PROPOSED RANNEY FALLS GENERATING STATION G3 EXPANSION PROJECT

TERRESTRIAL TECHNICAL SUPPORT DOCUMENT

Submitted to:
Ontario Power Generation Inc.
700 University Avenue
Toronto, Ontario
M5G 1X6

By:
SENES Consultants
121 Granton Drive, Unit 12
Richmond Hill, Ontario
L4B 3N4

Prepared by: April 2016
Jerry Fitchko, SENES — Date
Phil Shantz, SENES
Project Manager
EA Consulting Team

Approved by: April 2016
Donald Gorber, SENES — Date
President

Reviewed by: April 2016
Gillian MacLeod — Date
Senior Environmental Specialist
Ontario Power Generation Inc.

Accepted by: April 2016
Iskander Boulos — Date
Project Manager
Ontario Power Generation Inc.

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

EXECUTIVE SUMMARY

Ontario Power Generation Inc. (OPG) is proposing to expand the capacity of its Ranney Falls Generating Station (GS) located on the Trent-Severn Waterway (TSW) in the Municipality of Trent Hills. There are two powerhouses on site. The main powerhouse has the G1 and G2 turbine units, each operating at approximately 5 MW during maximum flows. A secondary powerhouse, referred to as the "Pup", contains the 0.72 MW G3 unit that ceased operations in June 2014.

Based on a Feasibility Study for the proposed Ranney Falls GS G3 Expansion Project (Ranney Falls G3 Project or Project), it was determined that a new G3 unit of up to 10 MW could be installed at the Ranney Falls GS site. This would increase total station capacity to approximately 20 MW. The "Pup" powerhouse would be decommissioned but the building will be left in place.

The proposed Ranney Falls G3 Project is being undertaken by OPG to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's Central Operations (COs). The Panel on the Future of the Trent-Severn Waterway (PFTSW, 2008) concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue green energy generating potential along the TSW. The proposed Project is consistent with the Provincial Policy Statement, which recommends that the use of existing infrastructure and public service facilities should be optimized, whenever feasible, before consideration is given to developing new infrastructure and public service facilities (OMMAH, 2014). OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

This Detailed Environmental Impact Analysis (DIA) Report was prepared to fulfill federal department obligations to the *Canadian Environmental Assessment Act, 2012 CEAA,* section 67. Parks Canada's legal accountability under CEAA 2012 is to ensure that project activities undertaken on the lands it manages do not result in significant adverse effects (Section 67 CEAA 2012). Parks Canada has jurisdiction over the bed of the canal at Ranney Falls. The DIA Report provides a description of the proposed undertaking, summarizes the overall environmental setting and anticipated environmental effects, recommends appropriate

mitigation measures to minimize or obviate these effects, and describes public, agency and Aboriginal consultation. More detailed information on the environmental setting, anticipated environmental effects and recommended mitigation measures is provided in four Technical Support Documents (TSDs) addressing the aquatic environment, terrestrial environment, land use and socio-economic environment, and cultural heritage resources. Two additional TSDs provide a more detailed description of outcomes of public and government agency, as well as First Nation and Métis Nation of Ontario, consultation and engagement.

An Open House was held on the project on June 17, 2015 and over twenty-four individuals attended that meeting. No individuals indicated an opposition to the proposed Project and several people indicated support for it. However, a number of questions were asked about the Project and a few local residents raised questions with respect to traffic, noise and potentially other nuisance effects. Responses were provided to them and OPG takes the position that it is always willing to listen to concerns and issues and address them wherever possible.

Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects due to construction activities associated with the proposed Project will be minimal, localized and short-term. It is anticipated that substantial economic benefits will be realized by Campbellford and other local communities due to the supply of required goods and services during the construction phase.

Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that the operation of the proposed Project will have negligible effects on the environment.

1.0 INTRODUCTION

1.1 SCOPE OF PROJECT

The Ranney Falls Generating Station (GS) site was formerly leased by the Federal Government to the Seymour Power Company. With its purchase of the Seymour Power Company on March 9, 1916, ownership rights to the site were acquired by the Province. Ranney Falls GS G1 and G2 units were commissioned in August 22, 1922 and September 2, 1922, respectively. Unit G3, which started operation in 1926, was acquired by the Hydro-Electric Power Commission of Ontario from the Quinte and Trent Valley Power Company in 1937. Ranney Falls GS was transferred to OPG on April 1, 1999, and is managed by OPG's Central Operations (COs) with remote operation from its North Bay Control Centre and maintained by its Campbellford Service Centre.

OPG is proposing to expand the capacity of its Ranney Falls GS that is located on the Trent-Severn Waterway (TSW) within the community of Campbellford in the Municipality of Trent Hills (Trent Hills), Northumberland County (Figure 1.1). There are two powerhouses on site (Figure 1.2). The main powerhouse has the G1 and G2 turbine units, each operating at approximately 5 MW during maximum flows. A secondary powerhouse, referred to as the "Pup", contains the 0.72 MW G3 unit that ceased operations in June 2014.

Ranney Falls GS was first identified by Ontario Hydro (1992) to be within the scope of the Small Hydroelectric Assessment and Retrofit Program (SHARP) for assessment of its long-term viability as a generating resource. The SHARP was established as a formalized approach to address operational optimization of the 33 existing small and ageing hydroelectric stations within the hydraulic generation system. Based on the criteria for age, capacity and operating condition, the SHARP identified Ranney Falls GS as a potential opportunity for renewal and improvement.

As a result, a Concept Phase Study for the Ranney Falls GS was undertaken by KST Hydroelectric Engineers (KST, 1992) to review all available project options and recommend a preferred alternative, as well as to identify the detailed engineering and environmental studies and their associated costs for the Definition Phase. Due to the cancellation of the SHARP, further work associated with the redevelopment of Ranney Falls GS was terminated.

Figure 1.1 Project Location

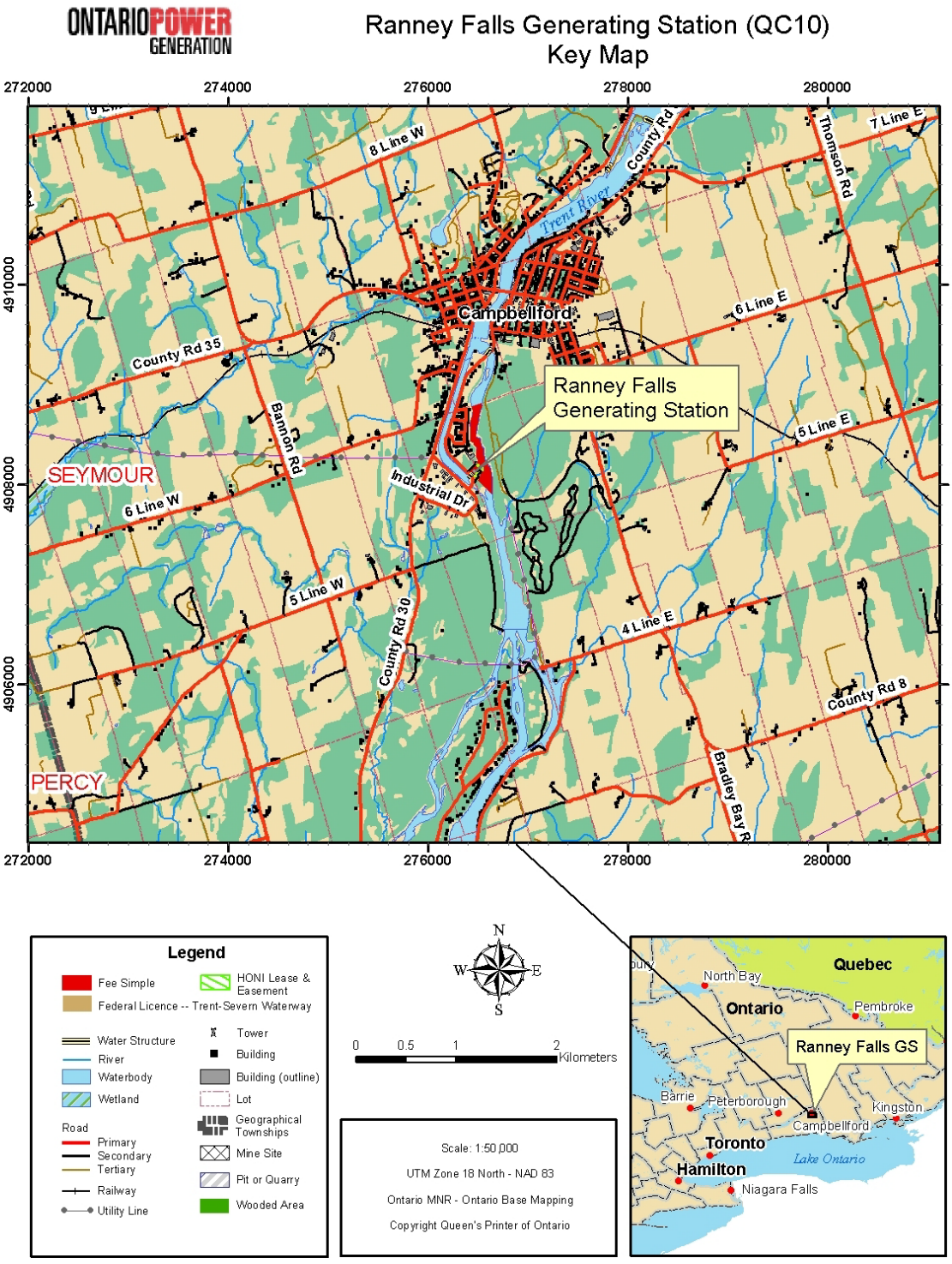


Figure 1.2 Aerial Photo of Ranney Falls GS Setting

In 2005, OPG again initiated a site evaluation and an assessment of concept alternatives for Ranney Falls GS expansion focusing on the redevelopment of the secondary "Pup" powerhouse. A Feasibility Study was completed in 2006, establishing that a new unit of up to 10 MW could be installed at the Ranney Falls GS site (Hatch Acres, 2006). This would increase the total station capacity to approximately 20 MW and result in total average annual generation of 83 GWh (an increase of 30.4 GWh). However, the project was deferred by OPG prior to initiation of the Definition Phase.

Based on the preliminary studies undertaken by KST (1992) and Hatch Acres (2006), OPG has concluded that the existing installed capacity does not make optimal use of the total water available (mean annual flow of approximately 118 m^3/s). As a result, OPG has identified an opportunity to expand its capacity by replacing the secondary "Pup" powerhouse with a new unit having an incremental capacity of up to 10 MW (OPG, 2011a).

Since 2006, the scope of the project including its layouts was further optimized and the proposed Ranney Falls G3 Project includes the following:

- expansion of the existing forebay;
- construction of a new G3 powerhouse with a new intake structure and 10 MW turbine unit adjacent to the existing main powerhouse;
- expansion of the existing tailrace channel;
- construction of a new electrical substation to connect with one of the Hydro One Networks Inc. (Hydro One) local distribution lines on site;
- construction of a new spillway to by-pass station flow to the tailrace channel for emergency situations;
- decommissioning the "Pup" powerhouse;
- rehabilitation of the forebay intake structure and its operating deck (work platform) adjacent to the roadway/TSW bridge;
- relocation of the existing upstream boom; and
- creation of enhanced habitat for Northern Map Turtle and Eastern Snapping Turtle and installation of fencing to prevent turtles accessing the construction area.

1.2 BACKGROUND

1.2.1 Purpose and Justification

The proposed Ranney Falls G3 Project undertaken by OPG is to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's COs, without any changes to the overall flow within the Trent River or to existing TSW water management. The proposed Project is consistent with the Provincial Policy Statement (PPS), which recommends that the use of existing infrastructure and public service facilities should be optimized, wherever feasible,

before consideration is given to developing new infrastructure and public service facilities (OMMAH, 2014).

The Ranney Falls GS is located on OPG land adjacent to Lock #11 and #12 of the TSW, which is designated as a National Historic Site of Canada. Water levels and flows in the Trent River and Trent Canal are managed by Parks Canada – TSW staff to:

- permit safe navigation;
- lessen flooding of agricultural, residential and commercial property;
- provide for recreational activities;
- protect fish and wildlife habitat;
- help maintain water quality; and
- generate green hydroelectric power.

Parks Canada – TSW staff work cooperatively with the MNRF and DFO to protect fish spawning areas and other wildlife habitat, as well as with local Conservation Authorities to reduce flooding. Parks Canada – TSW staff are also in daily contact with OPG, other public utilities and private interests, which operate and maintain generating stations within the TSW drainage basins.

A management plan for the TSW National Historic Site received ministerial approval in 2000 (Parks Canada, 2000). The Panel on the Future of the Trent-Severn Waterway (PFTSW, 2008) was mandated in 2007 to assess and make recommendations to the federal Minister of the Environment concerning the future contributions and management of the TSW. The PFTSW review pre-empted the typical five-year management plan review cycle. The process to develop a new management plan began in late 2011, and was subsequently postponed following a review of the management plan cycle. The next management plan review is scheduled for completion in 2018.

In addition to other considerations, the PFTSW considered “ways in which the Waterway can contribute to economically sustainable communities, including the role of renewable energy.” The PFTSW concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue the potential for generation of green energy along the TSW. The PFTSW acknowledged that the *Canadian Environmental Assessment Act* (*CEAA*), if applied knowledgeably and rigorously, provides the process and regulatory instrument for proposed hydroelectric projects to ensure the protection of natural and cultural values of the TSW. *CEAA* (S.C. 1992, c. 37) was repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force (see Section 1.0).

Northumberland-Quinte West MPP Rob Milligan held a public meeting on February 18, 2012 in Campbellford to promote new waterpower developments within the provincial riding with 37 potential hydroelectric sites identified that, if developed, could generate 21 MW of electricity, providing power to between 15,000 and 18,000 homes. The sites include old lumber and grist mills, as well as sites along the TSW.

1.2.2 Alternatives and Alternative Means

Alternative 1 – Redevelopment

OPG has concluded that the existing installed capacity of Ranney Falls GS does not make optimal use of the total water available at the site. As a result, OPG has identified an opportunity to expand its capacity by replacing the "Pup" with a new unit having an incremental capacity of up to 10 MW (OPG, 2011a).

Alternative 2 – Status quo

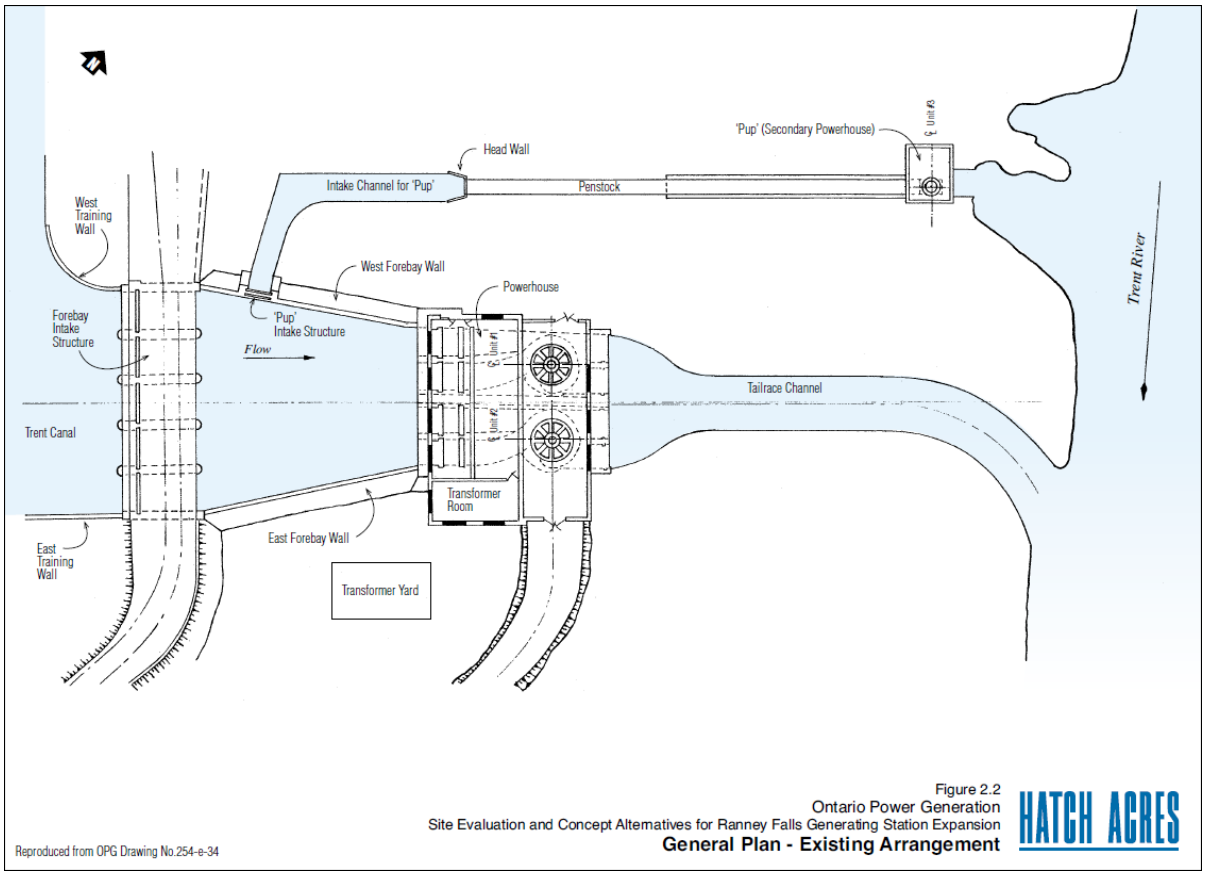
Maintenance of the "status quo" would result in the loss of hydroelectricity production capacity of 0.72 MW due to the decommissioning of the "Pup". It would also preclude the opportunity to expand the capacity of the Ranney Falls GS by replacing the "Pup" with a new unit having an incremental capacity of up to 10 MW.

1.2.3 Existing Conditions

The existing Ranney Falls GS consists of a forebay intake structure, forebay, the main powerhouse and its tailrace, the Pup and its Intake, penstock and tailrace, and storage facilities (see Figures 1.3 and 1.4). A brief description of this existing infrastructure is provided below.

Figure 1.3 Aerial Photo of Existing Ranney Falls GS Infrastructure Layout

Figure 1.4 Schematic of Existing Ranney Falls GS Infrastructure Layout



Forebay Intake Structure

The forebay intake structure, which diverts flow from the Trent Canal to the Ranney Falls GS, consists of five bay sluiceways with a road bridge to the northeast and an operating deck (work platform) for stoplog operation to the southwest. The bridge and the portions of the supporting piers under the bridge are owned and operated by Parks Canada – TSW. Parks Canada – TSW recently rehabilitated the piers with new concrete surfacing.

The operating deck, stoplogs and the portions of the supporting piers under the deck are owned and operated by OPG. The stoplogs are used to dewater the forebay. The stoplog gains and operating deck, and the portions of the supporting piers under the operating deck require repairs.

Safety booms are installed in the Trent Canal and forebay upstream and downstream of the forebay intake structure (see Figures 1.2 and 1.3).

Forebay

The existing forebay is located between the forebay intake and the headworks for the main powerhouse. Concrete gravity retaining walls contain the forebay on the east and west sides. The forebay substrate consists of bedrock. A channel in the west forebay wall supplies water to the "Pup" powerhouse. The east and west retaining walls were resurfaced in 1994 and meet current dam safety requirements.

Main Powerhouse

The main powerhouse accommodates two concrete gravity type intakes, two vertical Kaplan turbine generator units (G1 and G2) and associated electrical and mechanical equipment and systems, auxiliary mechanical and electrical systems, restroom and control room.

The main powerhouse can be accessed by the existing road to the east which was rebuilt in 1992. The road connects to Trent Drive at the bridge spanning Lock #12.

The main powerhouse tailrace channel is a man-made open cut through the layered rock formation to the Trent River.

Main Substation

The main outdoor substation (transformer yard), located to the south of the main powerhouse, accommodates one 44 kV transformer and associated electrical equipment with supporting structures and underground piping (see Figure 1.4). It connects to Hydro One's 44 kV distribution line (R8S) at the wood pole located at the south of the Trent Drive.

Pup Facilities

The Pup facilities include the entrance gate, approach channel, intake, penstock, and powerhouse and tailrace channel. The entrance gate is located at the west retaining wall and controls the flows to the G3 unit. The approach channel is a concrete-lined open channel extending from the entrance gate to the concrete gravity intake structure at the upstream end of the penstock. The penstock is an exposed steel pipe on supporting concrete saddles which connects to the vertical Kaplan turbine generator (G3) in the "Pup" powerhouse. A short tailrace channel extends from the "Pup" powerhouse to the Trent River.

The "Pup" substation is located to the southeast of the powerhouse, accommodating a 44 kV transformer and associated electrical equipment. It connected to Hydro One's 44 kV distribution line (R9S) at the wood pole located at the south abutment of the Ranney Gorge Suspension Bridge.

The "Pup" powerhouse is accessed from Trent Drive by a road that runs parallel to the penstock to the west of the main powerhouse. A stormwater culvert draining the adjacent property to the west discharges into the penstock trench.

Storage Facility

The storage facility consists of a fenced yard and storage shed to the east of the main powerhouse and public trail to Ranney Gorge Suspension Bridge (see Figure 1.3).

Existing Ranney Falls GS Operation

The current spill discharge for flood control at the site and emergency shutdown and normal outage of the GS is the sole responsibility of Trent-Severn Waterway (TSW). TSW Dam #10 has been operated to discharge the relevant flows.

The main powerhouse has the G1 and G2 units each operating at approximately 5 MW at design flows of 47.5 m^3/s and 45.4 m^3/s, respectively (OPG, 2011a). The "Pup" powerhouse contains the 0.72 MW G3 unit with a design flow of 8 m^3/s. Total design flow is 100.9 m^3/s. The G3 unit has reached its end-of-life and ceased operation in June 2014.

Both powerhouses share a common forebay intake structure, with the G3 unit fed by a penstock from a channel branching off the forebay. The headwater of the Ranney Falls GS is the Trent Canal at the upstream end of Lock #12, with the tailwater merging into the Trent River. The average gross head is approximately 14.27 m. Dam #10 diverts flow down a 1.5 km section of canal to feed the Ranney Falls GS and the operational requirements of Locks #11 and #12. The average available flow is approximately 118 m^3/s. River flow that is in excess to the GS and lockage requirements is spilled through Dam #10 (upstream of the GS) to the original Trent River channel. The Trent River flow merges with flows from the Ranney Falls GS tailrace at 1.1 km downstream of Dam #10.

