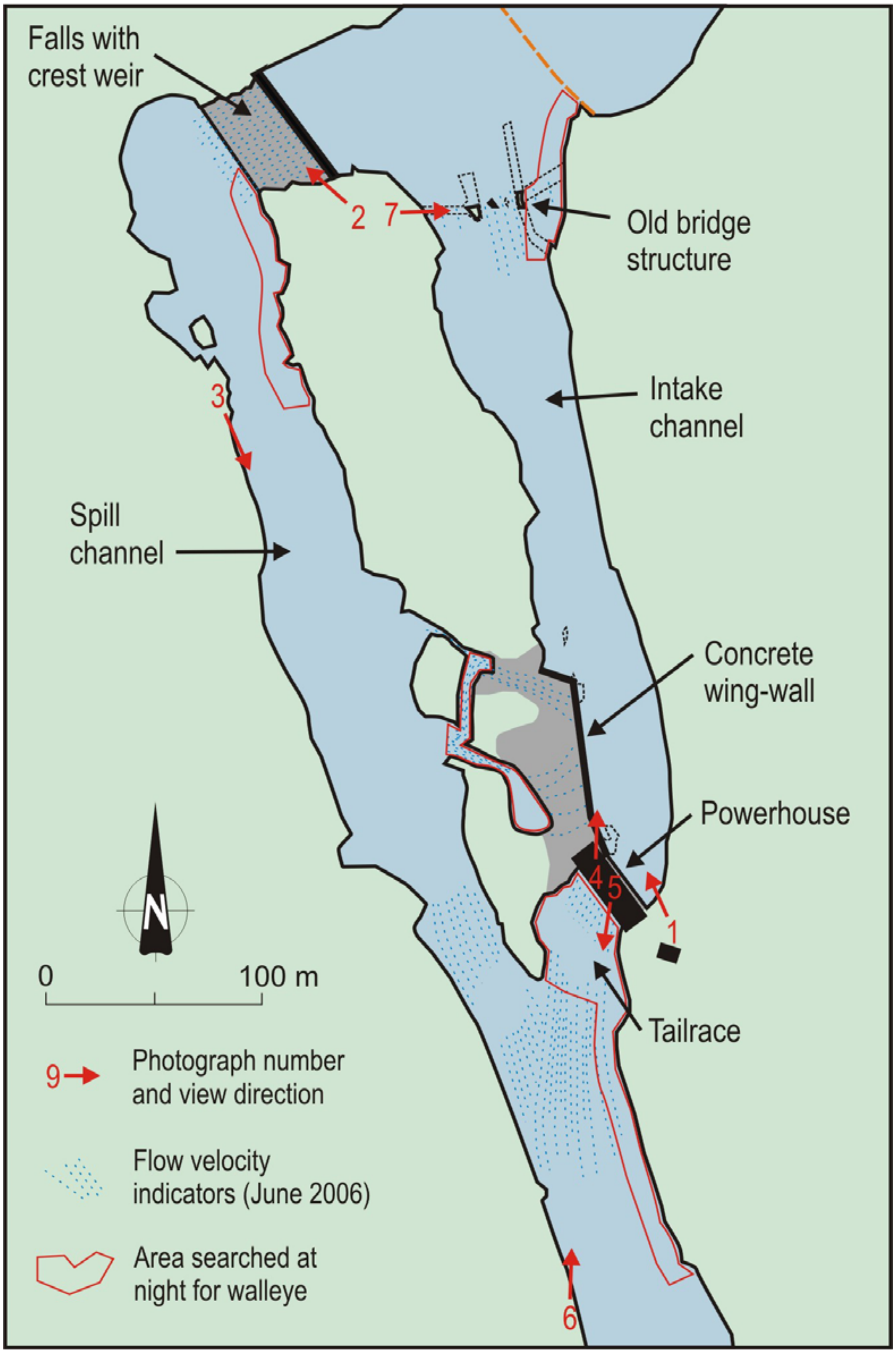

Figure 2: Areas examined for spawning walleye and locations of photographs provided in Appendix A.

3.2 Background fish community information

Dillon Consulting Ltd. (1999) compiled a list of fish that were known to occur in the Montreal River from the MNR and the ROM files, and added the fish that they captured or observed in the vicinity of the Latchford Dam (Table 1). We found no records of fish collections at Hound Chute in the MNR files. One MNR fish collection, from August 1977, was located 1 km upstream of Hound Chute, in which were captured golden shiner, common shiner, mimic shiner, and yellow perch. Of the species listed in Table 1, none are presently tracked by the Natural Heritage Information Centre (http://nhic.mnr.gov.on.ca/nhic_.cfm; July 21, 2006). None of the fish that occur in the Montreal River (Table 1) are presently considered at-risk federally by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC; http://nhic.mnr.gov.on.ca/nhic_.cfm).

Table 1: Fish species documented from the Montreal River (Dillon Consulting Ltd. (1999)).

Common name	Scientific name	Captured or observed by C. Portt and Associates at Hound Chute. June 2006.
lake whitefish	*Coregonus clupeaformis*	-
cisco	*Coregonus artedi*	-
northern pike	*Esox lucius*	-
common white sucker	*Catostomus commersonii*	-
golden shiner	*Notemigonus crysoleucas*	-
mimic shiner	*Notropis volucellus*	87 captured
common shiner	*Luxilus cornutus*	-
blacknose shiner	*Notropis heterolepis*	-
spottail shiner	*Notropis hudsonius*	-
fathead minnow	*Pimephales promelas*	-
bluntnose minnow	*Pimephales notatus*	2 captured
brassy minnow	*Hybognathus hankinsoni*	-
longnose dace	*Rhinichthys cataractae*	14 captured
burbot	*Lota lota*	-
ninespine stickleback	*Pungitius pungitius*	-
rock bass	*Ambloplites rupestris*	-
smallmouth bass	*Micropterus dolomieu*	1 captured and ~ 15 observed
pumpkinseed	*Lepomis gibbosus*	-
yellow perch	*Perca flavescens*	-
walleye	*Sander vitreus*	2 observed
johnny darter	*Etheostoma nigrum*	-
Iowa darter	*Etheostoma exile*	-
logperch	*Percina caprodes*	-
mottled sculpin	*Cottus bairdii*	3 captured

3.3 Electrofishing catches and video observations

Electrofishing on June 20, 2006, along a total of 281 m of shoreline downstream from the Hound Chute tailrace, captured five species of fish (Table 1). During approximately six hours of underwater video observations, two walleye were observed in the tailrace, approximately five smallmouth bass were observed downstream of the GS and in the spill channel, and approximately ten smallmouth bass were observed in the intake channel upstream of the GS.

3.4 Existing habitat

Depth contours, flow patterns and substrate are presented in Figures 3 and 4. Much of the aquatic habitat downstream of the Hound Chute GS facility (including the spillway channel) is fairly shallow, with the exception of a plunge pool immediately downstream of the falls at the upstream end of the spillway channel, and the excavated tailrace. Most of the aquatic habitat upstream of the Hound Chute GS is deeper. As would be expected from the difference in average depths, flow velocity was generally higher downstream of the GS. Though flow velocity generally increases with the river flow, the intake channel will usually show less variation in flow velocity, and the spillway channel will generally show more variation in flow velocity, as OPG attempts to maximize flow through the GS. The spillway channel was observed to have very high flow velocities during the spring freshet, but was essentially a quiet backwater area by the beginning of summer. Bedrock is exposed within the two falls, as well as in a portion of the intake channel. Most of the substrate within the study area was dominated by cobble, boulder and gravel, in various proportions. Large woody debris occurred at a few locations, generally where the water was deepest (Figures 3 and 4).

The remains of an old bridge, consisting of rock-filled wood cribs and weathered concrete piers, are located at the upstream end of the intake channel (Figure 2; Appendix A: Photograph 7).

3.5 Walleye spawning

A search for spawning walleye was conducted after dark on April 30 and May 4, 2006, when water temperatures were 7.8°C and 10.8°C respectively. The areas searched are shown in Figure 2. No walleye were observed, though many walleye were observed spawning on both those nights at the Latchford Dam, located approximately 10 km upstream on the same river (Figure 1).