1.2.4 Federal and Provincial Approvals

Federal Approvals

A number of permits, licences and approvals under federal legislation may be required for the proposed Ranney Falls G3 Project to proceed, including:

- Parks Canada licence to carry out the undertaking under the *Dominion Water Power Act* regulations;
- Parks Canada – TSW Work Permit under the Historic Canals Regulations pursuant to the *Department of Transport Act*;
- *Fisheries Act* authorization from the DFO for harm to fish and fish habitat with conditions for mitigation and compensation; DFO has determined that the proposed Project "will not

likely result in impacts to fish and fish habitat", a formal approval from DFO is not required (C. Strand, DFO, 2012, pers. comm. and follow up DFO Fisheries Protection email dated July 31, 2014);

- *NPA* approval of any substantial interference with navigation, or determination of no interference with navigation, from Transport Canada for any works built or placed in, on, over, under, through or across "scheduled" waters;
- *Species at Risk Act (SARA)* permit for the removal of plant species at risk (SAR), or damage or destruction of SAR habitat on federal lands in Ontario; and
- Explosives Transportation Permit from Natural Resources Canada under the *Explosives Act*.

As indicated in Section 1.0, based on technical information provided by OPG, DFO has determined that the proposed Project "is not likely to result in impacts to fish and fish habitat provided that additional mitigation measures are applied" (see Section 4.1.4). Based on the LOA dated July 17, 2012, a formal approval (authorization) from DFO is not required (C. Strand, DFO, 2012, pers. comm. and follow-up DFO Fisheries Protection email dated July 31, 2014).

Environment Canada, CWS, has approved the "Turtle Nesting Habitat Mitigation Plan" prepared by OPG to create and enhance access and nesting habitat for Northern Map Turtle (*Graptemys geographica*) and Eastern Snapping Turtle (*Chelydra serpentina serpentina*), both designated as Special Concern federally and provincially (K-A. Fagan, Environment Canada, 2012, pers. comm.) (see Section 4.1.3). An In-water and Shoreline Work Permit Application was submitted to Parks Canada – TSW on December 9, 2014 to obtain approval for implementation of the Plan under the Historic Canals Regulations pursuant to the *Department of Transport Act*.

As the Trent River/Canal from Rice Lake to Lake Ontario is included in the *NPA* List of Scheduled Waters, an application (Notice of Works Form) for approval of the proposed Project was submitted by OPG to Transport Canada on December 19, 2014. OPG subsequently received a letter dated December 30, 2014 from Transport Canada indicating that the information provided by OPG was complete for the purpose of commencing agency review.

Provincial Approvals

Based on current information, a number of permits, licences and approvals under provincial legislation may also be required. These approvals and permits may include:

- Permit for SAR plant removal, or disturbance or destruction of SAR habitat from the MNRF under the *Endangered Species Act (ESA)*;
- Permits to Take Water (PTTW) for construction (including use of temporary settling pond) and dewatering if greater than 50,000 L/day from the MOECC (MOE, 2007) under the *Ontario Water Resources Act (OWRA)*;

- Environmental Compliance Approval (MOE, 2011a) for air, noise, waste disposal and/or sewage works and wastewater for spill containment associated with the new facility from the MOECC under the *Environmental Protection Act (EPA)*;
- Waste Manifest from the Ontario Ministry of Transportation (MTC) under the *Dangerous Goods Transportation Act*;
- Letters of Clearance for archaeological resources from the Ontario Ministry of Tourism, Culture and Sport (MTCS) under the *Ontario Heritage Act*; and
- Fish Scientific Collectors Permit for fish removal and relocation from the MNRF under the *Fish and Wildlife Conservation Act*.

A transmission line (115 kV or higher) greater than 2 km long associated with a generation project requires a Section 92 Leave to Construct under the *Ontario Energy Board Act* from the Ontario Energy Board. As the proposed Ranney Falls G3 Project does not involve transmission infrastructure, a section 92 Leave to Construct will not be required.

As indicated in Section 1.0, OPG is exempt from the LTC Permit for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under Ontario Regulation 163/06 of the *Conservation Authorities Act* (M. Lovejoy, LTC, 2012, pers. comm.).

Under subsection 62.0.1(1) of the *Planning Act*, energy projects that are approved under the *EA Act* are exempt from *Planning Act* requirements. However, as the proposed Ranney Falls G3 Project is not subject to the *EA Act*, OPG will apply for Site Plan approval and a Building Permit from Trent Hills. OPG will also consult with Trent Hills regarding construction planning, schedules, noise regulation (Trent Hills, 2005) and local traffic management. An Access/Use permit for municipal road and heavy load transportation may be required from Trent Hills.

Other Relevant Regulations/Guidelines Not Requiring Permitting

There are a number of federal and provincial regulations/guidelines that need to be considered throughout the regulatory approval process and the subsequent construction phase that do not necessarily require a formal permitting process. These include but are not limited to the following:

Federal

- *Migratory Birds Convention Act (MBCA)* and Migratory Birds Regulations prohibit the taking or killing of migratory birds and their nests and eggs, and the deposit of substances harmful to migratory birds in areas they frequent;
- Migratory birds environmental assessment guideline (Milko, 1998a);
- Ontario In-water Construction Timing Window Guidelines for the Protection of Fish and Fish Habitat (DFO, 2010);

- Canadian Technical Report of Fisheries and Aquatic Sciences 2107 Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. (Department of Fisheries and Oceans, 1998);
- Policy on Wetland Conservation (Environment Canada, 1991) with the goal of sustaining wetland functions;
- Wetlands environmental assessment guideline (Milko, 1998b);
- A Wildlife Policy for Canada (CWS, 1990; Lynch-Stewart, 2004) with the goal to maintain and restore ecological processes and the diversity of ecosystems, species and genetic variability within species;
- Canadian Biodiversity Strategy (Environment Canada, 1995) based on the Convention on Biological Diversity (UNEP, 1994) with the goal of conserving biological ecosystems, species and genetic variability within species; and
- Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff (DFO, 2006).

Provincial

- PPS which provides policy direction on matters of provincial interest related to land use planning and development (OMMAH, 2014);
- *Places to Grow Act* administered by the Ontario Ministry of Infrastructure and the Growth Plan for the Greater Golden Horseshoe (OMPIR, 2006);
- Under the *EPA*, regulations regarding the systematic control of collection, storage, transportation, treatment, recovery and disposal of waste including hazardous waste;
- Water Management Policies and Guidelines (Policy 1 and 2) of the MOECC (MOEE, 1994);
- Ontario Biodiversity Strategy (MNR, 2005; Ontario Biodiversity Council, 2011);
- Standards and Guidelines for Consultant Archaeologists (MTC, 2010); and
- Statements of Environmental Values by the Ontario Ministry of Natural Resources, (now MNRF), Ontario Ministry of the Environment (now MOECC) and Ontario Ministry of Culture (now MTCS) under the *Environmental Bill of Rights*.

In addition, the proposed Ranney Falls G3 Project must conform to Parks Canada policy and directives (see Section 2.2.5).

A final determination of the likely applicable federal and provincial permits and approvals cannot be made until the detailed design phase of the proposed Project is complete.

1.2.5 Conformance with Parks Canada Policy and Directives

As indicated in Section 2.2.1, the management plan for the TSW National Historic Site of Canada received ministerial approval in 2000 (Parks Canada, 2000). The process to develop a new management plan began in late 2011, and was subsequently postponed following a review

of the management plan cycle. The next management plan review is scheduled for completion in 2018. The proposed Project must conform to relevant Parks Canada policy and directives. Those policies and directives include:

Parks Canada Guiding Principles and Operational Policies guides stewardship responsibility to ensure that the record of our past, the rich diversity of wild spaces and species, the beauty and grandeur of our lands and seas, and the cultural character of our communities are not inadvertently lost over time. This policy document guides these efforts, designation and management.

National Historic Site Policy objectives are to foster knowledge and appreciation of Canada's past through a program of historical commemoration and to ensure commemorative integrity of national historic sites are maintained by protecting and presenting these sites and their associated resources for future generations.

Cultural Resources Management (CRM) Policy serves as the overall management policy for Parks Canada-administered national historic sites. As *CRM Policy* supports the management of cultural resources, it applies to conserving and preserving the national treasures that are under the stewardship of the Parks Canada Agency.

Historic Canals Policy Regulations outlines respecting the management, maintenance, proper use and protection of the historic canals administered by the Parks Canada Agency.

Historic Canals Policy fosters appreciation, enjoyment and understanding of Canada's historic canals by providing for navigation; by managing cultural and natural resources for purposes of protection and presentation; and by encouraging appropriate uses.

Canal Regulations outlines respecting the use and operations of canals.

OPG respectfully submits that the proposed Ranney Falls G3 Project does conform to the Parks Canada policy and directives presented above. As indicated in Section 3.1.7, the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS are considered to be cultural heritage landscapes (CHLs). As indicated in Section 4.2.5, construction of the proposed Project will not result in displacement of these CHLs. However, there is potential for temporary disruption to public access from the Ranney Falls GS property via the Ranney Gorge Suspension Bridge to Ferris Provincial Park on the opposite side of the Trent River (see Figure 1.3). To minimize and/or manage the potential conflict between public and construction traffic access, an Access Management Plan will be developed in consultation with Ontario Parks and Friends of Ferris Provincial Park. TSW will also be kept informed on the progress of the access management plan.

In addition, there is potential for disruption of local viewsheds from vessels using the section of the Trent Canal adjacent to the proposed Project forebay expansion, as well as for the public accessing the Ranney Gorge Suspension Bridge and Ferris Provincial Park. As partial mitigation, construction will not occur on Sundays and public holidays, likely the time of peak public boating use on the Trent Canal and recreational use of Ferris Provincial Park.

The potential access and visual disruption effects on these CHLs will be temporary, i.e., occurring during the construction phase of the proposed Project, and will be dissipated with the implementation of the Site Rehabilitation Plan.

Furthermore, there will be no displacement of the existing Ranney Falls GS powerhouse buildings. The proposed Ranney Falls G3 Project powerhouse building will adjoin the existing main powerhouse building and have a similar structure and façade, thereby providing overall architectural coherence. The “Pup” powerhouse building and tailrace will be preserved.

The operation of the proposed Ranney Falls GS Project will not affect the status and significance of the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS as CHLs.

As indicated in Section 4.2.4, during proposed Project operation, there will be negligible impacts on vessel utilization of the Trent Canal during the navigation season as a result of slightly higher flow velocities.

As indicated in Section 3.7, the Ranney Falls GS property supports a number of ecological functions and attributes that would potentially qualify portions of the property as Significant Wildlife Habitat. The displacement of turtle nesting habitat and potential snake hibernacula habitat will be offset by existing habitat enhancement on areas of the Ranney Falls GS property unaffected by the proposed Project, as well as on nearby TSW property (see Sections 4.1.2 and 4.1.3). Moreover, habitat on the property will be considerably increased in extent and enhanced after construction. Similarly, the implementation of mitigation measures will ensure that the proposed Project will not have an adverse effect on the proximate Significant Woodlands or their ecological functions (see Section 4.1.2).

As indicated in Section 2.2.1, the PFTSW (2008) was mandated in 2007 to assess and make recommendations to the federal Minister of the Environment concerning the future contributions and management of the TSW. The PFTSW concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue the potential for generation of green energy along the TSW. The proposed Ranney Falls G3 Project conforms with this policy recommendation.

1.3 PROJECT DESCRIPTION

1.3.1 Project Components

It should be noted that the proposed Project components/structures and activities presented in this section will be refined in this phase, which involves detailed engineering design to be undertaken concurrently with DIA Report preparation.

With the exception of the electrical substation, all of the structures will be located entirely on the west side of the existing main powerhouse.

As indicated in Section 2.1, the stoplog gains and operating deck, and the portions of the supporting piers under the operating deck of the forebay intake structure require rehabilitation, which will be undertaken during construction of the proposed Ranney Falls G3 Project.

The general arrangement of the proposed Project components/structures is presented in Figures 1.5 and 1.6. A brief description of each proposed infrastructure is provided below.

Figure 1.5 Aerial Photo of Existing Ranney Falls GS Showing Proposed Project Infrastructure Layout

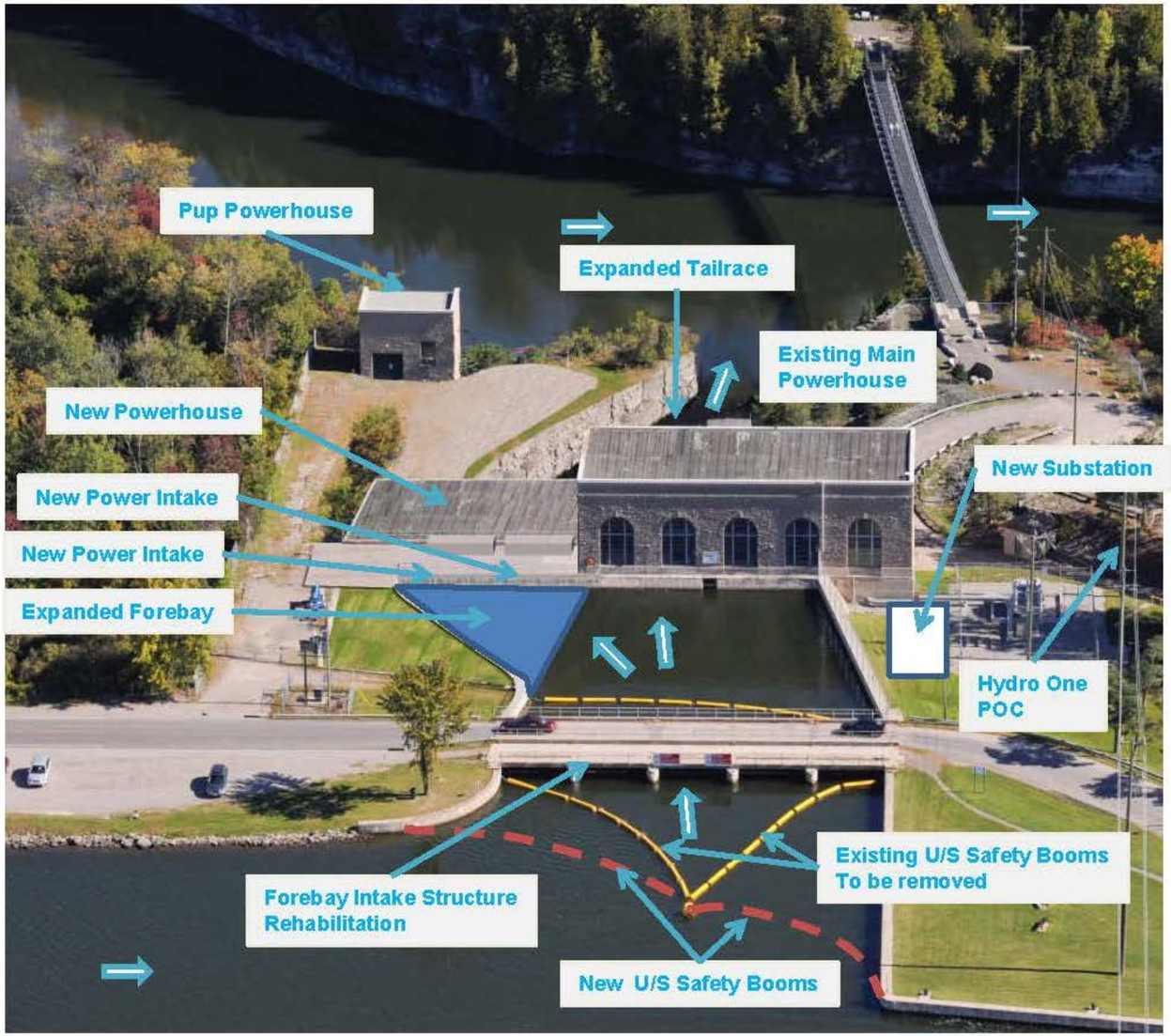
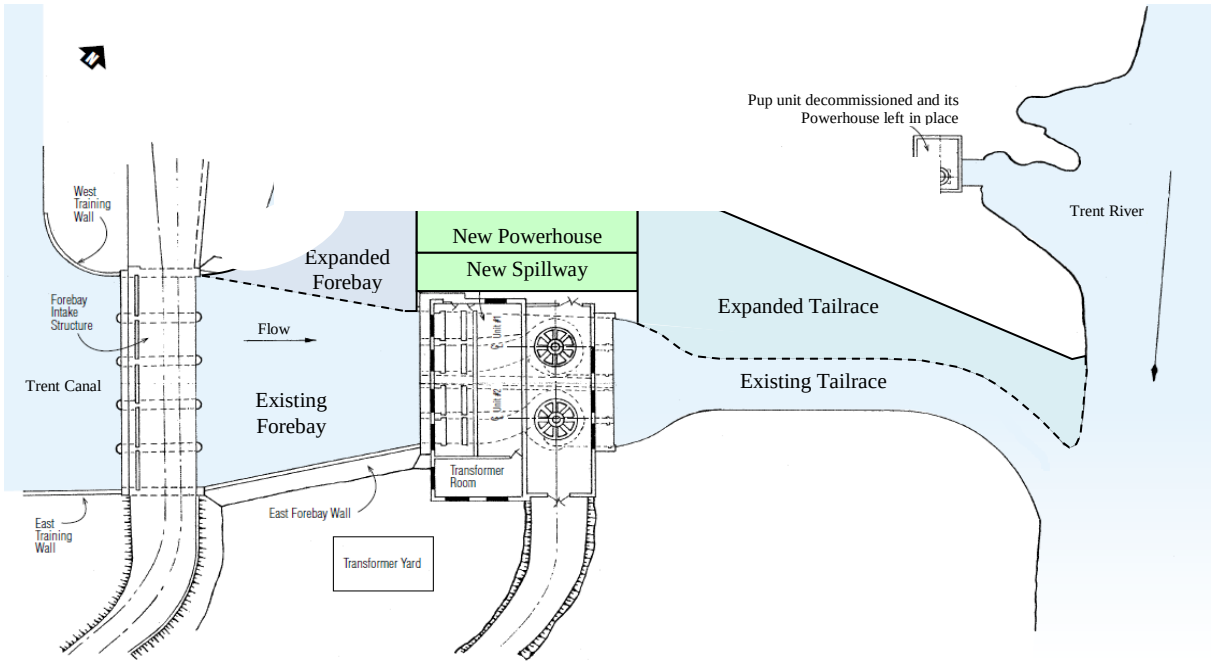


Figure 1.6 Schematic of Proposed Ranney Falls G3 Project Infrastructure Layout



Forebay Intake Rehabilitation

The forebay intake rehabilitation includes repairing the stoplog gains and operating deck, and resurfacing the portions of the supporting piers under the operating deck. The operating deck will be upgraded to accommodate the operational loads incorporate modern railings and safety signage to facilitate pedestrian use. All of the upgrade and repair work will include contemporary concrete and steel materials to renew the structure. The TSW will be provided with engineering drawings and will be consulted with on proposed repairs.

Expanded Forebay

The existing forebay will be extended westward to form a large open channel which will draw water from the Trent Canal through the forebay intake into the intakes of the existing two units (G1 and G2), the new unit (G3) and the new spillway. The new intakes will align with the existing intakes.

The west side wall of the approach channel will be streamlined from the west abutment pier of the forebay intake to the new spillway intake west wall.

The bottom slope of the expanded forebay starting from the forbay intake downstream bottom will smoothly transit downward at an approximately 16% grade. A 2 m wide and 1 m deep rock trap to capture potential debris will be constructed in front of the new powerhouse intake and spillway intake.

The expanded forebay will be designed and verified to satisfy hydraulic requirements under all new operating scenarios. Under normal operational conditions, the expanded forebay will be designed to pass the design flow of 80 m^3/s for the new G3 (a 10-time increase over the existing "Pup" unit), with total station design flow of 171 m^3/s (compared to existing flow of 100m^3/s). The current operating levels in the existing forebay fluctuate from 145.76 m to 146.21 m. The operating levels in the expanded forebay will not change. Under emergency conditions, the expanded forebay will be designed to pass the design flow of 171 m^3/s.

New Powerhouse Intake

The new G3 intake, to be constructed on competent rock foundation, will have one concrete hydraulic passage, approximately 24 m long and 10 m wide, which will initially consist of rectangular sections converging to a circular section of 7.5 m diameter that connects to a Kaplan turbine. The structure will be subject to dam safety requirements.

Trashracks made of steel will be installed in front of the new G3 intake. A 6.5 m high by 7.5 m wide vertical sliding steel gate with a lifting mechanism will be installed to allow for the complete shutdown of the turbine. The gate will be heated for winter operation. Two new sets of stoplogs will be installed upstream and downstream to dewater the water passage for station inspection and maintenance.

New Powerhouse Structures

The new powerhouse footprint will be approximately 10 m by 22 m with sufficient space to satisfy equipment operation and maintenance requirements. The powerhouse will be constructed on competent rock foundation to support the turbine generator, associated equipment and the powerhouse structure. The powerhouse will be above the unit draft tube and the spillway tunnel. The roof will be at elevation 143.0 m to facilitate the mechanical handling for turbine, spillway gate, unit gate and downstream sectional gates. The main floor will be at elevation of 134.0 m to accommodate the electrical and mechanical equipment and associated systems. All floor slabs will be designed and constructed to provide adequate lay-down area and to withstand the heaviest equipment anticipated for loading/unloading of the turbine generator. The west side wall of the powerhouse will be against rock surfaces. The east wall will be against the rock surface of the rock partition between the existing main powerhouse and the new spillway. The north bulkhead wall will face the tailrace. The south side wall will form the power intake downstream wall. All walls will be designed and constructed to be watertight. The walls will be designed to support all loads without dependence on the rock support and the support from second phase concrete. The north bulkhead wall will be designed to withstand the ice load from tailrace freezing.

A single Kaplan turbine (horizontal axis) unit with a nominal capacity of up to 10 MW at design flow of 80 m^3/s will be installed. The design of the draft tube will take into account the turbine hydraulic design requirements which prevent draft tube hydraulic instability.

New Spillway

OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

The spillway consists of intake, tunnel, outlet and stilling basin with an overall foot print of 7 m wide by 37 m long and will be constructed on competent rock foundation. A 5 m high by 5 m wide vertical sliding steel spillway gate with heating system for winter operation will be installed at the downstream to control the flows. Stoplogs will be installed upstream and sectional gates will be installed downstream of the spillway gate to dewater the spillway tunnel.

The spillway intake will be designed to satisfy the hydraulic requirements and the outlet floor will be submerged below the minimum tailrace level to prevent ice formation in the tunnel. The spillway tunnel is 5 m by 5 m tunnel with floor sloping from elevation 13.0 down to elevation 121.44 m. The stilling basin will have energy dissipating concrete blocks to dissipate energy.

The intake and tunnel will be designed as watertight hydraulic structures and to meet dam safety requirements.