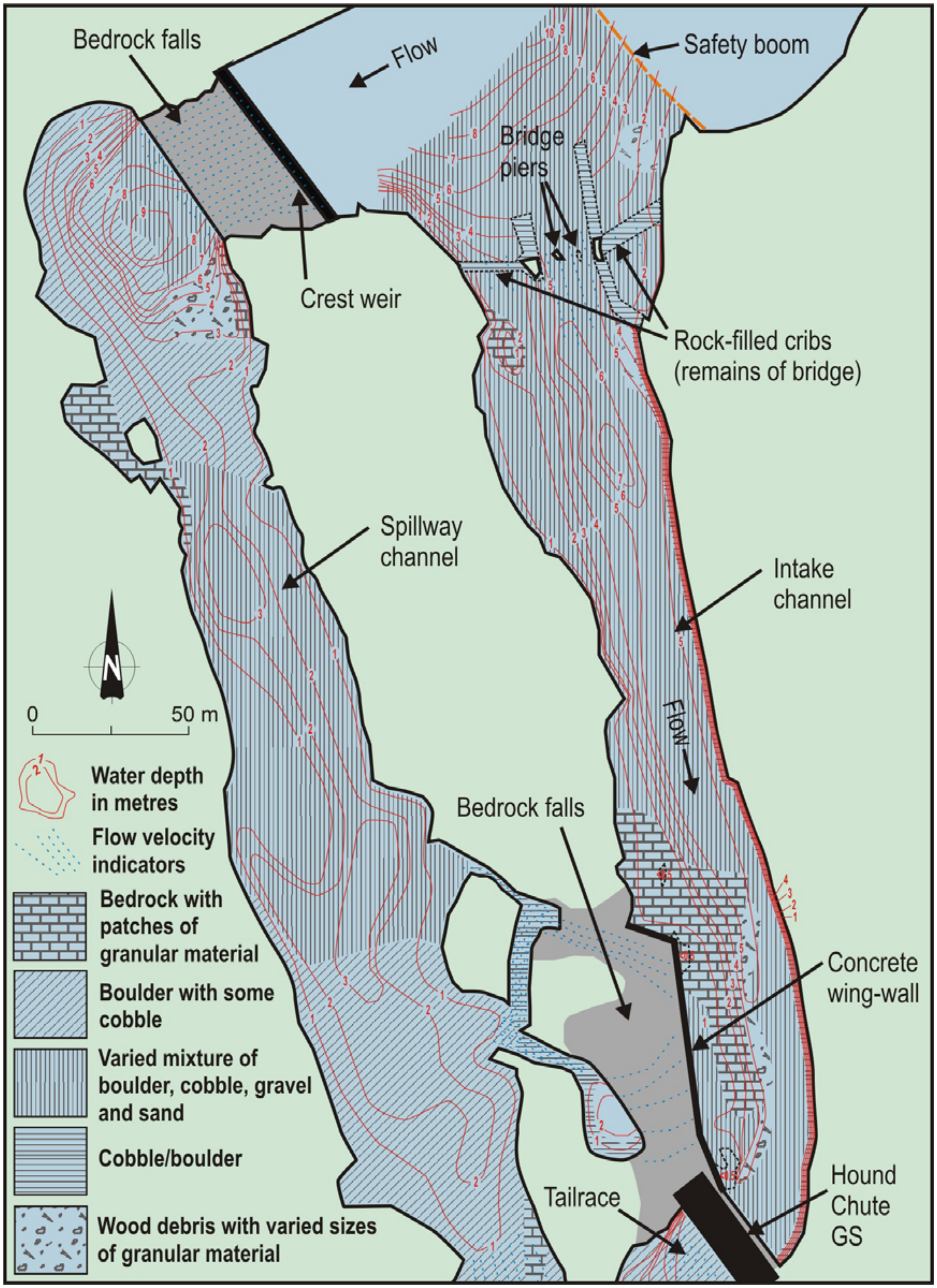

Figure 3: Bathymetry, substrate, flow velocity features, and location details within the upstream portion of the Hound Chute GS study area.

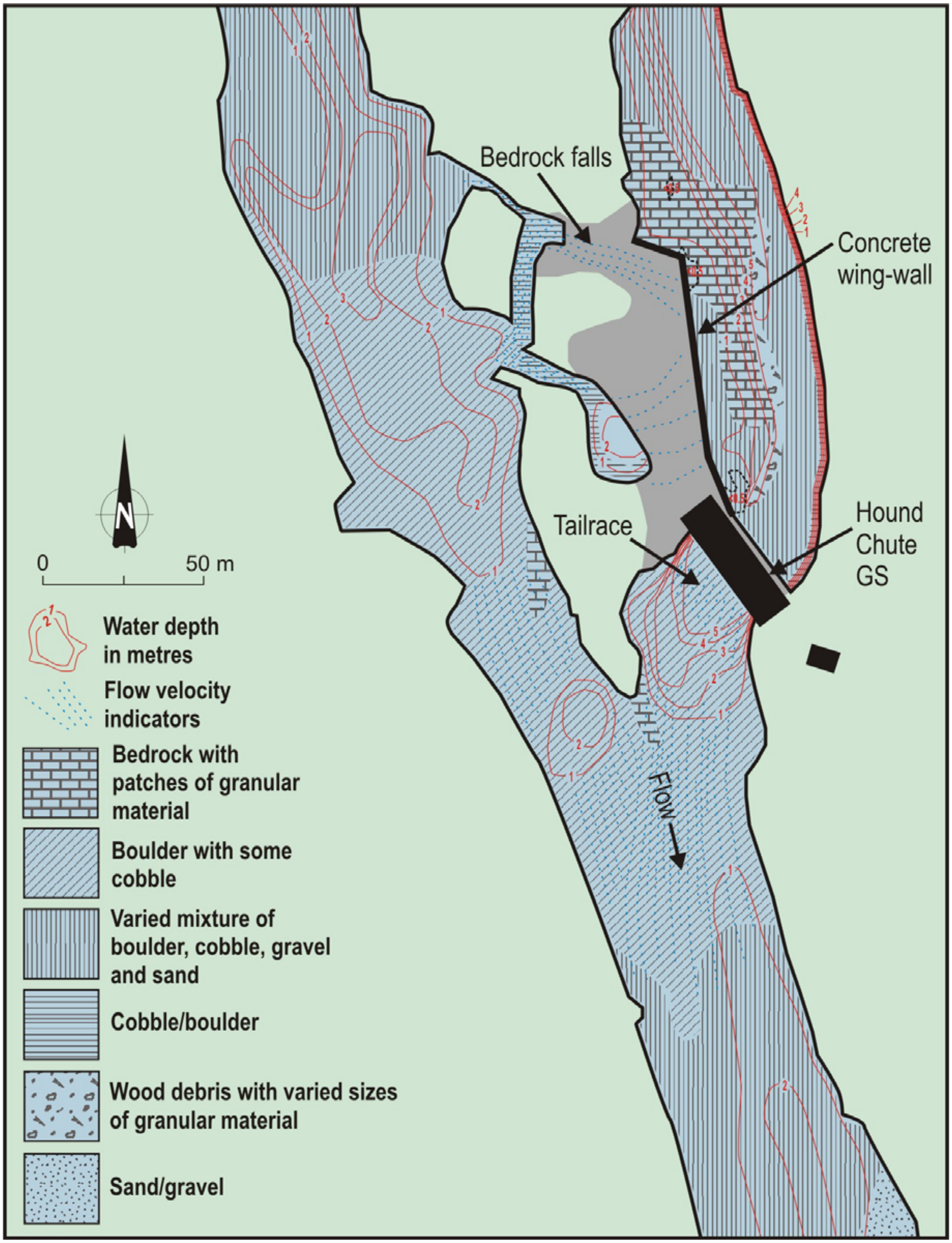

Figure 3: Bathymetry, substrate, flow velocity features, and location details within the downstream portion of the Hound Chute GS study area.