Expanded Tailrace Channel

The expanded tailrace channel will be designed with a maximum discharge capacity of 171 m^3/s, either from unit G1, G2 and G3 under normal operation or from spillway during emergency shutdown of the units. The expanded tailrace channel will be located to the east of the “Pup” powerhouse tailrace to accommodate paths for the G3 and stilling basin for the spillway. The tailrace channel will be expanded with the width near the powerhouses from 18 m to 36 m and the width at the outlet from 7 m to 18 m. The channel floor from the new G3 draft tube outlet will have a 5 m horizontal section and then subsequently change from elevation 123.0 m to 126.0 m with a slope 1V:5dvH. The channel floor from the spillway outlet will have a 15 m long stilling basin with energy dissipating blocks and then subsequently change from elevation 120.44 m to 126.0 m with a slope of 1V:2H. The channel floor from the existing G1 & G2 draft tube outlets will not be altered.

Distribution Connection

The new G3 will be connected to the other Hydro One 44 kV distribution line (R8S) that parallels the R9S line east of the existing Ranney Falls GS. The new substation will be built south to the existing substation to accommodate connecting electrical equipment and supporting structures and foundations.

Decommission of the Existing Pup Facilities

The existing Pup facilities will be decommissioned. The entrance gate will be dismantled. The existing approach channel will be incorporated into the expanded forebay. The intake structure and penstock will be removed. The powerhouse building will be preserved in accordance with the environmental assessment commitments. The existing Pup tailrace will be returned back to river bed. The single transformer station will be dismantled and all structures will be removed.

Relocation of the Upstream Safety Boom

The safety boom upstream of the forebay intake will be relocated slightly further upstream to accommodate the new operation. Safety fencing will be installed accordingly.

Creation of Habitat for Northern Map Turtle and Eastern Snapping Turtle

A complimentary habitat for Northern Map Turtle and Eastern Snapping Turtle has been created adjacent to the existing Pup tailrace area (TSW, Environment Canada and Ontario Parks will be consulted with respect to post construction monitoring).

1.3.2 Construction

The Ranney Falls G3 Project will be executed under a design-bid-build approach. During the Definition Phase, a water-to-wire (W2W) contractor will be engaged through a Request-for-Proposal (RFP) to complete the final design and layouts, and then the owner's engineer will complete the detailed design for permanent civil works. A Civil Contractor will be selected through a RFP process. All the temporary works will be the sole responsibility of the selected Civil Contractor and W2W Contractor. The Definition Phase is anticipated to be completed in December 2016.

The Execution Phase includes two stages – stage 1 for civil construction and stage 2 for W2W installation. During the stage 1, the existing G1 and G2 will be taken out of service, the Civil Contractor will design, build and remove the upstream and downstream cofferdams, complete the civil construction, including forebay intake rehabilitation, excavation and construction of the expanded forebay, powerhouse intake and powerhouse, spillway, expanded tailrace and new substation foundations, installation of auxiliary electrical and mechanical equipment and systems, trashrack, unit headgate, spillway headgate and stoplogs/section gates, water up the

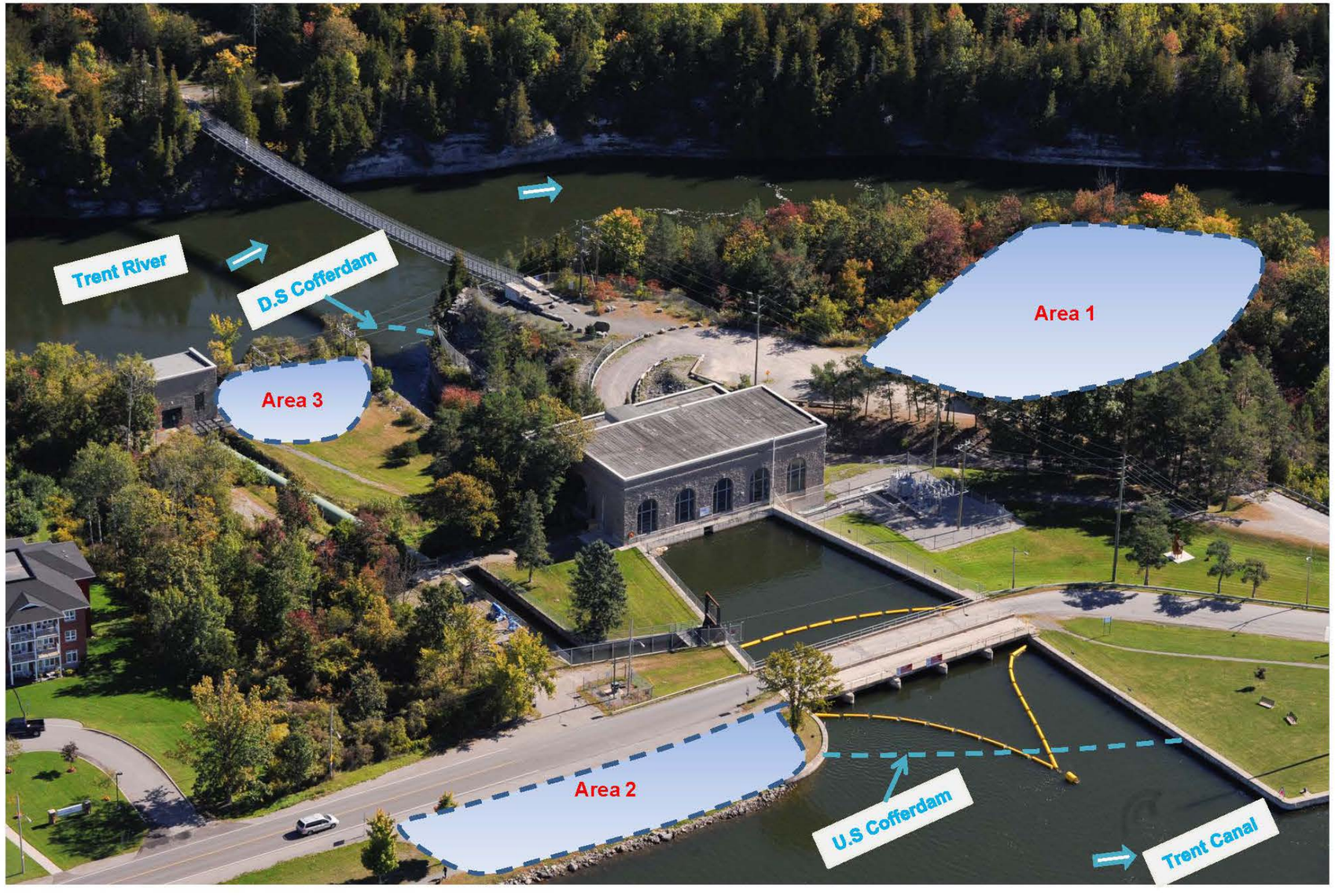
expanded forebay and tailrace, and return the existing G1 and G2 into service. Then the stage 2 starts. The W2W Contractor will install, test and commission the turbine, generator and ancillary electrical and mechanical equipment and systems, and place the new G3 into service. The OPG project team including Owner's engineer will provide oversight during the two stages to ensure quality and schedule. The Execution Phase is anticipated to start in January 2017 and be completed by December 2019.

As the environmental assessment process will be completed during the Definition Phase, the detailed engineering design will be undertaken concurrently with DIA Report preparation. Commitments made in the DIA are being communicated to the design team.

An initial perspective on what might be the construction and installation methods that would be employed by the contractors is presented below. However, it should be noted that the final sequencing, construction and dewatering methods used would be defined by the successful contractors on the basis of environmental requirements and constraints outlined in the OPG procurement process.

Proposed construction laydown areas include OPG's storage yard, the lawn to the south of the main powerhouse and the area between the access road to the "Pup" powerhouse and the proposed expanded tailrace (see Section 4.1.2). OPG is also pursuing approval from Parks Canada – TSW for use of the lawn area south of Trent Drive to the east and west of the existing forebay.

Figure 1.7 Construction Laydown Areas



Fencing will be installed prior to construction initiation to prevent turtle access to current nesting habitat in the construction area.

During stage 1, the Civil Contractor will be the Constructor. An upstream cofferdam will be installed upstream of the forebay intake for repairing the forebay structure and civil construction. The upstream cofferdam may be made of sheet piles or rock fill. The downstream cofferdam will consist of a dam within the existing tailrace channel outlet and rock plug to seal the expanded channel portion. The dam within the existing tailrace may be made of rocks from the excavation and waterproof membrane. A cementitious grout curtain may be installed through the rock plug to stop inflows from the Trent River.

After cofferdams installation, the existing forebay and tailrace channel will be dewatered and any fish present transferred to the Trent Canal and Trent River, respectively, prior to complete dewatering. Cofferdams installation and dewatering will be undertaken outside of the timing restriction for in-water construction to protect the fish spawning and egg incubation period for warmwater and coolwater fish communities (April 1 to June 30).

The upper shale-rich bedrock domain with a thickness in the range of 18 to 23 m will be the main domain encountered during excavation (see Section 3.4). This material will form the walls of all planned excavations, temporary plugs and at least some of the excavation floors, depending on excavation depth. It is expected that the overlying overburden and upper weathered bedrock horizon with a thickness likely varying between 1 and 4 m can be excavated using conventional earthmoving equipment such as excavators and bulldozers, without ripping, or drilling and blasting. Based on the geotechnical findings, the upper shale-rich bedrock domain is considered to be non-rippable and therefore its excavation is expected to require drilling and blasting (Knight Piésold Ltd., 2011a).

The lower shale-poor bedrock domain is likely to be near the base of the excavation and the new powerhouse may be founded on this domain, or near boundaries of the two domains, i.e., upper shale-rich and lower shale-poor. Therefore, significant excavation in the lower shale-poor bedrock domain is not anticipated. If excavation of the lower domain is necessary, it is expected that drilling and blasting will be required due to its greater competency. The current excavation plan indicates that the excavation will be limited to the upper shale-rich bedrock domain (Knight Piésold Ltd., 2011a).

As indicated in Section 3.4, the upper shale-rich bedrock domain consists of inter-bedded shale and limestone with a number of weak clay-like seams believed to be associated with the shale-rich layers. Any seams in the powerhouse foundation area will be excavated if they are within 1.5 m of the excavation base. In the absence of these weak materials in the immediate vicinity of the foundation, the bearing capacity is expected to be within the range of typical values for soft bedrock (Knight Piésold Ltd., 2011a).

It is expected that the material excavated from the upper shale-rich bedrock domain may be suitable for structural fill. It will be important to ensure that the excavated material is well graded and that it contains only a small proportion of thin, flat or elongated particles (which may come from the shale layers) if it is to be used for fill (Knight Piésold Ltd., 2011a).

The shale layers and soil seams encountered in the rock walls may become locally recessed during excavation, resulting in local wall stability issues associated with overhanging limestone beds. Intersecting steeper discontinuities will need to be mapped during excavation and may result in a few wedges that need to be stabilized. Rock mass performance is expected to be reasonable and steep walls should be achievable with careful excavation practices (Knight Piésold Ltd., 2011a).

The groundwater table on the lower level of the Ranney Falls GS property occurs within the upper shale-rich bedrock domain at an approximate depth of 5 to 7 m. Groundwater and precipitation/runoff inflows can be expected due to any excavation within the upper shale-rich bedrock domain. Based on the geotechnical survey findings, inflows are expected to be manageable during excavation with inflow at a rate up to 3 to 5 l/s. Higher than expected inflows may occur if high permeability features are encountered, or if blasting and rock excavation techniques significantly modify the intrinsic hydraulic conductivity of the rock mass (Knight Piésold Ltd., 2011a). To minimize dewatering requirements, a cementitious grouting curtain may be required along the excavation line just before starting the excavation to seal the paths of groundwater inflow. The cementitious grouting will be made of cement, fine sand and water in compliance with industrial practices. Other methods that are generally accepted in the construction industry to reduce or avoid the groundwater inflow may also be employed. All the water from the construction pit will be properly tested and pre-treated if required prior to discharging into Trent River.

The drainage culvert from the adjacent property will be diverted out of the construction pit.

Once the excavation is completed, the Civil Contractor will complete the repair of the forebay structure, decommission of the existing G3 facilities, the construction of the retaining walls, intakes, powerhouse and spillway and installation of the auxiliary electrical and mechanical equipment and systems and gates. Then the Contractor will remove the upstream cofferdam and water up the forebay. The expanded tailrace channel will be watered up, and then the downstream cofferdam including the rock plug and extended riverbed will be removed through in-water excavation, adequate silt curtains will be installed to protect the Trent River water body. After the downstream cofferdam is removed, the existing G1 and G2 units will be returned to service.

During stage 2, the W2W Contractor will be the Constructor. The W2W contractor will install, test, and commission the new G3, including turbine generator, transformer, switchgear, protection and control systems, and also have responsibility for the Hydro One Network connection.

After the Civil and W2W Contractors are retained, they will develop the EMPs that will be provided to the TSW to review. That EMP will be cover a number of details but may not include all the details such as rock plug removal in the EMPs. However, OPG is willing to involve the TSW in a further review of the grouting and removal of the rock plug activities when those work activities are further planned out.

The Execution Phase including civil construction and W2W installation is anticipated to last up to 36 months with the earliest possible in-service date in 2019.

1.3.3 Operation

Operation of the new Ranney Falls complex including the existing G1 and G2, new G3 and new spillway will result in optimal use of the total water available for power generation (mean annual flow of approximately 118 m^3/s), while still complying with the current water level limits.

The new spillway that is to be built in between the existing powerhouse and the new powerhouse will be used solely to control water levels within the Trent Canal which will ensure compliance with the current level limits during an emergency shutdown of the units.

During the navigation season from mid-May to mid-October, generating flows transported through the Trent Canal by TSW are generally up to the current Ranney Falls GS design capacity of 100.9 m^3/s. With the proposed project, the maximum flow transported through the Trent Canal for power generation will be increased from 100 to 120 m^3/s. During the non-navigation season from mid-October to mid-May, the maximum generating flows transported through the Trent Canal will be up to 171 m^3/s.

As illustrated in Figure 1.8 below, Dam #10 currently diverts flow to the 1.5 km section of the Trent Canal to feed the Ranney Falls GS and meet the operational requirements of Locks #11 and #12. River flow that is in excess of the generating station and lockage requirements is spilled through Dam #10 to the original Trent River. The Trent River flow merges with flows from the Ranney Falls GS tailrace approximately 1.1 km downstream of Dam #10. Currently, the 101 m^3/s, passes through the Ranney Falls GS and Locks #11 and #12. With the proposed increased generating capacity, it is planned that a flow of up to 171 cms will be diverted to the Ranney Falls complex and Locks #11 and #12. The hydrological conditions due to dam spillage and leakage are depicted in Photographs 1.1 and 1.2, respectively.

Figure 1.8 Dam #10 & Trent Canal &Trent River

Photograph 1.1 Trent River Hydraulic Regime During Dam #10 Spillage

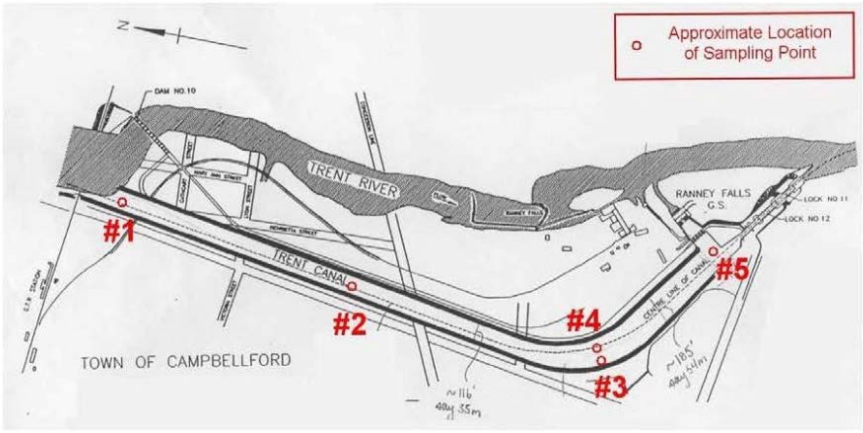
Photograph 1.2 Trent River Hydraulic Regime During Dam #10 Leakage

The new spillway will be used to by-pass station flow to the tailrace channel in emergency shutdown situations to control water levels within the Trent Canal in compliance with the current limits.

A number of studies have been undertaken to verify the hydraulic performance of this 1.5 km section of the Trent Canal under the existing water level limits with the existing and new operation flows, as well as the hydraulic performance of the existing G1 and G2 and proposed G3, and the new spillway. The conclusions have been taken into consideration ensuring the final design in compliance with the existing operation water level limits.

A study of erosion potential of bed substrate in the Trent Canal upstream of Ranney Falls GS (see Figure 1.9) due to increased flows as high as 171 m^3/s was undertaken by Environment Canada (Krishnappan, 2007). The objective of the study was to determine the critical shear stress and erosion rate of the canal's wetted perimeter. It was determined that with an applied shear stress of 8 Pa reflecting an increase in flow velocity from 0.9 m/s at the existing maximum flow of 101 m^3/s to 1.5 m/s at the proposed maximum flow of 171 m^3/s, the canal bottom armour layer remained stable with minor transport of fine material that underlies the armour layer. Moreover, the maximum equivalent canal flow rate of 171 m^3/s could be sustained in the canal without affecting canal dyke stability.

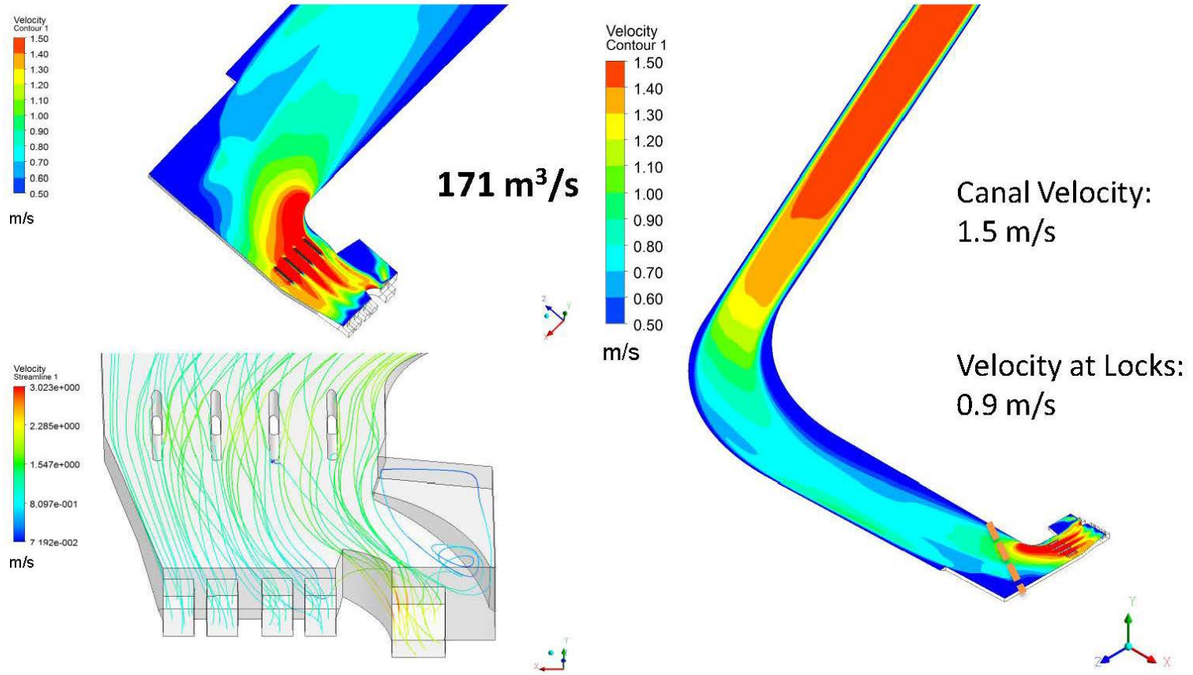
Figure 1.9 Trent Canal Bed Substrate Erosion Potential Study Locations



As part of a numerical hydraulic study, using HEC-RAS software, developed by the Hydrologic Engineering Centre (HEC) of the U.S Army Corps of Engineers (USACE), to investigate water surface profiles and flow velocities in the Trent Canal between Dam #10 and Ranney Falls GS, under the current water level limits, with the existing and future flows. The study concluded that the Trent Canal can transport the maximum power flows up to171 m^3/s, while maintaining the water levels within the current limits and maximum flow velocities within the Trent Canal will increase from 0.9 m/s to 1.5 m/s. Based on the scenarios modeled, the proposed spillway will be able to effectively control water level within the Trent Canal during an emergency shutdown of the units.

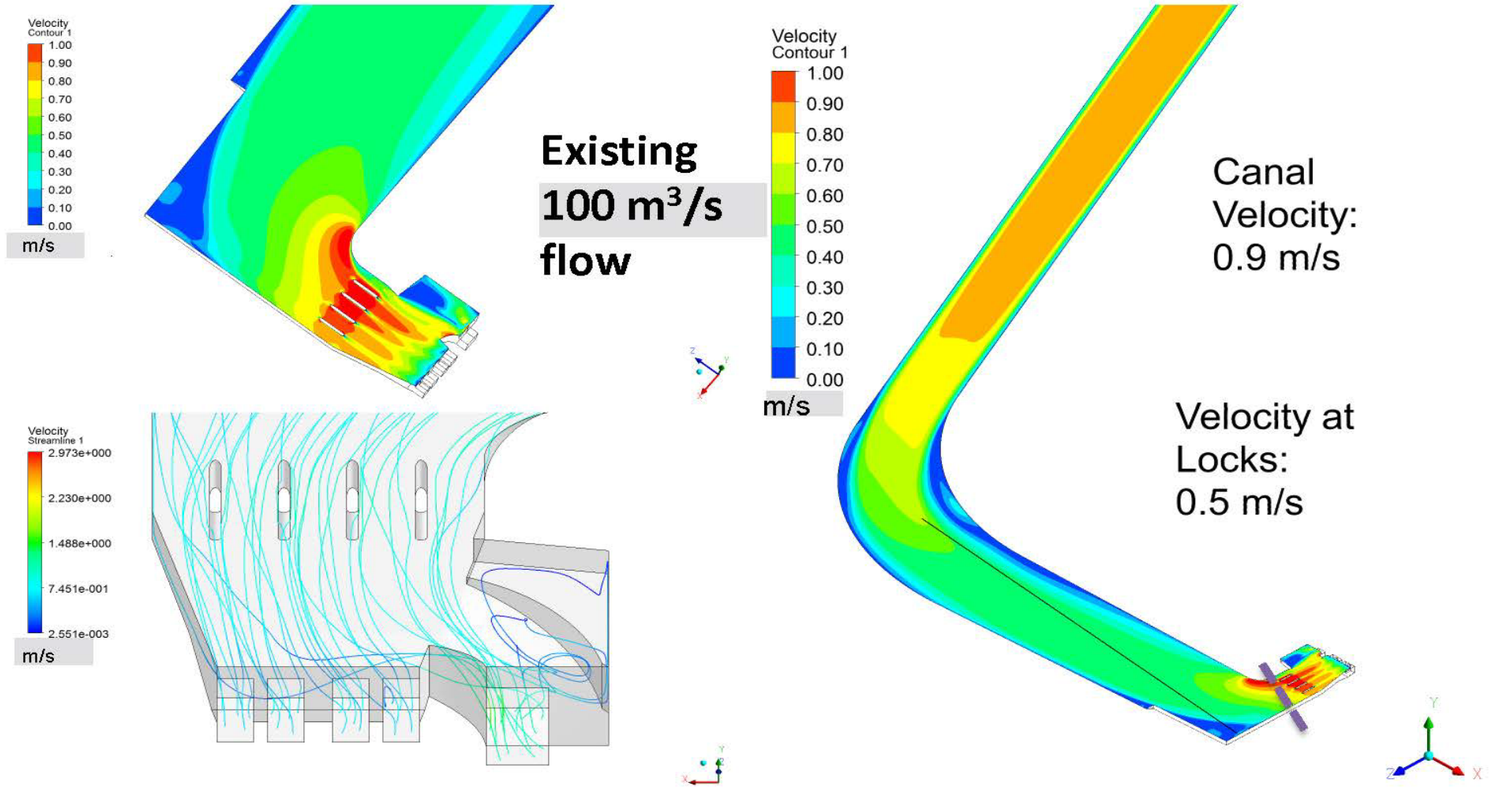
A hydraulic study using the Computational Flow Dynamics (CFD) model was undertaken to assess the potential for vortex formation at the forebay under existing and future flow conditions. Simulation of existing flow conditions indicated no major swirling flows in the flow field near the existing intakes, which is consistent with observations at Ranney Falls GS. Simulations of the future flow conditions indicated no significant cross-circulations near the new intakes, suggesting that the potential for vortex formation at the new G3 intake and spillway intake is likely to be negligible.

Figure 1.10 Flow Velocities in the Straight Canal Reach and at the Locks Based on Proposed Flow Increase



2

Figure 1.11 Flow Velocities in the Straight Canal Reach and at the Locks Based on Current Navigation Flow



Note: **velocities at flow of 120 m³/s is expected to be 1.0 m/s in the Canal and 0.6 m/s at the Locks**

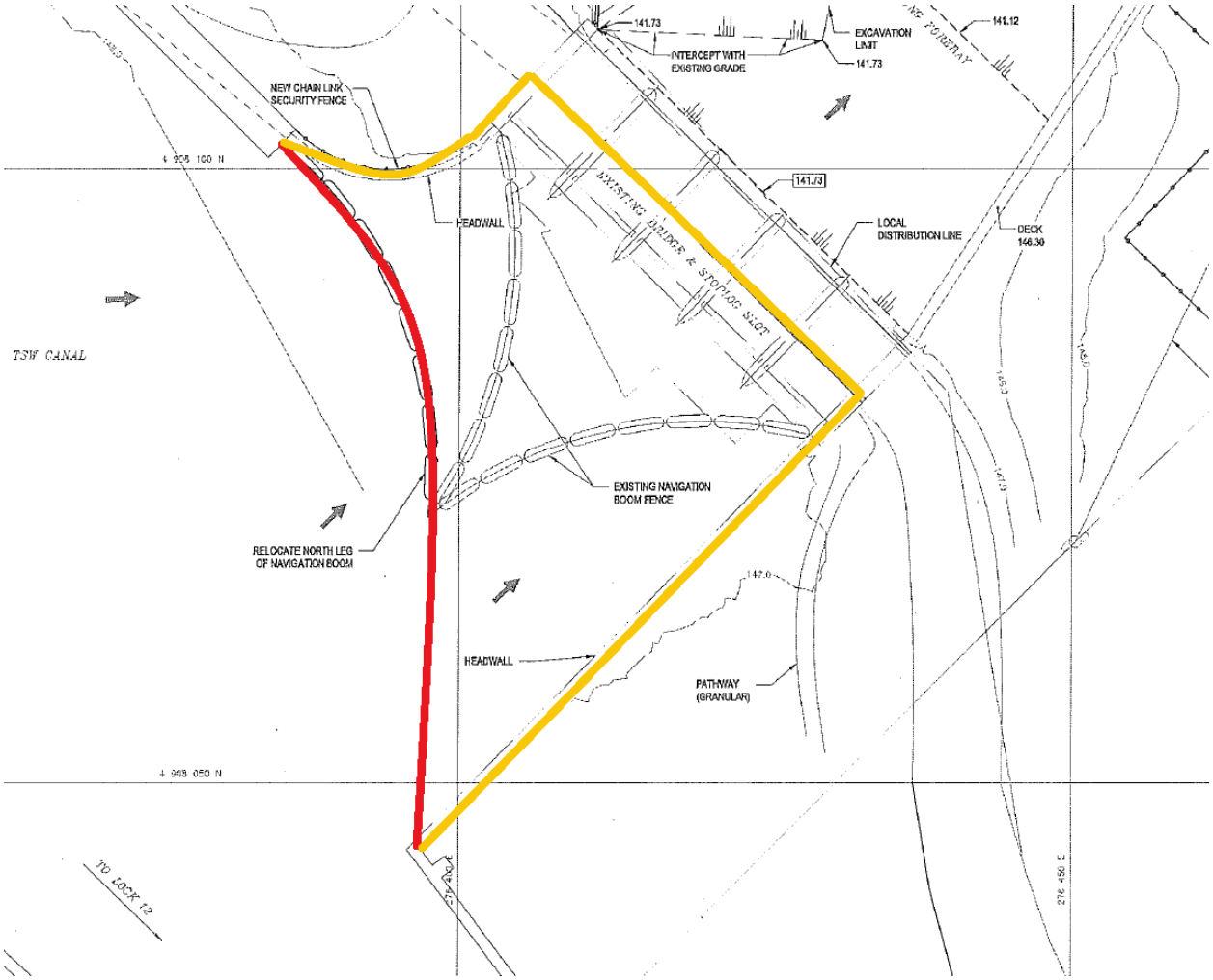
Based on a maximum flow of 171 m^3/s, velocities in the straight section of the canal and near the forebay intake structure were expected to increase from 0.9 to 1.5 m/s and from 0.5 to 0.9 m/s, respectively (see Figure 1.10). However, during the navigation season from mid-May to mid-October with flow limited to 120 m^3/s from the current 100 m^3/s, the maximum flow velocity in the straight section of the canal is expected to increase from 0.9 to 1.0 m/s (see Figure 1.11). In the area near the forebay intake structure, the maximum flow velocity is expected to only increase from 0.5 to 0.6 m/s. It should be noted that flow velocities in the navigable part of the Trent River near the Campbellford main town bridge are higher than those anticipated in the Trent Canal upstream of Locks #11 and #12.

The simulation indicated that the proposed spillway would have sufficient capacity to pass the increased flow up to 171 m^3/s.

As indicated in Section 2.3, a gate with lifting mechanism will provide for complete isolation. The existing stoplog gates in the forebay intake structure will be utilized to dewater the expanded forebay for station inspection and maintenance.

The V-shaped safety booms currently installed in the Trent Canal in front of the Forebay Intake structure will remain in place (see Figure 1.5), but will be reconfigured to prevent vessels from being subjected to the slightly higher traverse velocity. The anchor point at the tip of the north and south leg of the V will be moved outward or upstream along the curved training wall (see Figure 1.12 below).

Figure 1.12 Safety Booms



OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

The technical and environmental aspects associated with the operation of the proposed Ranney Falls G3 Project will be reviewed during this phase, and will be refined and confirmed as the engineering work and DIA proceed.

1.4 DESCRIPTION OF THE STUDY AREAS

The proposed Ranney Falls G3 Project is located within the community of Campbellford in Trent Hills, Northumberland County (Figure 1.1).

In the baseline description of the terrestrial 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 southern Ontario and provides for the baseline description of climate, air quality, geology and physiography.

Local Study Area
The local study area is centred on the proposed Ranney Falls G3 Project location and extending approximately up to 10 km in radius. The local setting provides for the environmental baseline description of soils, vegetation, significant natural features and wildlife.

Site-specific Study Area
The site-specific study area includes those areas on or adjacent to the Ranney Falls GS property that may or will be affected by the proposed Project.

1.5 STUDY APPROACH

Since 2006, a number of environmental baseline studies have been undertaken for the previous design concepts for the proposed expansion of the Ranney Falls "Pup" powerhouse, including vegetation inventories, a breeding bird survey and incidental wildlife observations. Site-specific studies were undertaken to assess the use of the Ranney Falls GS property as nesting habitat by Northern Map Turtle (*Graptemys geographica*) and Eastern Snapping Turtle (*Chelydra serpentina*) (Bennett and Litzgus, 2007, 2008), both designated as Special Concern federally under Schedule 1 of SARA (COSEWIC, 2012;) and provincially (MNRF, 2014). The site-specific terrestrial survey and other desk-top information was used to prepare a draft Project Description (Coker, 2007) and draft Environmental Impact Assessment (Coker *et al*., 2008) for the previously proposed project. However, the project was deferred by OPG prior to commencement of the formal EA and consultation process. Much of the information collected is, however, still relevant for the current design.

As part of the proposed Ranney Falls G3 Project, additional field studies have been undertaken including a geotechnical investigation (Knight Piésold Ltd., 2011b), a terrestrial survey of the remainder of the Ranney Falls GS property and adjacent significant woodlands, and soil quality monitoring as part of the Phase II Environmental Site Assessment (SENES, 2012).

1.6 STRUCTURE OF THE REPORT

As the proposed Ranney Falls G3 Project is on a federal waterway and subject to the federal *Dominion Water Power Act* administered by Parks Canada, it is not subject to the Ontario *Environmental Assessment Act* (V. Mitchell, MOE, 2012, pers. comm.). The proposed Project is also exempt from the Lower Trent Conservation (LTC) Permit for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under Ontario Regulation 163/06 of the *Conservation Authorities Act* (M. Lovejoy, LTC, 2012, pers. comm.).

This report was prepared as a TSD to the DIA Report for the proposed Ranney Falls G3 Project (SENES, 2015) to fulfill federal department obligations to the *CEAA 2012*. As part of the federal government plan for Responsible Resource Development, which seeks to modernize the regulatory system for project reviews, the *CEAA* (S.C. 1992, c. 37) was repealed when the *CEAA 2012* came into force. For projects on federal lands that are not designated projects, *CEAA 2012* requires that before federal authorities make any decision that would allow a project to proceed, they must determine whether a project is likely to cause significant adverse environmental effects (Section 67 CEAA 2012). As *CEAA 2012* does not establish a process for determining whether the undertaking of a non-designated project is likely to cause significant adverse environmental effects, the involved federal departments, e.g., Parks Canada, DFO, Transport Canada, Environment Canada, must establish their own (or conduct joint efforts) for the environmental effects review process. The DIA Report and this Terrestrial TSD provide the requisite information to enable the involved federal departments to undertake the environmental effects review process.

The DIA Report provides a description of the proposed undertaking, summarizes the overall environmental setting and anticipated environmental effects, recommends appropriate mitigation measures to minimize or obviate these effects, and describes agency, public and Aboriginal consultation.

This Terrestrial TSD is organized into four main chapters:

- Chapter 1.0 **Introduction** – provides a description of the proposed Ranney Falls G3 Project, the study areas and study approach;
- Chapter 2.0 **Baseline Terrestrial Environment Conditions** – describes the baseline terrestrial environment conditions in the study areas;
- Chapter 3.0 **Effects Assessment and Mitigation Measures** – details the assessment of terrestrial environment effects, presents mitigation measures to minimize or obviate these effects and delineates the net effects; and
- Chapter 4.0 **Summary and Conclusions** – summarizes the potential effects and recommended mitigation/remedial measures.

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

2.0 BASELINE TERRESTRIAL ENVIRONMENT CONDITIONS

2.1 ATMOSPHERIC CONDITIONS

2.1.1 Climate

The climate of southern Ontario is classified as modified continental, moderated by the proximity of the Great Lakes (Lake Ontario to the south), but differing appreciably from one location to another and from year to year (Brown *et al*., 1974). The variability in southern Ontario climate is due to local differences in topography, distance from the Great Lakes and direction of prevailing winds. The proposed Ranney Falls G3 Project is located within the Simcoe and Kawartha Lakes Climatic Region, as defined by Brown *et al*. (1974). This Climatic Region is greatly influenced by proximity to Lake Ontario, which moderates temperatures and provides moisture-laden air to adjacent lands. Air masses affecting this Climatic Region include flows of cold dry air from the Arctic, moist warm air from the Gulf of Mexico, and dry prevailing winds (westerlies) from the Pacific.

Winter severity varies from year to year, depending on the duration and number of episodes of domination of the region by Arctic air masses. During the summer, the Bermuda High often becomes the controlling weather feature, extending its influence over most of southern Ontario. The potential for stagnant air masses is greatest during mid- to late summer. The intensity of migrating storms usually peaks in late fall (November) and early spring (March). A summary of pertinent climatic and related plant growth data for the Simcoe and Kawartha Lakes Climatic Region is provided in Table 2.1. Based on data collected from 1931 to 1960 (Brown *et al*., 1974), the mean growing season length for this Climatic Region is 195 days.

Table 2.1 Climatic Data for the Simcoe and Kawartha Lakes Climatic Region[1]

Climatic Parameter	Simcoe and Kawartha Lakes Climatic Region		
Mean Annual Temperature °C (°F)		6.1 (43)	
Mean Daily Temperature °C (°F)	Minimum		Maximum
January	-13.3 (8)		-3.3 (26)
April	-0.6 (31)		10.6 (51)
July	13.9 (57)		26.1 (79)
October	2.8 (37)		14.4 (58)
Mean Date of Last Spring Frost		18 May	
Mean Date of First Fall Frost		28 September	
Mean Annual Frost-Free Days		135	
Mean Start of Growing Season		18 April	
Mean End of Growing Season		28 October	
Annual Length of Growing Season (Days)		195	
Mean Annual Growing Degree Days		3,200	
Mean Annual Precipitation – mm (inch)		813 (32)	
Mean Annual Snowfall – mm (inch)		1,778 (70)	

[1] Source: Brown *et al*. (1974).

Based on the ecoclimatic classification system developed by Environment Canada (Ecoregions Working Group, 1989), the proposed Ranney Falls G3 Project occurs within the Humid Mid-Cool Temperate Ecoclimatic Region of the Cool Temperate Ecoclimatic Province. Summers are typically warm and winters are mild. Mean daily temperatures remain above 0ºC from April through late November. Precipitation is distributed fairly evenly throughout the year.

Mean daily temperature and precipitation data for the Trenton Airport and Peterborough Airport meteorological stations are presented in Table 2.2. The mean annual temperatures at the two stations are 7.0ºC and 5.9ºC, respectively. Mean monthly precipitation varies between lows of 54.0 and 50.6 mm in February and highs of 91.8 and 83.2 mm in November and August, respectively, with no pronounced wet or dry season. Summer thunderstorm activity is relatively frequent. Total annual precipitation at the Trenton Airport is approximately 894 mm with 759 mm falling as rain and 169 cm falling as snow. For the Peterborough Airport station, total annual precipitation is approximately 840 mm with 682 mm and 162 cm as rain and snow, respectively.

Frost data for the two meteorological stations are summarized in Table 3.2. The average length of the frost-free period ranges from 122 to 154 days. Frozen ground conditions usually occur between late December and early March; however, year-to-year variation is considerable, depending on weather and local differences in vegetation, soil types, proximity to waterbodies and topography.

The prevailing winds in the region are usually from a southwesterly direction (Table 2.4). The annual hourly wind speeds with 1:10, 1:30 and 1:100 probabilities of exceedance in Peterborough and Campbellford are 75.6, 86.4 and 97.2 km/h, respectively (ACNBC, 1980). In Trenton, they are higher, i.e., 82.8, 93.6 and 100.8 km/h, respectively.

2.1.2 Air Quality

In southern Ontario, poor air quality is most often the result of high levels of ground-level ozone (O_3) and airborne particulate matter (PM). Ground-level O_3 is the primary component of smog with a contribution by fine PM. O_3 results from chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of heat and sunlight.

The air pollutant life cycle is largely influenced by large-scale weather systems. Ground-level O_3, its precursors and fine PM can travel via these weather systems thousands of kilometres from their source. It is because of the long-range transport of airborne pollutants that transboundary flow from the U.S. plays a significant role in air quality considerations throughout southern Ontario.

Table 2.2 Mean Temperature and Precipitation Data, 1971-2000[1]

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Trenton Airport[2]													
Temperature (°C)	-7.5	-6.3	-1.0	6.1	12.7	17.6	20.5	19.4	14.8	8.3	2.6	-4.0	7.0
Rainfall (mm)	35.4	28.4	49.5	70.9	71.4	79.5	56.1	77.1	87.6	75.6	81.6	46.1	759.3
Snowfall (cm)	46.7	33.2	26.7	6.4	0.2	0.0	0.0	0.0	0.0	0.4	12.4	43.4	169.4
Total Precipitation (mm)	70.1	54.0	72.4	77.1	71.6	79.5	56.1	77.1	87.6	76.0	91.9	80.4	893.8
Days with Precipitation[3]	13.3	13.2	13.5	12.3	12.2	11.9	9.1	10.7	11.6	12.8	14.7	15.8	154.2
Average Snow Depth (cm)	10	10	5	0	0	0	0	0	0	0	1	6	3
Peterborough Airport[4]													
Temperature (°C)	-8.0	-7.7	-2.0	5.7	12.4	16.8	19.4	18.2	13.5	7.3	1.7	-5.3	5.9
Rainfall (mm)	24.2	21.9	37.1	59.3	72.8	76.7	66.7	83.2	77.7	67.9	62.7	31.9	682.0
Snowfall (cm)	40.7	30.2	25.4	7.5	0.1	0.0	0.0	0.0	0.0	1.6	16.3	40.3	162.0
Total Precipitation (mm)	58.5	50.6	65.0	68.8	73.2	76.7	66.7	83.2	78.4	70.0	79.0	70.3	840.3
Days with Precipitation[3]	17.0	13.8	13.5	12.6	12.4	11.4	9.8	11.8	12.5	13.7	15.6	16.5	160.7
Average Snow Depth (cm)	17	22	11	1	0	0	0	0	0	0	1	8	5

1 Source: www.climate.weatheroffice.ec.gc.ca/climate_normals

2 Latitude: 44°07'00"N; Longitude: 77°32'00"W; Elevation: 86.30 m.

3 ≥0.2 mm.

4 Latitude: 44°14'00"N; Longitude: 78°22'00"W; Elevation: 191.40 m.

Table 2.3 Frost Data, 1951-1980[1]

Parameter	Trenton Airport[2]	Peterborough Airport[3]
Mean Frost-Free Period (Days)	154	122
Average Last Frost (Spring)	04 May	20 May
Average First Frost (Fall)	06 October	20 September
Earliest Last Frost (Spring)	08 April[4]	02 May
Latest Last Frost (Spring)	27 May[4]	12 June
Earliest First Frost (Fall)	12 September[4]	31 August
Latest First Frost (Fall)	26 October[4]	07 October
Longest Frost-Free Period (Days)	196[4]	144
Shortest Frost-Free Period (Days)	121[4]	103

[1] Source: AES (1982).
[2] Based on 30 years of data.
[3] Based on 43 years of data.
[4] Based on 12 years of data.

Table 2.4 Wind Data, 1971-2000[1]

Parameter	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Trenton Airport[2]													
Average Wind Speed (km/h)	16.8	15.1	15.5	16.0	13.5	12.1	11.8	10.7	11.6	12.9	14.9	15.3	13.8
Most Frequent Direction	W	W	W	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
Max. Hourly Speed (km/h)	89	74	105	76	64	72	64	63	64	74	80	69	
Max. Gust Speed (km/h)	153	113	145	128	106	119	127	103	116	106	145	154	
Max. Gust Direction	NW	W	SW	SW	SW	SW	SW	SW	SW	NW	SW	SW	SW
Peterborough Airport[3]													
Average Wind Speed (km/h)	12.7	11.7	12.6	13.0	11.0	10.0	8.8	7.8	8.6	9.8	11.6	11.7	10.8
Most Frequent Direction	SW	W	W	W	W	W	W	W	SW	SW	SW	SW	W
Max. Hourly Speed (km/h)	64	69	58	70	52	52	42	46	52	56	63	63	
Max. Gust Speed (km/h)	100	87	117	101	109	104	98	133	89	89	100	104	
Max. Gust Direction	CALM	W	W	SW	S	W	NW	SW	W	W	SW	SW	SW

1 Source: www.climate.weatheroffice.ec.gc.ca/climate_normals

2 Latitude: 44°07'00"N; Longitude: 77°32'03"W; Elevation: 86.30 m.

3 Latitude: 44°14'00"N; Longitude: 78°22'00"W; Elevation: 191.40 m.

Air quality is influenced by local and long-range (cross-border) contaminants generated in upwind urban and industrial areas. Air quality in southern Ontario is affected in part by emissions from the U.S., which contribute approximately 55% of smog (MOE, 2005a). The remaining portion is largely due to fossil fuel combustion in Canada (including vehicle emissions). Typically, these emissions consist of NO_x, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and suspended PM, which is equivalent to total suspended particulates. Particulates are also reported as PM smaller than 10 µ and PM smaller than 2.5 µ ($PM_{2.5}$).

Table 2.5 presents the 2010, 2011 and 2012 ambient air quality statistics for the Ontario Ministry of the Environment and Climate Change (MOECC) monitoring station in Peterborough, along with the provincial Ambient Air Quality Criteria (AAQC). The 1-h O_3 AAQC was exceeded 12, two and 15 times in 2010, 2011 and 2012, respectively (MOE, 2012, 2013; MOECC, 2014). There were no exceedances of the 1-h and 24-h NO_2 AAQC.

In 2000, the Canadian Council of Ministers of the Environment (CCME, 2000) developed a Canada-Wide Standard (CWS) for $PM_{2.5}$ as a result of the pollutant's adverse effects on human health and the environment. The CWS for $PM_{2.5}$ of 30 µg/m^3 over a 24-h averaging time was not exceeded in 2010, 2011 and 2012.

Overall, ambient air quality in the Peterborough area can be considered to be good relative to other locations in southern Ontario (MOE, 2012, 2013; MOECC, 2014).