4.0 DISCUSSION

4.1 Fish community

The fish community within the Montreal River in the vicinity of the Hound Chute GS appears to be relatively simple and numerically sparse, based mainly upon the long period of video observations (Table 1). Few fish species were also captured by electrofishing, however, more species would likely be captured if a broader range of habitats over several seasons were sampled. It is unclear why so few fish were observed or captured, however the clear water and the general lack of epiphytic growth on the substrate, as well as the lack of macrophytes, suggest that productivity of the area is relatively low.

The fact that walleye were not observed during the spawning period may reflect the limited, and generally poor spawning habitat that was accessible for viewing, or low walleye abundance in the reach of the Montreal River between Hound Chute and the dam at Ragged Chute, approximately 4.2 km downstream.

4.2 Fish habitat

The Montreal River in the vicinity of the Hound Chute GS provides a variety of riverine habitats. Different velocity and depth habitats are available, though substrate type is relatively coarse. Large boulders, steep inclines, large woody debris, and an old bridge structure, all provide good habitat structure. Though possibly in low numbers, fish such as walleye and suckers likely migrate to the riffles in the vicinity of the Hound Chute GS to spawn. These riffles differ throughout in water depth, velocity, and substrate size, and therefore the location of the optimal combination of these parameters that are required for spawning will vary with discharge conditions through the powerhouse and the spill channel. At the time of the walleye spawning investigation (April 30 and May 4, 2006) it was observed that most of the riffles in the vicinity of the GS had flow velocities that were too high for walleye spawning, however, spawning conditions may be suitable on other occasions when lower river discharge rates occur. Suitable substrate for walleye spawning is present at the downstream end of the study area and beyond, and it is possible that velocities in that area are more suitable.

The small fishes captured in the study area likely reside here year-round, making short spawning migrations to local areas with suitable spawning conditions.

5.0 SUMMARY

No species considered at-risk are known to occur in the vicinity of the Hound Chute GS. The variety of habitats and habitat conditions within the study area can provide one or more of the spawning, nursery, foraging, over-wintering, juvenile, and adult habitat requirements for many of the fishes that reside in the Montreal River downstream of the Lower Sturgeon GS. Walleye were not observed spawning within the study area, and fish abundance and diversity was observed to be low.

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HOUND CHUTE GS
MONTREAL RIVER
FISHERIES IMPACT ASSESSMENT
2006

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 METHODS 1
3.0 POTENTIAL IMPACTS TO FISH HABITAT 2
3.1 Generating station redevelopment 2
3.2 Temporary construction impacts 6
3.3 Operation of the new Hound Chute GS 8
4.0 CONCLUSION 10
5.0 REFERENCES 11

1.0 INTRODUCTION

C. Portt and Associates was retained, as part of the SENES Consultants Limited project team, by Ontario Power Generation (OPG) to conduct a fisheries impact assessment of the proposed Hound Chute Generating Station (GS) redevelopment. The Hound Chute GS is located approximately 10 km south of Cobalt, Ontario (Figure 1). This report presents the results of the fisheries impact assessment, that is based upon investigations of aquatic habitat and the fish community at the Hound Chute GS in 2006, as well as the proposed redevelopment works.

2.0 METHODS

The results of investigations of the existing fisheries at the Hound Chute GS (C. Portt and Associates, 2006) were used in conjunction with information provided by OPG regarding the proposed GS expansion project to assess the potential impact of the project on the fisheries resources that utilize the Hound Chute GS site.

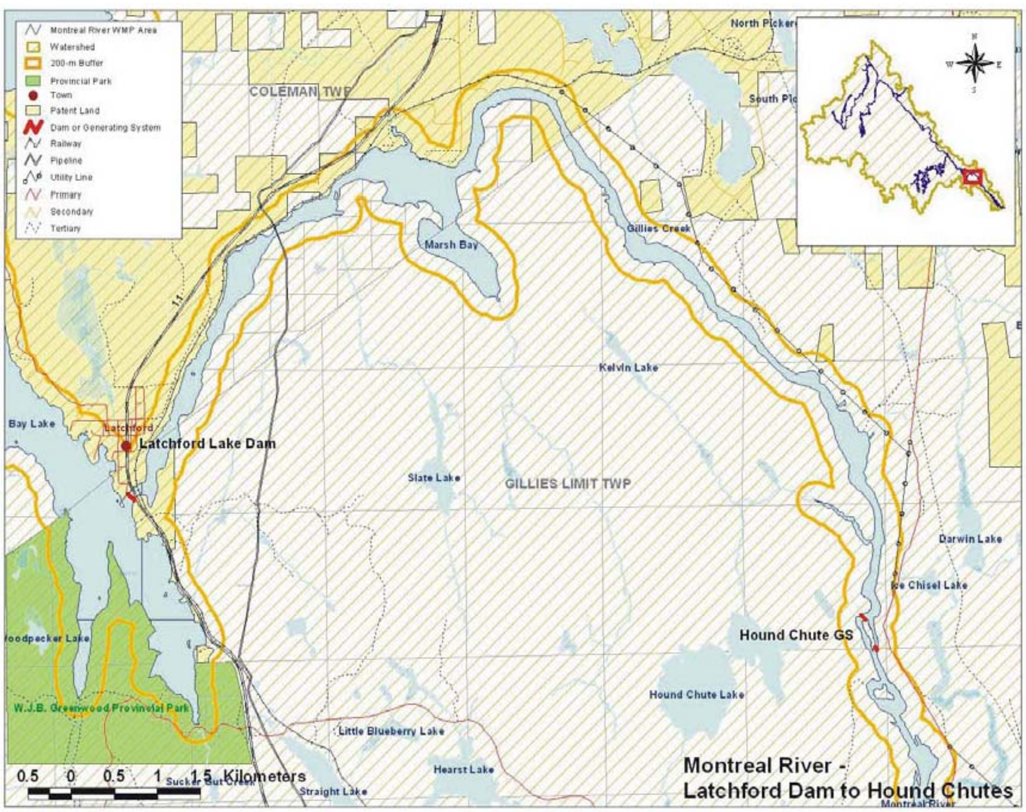


Figure 1: Location of the Hound Chute GS on the Montreal River. Inset shows Montreal River watershed. Map courtesy of OPG.