Table 2.5 Peterborough Ambient Air Quality Statistics, 2008-2010[1]

Parameter	Percentiles							Maximum		AAQC[2]		No. of Times Above AAQC	
	10%	30%	50%	70%	90%	99%	Mean	1h	24h	1h	24h	1h	24h
2010													
O_3 (ppb)	14	24	30	36	46	67	30.5	91	59	80		12	
NO (ppb)	0	1	1	2	3	17	1.7	93	14				
NO_2 (ppb)	1	2	3	6	11	24	5.0	38	21	200	100	0	0
NO_x (ppb)	2	3	5	7	13	38	6.7	119	30				
$PM_{2.5}$ (µg/m^3)	0	2	3	6	12	26	5.1	49	26		30[3]		0
2011													
O_3 (ppb)	12	21	28	34	43	62	27.9	86	60	80		2	
NO (ppb)	0	1	1	2	4	27	2.2	87	21				
NO_2 (ppb)	1	2	3	4	9	30	4.3	46	28	200	100	0	0
NO_x (ppb)	2	3	4	6	13	47	6.6	99	41				
$PM_{2.5}$ (µg/m^3)	1	2	4	7	12	23	5.5	48	23		30[3]		0
2012													
O_3 (ppb)	13	22	28	34	46	70	29.1	90	64	80		15	
NO (ppb)	0	1	1	1	3	18	1.8	89	17				
NO_2 (ppb)	1	1	2	4	8	20	3.7	32	18	200	100	0	0
NO_x (ppb)	1	2	4	5	11	34	5.4	98	35				
$PM_{2.5}$ (µg/m^3)	0	2	4	6	11	20	4.9	50	21		30[3]		0

[1] MOE (2012, 2013; MOECC, 2014); Station 59006 (10 Hospital Drive).
[2] AAQC = Ambient Air Quality Criteria (MOE, 2005b).
[3] Canada-Wide Standard (CCME, 2000).

2.1.3 Environmental Noise

Environmental noise levels will vary according to a number of factors including the local noise source, receptor locations and surrounding environment. Specific factors influencing noise levels within the proposed Project study area include noise intensity, number of sources, sound properties, source proximity, surrounding topography, buildings, vegetative barriers and atmospheric conditions.

The major sources of noise in the area of the proposed Ranney Falls G3 Project are associated with road and boat traffic.

2.2 GEOLOGY

Regionally, southern Ontario is underlain by relatively flat-lying, undeformed sedimentary bedrock of Paleozoic age which overlies older crystalline Precambrian bedrock. The Precambrian/Paleozoic unconformity lies to the east (extending from Port Severn on Georgian Bay south to the Lake Ontario outlet to the St. Lawrence River), whereas the Niagara Escarpment is located to the west. The bedrock forms part of the Western St. Lawrence Platform, an extension of the stable interior North American Platform. Within this platform, orogenic and tectonic activity during the Cambrian Period created a series of basins and arches, including the Michigan Basin (centred along the Michigan Peninsula), the Appalachian Basin (extending from the Great Lakes to Alabama) and the Algonquin Arch, a structural high which separates the two basins. From this arch, the bedrock dips gently 6 to 9 m per km towards the Michigan Basin to the west and the Appalachian Basin to the south. Although an overall stable region, the geology is a result of repeated sequences of subsidence, sedimentation and erosion controlled by tectonic forces and eustatic sea level fluctuations operating from the Middle Precambrian to the Early Cretaceous Period (Williams *et al*., 1992).

The bedrock is composed of carbonates of the Michigan Basin deposited under shallow epicontinental marine conditions in the Middle to Upper (Late) Ordovician Period. During the Cambrian marine transgression, sandstones were gradually succeeded by dolostones that progressively onlapped and overlapped the Algonquin Arch (Johnson *et al*., 1992). The basal sediments were eventually eroded and Middle to Upper Ordovician carbonates and shales that compose the region were unconformably deposited over them. Outcrops of basement Precambrian rock are rare in the region.

The bedrock which underlies the regional study area consists of several southeast-to-northwest trending formations which increase in age toward the east (Hewitt, 1972). Upper Ordovician shales and shales with interbedded limestone underlie the area below, and to the east of, the Niagara Escarpment, whereas the Escarpment itself consists primarily of Middle and Lower Silurian sandstone, shale and dolomite. Further east, Upper and Middle Ordovician limestone bedrock is present.

The proposed Ranney Falls G3 Project is underlain by the Middle Ordovician Verulam Formation of the Simcoe Group consisting of light to dark grey, brown grey, interbedded, micritic to coarse-grained, fossiliferous limestone with inter-beds of calcareous shale (Johnson *et al*., 1992). This bedrock is not erosion-resistant and commonly weathers to rubble. The interbedded limestones and shales occur as rubbly outcrops and bluffs of horizontal strata along the Trent River upstream and downstream of the Ranney Falls GS site. The beds of limestone with lesser layers of shale were formed from sediments deposited in a shallow sea approximately 460 million years ago and contain fossils such as corals, bryozoans, crinoids and brachiopod shells. Overburden thickness is typically less than 8 m, except in those areas overlain by esker or drumlin deposits. The Verulam Formation has a gradational lower contact with the Middle Ordovician Bobcaygeon Formation of the Simcoe Group which underlies downtown Campbellford. The Bobcaygeon Formation consists of dark to light grey, brown to blue-grey, interbedded, micritic to coarse-grained, fossiliferous limestone with variable argillaceous content.

On the Ranney Falls GS property, outcrop exposure is limited to four locations (Knight Piésold Ltd., 2011a):

1. cliff sides of the main powerhouse tailrace cut channel at the Trent River;
2. cliff located between the “Pup” powerhouse outflow and the mouth of its tailrace at the Trent River;
3. the northwestern side of the penstock adjacent to the “Pup” powerhouse; and
4. the northwestern side of the penstock adjacent to its intake channel.

Based on the geotechnical survey, three bedrock domains were encountered below the overburden (Knight Piésold Ltd., 2011a,b):

1. a weathered horizon with a thickness likely varying between 1 and 4 m and that may be greater in the vicinity of vertical discontinuities;
2. an upper shale-rich bedrock domain with a thickness in the range of 18 to 23 m, consisting of inter-bedded shale and limestone with a number of weak clay-like seams believed to be associated with the shale-rich layers; and
3. a lower shale-poor bedrock domain with a thickness of at least 15 to 20 m, consisting of a series of inter-bedded shale and limestone layers with proportionately less shale and clay-like seams.

Acid Base Accounting testing indicated that bedrock on the Ranney Falls GS property is highly neutralizing, as expected for the limestone and shale units. This finding is supported by the low sulphide content (<0.15%) and carbonate portion (~50%) (Knight Piésold Ltd., 2011b).

The local study area lies in a zone of mild potential (Zone 1) for seismic activity (ACNBC, 1980). Unlike the traditional earthquake-prone zones along plate margins, e.g., those known in the western Rocky Mountains, seismic activity in the study area is related to slippage along ancient

fault lines located within the North American continental plate. Earthquake prediction in the study area is difficult, as few ancient faults have been identified.

2.3 PHYSIOGRAPHY

The proposed Ranney Falls G3 Project lies within the West St. Lawrence Lowland Physiographic Division of the St. Lawrence Lowlands Physiographic Region (Bostock, 1970; Clayton *et al*., 1977). The Niagara Escarpment breaks the West St. Lawrence Lowland into two parts. The land west of the Escarpment slopes gradually to the southwest towards Lake Erie. East of the Escarpment, the land rises gently northward from Lake Ontario to Georgian Bay.

During the Quaternary Period, the Laurentide Ice Sheet dominated much of Canada, including southern Ontario. A series of glacial advances and retreats was initiated approximately 190,000 years B.P. (before present) and lasted to the beginning of the Holocene Epoch at 10,000 B.P. The two main stages of glaciation, Illinoian and Wisconsinan, were divided by the Sangamonian Interglacial stage between 115,000 to 135,000 years B.P. The Labrador Sector of the Laurentide Ice Sheet, with the main direction of ice flow from the northeast, mainly affected the present-day study area (Barnett, 1992).

Generalized mapping of the 55 physiographic regions of southern Ontario suggests that the proposed Project is located within the Iroquois Plain physiographic region (Figure 19 in Chapman and Putnam, 1984), more specifically within the Trent Embayment of the Iroquois Plain. The Iroquois Plain is actually the near-shore lakebed of glacial Lake Iroquois, which formed about 12,600 B.P. and was drained about 11,500 B.P., forming the current Lake Ontario basin. The Trent Embayment was a very large bay of Lake Iroquois that contained many islands and is marked by various types of lacustrine deposits such as sand plains or stratified silt near Campbellford (Chapman and Putnam, 1984).

As indicated in Map 2226 “Physiography of the South Central Portion of Southern Ontario” (Chapman and Putnam, 1972), the Ranney Falls GS property is located on limestone plains, with characteristics similar to the Prince Edward Peninsula physiographic region to the south. This physiographic region is a limestone plain with shallow soils, less than 0.3 m in depth and mostly only a few centimeters of unconsolidated matter over the bedrock, that are classified in the Farmington soil series (Chapman and Putnam, 1984).

The Ranney Falls GS property is surrounded by numerous drumlins within a drumlinized till plain that forms part of the Peterborough Drumlin Field physiographic region (Chapman and Putnam, 1972, 1984). The hilly terrain in this physiographic region is the result of the Laurentide Ice Sheet which deposited silt, sand and boulders (glacial till) in the forms of whaleback hills (drumlins) and sinuous ridges (eskers) during its retreat initiated approximately 13,000 years ago (Sly and Lewis, 1972). Approximately 3,000 drumlins occur in the area at an average density of two to three drumlins per km^2 (TCCSPC, 2011). The drumlins are typically elongated, low-lying hills less than 1.5 km in length, 400 m or less in width and 25 m in height (Gillespie and Acton, 1981). While the general orientation of the drumlin axes in this field is

from northeast to southwest, the direction of ice movement around Campbellford was only 10^{o} west of south (190^{o}) (Chapman and Putnam, 1984). The drumlins in Northumberland County are composed of highly calcareous till with a greater occurrence of boulders of Precambrian origin, many being up to 1 m in diameter. The area is characterized as having moderate to high relief associated with the drumlins and low to moderate relief in the more planer areas between the hills.

In the area of the Ranney Falls GS, topography is generally level, with the exception of the bluffs along the Trent River. The Ranney Falls GS property consists of generally flat upper (adjacent to Trent Drive) and gently sloping lower (adjacent to Trent River) areas with a relatively steep connecting slope (elevation difference of approximately 14 m) adjacent to both sides of the main powerhouse (OPG, 2011a).

The overburden thickness on the Ranney Falls GS property varies between a few centimetres to over 3 m (Ontario Hydro, 1989; Knight Piésold Ltd., 2011a,b). Deeper overburden was encountered within the upper part of the property. Samples from the upper area indicated that the material has varied characteristics and that at least some of it appears to be fill. The majority of the encountered material was described as sandy gravel.

It is suspected that the natural overburden was mostly stripped from the lower area during construction of the existing Ranney Falls GS. Fill has been placed on the northwest side of the "Pup" powerhouse penstock in order to create the access road (Knight Piésold Ltd., 2011a,b).

2.4 SOILS

As indicated above, surficial till material is the result of glacial activities during the late Wisconsinan stage of glaciation. The unconsolidated surface deposits of glacial origin are the parent material from which the soils have developed. The deposits of till overburden are deep over most of Northumberland County, although thin in a few locations along the Trent River in the Campbellford area.

The soils on the Ranney Falls GS property are Farmington loam (Hoffman and Acton, 1974). These soils comprise considerably less than 1% of Northumberland County and occur along the Trent River, primarily between Meyersburg and Campbellford. These shallow soils developed from calcareous loam or clay loam till, with a depth of less than 0.3 m over the underlying limestone bedrock. The soils are very stony and well drained; however, because of their stoniness and shallowness, they have low moisture-holding capacity. The soil profile varies. In thin deposits there is seldom more than a thin surface layer over the bedrock. In deeper deposits, the dominant horizon is a brown to dark brown subsoil layer, just below the surface. This kind of soil development is classified as Brown Forest.

Based on Canada Land Inventory (CLI, 1968), the soils on the Ranney Falls GS property are categorized as Class 6, i.e., capable only of producing perennial forage crops, and improvement practices are not feasible, due to their shallowness (less than 0.3 m) to solid bedrock.

A soil quality monitoring program was undertaken involving the collection and analysis of soil at 11 locations within the proposed Project footprint. Elevated concentrations of metals, VOCs and/or petroleum based hydrocarbons were identified in most samples based on the MOE (2011b) most stringent generic site condition Soil Standards for shallow soils (Table 6) and for within 30 m of a water body (Table 8) in a potable groundwater condition.

A soil sampling and analytical program was undertaken as part of the groundwater monitoring and environmental site investigation for the proposed Project that focused on two main concerns identified during the Phase 1 Environmental Site Assessment (SENES, 2012a):

1. potential contaminants of concern, i.e., metals and petroleum hydrocarbons, associated with the operation of the existing septic field located on site; and
2. residual arsenic within the overburden as a result of past herbicide application practices.

Based on the analytical results (SENES, 2012b), the concentration of one or more metals in eight of the nine soil samples exceeded MOECC soil quality standards (MOE, 2004). Concentrations of total xylene and at least one of the petroleum hydrocarbon fractions exceeded MOECC soil quality standards in five of the nine samples. PCB concentrations were below the analytical detection limit in all samples analyzed with the exception of one sample with a measurable concentration below MOECC standards. Arsenic concentrations in nine of 22 samples were above the MOECC standard.

It was concluded that hydrocarbons occur naturally within petroliferous or bituminous shale rocks.

2.5 VEGETATION

The proposed Ranney Falls G3 Project is located in the Huron-Ontario Forest Section of the Great Lakes-St. Lawrence Forest Region (Rowe, 1977). The natural vegetation is dominated by mixed woods forests, which are transitional between the southern deciduous forests and the northern coniferous forests. The Huron-Ontario Forest Section is characterized by the occurrence of a number of dominant broad-leaved species such as Sugar Maple (*Acer saccharum* ssp. *saccharum*), Red Maple (*A. rubrum*), American Beech (*Fagus americana*), Red Oak (*Quercus rubra*), White Oak (*Q. alba*), Bur (Mossy-cup) Oak (*Q. macrocarpa*), Basswood (*Tilia americana*), Red Ash (*Fraxinus pennsylvanica*) and White Ash (*F. americana*). Frequently, Eastern White Pine (*Pinus strobus*), Eastern Hemlock (*Tsuga canadensis)* and Balsam Fir (*Abies balsamea*) occur with the common hardwoods, and to a lesser extent, Large-toothed Aspen (*Populus grandidentata*) is present. In cool, organic lowlands, Eastern White Cedar (*Thuja occidentalis*), Tamarack (*Larix laricina*), spruce (*Picea* spp.) and Balsam Fir are found. Red Maple, Silver Maple (*Acer saccharinum*) and Black Ash (*Fraxinus nigra*) are dominant in lowland swamps. Pockets of species common to boreal habitat are also present, including Tamarack, Balsam Fir, Eastern White Cedar and Yellow Birch (*Betula alleghaniensis*), as well as Speckled Alder (*Alnus incana*) and Black Spruce (*Picea mariana*).

Agricultural and urban land uses across southern Ontario have fragmented this Forest Region, leaving only smaller remnant woodlots in the landscape, some of which are still representative of the original communities.

The CLI (1971) indicates that the lands in the proposed Ranney Falls G3 Project area are designated as 80% Class 5, and 20% Class 2, with severe and slight limitations, respectively, to the growth of commercial forests. The Class 5 lands are limited by restriction of the rooting zone by bedrock, whereas the Class 2 lands are limited by low fertility and/or physical restriction to rooting by dense or consolidated layers, other than bedrock.

The woodlands adjacent to the northwest of the Ranney Falls GS property within the Island Park Retirement Community property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been designated as significant woodlands (LTC, 2001). These two woodlands are delineated by green shading in Figure 2.1. It should be noted that the delineation of the woodland within the Island Park Retirement Community property by LTC was likely based on previous aerial photography prior to Seniors Home construction. The woodlands in Ferris Provincial Park on the opposite side of the Trent River are also designated as significant (see Section 2.6).

2.5.1 Site-specific Vegetation Communities

Terrestrial field surveys were undertaken by Dougan & Associates (K. Ursic) on October 31, 2006 and June 25, 2007 for the lands that include the Ranney Falls GS site and bound by Trent Drive, the Trent River, the Island Park Retirement Community fence line and the northwestern wall of the main powerhouse. Those surveys included classification of all vegetation communities using the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al*., 1998), an inventory of plant species and incidental observations of wildlife (see Section 2.7). As part of the current EA of the proposed Ranney Falls G3 Project, a supplemental terrestrial field survey was undertaken by Beacon Environmental (K. Ursic) on November 16, 2011 of lands that may be directly or indirectly affected by construction activities including the significant woodland on the adjacent Island Park Retirement Community property.

The vegetation features within the site-specific study area were compartmentalized into 44 distinct polygons. Each vegetation polygon was mapped in GIS using 2006 digital aerial photography obtained from the LTC. Vegetation communities were delineated based on their similarities in landform, vegetation structure and composition. Each of the vegetation polygons was classified according to the ELC vegetation type using species composition and site type data collected in the field (Lee *et al*., 1998).

Figure 2.1 ELC Communities within the Site-specific Study Area

ELC Communities of the Ranney Falls GS Property

Figure 2.1

Ranney Falls G3 Project

Legend

ELC Communities

Significant Woodlands

Unit	ELC Code	ELC Description
1a	FOD9-5	Fresh to Moist Bur Oak Deciduous Forest
1b	FOD7-1	Fresh to Moist White Elm lowland Deciduous Forest
1c	SWD4-2/SWT2-5	White Elm Deciduous Swamp/Red-Osier Dogwood Thicket Swamp
1d	FOD8-1	Fresh to Moist Poplar Deciduous Forest
1e	FOD7-2	Fresh to Moist lowland Ash Deciduous Forest
1f	CuT	Cultural Thicket
2a	CuM	Lawn
2b	CuM	Lawn
2c	CuW	Cultural Woodland
2d	CuT	Cultural Thicket
2e	CuM	Cultural Meadow
2f	CuM	Cultural Meadow
2g	FOC2-2	Dry to Fresh White Cedar/Coniferous Forest
2h	CuT	Cultural Thicket
2i	unV	unvegetated
2j	TAT1-3	Dry to Fresh White Birch Carbonate Talus
2k	CuT	Cultural Thicket
3a	CuM	Lawn
3b	CuM	Lawn
3c	FOC2-2	Dry to Fresh White Cedar/Coniferous Forest
3d	CuM	Cultural Meadow
3e	FOM4-2	Dry to Fresh White Cedar - Poplar Mixed Forest
3f	unV	unvegetated
3g	TAT1-2	Dry to Fresh White Cedar/Carbonate Talus
3h	unV	unvegetated
3i	CuP3-3	Scotch Pine Coniferous Plantation
3j	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest
3k	CuP3-3	Scotch Pine Coniferous Plantation
3l	CuP3-3	Scotch Pine Coniferous Plantation
3m	CuT	Cultural Thicket
3n	SWT2-2	Willow Mineral Thicket Swamp
3o	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest
3p	SWT3-2/MAM3-9	Willow Organic Thicket Swamp/Fresh Organic Meadow Marsh
3q	FOD8-1	Fresh to Moist Poplar Deciduous Forest
3r	FOD5-3	Dry to Fresh Sugar Maple-Oak Deciduous Forest
3s	CuM	Lawn
3t	CuT	Cultural Thicket
3u	CuT	Cultural Thicket
3w	FOD5-6	Dry to Fresh Sugar Maple-Basswood Deciduous Forest
3x	CuM	Cultural Meadow
3y	CuT	Cultural Thicket
3z	CuM	Lawn

First Base Solutions
Web Mapping Service 2008

UTM Zone 17 N, NAD 83

0 20 40 80 Meters

1:2,000

BEACON ENVIRONMENTAL

Project 211250
December 2011

A total of 20 community types were documented from the site-specific study area. Of these, 15 are considered to be of natural origin, whereas five are of semi-natural or cultural origin. A description of the vegetation communities observed in the study area is provided in Table 2.6. Their locations are indicated in Figure 2.1.

Much of the study area is comprised of anthropogenically modified vegetation features including lawn, ornamental plantings and cultural woodlands. The lands immediately associated with Ranney Falls GS are periodically maintained. Semi-natural communities have developed on lands that have been previously disturbed or modified during construction of the Ranney Falls GS and TSW. Natural communities in the study area are generally confined to the banks of the Trent River and undisturbed areas between the TSW and Ranney Falls GS. These lands include treed cliffs, forests, thickets and wetlands.

The most noteworthy natural vegetation communities in the study area include the cliff and forested habitats associated with the Trent River.

The cliff vegetation communities associated with the Trent River are classified as Bulblet Fern - Herb Robert Open Shaded Limestone/Dolostone Cliff Face Vegetation Type. This community type is ranked as provincially significant by the MNRF Natural Heritage Information Centre (NHIC). A similar community has also developed on the walls along the tailrace channel to the main powerhouse; however, this community is artificial in origin and not considered to be of similar significance.

Table 2.6 Vegetation Communities within the Site-specific Study Area

Unit[1]	ELC Code	ELC Description	Overstorey	Understorey	Groundcover	Soils	Moisture Regime/ Drainage	Slope	Structural Diversity	Sensitivity	Comments
1a	FOD9-5	Fresh to Moist Bur Oak Deciduous Forest	Bur Oak, Green Ash, Basswood	Red Cedar, Lilac, Honeysuckle	Garlic Mustard, Dame's Rocket, Catnip	Shallow Loam	Fresh/Well	2%	Low	Low	
1b	FOD7-1	Fresh to Moist White Elm Lowland Deciduous Forest	White Elm, Bur Oak, Poplar	Grey Dogwood, Honeysuckle, Sumac	Garlic Mustard, Dame's Rocket, Catnip	Shallow Loam	Fresh/Well	5%	Low	Low	
1c	SWD4-2/SWT2-5	White Elm Deciduous Swamp/Red-osier Dogwood Thicket Swamp	Crack Willow, White Elm, Manitoba Maple	Dogwood, Willow, Cedar	Reed Canary Grass, Fowl Manna Grass, Impatiens	Shallow Loam and Organics	Moist/ Imperfect	2%	Moderate	Moderate	Seepage
1d	FOD8-1	Fresh to Moist Poplar Deciduous Forest	Poplar, Cedar, Green Ash	Honeysuckle, Sumac	Dame's Rocket, Raspberry	Shallow Loam	Fresh/Well	2%	Low	Low	
1e	FOD7-2	Fresh to Moist Lowland Ash Deciduous Forest	Green Ash, White Elm, Bur Oak, Basswood	Green Ash, Red Cedar, Sumac	Garlic Mustard, Dame's Rocket, Catnip	Shallow Loam	Fresh/Well	2-10%	Moderate	Low	
1f	CUT	Cultural Thicket	Bur Oak	Red Cedar, Honeysuckle, Lilac	Reed Canary Grass, Garlic Mustard, Dame's Rocket, Catnip	Shallow Loam	Fresh/Well	2%	Low	Low	Riparian – Subject to Flooding
2a	CUM	Lawn			Bluegrass	Shallow Loam	Fresh/Well	0%	Low	Low	Maintained
2b	CUM	Lawn			Bluegrass	Shallow Loam	Fresh/Well	0%	Low	Low	Maintained
2c	CUW	Cultural Woodland	Scotch Pine (10) (15-40 cm dbh), Basswood (3) (20-40 cm dbh)	Sumac, Honeysuckle, Raspberry, Manitoba Maple	Goldenrod, Dame's Rocket, Garlic Mustard, Coltsfoot	Loam	Fresh/Well	5-20%	Low	Low	Maintained

Unit[1]	ELC Code	ELC Description	Overstorey	Understorey	Groundcover	Soils	Moisture Regime/ Drainage	Slope	Structural Diversity	Sensitivity	Comments
2d	CUT	Cultural Thicket		Manitoba Maple, Basswood	Goldenrod, Dame's Rocket, Garlic Mustard, Coltsfoot	Variable, Fill	Fresh/Well	5-10%	Low	Low	Fill/Spoil Pile
2e	CUM	Cultural Meadow			Goldenrod, Dame's Rocket, Garlic Mustard, Coltsfoot	Loam, Bedrock	Fresh/Well	5-10%	Low	Low	Penstock Trench; Localized Seepage
2f	CUM	Cultural Meadow			Bluegrass, Weeds	Gravel, Bedrock	Moderately Dry/Rapid	0%	Low	Low	Maintained
2g	FOC2-2	Dry to Fresh White Cedar Coniferous Forest	Red Cedar, White Cedar	Lilac, Juniper, Honeysuckle, Prickly Ash	Weeds	Bedrock	Moderately Dry/Rapid	0%	Low	Low	Adjacent to Tailrace from Main Powerhouse
2h	CUT	Cultural Thicket	Green Ash	Red Cedar, Juniper, Lilac, Prickly Ash	Weeds	Bedrock	Moderately Dry/Rapid	0%	Low	Low	Adjacent to Tailrace from Main Powerhouse
2i	UNV	Unvegetated			Weeds	Bedrock	Moderately Dry/Rapid	0%	Low	High (Turtle Nesting)	Gravel Pad of "PUP" Transformer Station; Turtle Egg Casings
2j	TAT1-3	Dry to Fresh White Birch Carbonate Talus		Green Ash, Birch, Red Cedar, Juniper	Weeds, Mosses, Lichens	Gravel, Cobbles, Bedrock	Moderately Dry/Rapid	15-50%	Moderate	High (Steep)	Slope above Trent River
2k	CUT	Cultural Thicket		Juniper, Lilac	Weeds, Mosses, Lichens	Gravel, Bedrock	Moderately Dry/Rapid	0-15%	Moderate	High (Turtle Nesting)	Top of Slope to Trent River; Turtle Egg Casings
3a	CUM	Lawn			Bluegrass	Shallow Loam	Fresh/Well	0%	Low	Low	Maintained
3b	CUM	Lawn			Bluegrass	Shallow Loam	Fresh/Well	0%	Low	Low	Maintained

Unit[1]	ELC Code	ELC Description	Overstorey	Understorey	Groundcover	Soils	Moisture Regime/ Drainage	Slope	Structural Diversity	Sensitivity	Comments
3c	FOC2-2	Dry to Fresh White Cedar Coniferous Forest	Red Cedar, White Cedar	Lilac, Juniper, Honeysuckle, Prickly Ash	Weeds	Bedrock	Moderately Dry/Rapid	0%	Low	Low	Adjacent to Tailrace from Main Powerhouse
3d	CUM	Cultural Meadow			Weeds	Gravel	Moderately Dry/Rapid	0%	Low	Low	Disturbed
3e	FOM4-2	Dry to Fresh White Cedar-Poplar Mixed Forest	White and Red Cedar, Scotch Pine, Basswood, Birch, Bur Oak, Red Oak, Chinquapin Oak	Ironwood, Juniper, Sumac, Lilac, Honeysuckle, Dogwood, Snowberry, Prickly Ash, Poison Ivy	Pennsylvania Sedge, Bracken Fern, Asters, Toadflax, Poverty Oat Grass, Fescues	Shallow Loam, Cobbles, Bedrock	Moderately Dry/Rapid	15-20%	High	High	High Native Diversity
3f	UNV	Unvegetated				Gravel	Moderately Dry/Rapid	0-2%	Low	Low	Maintenance Yard
3g	TAT1-2	Dry to Fresh White Cedar Carbonate Talus	White Cedar	White Cedar, Dogwood,	Herb Robert, Ivory Sedge, Ferns	Bedrock	Moderately Dry/Rapid	60-200%	High	High	Cliffs over Trent River
3h	UNV	Unvegetated			Weeds	Gravel	Moderately Dry/Rapid	0%	Low	Low	Disturbed
3i	CUP3-3	Scotch Pine Coniferous Plantation	Scotch Pine		Bluegrass	Loam	Fresh/Well	0-5%	Low	Low	Maintained
3j	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest	Chinquapin Oak, Red Cedar, Basswood, Bur Oak	Ironwood, Buckthorn, Lilac, Honeysuckle, Juniper, Prickly Ash, Poison Ivy	Pennsylvania Sedge, Asters, Toadflax, Poverty Oat Grass	Shallow Loam, Cobbles, Bedrock	Moderately Dry/Rapid	15-30%	High	High	High Native Diversity
3k	CUP3-3	Scotch Pine Coniferous Plantation	Scotch Pine		Bluegrass	Loam	Fresh/Well	0-10%	Low	Low	Maintained
3l	CUP3-3	Scotch Pine Coniferous Plantation	Scotch Pine		Bluegrass	Loam	Fresh/Well	0-5%	Low	Low	Maintained

Unit[1]	ELC Code	ELC Description	Overstorey	Understorey	Groundcover	Soils	Moisture Regime/ Drainage	Slope	Structural Diversity	Sensitivity	Comments
3m	CUT	Cultural Thicket	Green Ash, Poplar	Dogwood, Honeysuckle, Buckthorn	Weeds	Loam, Fill, Rubble	Fresh/Well	5-30%	Low	Low	Highly Disturbed, Fill and Waste
3n	SWT2-2	Willow Mineral Thicket Swamp	Crack Willow, Green Ash, Poplar	Bebb's Willow, Pussy Willow, Missouri Willow, Dogwoods	Sedges, Rushes, Cattails	Silt Loam and Organics	Moist/Poor	0-2%	High	High	High Native Diversity
3o	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest	Bur Oak, Red Cedar, Scotch Pine, Chinquapin Oak	Dogwood, Snowberry, Honeysuckle, Maple-leaved Viburnum	Pennsylvania Sedge, Asters, Toadflax, Poverty Oat Grass, Gromwell, False Solomon's Seal	Loam	Fresh/Well	0-10%	High	High	High Native Diversity
3p	SWT3-2/MAM3-9	Willow Organic Thicket Swamp/Forb Organic Meadow Marsh		Dogwood, Willow, Raspberry, Meadowsweet	Sedges, Rushes, Swamp Thistle, Watercress	Organic	Moist/Poor	0-2%	Moderate	High	High Native Diversity
3q	FOD8-1	Fresh to Moist Poplar Deciduous Forest	Poplar, Green Ash, White Elm, Basswood	Buckthorn, Dogwood	Weeds	Loam	Fresh/Well	0-5%	Low	Low	Extensive debris and waste.
3r	FOD5-3	Dry to Fresh Sugar Maple-Oak Deciduous Forest	Sugar Maple, Red Oak, Basswood, White Ash	Honeysuckle, Gray Dogwood	Garlic Mustard, Meadow Rue, False Solomon's Seal	Loam	Fresh/Well	30-80%	High	High	Remnant Forest, Steep Slopes
3s	CUM	Lawn			Bluegrass	Loam	Fresh/Well	0%	Low	Low	Maintained
3t	CUT	Cultural Thicket		Gray Dogwood, Honeysuckle, Sumac	Weeds	Loam	Fresh/Well	0-5%	Low	Low	
3u	CUT	Cultural Thicket		Honeysuckle, Sumac	Dog Strangling Vine, Weeds	Loam, Fill	Fresh/Well	20-50%	Low	Low	

Unit[1]	ELC Code	ELC Description	Overstorey	Understorey	Groundcover	Soils	Moisture Regime/ Drainage	Slope	Structural Diversity	Sensitivity	Comments
3v	FOD5-6	Dry to Fresh Sugar Maple-Basswood Deciduous Forest	Sugar Maple, Basswood	Gray Dogwood, Honeysuckle	Weeds	Shallow Loam, Cobbles, Bedrock	Moderately Dry/Rapid	15-30%	Moderate	High	Active Otter Den
3w	CUM	Cultural Meadow			Bluegrass	Loam	Fresh/Well	0%	Low	Low	Maintained
3x	CUT	Cultural Thicket	Manitoba Maple	Juniper, Red Cedar, Sumac, Honeysuckle	Weeds	Loam	Fresh/Well	50%	Low	Low	
3y	CUT	Cultural Thicket		Dogwoods	Weeds	Shallow Loam	Fresh/Well	0%	Low	Low	
3z	CUM	Lawn			Bluegrass	Loam	Fresh/Well	0%	Low	Low	Maintained

[1] See Figure 2.1 for unit location.

The forested habitats overlooking the Trent River are also considered to be noteworthy. Some of the forested communities (ELC units 3e, 3j and 3o on Figure 2.1) support populations of Chinquapin (Yellow) Oak (*Quercus muhlenbergii*). While this species is not considered significant, it is considered provincially uncommon with a NHIC ranking of S4 (apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors). These communities support other floristic elements, such as Pennsylvania Sedge (*Carex pensylvanica*), Umbellate Bastard Toadflax (*Comandra umbellate*), Snowberry (*Symphoricarpus albus* var. *albus*) and Serviceberry (*Amelanchier* sp.), that suggest these communities may have historically been more open in character and supported savannah and prairie, but have become overgrown due to fire suppression and lack of cultural disturbances. In their former phase, they would be considered significant.

Other noteworthy vegetation communities in the site-specific study area include several wetland features (ELC units 1c, 3p and 3n on Figure 2.1). Unit 1c is situated on the Island Park Retirement Community property immediately adjacent to the Ranney Falls GS property. This wetland is fed by bedrock seepage. Drainage flows from this wetland are directed to the penstock trench via a culvert. Discharge at the time of survey was approximately 0.5 L/s; however, the high watermark on the culvert suggests flows could be in the order of 2 to 3 L/s during the spring. ELC units 3n and 3p are situated in a large depressional area immediately south of the maintenance yard. ELC unit 3n is a dogwood thicket swamp situated at the toe of the slope of the laneway embankment. ELC unit 3p is a large marsh community. It supports a high diversity of native species. Both communities are sustained primarily by groundwater discharge. There is a small permanently flowing channel that meanders through ELC unit 3p from north to south. There are no inlets or outlets (i.e., culverts/catchbasins) associated with this drainage feature. Flows upstream and downstream are subsurface through bedrock and rubble.

Table 2.7 lists the 176 species identified within the site-specific study area. Of these, 109 are designated by the NHIC as S5 (secure – common, widespread and abundant in the Province); seven are designated as S4 (apparently secure); and two are designated as S4S5 (apparently secure to secure). The remaining 58 species are designated as SNA (not applicable – a conservation status rank not applicable because the species is not a suitable target for conservation activities). The percentage of exotic (SNA) species (33%) was above the general proportion of non-native plants in the Province, estimated around 25% (e.g., Kaiser, 1983), reflecting the anthropogenic nature of the Ranney Falls GS property.

Table 2.7 also lists plant species identified by Gregory (2010) on the Ranney Falls GS property as part of botanical surveys undertaken of ten CHPG generating stations on the TSW during June 21 to 24, 2010. The primary objectives of the surveys were to identify and map plant species at risk (SAR) and to inventory vascular plant species present on the GS properties. The survey of the Ranney Falls GS property encompassed the southern portion that supports the natural deciduous and coniferous woodlands and the small shallow marsh community. Most of the species observed are considered to be common and widespread in the region, with the

exception of the regionally rare Chinquapin Oak. Of the 105 species recorded, 66 are designated by the NHIC as S5 (secure); one is S5? (secure – rank uncertain); one is S4S5 (secure to apparently secure); six are S4 (apparently secure) and 30 are SNA (not applicable). The percentage of exotic species was 29%.

Table 2.7 Plant Species Observed within the Site-specific Study Area

Scientific *Name*	Common Name[1]	Ursic[2]	Gregory[3]	Provincial Status[4]
Aceraceae	**Maple Family**			
Acer negundo	Manitoba Maple (Box Elder)	x	x	S5
A. platanoides	Norway Maple		x	SNA
A. saccharinum	Silver Maple	x		S5
A. saccharum	Sugar Maple		x	S5
Anacardiaceae	**Cashew or Sumac Family**			
Rhus aromaticaa	Fragrant Sumac		x	S5
R. typhina	Staghorn Sumac	x	x	S5
Toxicodendron radicans ssp. *negundo*	Poison Ivy	x	x	S5
Alismataceae	**Water Plantain Family**			
Alisma plantago-aquatica (*triviale*)	Broad-leaved (Northern) Water-plantain	x		S5
Apiaceae	**Carrot or Parsley Family**			
Daucus carota	Wild Carrot		x	SNA
Taenidia integerrima	Yellow Pimpernell		x	S4
Apocynacaceae	**Dogbane Family**			
Apocynum androsaemifolium	Spreading Dogbane		x	S5
Asclepiadaceae	**Milkweed Family**			
Asclepias incarnata	Swamp Milkweed	x		S5
A. syriaca	Common (Kansas) Milkweed	x		S5
Cynanchum rossicum	European Swallow-wort	x		SNA
Asteraceae	**Composite or Aster Family**			
Achillea millefolium var. *millefolium*	Common Yarrow	x		SNA
Ageratina altissima	White Snakeroot	x		S5
Ambrosia artemisiifolia	Annual Ragweed	x	x	S5
Antennaria neglecta	Field Pussytoes	x		S5
Arctium minus var. *minus*	Lesser (Common) Burdock	x		SNA
Bidens cernua	Nodding Beggar-ticks	x		S5
Centaurea sp.	Starthistle species	x	x	-[5]
Cirsium arvense	Creeping (Canada) Thistle	x		SNA
C. muticum	Swamp Thistle	x		S5
C. vulgare	Bull Thistle	x		SNA
Conyza canadensis	Fleabane	x		S5
Erechtites hieraciifolia	Fireweed	x		S5
Erigeron sp.	Fleabane species	x		-
E. philadelphicus	Philadelphia Fleabane	x		S5
Eupatorium maculatum ssp. *maculatum*	Spotted Joe-pye Weed	x	x	S5
Eurybia macrophylla	Large-leaf Wood Aster	x	x	S5
Euthamia graminifolia	Grass-leaved Goldenrod (Flat-top Fragrant-golden-rod)	x		S5
Helianthus divaricatus	Woodland Sunflower	x	x	S5
Hieracium sp.	Hawkweed species	x		-
H. caespitosum	A Hawkweed		x	SNA
Leucanthemum vulgare	Oxeye Daisy	x	x	SNA
Solidago caesia	Bluestem Goldenrod	x		S5
S. canadensis var. *canadensis*	Canada Goldenrod	x		S5
S. canadensis var. *scabra*	Tall Goldenrod	x		S5
S. juncea	Early Goldenrod	x	x	S5
S. nemoralis var. *nemoralis*	Field Goldenrod	x		S5
S. rugosa	Rough-leaf Goldenrod	x		S5
Sonchus arvensis ssp. *arvensis*	Field Sowthistle	x		SNA
Symphyotrichum cordifolium	Heart-leaf Aster	x	x	S5
S. ericoides var. *ericoides*	White Heath Aster	x		S5
S. lanceolatum spp. *lanceolatum*	Panicled Aster	x		S5
S. novae-angliae	New England Aster	x		S5
S. puniceum	Purple-stemmed (Swamp) Aster	x	x	S5
S. urophyllum	Arrow-leaved Aster	x		S4

Scientific *Name*	Common Name[1]	Ursic[2]	Gregory[3]	Provincial Status[4]
Taraxacum officinale	Common Dandelion	x	x	SNA
Tragopogon sp.	Goat's-beard species	x		-
T. dubius	Meadow Goat's-beard	x		SNA
Tussilago farfara	Colt's Foot	x		SNA
Balsaminaceae	**Balsam Family**			
Impatiens capensis	Spotted Jewel-weed	x		S5
Berberidaceae	**Barberry Family**			
Berberis vulgaris	European Barberry		x	SNA
Betulaceae	**Birch Family**			
Betula papyrifera	Paper Birch	x	x	S5
B. pendula	European White Birch	x		SNA
Ostrya virginiana	Eastern Hop-hornbeam	x	x	S5
Boraginaceae	**Borage or Forget-me-not Family**			
Cynoglossum officinale	Common Hound's-tongue		x	SNA
Echium vulgare	Common Viper's-bugloss	x	x	SNA
Lithospermum officinale	European Gromwell	x		SNA
Brassicaceae	**Crucifers or Cabbage Family**			
Alliaria petiolata	Garlic Mustard	x	x	SNA
Barberea vulgaris	Yellow Rocket	x		SNA
Capsella bursa-pastoris	Common Shepherd's Purse	x		SNA
Cardamine pensylvanica	Pennsylvania Bitter-cress		x	S5
Erysimum sp.	Erysimum species	x		-
E. inconspicuum	Small-flower Prairie Wallflower		x	S4
Hesperis matronalis	Dame's Rocket	x	x	SNA
Lepidum campestre	Field Pepper-grass		x	SNA
Rorippa nasturtium-aquaticum	True Watercress	x		SNA
Sisymbrium officinale	Hairy-pod Hedgemustard	x		SNA
Campanulaceae	**Bellflower Family**			
Campanula rotundifolia	American Harebell		x	S5
Caprifoliaceae	**Honeysuckle Family**			
Diervilla lonicera	Northern Bush-honeysuckle		x	S5
Lonicera dioica	Mountain Honeysuckle		x	S5
L. tatarica	Tatarian Honeysuckle	x	x	SNA
Symphoricarpos albus var. *albus*	Snowberry	x	x	S4S5
Triosteum aurantiacum	Coffee Tinker's-weed		x	S5
Viburnum lentago	Nannyberry	x		S5
V. rafinesquianum	Downy Arrowwood		x	S5
Caruophyllaceae	**Pink or Carnation Family**			
Cerastium arvense	Field Mouse-ear Chickweed		x	S4
Silene vulgaris	Maiden's Tears		x	SNA
Celastraceae	**Staff Vine or Bittersweet Family**			
Celastrus scandens	Climbing Bittersweet	x	x	S5
Clusiaceae	**St. John's Wort Family**			
Hypericum perforatum	St. John's-wort	x	x	SNA
Cornaceae	**Dogwood Family**			
Cornus amomum	Silky Dogwood	x		S5
C. racemosa	Gray Dogwood	x		S5
C. rugosa	Roundleaf Dogwood		x	S5
C. stolonifera (*sericea*)	Red-osier Dogwood	x	x	S5
Crassulaceae	**Orpine Family**			
Sedum acre	Gold-moss		x	SNA
Cucurbitaceae	**Gourd Family**			
Echinocystis lobata	Wild Mock-cucumber	x		S5
Cupressaceae	**Cedar Family**			
Juniperus communis	Ground Juniper	x	x	S5
J. virginiana	Eastern Red Cedar	x	x	S5
Thuja occidentalis	Eastern White Cedar	x	x	S5
Cyperaceae	**Sedge Family**			
Carex aurea	Golden-fruited Sedge	x		S5
C. cristatella	Crested Sedge	x		S5
C. deweyana	Short-scale Sedge	x		S5
C. eburnean	Ebony Sedge	x		S5
C. gracillima	Graceful Sedge	x		S5
C. granularis	Meadow Sedge	x		S5
C. hystericina	Porcupine Sedge	x	x	S5
C. intumescens	Bladder Sedge	x		S5

Scientific *Name*	Common Name[1]	Ursic[2]	Gregory[3]	Provincial Status[4]
C. pedunculata	Longstalk Sedge	x		S5
C. pellita	Woolly Sedge	x	x	S5
C. pensylvanica	Pennsylvania Sedge	x	x	S5
C. praegracilis	Clustered Field Sedge	x		SNA
C. radiata	Stellate Sedge	x		S4
C. vulpinoidea	Fox Sedge		x	S5
Eleocharis erythropoda	Bald Spikerush		x	S5
Scirpus atrovirens	Woolgrass (Dark-green) Bulrush	x	x	S5
S. cyperinus	Cottongrass Bulrush	x	x	S5
Dennstaedtiaceae	**Fern Family**			
Pteridium aquilinum	Bracken Fern	x		S5
Dipsacaceae	**Teasel Family**			
Dipsacus fullonum ssp. *sylvestris*	Common (Fuller's) Teasel	x	x	SNA
Dryopteridaceae	**Wood Fern Family**			
Cystopteris tenuis	Bladderfern	x		S5
Dryopteris carthusiana	Spinulose Shield Fern	x		S5
D. marginalis	Marginal Wood-fern	x		S5
Onoclea sensibilis	Sensitive Fern		x	S5
Equisetaceae	**Horsetail Family**			
Equisetum arvense	Field Horsetail	x	x	S5
Fabaceae	**Legume Family**			
Desmodium canadense	Showy Tick-trefoil	x		S4
Lotus comiculatus	Birds-foot Trefoil		x	SNA
Medicagp lupulina	Black Medic	x		SNA
Melilotus sp.	Sweet Clover species	x		-
M. albus	White Sweet Clover	x		SNA
Robinia pseudoacacia	Black Locust	x		SNA
Trifolium pratense	Red Clover	x		SNA
Fagaceae	**Beech Family**			
Quercus macrocarpa	Bur (Mossy-cup) Oak	x	x	S5
Q. muhlenbergii	Chinquapin (Yellow) Oak	x	x	S4
Q. rubra	Northern Red Oak	x		S5
Geraniaceae	**Geranium Family**			
Geranium maculatum	Wild Crane's-bill		x	S5
G. robertianum	Herb-robert	x		SNA
Grossulariaceae	**Currant Family**			
Ribes americanum	Wild Black Currant	x		S5
R. cynosbati	Prickly Gooseberry	x	x	S5
R. triste	Swamp Red Currant	x		S5
Juncaceae	**Rush Family**			
Juncus effusus	Soft Rush	x	x	S5
J. tenuis	Slender (Path) Rush			S5
Lamiaceae	**Mint Family**			
Clinopodium vulgare	Field Basil		x	S5
Leonurus cardiaca ssp. *cardiaca*	Common Mother-wort	x		SNA
Lycopus americanus	American Bugleweed		x	S5
Monarda fistulosa	Wild Bergamot Bee-balm	x	x	S5
Nepeta cataria	Catnip	x	x	SNA
Trichostema brachiatum	False Pennyroyal	x		S4
Lemnaceae	**Duckweed Family**			
Lemna minor	Lesser Duckweed		x	S5
Liliaceae	**Lily Family**			
Allium tricoccum	Wild (Small White) Leek	x		S5
Asparagus officinalis	Garden Asparagus-fern	x	x	SNA
Maianthemum racemosum ssp. *racemosum*	False Solomon's-seal	x	x	S5
M. stellatum	Starflower False Solomon's-seal	x	x	S5
Polygonatum pubescens	Downy Solomon's-seal		x	S5
Lythraceae	**Loosestrife Family**			
Lythrum salicaria	Purple Loosestrife	x	x	SNA
Oleaceae	**Olive Family**			
Fraxinus americana	White Ash	x	x	S5
F. pennsylvanica	Green Ash	x		S5
Syringa vulgaris	Common Lilac	x	x	SNA
Onagraceae	**Evening-primrose Family**			
Circaea lutetiana	Southern Broadleaf Enchanter's Nightshade	x		S5