3.0 POTENTIAL IMPACTS TO FISH HABITAT

3.1 Generating station redevelopment

The existing four unit Hound Chute GS, with a maximum output of 3.6 megawatts, will be replaced by a new twin unit GS with a maximum output of approximately 10.2 megawatts. The existing GS will be completely demolished and the proposed GS will be built upon the footprint of the existing GS. The general configuration of the proposed GS will remain the same as the existing GS, with water from the intake channel directly entering short penstocks contained within the powerhouse, passing through the turbines and draft tubes, and then discharging via the tailrace. The proposed GS will be longer and rotated approximately 28° counter-clockwise from the existing GS, which extends the proposed facility into the intake channel (Figure 2; Photograph 1) and tailrace (Photograph 2), resulting in a permanent loss of approximately 262 m^2 (0.026 ha) of habitat in the intake channel, and 111 m^2 (0.011 ha) of habitat in the tailrace. The intake and the tailrace of the proposed facility will occupy similar locations and have almost the same orientation as the existing facility, however, they will be deepened to accommodate the larger plant flows (Francois Vitez, Ing., Gestion Conseil SCP, personal communication. November 28, 2006). To facilitate flow through the intake channel, the remains of the old rock-filled crib and concrete bridge that is located within the upstream end of the intake channel (Figure 2; Photograph 3), will be demolished, and the material will be used to create additional habitat structure nearby.

<u>Mitigation</u>

- In-water construction activities should be timed to avoid the spawning and incubation period of spring spawning fishes such as walleye (*Sander vitreus*), suckers (Catostomidae), and smallmouth bass (*Micropterus dolomieu*), which typically excludes in-water work from April 1 to June 30.
- 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.
- 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 cofferdam enclosures.
- All materials and equipment used for the purpose of site preparation and 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.
- The floor of the new tailrace and any area of the existing riverbed that is re-contoured to expose bedrock, should be covered by a layer of cobble-sized material to provide better habitat.
- The rock and wood beams from the cribbing of the old bridge should be reconfigured as low mounds (1 m maximum height) that will provide structural habitat for invertebrates and fish. These mounds should be distributed near the upstream end of the intake channel adjacent to areas of higher flow velocity, where they will provide good invertebrate and fish habitat. Widely spaced small mounds of rock and wood material within the flat shallow area east of the intake channel might improve this location as a spawning area for smallmouth bass (Figure 2).