Scientific *Name*	Common Name[1]	Ursic[2]	Gregory[3]	Provincial Status[4]
Epilobium sp.	Willow-herb species	x		-
Oenothera biennis	Common Evening-primrose	x	x	S5
Oxalidaceae	**Wood Sorel Family**			
Oxalis dillenii	Dillen's Woodsorrel		x	S5?
Papaveraceae	**Poppy Family**			
Sanguinaria canadensis	Bloodroot	x		S5
Pinaceae	**Pine Family**			
Picea glauca	White Spruce	x		S5
Pinus sylvestris	Scotch Pine	x	x	SNA
Poaceae	**Grass Family**			
Agrostis sp.	Bentgrass species	x		-
A. gigantean	Redtop (Black Bentgrass)	x		SNA
Bromus inermis	Smooth (Awnless) Brome	x	x	SNA
B. tectorum	Downy Chess (Chest Grass)	x		SNA
Calamagrostis canadensis	Canada Bluejoint		X	S5
Danthonia spicata	Poverty Oatgrass	x		S5
Dichanthelium acuminatum var. *acuminatum*	Acuminate Panic Grass	x		S5
Echinochloa crus-gali	Barnyard Grass	x		SNA
Elymus hystrix	Bottlebrush Grass	x		S5
E. repens	Quack Grass	x		SNA
Festuca sp.	Fescue species	x		-
Glyceria striata var. *striata*	Fowl Manna-grass	x		S4S5
Lolium perenne	Perennial Ryegrass	x		SNA
L. pratense	Meadow Fescue	x		SNA
Muhlenbergia mexicana	Mexican Satin Grass (Muhly)	x		S5
Panicum sp.	Panic Grass species			-
P. philadelphicum	Witch (Philadelphia Panic) Grass	x		S4
Phalaris arundinacea	Reed Canary Grass	x	x	S5
Phleum pratense	Meadow Timothy	x		SNA
Poa compressa	Canada Bluegrass	x	x	SNA
Puccinellia distans	Spreading Alkali Grass	x		SNA
Setaria glauca (*pumila*)	White Foxtail	x		SNA
S. viridis	Green Bristle Grass	x		SNA
Sporobolus neglectus	Small Dropseed	x		S4
Polygalaceae	**Milkwort Family**			
Polygala senega	Seneca Snakeroot		X	S4
Primulaceae	**Primrose Family**			
Lysimachia ciliata	Fringed Loosestrife	x		S5
Ranunculaceae	**Buttercup Family**			
Anemone virginiana var. *virginiana*	Virginia Anemone	x	x	S5
Aquilegia canadensis	Wild Columbine		x	S5
Caltha palustris	Marsh Marigold	x		S5
Clematis virginiana	Virginia Virgin-bower	x		S5
Ranunculus acris	Tall Buttercup	x		SNA
Thalictrum dioicum	Early Meadow-rue	x	x	S5
Rhamnaceae	**Buckthorn Family**			
Rhamnus cathartica	Buckthorn	x	x	SNA
Rosaceae	**Rose Family**			
Agrimonia gryposepala	Tall Hairy Groovebur	x		S5
Amelanchier sp.	Serviceberry species	x		-
Crataegus sp.	Hawthorn species	x		-
Fragaria vesca ssp. *americana*	Woodland Strawberry	x		S5
F. virginiana	Virginia Strawberry	x	x	S5
Geum sp.	Avens species	x		-
G. rivale	Purple Avens	x		S5
Potentilla arguta	Tall Cinquefoil		x	S4
P. norvegica	Norwegian Cinquefoil		x	S5
P. recta	Sulphur Cinquefoil	x		SNA
Prunus mahaleb	Perfumed Cherry	x		SNA
P. pensylvanica	Fire (Pin) Cherry	x		S5
P. serotina	Wild Black Cherry	x		S5
P. virginiana	Choke Cherry	x		S5
Rosa blanda	Smooth Rose	x	x	S5
R. multiflora	Rambler Rose	x		SNA
Rubus allegheniensis	Allegheny Blackberry	x		S5
R. idaeus ssp. *idaeus*	Red Raspberry	x	x	SNA

Scientific *Name*	Common Name[1]	Ursic[2]	Gregory[3]	Provincial Status[4]
Sorbus aucuparia	European Mountain-ash			SNA
Waldsteinia fragarioides	Barren Strawberry		x	S5
Rubiaceae	**Bedstraw Family**			
Galium aparine	Catchweed Bedstraw		x	S5
G. mollugo	White Bedstraw	x		SNA
Rutaceae	**Rue or Citrus Family**			
Zanthoxylum americanum	Northern Prickley Ash	x	x	S5
Salicaceae	**Willow Family**			
Populus grandidentata	Large-tooth Aspen	x		S5
P. tremuloides	Quaking Poplar	x		S5
Salix alba	White Willow		x	SNA
S. bebbiana	Bebb's Willow	x		S5
S. discolour	Pussy Willow	x		S5
S. eriocephala	Heart-leaved Willow	x		S5
S.fragilis	Creek Willow		x	SNA
S. x rubens	A Willow	x		SNA
Santalaceae	**Sandalwood Family**			
Comandra umbellata	Umbellate Bastard Toad-flax	x	x	S5
Scrophulariaceae	**Figwort Family**			
Chaenorrhinum minus	Common Dwarf Snapdragon	x		SNA
Linaria vulgaris	Butter-and-eggs	x		SNA
Verbascum thapsus	Common (Great) Mullein	x	x	SNA
Solanaceae	**Potato Family**			
Solanum dulcamara	Climbing Nightshade	x		SNA
Thelypteridaceae	**Marsh Fern Family**			
Thelypteris palustris	Marsh Fern	x		S5
Tiliaceae	**Linden Family**			
Tilia americana	American Basswood	x	x	S5
Typhaceae	**Cattail Family**			S5
Typha latifolia	Broad-leaf Cattail	x	x	
Ulmaceae	**Elm Family**			S5
Ulmus americana	American Elm	x	x	
Verbenaceae	**Verbena or Vervain Family**			
Verbena urticifolia	White Vervain	x		S5
Vitaceae	**Grape Family**			
Parthenocissus vitacea	Thicket (Virginia) Creeper	x	x	S5
Vitis riparia	Riverbank Grape	x	x	S5

[1] Bracketed nomenclature after NHIC.

[2] Ursic = based on October 31, 2006, June 25, 2007 and November 16, 2011 surveys undertaken by K. Ursic for the proposed Ranney Falls G3 Project EA.

[3] Gregory = based on a June 2010 survey by Gregory (2010).

[4] NHIC: S5 = secure; S5? = secure – rank uncertain (?); S4S5 = apparently secure to secure; S4 = apparently secure; SNA = not applicable.

[5] Status uncertain as taxonomy only at genus level.

2.5.2 Significant Plant Species

Undisturbed areas of native vegetation within the proposed Ranney Falls G3 Project area have the potential to support plant species which are at risk, i.e., species which are designated with significant status under federal and/or provincial legislation. Federally, SAR are recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2012) and are protected under the *Species at Risk Act*. Provincially these are recognized by the Committee on the Status of Species at Risk in Ontario (COSSARO) under the *Endangered Species Act* (*ESA*), in conjunction with the Species at Risk in Ontario (SARO) List (MNRF, 2014). Species listed as provincially endangered or threatened and their habitats are afforded protection under the *ESA*.

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

A review of the NHIC database revealed records for several significant plant species within a square kilometre of the proposed Ranney Falls G3 Project area (Map Square 18TQ70). It should be noted that these records are historical and do not necessarily overlap with the proposed Project area and could be from Ferris Provincial Park located on the other side of the Trent River and surrounding lands.

Eastern Prairie Fringed-orchid (*Platanthera leucophaea*) is a federally and provincially endangered species that was recorded from Map Square 18TQ70 in 1911. This species is typically associated with fen wetlands. No such habitats currently occur in the site-specific study area. Prairie Dropseed (*Sporobolus heterolepis*) is a provincially significant (S3) species that was recorded from Map Square 18TQ70 in 1862. The NHIC S3 designation indicates a vulnerable status due to restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation in the Province. It is typically associated with prairie and alvar habitats. No such habitats currently occur in the study area. Additionally, Awnless Graceful Sedge (*Carex formosa*), a species designated as S4, was also recorded previously from the broader area. This species was not observed in the study area during the surveys.

None of the plant species recorded within the site-specific study area (see Table 2.7) is designated as SAR at the provincial or federal level. Similarly, none of the plant species is considered provincially or regionally rare. There are five plant species associated with the study area that are considered uncommon in the Lake Ontario lowlands (W. Bakowsky, MNR, 2011, pers. comm.) and have been assigned a rank of S4 by the NHIC: Chinquapin (Yellow) Oak, False Pennyroyal, Showy Tick-trefoil, Arrow-leaved Aster and Small Dropseed.

Chinquapin (Yellow) Oak was observed in ELC forest units 3e, 3j and 3o (see Figure 2.1), immediately to the north and south of the maintenance yard. The Canadian range of this oak species is limited to southwestern Ontario and the Thousand Islands area. Its presence is known along the Trent River where it is associated with Limestone Woodlands and Savannahs (Catling and Catling, 1993). This species has a coefficient of conservatism value of 9 (NHIC database) which indicates it has a high affinity for specialized habitat conditions such as shallow soils on limestone bedrock.

False Pennyroyal was observed in ELC unit 2i (see Figure 2.1) where it grows on fine gravel substrate adjacent to the “Pup” transformer substation. This species also has a coefficient of conservatism value of 9 reflecting its strong affinity for shallow soils over limestone bedrock. This species is recognized as an indicator species of alvar habitats, which are considered globally imperilled. The presence of this species within disturbed portions of the site-specific study area is opportunistic and not related to the occurrence of any remnant alvar habitats.

The other three uncommon species (Showy Tick Trefoil, Arrow-leaved Aster and Small Dropseed) have lesser coefficient of conservatism values indicating that they can occupy a broader range of habitats.

2.6 SIGNIFICANT NATURAL FEATURES

There are a number of recognized natural areas situated within 10 km of the proposed Ranney Falls G3 Project. These natural areas include forests, wetlands and other natural features. Some of these features support ecological functions and/or attributes that are considered significant at the provincial, regional or local scale.

Natural features such as wetlands can provide important habitat for a variety of plant and wildlife species. Furthermore, wetlands provide water storage and control functions which reduce erosion and flooding, and improve water quality. Wetlands also increasingly provide areas for a range of recreational pursuits, including nature appreciation.

The Ontario Government (1992) issued a Wetlands Policy Statement, which was subsequently incorporated into the PPS (OMMAH, 2005), which is intended to ensure that there will be no net loss of wetland functions of Provincially Significant Wetlands (PSWs). The PPS has recently been amended (OMMAH, 2014). A PSW is a wetland that the MNR has classified as Provincially Significant through an evaluation of biological, social, hydrological and special features of the area (MNR, 1993).

Areas of Natural and Scientific Interest (ANSIs) and Environmentally Sensitive Areas (also designated as Environmentally Significant Areas in some inventories) (ESAs) have been identified by the MNR and Conservation Authorities and/or municipalities, respectively, where it has been determined that the natural landscape and/or its features require protection for heritage appreciation, scientific study or conservation education purposes. Life Science ANSIs are natural areas selected to protect outstanding landscapes, environments and biotic communities. Earth Science ANSIs are geological sites selected to protect outstanding examples of rock types, fossil localities, landform associations and areas containing significant groundwater resources. ESAs are land and water areas with natural features or ecological functions of such significance as to require protection or preservation. Other natural areas of local and possibly regional significance have also been identified.

The PSW, ANSIs and ESAs located within 10 km of the proposed Ranney Falls G3 Project are listed below along with a description of their significant features (Hall and Jones, 1976; Van Patter and Hilts, 1985; LTC, 2001; NHIC database):

- Trout Creek PSW, located approximately 5 km east of Campbellford and 120.8 ha in area, provides habitat for provincially, regionally and locally significant species, nesting habitat for the Great Blue Heron (*Ardea herodias*) and fish spawning and nursery habitat.

- Hoards Creek Tributary PSW, located approximately 9 km northeast of Campbellford and 152 ha in area, provides breeding/feeding habitat for two provincially significant bird species.
- Nappan Island Complex PSW, located approximately 9 km north of Campbellford and 496 ha in area, supports at least one significant vegetation community – a shrub-rich poor fen community that is considered rare in southern Ontario, a high diversity of breeding birds species including SAR and significant fish spawning and rearing habitat.
- Barry Lake Complex PSW, approximately 10 km west of Campbellford and 101.4 ha in area, supports a unique boreal-like community in portions of the swamp area, as well as provincially, regionally and locally significant species.
- Murray Marsh PSW and Provincially Significant Life Science ANSI, located approximately 10 km south of Campbellford, is the largest (approximately 4,850 ha) and most complete tract of undisturbed marsh and swamp forest remaining in southeastern Ontario and is of regional significance for wildlife. The 13 different vegetation communities are comprised of more than 300 plant species. The area supports a large deer yard and a number of rare nesting birds, and is the only major flood water storage for the Trent River system south of Campbellford. Over 60% of the marsh is protected with the combined ownership of LTC and MNRF.
- Petherick's Corner Esker Provincially Significant Earth Science ANSI and Petherick Corners Lowland ESA, located approximately 5 km northeast of Campbellford and 94 ha in area, contains a well formed and relatively undisturbed portion of the Campbellford esker formed during the Late Wisconsinan glaciation stage.
- Petherick's Island Beaches Provincially Significant Earth Science ANSI and Petherick Island ESA are located approximately 8 km northeast of Campbellford. This 66 ha area consists of several gravel bars or beaches radiating in a southwestward direction onto a limestone bedrock outcrop, exhibiting Late Wisconsinan, North Bay Interstadial features. The site probably represents the shallow Trent embayment (shoal) of Lake Iroquois which subsequently became an island in Lake Frontenac.
- Healey Falls Provincially Significant Earth Science ANSI is located approximately 8 km north of Campbellford and 6 ha in area, River erosion has cut down through Trenton limestones to expose the massive Leray beds of the upper Black River Group.
- Birch Point Swamp ESA, located approximately 8 km north of Campbellford and 57 ha in area, is a low lying tract of land adjacent to the Trent River where it widens to become Burnt Point Bay. The lowland cedar-balsam fir woods contain a number of unusual plant species which are characteristic of more northern woods. The wetland area provides habitat for marsh and shoreline birds, Muskrat (*Ondatra zibethicus*) and Beaver (*Castor canadensis*), as well as spawning, nursery and feeding habitat for fish.
- Hermiston Lake Site ESA, approximately 648 ha in area, is located approximately 9 km south of Campbellford. This site is characterized by swampy, low lying areas which are interspersed with well drained upland sections. A low, sinuous ridge, a section of the Campbellford esker, meanders around several excellent examples of drumlins. This section of the Campbellford esker is considered to represent one of the best examples of esker morphology observed in southern Ontario.

- Godolphin Esker ESA, located approximately 9 km west of Campbellford and 266 ha in area, is situated within a low lying tract of land between large hills believed to be kames.

The status of the Birch Point Swamp ESA, Hermiston Lake Site ESA and Godolphin Esker ESA, designated by Hall and Jones (1976), remains undetermined at this time.

There are two non-PSWs, Godolphin Esker Wetland Complex and Stevenson Lake Wetland, located 7 km and 8 km east of Campbellford, respectively (LTC, 2001).

In addition to providing for the protection of PSWs, the PPS provides for the protection of Significant Wildlife Habitat (OMMAH, 2014). According to the PPS, development and site alteration shall not be permitted in significant wildlife habitat unless it has been demonstrated that there will be no negative impacts on its natural features or ecological function. The "Significant Wildlife Habitat Technical Guidelines" (MNR, 2000) categorize significant wildlife habitat using the following categories:

- habitats of seasonal concentrations of animals;
- rare vegetation communities or specialized habitat for wildlife;
- habitats of species of conservation concern; and
- animal movement corridors.

The Ranney Falls GS property supports a number of functions and attributes that would potentially qualify portions of the property as significant wildlife habitat including:

- seasonal concentration areas potentially could include reptile hibernacula (see Section 2.7.3);
- the rare vegetation community, Bulblet Fern – Herb Robert Open Shaded Limestone/Dolostone Cliff Face Type, associated with the cliffs of the Trent River (see Section 2.3.1);
- specialized habitats for wildlife identified within the study area including turtle nesting habitat, as well as River Otter (*Lontra canadensis*) feeding/denning site (see Sections 2.7.3 and 2.7.1);
- habitat of species of conservation concern including Eastern Snapping Turtle, Northern Map Turtle and the Monarch (*Danaus plexippus*) (see Sections 2.7.3 and 2.7.4); and
- the movement corridor represented by the Trent River valley which supports connectivity functions for a variety of wildlife species at the landscape level.

In addition to significant wildlife habitat, development and site alteration shall not be permitted in Significant Woodlands south and east of the Canadian Shield and in Significant Valleylands, unless it has been demonstrated that there will be no negative impacts on the natural features or ecological functions (OMMAH, 2014).

The woodlands adjacent to the northwest of the Ranney Falls GS property within the Island Park Retirement Community property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been designated as Significant Woodlands by LTC (2001) (see

Figure 2.1). The woodlands in Ferris Provincial Park on the opposite side of the Trent River are similarly designated.

Significant Valleylands have not been identified by LTC (2001); however, the Trent River and associated riparian environment would likely qualify as a Significant Valleyland.

2.7 WILDLIFE

The local study area provides woodland, riparian and urban habitat for wildlife. In this area, most wildlife species are fully habituated to human activities and are restricted to specialized habitats.

2.7.1 Mammals

White-tailed deer (*Odocoileus virginianus*) is the principal large wildlife species in the area. Deer have seasonal ranges as a result of current land use practices. In the spring, summer and early autumn, deer disperse to forest edges around farmlands, woodlots and the fringes of swamps. They are most abundant where there is an optimal mix of sheltering forest and farmland. During the winter, deer congregate in areas of denser cover, especially dense woodlots, swamps and conifer stands.

The CLI (1970) has categorized the lands around the Ranney Falls GS as Class 4, with moderate limitations to the production of deer, due to deficient soil moisture and restriction of rooting zone by bedrock or other impervious layers.

Table 2.8 provides a list of mammals possibly present in the local study area based on distribution maps (Dobbyn, 1994).

Of the 41 native species listed in Table 2.8, 34 are ranked by the NHIC as S5 (secure); five are S4 (apparently secure); one is S3? (vulnerable – rank uncertain); and one is S2S3 (imperilled to vulnerable). The imperilled status (S2) reflects rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the Province.

During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) observed Gray Squirrel, Eastern Chipmunk and Red Squirrel.

Woodchuck and Eastern Chipmunk were observed during the July 6, 2007 breeding bird survey (Coker *et al*., 2008). In addition, River Otter scat and feeding/denning site were observed in ELC unit 3v (see Figure 2.1) during the November 16, 2011 survey.

Table 2.8 Mammal Species Possibly Present in the Local Study Area[1]

Common Name	Scientific Name	Provincial Status[2]
Shrews	**Soricidae**	
Northern Short-tailed Shrew	*Blarina brevicauda*	S5
Smoky Shrew	*Sorex fumeus*	S5
Water Shrew	*S. palustris*	S5
Moles	**Talpiae**	
Star-nosed Mole	*Condylura cristata*	S5
Hairy-tailed Mole	*Parascalops breweri*	S4
Bats	**Vespertilionidae**	
Big Brown Bat	*Eptesicus fuscus*	S5
Eastern Small-footed Bat	*Myotis leibii*	S2S3
Little Brown Bat	*M. lucifugus*	S5
Northern Long-eared Bat	*M. septentrionalis*	S3?
Rabbits and Hares	**Leporidae**	
Snowshoe Hare	*Lepus americanus*	S5
Eastern Cottontail[3]	*Sylvilagus floridanus*	S5
Squirrels	**Sciuridae**	
Northern Flying Squirrel	*Glaucomys sabrinus*	S5
Woodchuck	*Marmota monax*	S5
Gray Squirrel	*Sciurus carolinensis*	S5
Eastern Chipmunk	*Tamias striatus*	S5
Red Squirrel	*Tamiasciurus hudsonicus*	S5
Beavers	**Castoridae**	
Beaver	*Castor canadensis*	S5
Mice, Rats and Voles	**Muridae**	
Gapper's Red-backed Vole	*Clethrionomys gapperi*	S5
Meadow Vole	*Microtus pennsylvanicus*	S5
House Mouse	*Mus musculus*	SNA
Muskrat	*Ondatra zibethicus*	S5
White-footed Mouse	*Peromyscus leucopus*	S5
Deer Mouse	*P. maniculatus*	S5
Southern Bog Lemming	*Synaptomys cooperi*	S4
Jumping Mice	**Dipodidae**	
Woodland Jumping Mouse	*Napaeozapus insignis*	S5
Meadow Jumping Mouse	*Zapus hudsonius*	S5
Porcupines	**Erethizontidae**	
American Porcupine	*Erethizon dorsatum*	S5
Dogs	**Canidae**	
Coyote	*Canis latrans*	S5
Eastern Wolf[4]	*C. lupus lycaon*	S4
Red Fox	*Vulpes vulpes*	S5
Bears	**Ursidae**	
Black Bear	*Ursus americanus*	S5
Raccoons	**Procyonidae**	
Northern Raccoon	*Procyon lotor*	S5

Common Name	Scientific Name	Provincial Status[2]
Weasels	**Mustelidae**	
River Otter	*Lontra canadensis*	S5
American Marten	*Martes americana*	S5
Fisher	*M. pennanti*	S5
Striped Skunk	*Mephitis mephitis*	S5
Ermine	*Mustela erminea*	S5
Long-tailed Weasel	*M. frenata*	S4
American Mink	*M. vison*	S4
Cats	**Felidae**	
Canada Lynx	*Lynx canadensis*	S5
Deer	**Cervidae**	
Moose	*Alces alces*	S5
White-tailed Deer	*Odocoileus virginianus borealis*	S5

[1] Source: Dobbyn (1994).