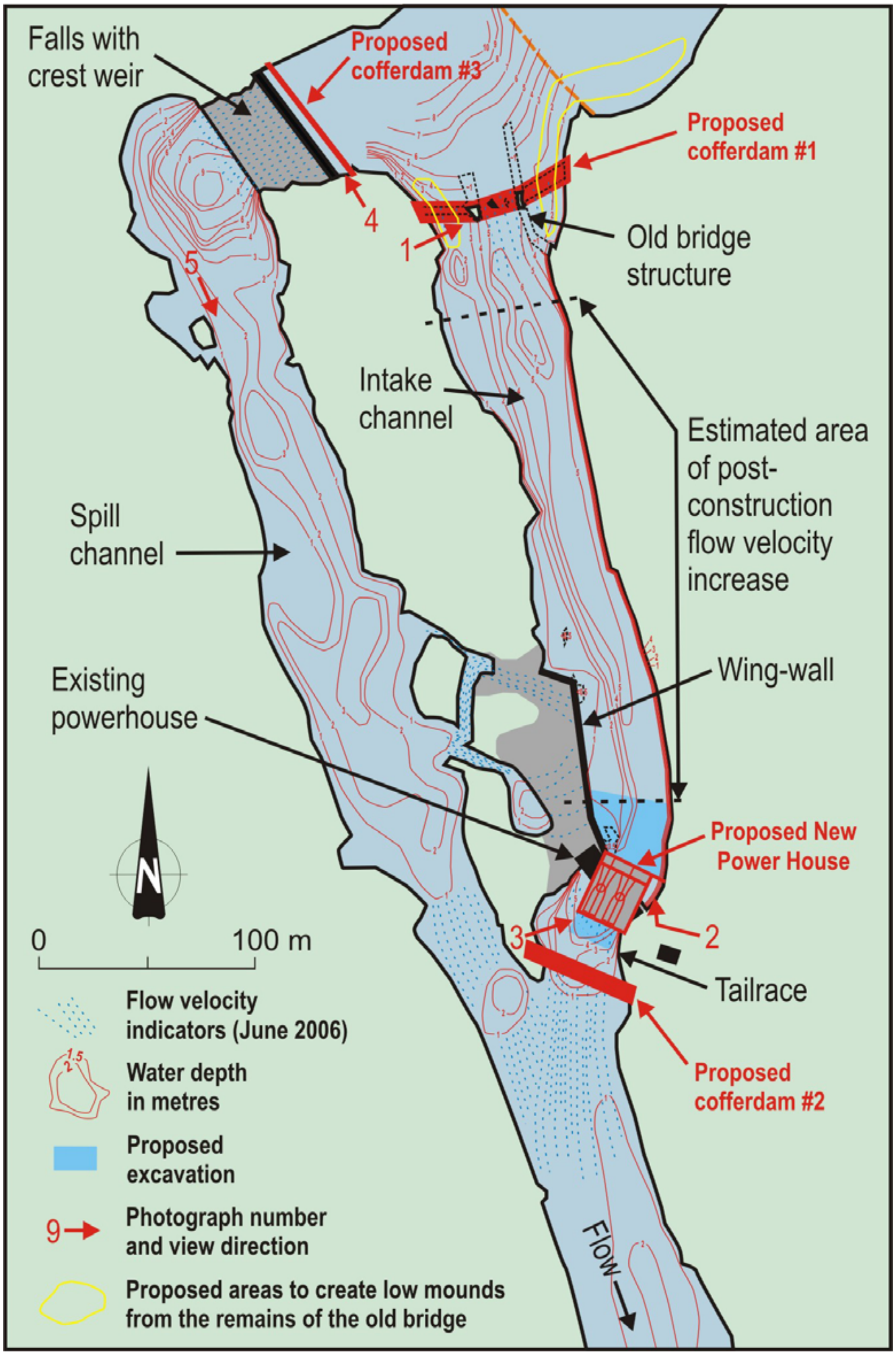
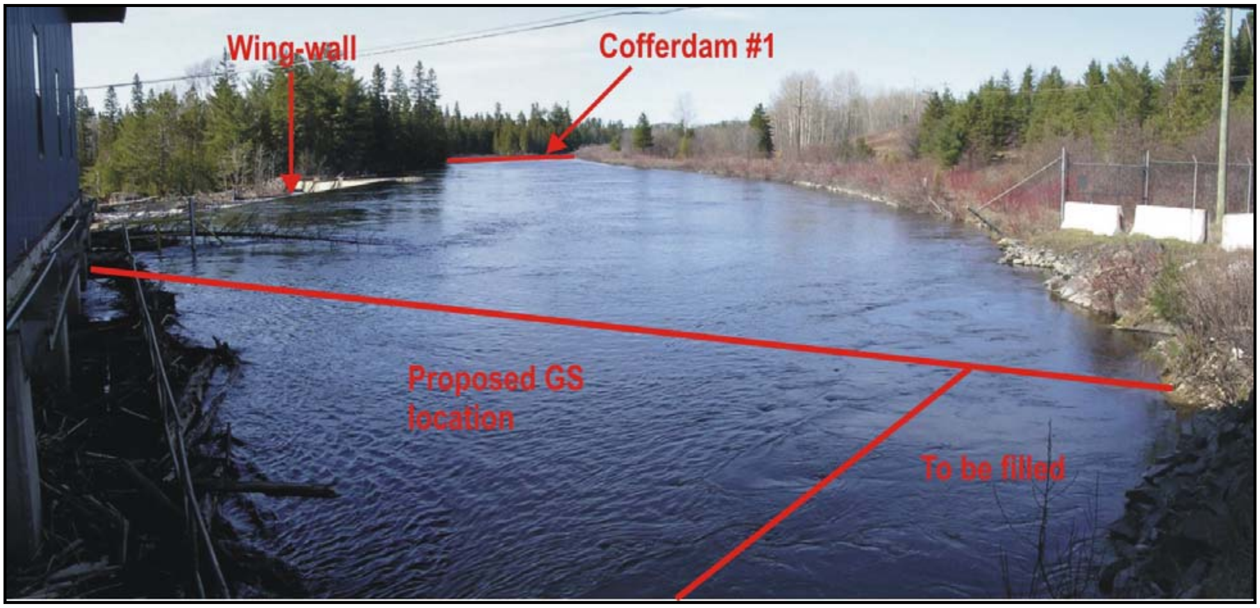


Figure 2: Detail of the study area in the vicinity of the Hound Chute GS, showing the proposed redevelopment works, photograph locations, water depths, and other details considered in this assessment. Note that the blue velocity indicators show areas where the water surface is broken, and denote faster water when close together, and slower water when more widely spaced.



Photograph 1: View of intake channel, upstream of GS. April 30, 2006. Red line shows approximate upstream location of proposed GS and area to be filled, as well as Cofferdam #1.

Photograph 2: Tailrace of existing GS. June 20, 2006. Red line shows approximate downstream location of proposed GS.

Photograph 3: Remains of old rock-filled crib and concrete bridge at upstream end of the intake channel, 2006 (Figure 2).

Assessed impact

Reconstruction of the Hound Chute GS almost within the same footprint as the existing GS, will result in permanent alterations and infilling to the intake channel and tailrace in the vicinity of the GS (Figure 2; Photographs 1 and 2). A portion of the intake channel for approximately 34 m upstream of the GS will require excavation to deepen the channel to accommodate the increased flow capacity of the proposed GS. Likewise, the tailrace will require excavation extending approximately 10 m downstream of the GS (Photograph 2). The proposed GS will be longer and rotated approximately 28° counter-clockwise from the existing GS, which extends the proposed facility into the intake channel (Photograph 1; Figure 2) and tailrace (Photograph 2; Figure 2), resulting in a permanent loss of approximately 373 m^2 (0.037 ha) of habitat. The areas being altered or covered are not thought to be critical habitats, and likely have substrates of exposed bedrock or exposed bedrock overlain with a relatively thin layer of coarse granular material. After construction, the excavated areas will be mitigated with the addition of coarse granular material, which will restore these areas to their current condition, only deeper. The old rock-filled crib and concrete bridge structure provides some habitat structure in its present form, and may enhance local habitats in its post-construction form as low rubble and log piles on the river bottom near the upstream end of the intake channel and in the shallow area to the east of the intake channel (Figure 2).

Provided that the recommended mitigation measures are implemented, the net impact to fisheries production will be negligible.

3.2 Temporary construction impacts

Temporary impacts to fish habitat will occur due to the placement of cofferdams and the dewatering of habitat within those cofferdams. Cofferdam #1 is required at the upstream end of the intake channel to dewater approximately 13,900 m^2 (1.39 ha) of the Montreal River between the GS and cofferdam (Photograph 1; Figure 2). Cofferdam #2 is required at the tailrace to dewater approximately 1000 m^2 (0.1 ha) of river, which is presently the existing tailrace (Photograph 2; Figure 2), to allow construction of the new tailrace configuration. Cofferdam #3 may be required at the upstream side of the existing spillway crest weir (Photograph 4), to allow the refurbishment of the dam. Cofferdam #1 will be a rock structure built upon the remains of an old bridge that is composed of rock-filled wooden cribs and concrete (Photograph 3; Figure 2). This old bridge will be demolished and its material redistributed as low piles upon the bottom when the cofferdam is removed. Cofferdam #2 will be a rock structure positioned at a shallow location downstream of the tailrace, and is expected to be in place for 12 to 14 months (Figure 2). At this time it is not known if Cofferdam #3 will be required (Fitchco, 2006), but if it is it will likely be made of wood and attached to the top of an existing submerged cofferdam, located immediately upstream of the crest weir (Francois Vitez, Ing., Gestion Conseil SCP, personal communication. November 28, 2006). Cofferdam #3 is expected to be in place for 3 to 4 months (Fitchco, 2006).

Photograph 4: View of upstream side of the crest weir at the upstream end of the spill channel. June 20, 2006.

During powerhouse construction when no flow is being diverted through the GS, all flow in the Montreal River will be passing over the crest weir and through the spill channel (Figure 2). During the refurbishment of the crest weir all flow in the Montreal River will be passing through the intake channel, and then either through the GS and/or over the wing-wall (Figure 2).

Mitigation

- In-water construction activities should be timed to avoid the spawning and incubation period of spring spawning fishes such as walleye, suckers, and smallmouth bass, which typically excludes in-water work from April 1 to June 30.
- If all water is being diverted through the spill channel at the time of the walleye and sucker spawning period, all water should continue to be diverted through the spill channel until the end of the hatch (June 15).
- 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 cofferdam enclosures.
- All materials and equipment used for the purpose of site preparation and 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.
- Blasting, if required, should adhere to the Fisheries and Oceans Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/guidelines-conseils/guides/explosguide/chap3_e.asp#GUIDELINES).

Assessed impact

The areas that will be temporarily dewatered do not constitute critical or important habitat. Some have historically been impacted by the construction and operation of the existing Hound Chute GS. Though the area between cofferdam #1 and the GS is relatively large (1.4 ha) compared to the size of the dewatered areas required at the three proposed upper Mattagami River sites, it does not contain any critical habitats and represents only 0.46% of the area between Hound Chute and the upstream dam at Latchford, or 12.5% of the aquatic habitat area within 1 km upstream of the existing GS. This area was also sparsely inhabited by fish, as indicated by the underwater video observations conducted on June 28, 2006 (C. Portt and Associates, 2006). These areas are not thought to be critical for any life stages of any of the species present, and the fact that they will be temporarily unavailable is not expected to have any significant or measurable impact on the overall fish production of the system, or even within a kilometre of the Hound Chute site.

Diverting all flow temporarily through the spill channel will not likely result in increased erosion. Montreal River average annual flow at Hound Chute is 86.3 m^3/s, with a 5-year return flow of 406 m^3/s and a 20-year return flow of 522 m^3/s (OPG *et al*. 2004). Despite these periodically high flow rates, there was no evidence of past erosion, which may be due, in part, to the bedrock/boulder shores of the spill channel that are densely covered with woody vegetation (Photograph 5). Since water management within the Montreal River will not change between pre-construction and post-construction, or through the construction period, the flows within the

Photograph 5: Downstream view within the spill channel. June 20, 2006.

river upstream and downstream of the spill channel will not be affected. Walleye spawning observations in 2006 did not identify the spill channel as a significant spawning area for walleye or suckers, and no other critical or important habitats are thought to occur here that may be impacted by this temporary change in spill channel flow regime. The temporary change in spill channel flow regime is not expected to have a negative effect upon the resident fish community within the spill channel.

Diverting all flow through the intake channel during the refurbishment of the crest weir will not likely result in increased erosion. Work on the crest weir will be short-term, and can be accommodated during the low-flow period.

3.3 Operation of the new Hound Chute GS

The redeveloped Hound Chute GS will remain a run-of-the-river hydroelectric plant, and therefore redevelopment will not change the flow regime of the Montreal River or the management of water levels in the upstream reservoir between Hound Chute and the Latchford dam. However, the proposed GS will have a greater flow capacity and therefore will alter the distribution of flow volume between the GS and the 400 m long spill channel (Figure 2). Presently, water is spilled through the spill channel or over the wing-wall when flows exceed the 57 m^3/s capacity of the GS (Fitchco, 2006), which occurs approximately 40% of the time (OPG *et al*. 2004). The redeveloped Hound Chute GS will have a rated flow of 104 m^3/s (Fitchco, 2006) which will decrease the frequency of water spilled through the spill channel or over the wing-wall to approximately 20% of the time (OPG *et al*. 2004). When the GS is capable of taking all river flow, a very small amount of leakage occurs through the crest weir and the wing-wall, but essentially the spill channel becomes a quiet backwater. This is not expected to change as a result of redevelopment.

Downstream of where the tailrace joins with the spill channel, flow velocity and volume will not differ between pre- and post-redevelopment, however, the adjusted location and discharge direction will result in some minor changes in flow velocity pattern in the immediate vicinity of the tailrace. Flow velocity entering the GS intake and exiting the tailrace will not differ significantly between pre- and post-development, however, the flow velocity in the intake channel, upstream of the proposed excavated area (Figure 2), will almost double from a maximum of approximately 0.9 m/s to a maximum of approximately 1.6 m/s between pre- and post- construction when the GS is operating at capacity and there is no flow over the wing-wall (Francois Vitez, Ing., Gestion Conseil SCP, personal communication. November 28, 2006). The maximum flow velocity in the vicinity of the old bridge structure will not change significantly between pre- and post- construction, since the old bridge structure is presently restricting the channel cross-section to approximately half its potential, and so post-construction flow velocity will remain similar to pre-construction velocity when the structure is demolished and the flow volume of the GS is doubled. The estimated area where post-construction flow velocity will be greater than pre-construction flow velocity is shown in Figure 2.

Mitigation

No mitigation is proposed.

Assessed impact

The existing flow regime within the spill channel due to leakage at the crest weir and the wing-wall is ≤1 m^3/s for approximately 60% of the time. Post-development flows of ≤1 m^3/s within the spill channel will occur approximately 80% of the time, with most flows in excess of this occurring during April - June (OPG *et al*. 2004). This will likely have a negligible effect upon the productivity within the spill channel, however, it is possible that this may have a slightly positive effect. The flow velocity in the spill channel appeared high for walleye spawning during the spring of 2006, and so a reduction in post-construction flows may improve the conditions for walleye spawning. Whether or not walleye spawning will occur in the spill channel post-development remains to be seen. Post-construction, the quiet backwater that the spill channel becomes during low flow will not be disturbed as often by periodic spill events. This change is not expected to affect fish productive capacity.

The post-construction doubling of velocities within a portion of the intake channel (Figure 2), calculated to be a maximum of 1.6 m/s at the most constricted location (Francois Vitez, Ing., Gestion Conseil SCP, personal communication), will likely have some effect upon the fish community composition within the affected area. Though it is not clear what that effect would be, it likely will not have a significant or measurable impact upon the productivity of the system given that the area affected is small and the existing habitat in that area is not critical or, based on the underwater video, heavily utilized.

The angle of the new tailrace will be slightly different from the existing tailrace angle, resulting in a minor change in flow direction that will likely cause some shifts in habitat utilization in the immediate vicinity of the tailrace. However, neither the types or quantities of habitat will change significantly, and no significant change in productivity is expected. There are no known critical habitats within the tailrace.

4.0 CONCLUSION

Provided that the recommended mitigation measures are implemented, it is our opinion that the redevelopment of the Hound Chute site, and the subsequent operation of the new and enlarged GS, will not have a significant or measurable impact upon the composition or production of the Montreal River fish community.

The key points of this assessment are as follows:

- No critical fish habitats, such as walleye, sucker or smallmouth bass spawning habitats, will be directly altered.
- The areas that will be directly altered are mostly manmade habitats (the intake structure and the adjacent substrate for approximately 34 m upstream; the tailrace and the adjacent substrate for approximately 10 m downstream; and, the submerged remains of the old bridge structure) and these will continue to provide similar habitats post-construction.
- The locations of the cofferdams and the dewatered areas will be temporarily unavailable as fish habitat, and will be completely reinstated post-construction. Although they do contain fish, the fact that they will be temporarily unavailable is not expected to have a significant impact on the productive capacity of the system.
- The material from the old bridge abutments that will be demolished will be reconfigured as low mounds that will provide structural habitat for invertebrates and fish. Distributing these mounds in quiet areas adjacent to areas of higher flow at the upstream end of the intake channel, as well as within the flat shallow area east of the intake channel, may increase the productivity of local habitats.
- Following the completion of construction the total amount of habitat will be permanently reduced by approximately 373 m^2 of non-critical, manmade habitat. The two areas that make up this habitat are located close to the intake and the draft tube of the existing GS, and are likely exposed bedrock or bedrock with a thin covering of boulder and cobble material, with low existing productive capacity.
- No significant or measurable change in the productivity of habitats is anticipated, provided that all recommended mitigation strategies are executed.

5.0 REFERENCES

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Ontario Power Generation Inc., Canadian Hydro Developers Inc., Public Works and Government Services Canada and Ministry of Natural Resources (OPG *et al.*). 2004. Montreal River System Water Management Planning. Draft Report, Volume 1 – Parts A & B, Final Report, Volume 2 – Parts C, D & Appendices.