[2] NHIC: S5 = secure; S4 = apparently secure; S3? = vulnerable, rank uncertain; S2S3 = imperilled to vulnerable; SNA = not applicable (non-native).

[3] Reported as present by http://www.turnstone.ca/birdetc.htm

[4] Designated as Special Concern federally by COSEWIC (2012) and provincially by COSSARO (MNRF, 2014).

2.7.2 Terrestrial Avifauna

There is a diversity of habitat types represented within the site-specific and local study areas that support breeding and foraging habitat for avifauna. Habitat types present include riverine environments, cliffs, forests, wetlands, thickets and open fields.

Table 2.9 provides a list of bird species recorded in the Ontario Breeding Bird Atlas as breeding or likely breeding within the 10-km by 10-km square grid (18TQ70) encompassing the Ranney Falls GS property (Bird Studies Canada, 2006). Of the 116 species likely or confirmed to be breeding within the grid, 60 are considered by the NHIC to be S5 (secure), 50 are S4 (apparently secure), one is S3 (vulnerable), and five are SNA (conservation status rank not applicable).

Table 2.9 Terrestrial Breeding Bird Species Recorded within a 10 km by 10 km Square Grid Overlapping the Site-specific Study Area[1]

Common Name	Scientific Name	Breeding Status	Provincial Status[2]
American Vultures	**Cathartidae**		
Turkey Vulture	*Cathartes aura*	Confirmed	S5
Ospreys, Eagles and Hawks	**Accipitridae**		
Osprey	*Pandion haliaetus*	Confirmed	S5
Northern Harrier	*Circus cyaneus*	Possible	S4
Cooper's Hawk	*Accipiter cooperi*	Confirmed	S4
Sharp-shinned Hawk	*A. striatus*	Possible	S5
Red-tailed Hawk	*Buteo jamaicensis*	Confirmed	S5
Falcons	**Falconidae**		
American Kestrel	*Falco sparverius*	Probable	S4
Partridges, Pheasants, Grouse, Turkeys and Quail	**Phasianidae**		
Ruffed Grouse	*Bonasa umbellus*	Confirmed	S4
Wild Turkey	*Meleagris gallopavo*	Confirmed	S5
Pigeons and Doves	**Columbidae**		
Rock Pigeon	*Columba livia*	Confirmed	SNA
Mourning Dove	*Zenaida macroura*	Confirmed	S5
Cuckoos	**Cuculidae**		
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Possible	S5
Typical Owls	**Strigidae**		
Great Horned Owl	*Bubo virginianus*	Probable	S4
Swifts	**Apodidae**		
Chimney Swift[4]	*Chaetura pelagica*	Probable	S4
Hummingbirds	**Trochilidae**		
Ruby-throated Hummingbird	*Archilochus colubris*	Possible	S5
Kingfishers	**Alcedinae**		
Belted Kingfisher	*Megaceryle alcyon*	Confirmed	S4
Woodpeckers	**Picidae**		
Red-headed Woodpecker[5]	*Melanerpes erythrocephalus*	Confirmed	S4
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Confirmed	S5
Downy Woodpecker	*Picoides pubescens*	Confirmed	S5
Hairy Woodpecker	*P. villosus*	Confirmed	S5
Northern Flicker	*Colaptes auratus*	Confirmed	S4
Pileated Woodpecker	*Dryocopus pileatus*	Probable	S5
Tyrant Flycatchers	**Tyrannidae**		
Eastern Wood-pewee	*Contopus virens*	Possible	S4
Alder Flycatcher	*Empidonax alnorum*	Possible	S5
Least Flycatcher	*E. minimus*	Possible	S4
Willow Flycatcher	*E. traillii*	Probable	S5
Eastern Phoebe	*Sayornis phoebe*	Confirmed	S5
Great-crested Flycatcher	*Myiarchus crinitus*	Probable	S4
Larks	**Alaudidae**		
Horned Lark	*Eremophila alpestris*	Confirmed	S5

Common Name	Scientific Name	Breeding Status	Provincial Status[2]
Swallows	**Hirundinidae**		
Purple Martin	*Progne subis*	Confirmed	S4
Tree Swallow	*Tachycineta bicolor*	Confirmed	S4
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Confirmed	S4
Bank Swallow[6]	*Riparia riparia*	Confirmed	S4
Cliff Swallow	*Petrochelidon pyrrhonota*	Confirmed	S4
Barn Swallow[4]	*Hirundo rustica*	Confirmed	S4
Jays, Magpies and Crows	**Corvidae**		
Blue Jay	*Cyanocitta cristata*	Confirmed	S5
American Crow	*Corvus brachyrhynchos*	Confirmed	S5
Common Raven	*C. corax*	Possible	S5
Titmice	**Paridae**		
Black-capped Chickadee	*Poecile atricapillus*	Confirmed	S5
Nuthatches	**Sittidae**		
Red-breasted Nuthatch	*Sitta canadensis*	Possible	S5
White-breasted Nuthatch	*S. carolinensis*	Probable	S5
Wrens	**Troglodytidae**		
House Wren	*Troglodytes aedon*	Probable	S5
Winter Wren	*T. troglodytes*	Possible	S5
Marsh Wren	*Cistothorus platensis*	Confirmed	S4
Kinglets, Gnatcatchers and Thrushes	**Muscicapidae**		
Blue-gray Gnatcatcher	*Polioptila caerulea*	Confirmed	S4
Eastern Bluebird	*Sialia sialis*	Possible	S5
Veery	*Catharus fuscescens*	Possible	S4
Hermit Thrush	*C. guttatus*	Possible	S5
Wood Thrush	*Hylocichla mustelina*	Confirmed	S4
American Robin	*Turdus migratorius*	Confirmed	S5
Mockingbirds and Thrashers	**Mimidae**		
Gray Catbird	*Dumetella carolinensis*	Confirmed	S4
Brown Thrasher	*Toxostoma rufum*	Confirmed	S4
Waxwings	**Bombycillidae**		
Cedar Waxwing	*Bombycilla cedrorum*	Probable	S5
Starlings	**Sturnidae**		
European Starling	*Sturnus vulgaris*	Confirmed	SNA
Vireos	**Vireonidae**		
Yellow-throated Vireo	Vireo flavifrons	Probable	S4
Warbling Vireo	V. gilvus	Probable	S5
Red-eyed Vireo	V. olivaceus	Probable	S5
Wood-Warblers, Sparrows, Blackbirds and Orioles	**Emberizidae**		
Nashville Warbler	*Vermivora ruficapilla*	Possible	S5
Black-throated Blue Warbler	*Dendroica caerulescens*	Confirmed	S5
Yellow-rumped Warbler	*D. coronata*	Confirmed	S5
Chestnut-sided Warbler	*D. pensylvanica*	Probable	S5

Common Name	Scientific Name	Breeding Status	Provincial Status[2]
Yellow Warbler	*D. petechia*	Confirmed	S5
Pine Warbler	*D. pinus*	Possible	S5
Black-throated Green Warbler	*D. virens*	Possible	S5
Black-and-white Warbler	*Mniotilta varia*	Possible	S5
American Redstart	*Setophaga ruticilla*	Possible	S5
Ovenbird	*Seiurus aurocapilla*	Confirmed	S4
Northern Waterthrush	*S. noveboracensis*	Confirmed	S5
Mourning Warbler	*Oporornis philadelphia*	Possible	S4
Common Yellowthroat	*Geothlypis trichas*	Confirmed	S5
Canada Warbler[5]	*Wilsonia canadensis*	Possible	S4
Eastern Towhee	*Pipilo erythrophthalmus*	Probable	S4
Scarlet Tanager	*Piranga olivacea*	Confirmed	S4
Northern Cardinal	*Cardinalis cardinalis*	Probable	S5
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Confirmed	S4
Indigo Bunting	*Passerina cyanea*	Confirmed	S4
Clay-colored Sparrow	*Spizella pallida*	Confirmed	S4
Chipping Sparrow	*S. passerina*	Confirmed	S5
Field Sparrow	*S. pusilla*	Probable	S4
Vesper Sparrow	*Pooecetes gramineus*	Possible	S4
Savannah Sparrow	*Passerculus sandwichensis*	Probable	S4
Grasshopper Sparrow	*Ammodramus savannarum*	Possible	S4
Swamp Sparrow	*Melospiza georgiana*	Confirmed	S5
Lincoln's Sparrow	*M. lincolnii*	Confirmed	S5
Song Sparrow	*M. melodia*	Confirmed	S5
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed	S5
Bobolink[4]	*Dolichonyx oryzivorus*	Confirmed	S4
Red-winged Blackbird	*Agelaius phoeniceus*	Confirmed	S4
Eastern Meadowlark[4]	*Sturnella magna*	Confirmed	S4
Common Grackle	*Quisculus quiscula*	Confirmed	S5
Brown-headed Cowbird	*Molothrus ater*	Confirmed	S4
Baltimore Oriole	*Icterus galbula*	Confirmed	S4
Finches	**Fringillidae**		
House Finch	*Carpodacus mexicanus*	Confirmed	SNA
Purple Finch	*C. purpureus*	Possible	S4
American Goldfinch	*C. tristis*	Confirmed	S5
Evening Grosbeak	*Coccothraustes vespertinus*	Possible	S4
Old World Sparrows	**Passeridae**		
House Sparrow	*Passer domesticus*	Confirmed	SNA

[1] Source: Bird Studies Canada (2006); Cadman *et al*. (2007), based on grid 18TQ70.

[2] NHIC: S5 = secure; S4 = apparently secure; S3 = vulnerable; SNA = not applicable.

[3] Designated as Special Concern provincially by COSSARO (MNRF, 2014) and Not at Risk federally by COSEWIC (2012).

[4] Designated as Threatened federally and provincially.

[5] Designated as Threatened federally and Special Concern provincially.

[6] Designated as Special Concern provincially.

During the July 6, 2007 breeding bird survey for the Ranney Falls GS lands bound by Trent Drive, the Trent River, the Island Park Retirement Community fence line and the northwestern wall of the main powerhouse, only four common bird species were observed: American Robin, Cedar Waxwing, Warbling Vireo and American Goldfinch. Given the small size of the proposed Project construction footprint and limited vegetation present, this result was not surprising (Coker *et al*., 2008).

During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) observed Blue Jay, Black-capped Chickadee, Gray Catbird, Yellow Warbler, Northern Cardinal and Common Grackle, as well as Pileated Woodpecker (based on characteristic holes in the trees).

During the November 16, 2011 survey, Black-capped Chickadee and Osprey were observed in ELC units 1a and 1b (see Figure 2.1) on the adjacent retirement home property and over the Trent River, respectively.

An Osprey nesting platform is located on TSW-Parks Canada land to the east of the Ranney Falls GS within ELC unit 3w (see Figure 2.1). This platform is not currently being used (G. Current, OPG, 2015, pers. comm.).

An artificial nesting structure for Chimney Swift has been installed on the Ranney Falls GS property near (to the southeast) of the main powerhouse. This species is designated as Threatened both federally (COSEWIC, 2012) and provincially (MNRF, 2014). Use of this structure has not been observed (M. Shaw, Environment Canada, 2011, pers. comm.; D. Brandt, OPG, 2012, pers. comm.).

The chimney of the abandoned paper mill/tannery approximately 400 m from the Ranney Falls GS property is used as a roost by Chimney Swift (M. Shaw, Environment Canada, 2011, pers. comm.).

2.7.3 Amphibians and Reptiles

Table 2.10 provides a list of amphibian and reptile species possibly present in the local study area based on the Ontario Nature (2013) "Ontario's Reptile and Amphibian Atlas" (http://www.ontarionature.org/protect/species/reptiles_and_amphibians/index.php), which also includes data from the previous Ontario Herpetofaunal Summary Atlas (Oldham and Weller, 2002), as well as records up to February 26, 2013. Of the 26 species listed in Table 2.9, 14 are ranked by the NHIC as S5 (secure), three are S4 (apparently secure), eight are S3 (vulnerable) and one is S2 (imperilled).

Table 2.10 Amphibians and Reptiles Possibly Present in the Local Study Area[1]

Common Name	Scientific Name	Provincial Status[2]
AMPHIBIANS		
Mudpuppy	**Proteidae**	
Common Mudpuppy	*Necturus maculosus maculosus*	S4
Newts	**Salamandridae**	
Red-spotted Newt	*Notophthalmus viridescens viridescens*	S5
Mole Salamanders	**Ambystomatidae**	
Jefferson/Blue-spotted Salamander Complex	*Ambystoma jeffersonianum- laterale* "complex"	S2
,		
Lungless Salamanders	**Plethodontidae**	
Eastern Red-backed Salamander	*Plethodon cinereus*	S5
Toads	**Bufonidae**	
Eastern American Toad	*Anaxyrus americanus americanus*	S5
Treefrogs	**Hylidae**	
Spring Peeper	*Pseudacris crucifer*	S5
Western Chorus Frog[3]	*P. triseriata*	S3
Gray Treefrog	*Hyla versicolor*	S5
True Frogs	**Ranidae**	
American Bullfrog	*Lithobates catesbeianus*	S4
Northern Green Frog	*L. clamitans melanota*	S5
Pickerel Frog	*L. palustris*	S4
Northern Leopard Frog	*L. pipiens*	S5
Mink Frog	*L. septentrionalis*	S5
Wood Frog	*L. sylvaticus*	S5
REPTILES		
Snapping Turtles	**Chelydridae**	
Eastern Snapping Turtle[4]	*Chelydra serpentina serpentina*	S3
Musk and Mud Turtles	**Kinosternidae**	
Eastern Musk Turtle[5]	*Sternotherus odoratus*	S3
Pond and Marsh Turtles	**Emydidae**	
Midland Painted Turtle	*Chrysemys picta marginata*	S5
Northern Map Turtle[4]	*Graptemys geographica*	S3
Blanding's Turtle[6]	*Emydoidea blandingii*	S3
Typical Snakes	**Colubridae**	
Northern Ribbonsnake[4]	*Thamnophis sauritus*	S3
Eastern Gartersnake	*T. sirtalis sirtalis*	S5
Common Watersnake	*Nerodia sipedon sipedon*	S5
Northern Brownsnake	*Storeria dekayi dekayi*	S5
Northern Red-bellied Snake	*S. occipitomaculata occipitomaculata*	S5
Eastern Hog-nosed Snake[6]	*Heterodon platirhinos*	S3
Eastern Milksnake[4]	*Lampropeltis triangulum triangulum*	S3

1 Source: Ontario Nature (2013).

2 NHIC: S5 = secure; S4 = apparently secure; S3 = vulnerable; S2 = imperilled.

3 Great Lakes/St. Lawrence – Canadian Shield population designated as Threatened federally by COSEWIC (2012) but Not at Risk provincially by COSSARO (MNRF, 2014).

4 Designated as Special Concern federally and provincially.

5 Designated as Threatened federally and Special Concern provincially.

6 Designated as Threatened federally and provincially.

There are a number of turtle species known to occur along the TSW in the vicinity of the proposed Project area. Midland Painted Turtle is one of the more common species that is known to be present. However, there are also several turtle SAR known to occur in the area including Eastern Snapping Turtle, Northern Map Turtle, Eastern Musk Turtle and Blanding's Turtle (Cebek *et al*., 2005). Eastern Snapping Turtle and Northern Map Turtle are the only turtle SAR regularly observed along the Trent River between Ranney Falls and Hague's Reach.

Turtles have been observed nesting on the Ranney Falls GS site in gravel substrate near the "Pup" transformer sub-station. In 2007, OPG retained the services of turtle researchers Dr. J. Litzgus and A. Bennett (M.Sc. candidate) to investigate which turtle species may be utilizing the site. In their study, Bennett and Litzgus (2007, 2008) confirmed that the area between the main powerhouse tailrace and the "Pup" powerhouse is utilized as nesting habitat by Northern Map Turtle and Eastern Snapping Turtle. Both of these species are designated as species of special concern federally (COSEWIC, 2012) and provincially (MNRF, 2014). An old walkway bisecting the property appears to be the western limit of the primary nesting area. The area above the walkway consists of open lawn and is unsuitable for nesting. Predated nests were also found in the storage area and the south-easterly portion of the property (Bennett and Litzgus, 2008).

A number of Midland Painted Turtles and Northern Map Turtles were also observed during the June 6, 2006 site visit basking along the water's edge and swimming in the Trent River downstream of Ranney Falls (Coker, 2007). A small dead Eastern Snapping Turtle, likely a road kill, was also observed at the entrance of the Ranney Falls GS parking lot. During the July 6, 2007 breeding bird survey, a single hatchling Eastern Snapping Turtle was observed part way down along the access road to the "Pup" powerhouse (Coker *et al*., 2008). Many (~25) other nest scrapes were observed, including at least one raided nest. Turtle egg casings were observed during the November 16, 2011 survey in the area adjacent to the "Pup" powerhouse transformer substation and on the rubble peninsula between the "Pup" and main powerhouse tailraces.

During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) noted the presence of several turtle nests on sand and gravel substrates along the shoreline in the northern portion of the property.

One Northern Map Turtle was observed inside the fenced "Pup" transformer area during the morning of June 13, 2012, whereas three and one Northern Map Turtles were observed digging nests during the mornings of June 14 and 15, 2012, respectively, just outside the fence (W.F. Weller, OPG, 2012, pers. comm.). One young-of-year (YOY) Northern Map Turtle and one YOY Midland Painted Turtle were also observed in the Ranney Falls GS headpond, likely indicating successful nesting on the property.

Two large specimens of Common Watersnake were observed in the bushes directly east of the "Pup" powerhouse close to the top of slope during the July 6, 2007 breeding bird survey (Coker

et al., 2008). A Common Watersnake was also observed at this location on June 13, 2012, as well as one along the fence of the main powerhouse tailrace (W.F. Weller, OPG, 2012, pers. comm.). According to Plourde *et al*. (1989), this species is considered "uncommon and widespread" in the former MNRF Central Region, which includes Northumberland County. The shed skin of an Eastern Gartersnake was also found on the bedrock and rubble peninsula between the two tailraces during the June 6, 2006 site visit (Coker, 2007). The entire area southeast of the "Pup" powerhouse likely provides suitable habitat (hibernacula) for snakes (Coker *et al*., 2008).

No amphibians were observed from the proposed Project area during the various surveys in 2007, 2008, 2011 and 2012. The only possible habitat for breeding amphibians in the vicinity of the proposed Project area is the marsh wetland (designated as ELC unit 3p on Figure 2.1) situated to the south of the maintenance yard. This area could potentially support populations of common species such as Eastern American Toad and Northern Leopard Frog.

2.7.4 Invertebrates

Eleven dragonfly species have been recorded in Map Square 18TQ70 overlapping the site-specific study area (Table 2.11). Eight are ranked by the NHIC as S5 (secure); two are S4 (apparently secure); and one is S3 (vulnerable).

Table 2.11 Odonata Species Recorded in the Local Study Area[1]

Scientific Name	Common Name	Provincial Status[2]
Aeshna constricta	Lance-tipped Darner	S5
Boyeria vinosa	Fawn Darner	S5
Enallagma erbium	Marsh Bluet	S5
Erythemus simplicicollis	Eastern Pondhawk	S5
Gomphus descriptus	Harpoon Clubtail	S3
Ischnura verticalis	Eastern Forktail	S5
Leucorrhinia intacta	Dot-tailed Whiteface	S5
Libellula incesta	Slaty Skimmer	S4
Pachydiplax longipennis	Blue Dasher	S5
Stylurus scudderi	Zebra Clubtail	S4
Sympetrum obtrusum	White-faced Meadowhawk	S5

[1] Source: NHIC database, based on Map Square 18TQ70.
[2] NHIC: S5 = secure; S4 = apparently secure; S3 = vulnerable.

Monarch, designated as Special Concern federally and provincially, was observed on the Ranney Falls GS property during the July 6, 2007 breeding bird survey (Coker *et al*., 2008). The Monarch is designated by the NHIC as S4 (apparently secure). No evidence of egg-laying was noted, but two of its traditional host plants, Common Milkweed and Swamp Milkweed are present on the property (see Table 2.7).

A search of the NHIC database indicated that the butterfly Juniper Hairstreak (*Callophrys gryneus*), designated as S2 (imperilled), has been recorded in Map Square 18TQ70 overlapping the site-specific study area. This species has a limited range in Canada where it is confined to southeastern and southwestern Ontario. The species is associated with Eastern Red Cedar. While Eastern Red Cedar is present in the site-specific study area (see Table 2.7), it is of limited abundance and would likely not support significant populations of Juniper Hairstreak.

2.7.5 Significant Wildlife Species

Based on the *SARA* Schedule 1 SAR Web Mapping Application (Environment Canada, CWS, 2010/2011), one mammal, four bird, six reptile and one arthropod species have ranges overlapping the Ranney Falls GS property:

- Northern Bobwhite (*Colinus virginianus*) and Spotted Turtle (*Clemmys guttata*), designated as Endangered federally by COSEWIC (2012) and provincially by COSSARO (MNRF, 2014); Grey Fox (*Urocyon cinereoargenteus*), Least Bittern (*Ixobrychus exilis*) and Hooded Warbler (*Wilsonia citrina*), designated as Threatened federally and provincially; and Cerulean Warbler (*Dendroica cerulean*), designated as Special Concern federally and provincially; but have not been recorded as possibly present in the site-specific study area (see Tables 2.8, 2.9 and 2.10);
- Eastern Musk Turtle, designated as Threatened federally and Special Concern provincially; Blanding's Turtle, designated as Threatened federally and provincially; and Northern Ribbonsnake and Milksnake, designated as Special Concern federally and provincially, have been recorded as possibly present in the site-specific study area (see Table 2.10); and
- Northern Map Turtle and Monarch, designated as Special Concern, have been observed on the Ranney Falls GS property (see Table 2.10 and Section 2.7.4).

The Environment Canada, CWS (2010/2011) distribution range mapping for Eastern Wolf, designated as Special Concern federally and provincially, and Eastern Hog-nosed Snake, designated as Threatened federally and provincially, does not overlap the site-specific study area (see Tables 2.8 and 2.10). It is unlikely that these species would be associated with the study area.

Environment Canada, CWS (2010/2011) distribution range mapping is not available for Chimney Swift, Barn Swallow, Bobolink and Eastern Meadowlark, designated as Threatened federally and provincially; Red-headed Woodpecker and Canada Warbler, designated as Threatened federally and Special Concern provincially; Black Tern, designated as Not at Risk federally, but Special Concern provincially; Bank Swallow, designated as Special Concern provincially; and Western Chorus Frog, designated as Threatened federally but Not at Risk provincially (see Tables 2.9 and 2.10). Only one species, Chimney Swift, could be associated with the site-specific study area. There is an artificial nesting structure for this species situated adjacent to the main powerhouse. There is also suitable habitat for this species associated with the abandoned mill north of the retirement home property.

Environment Canada, CWS (2010/2011) distribution range mapping is also not available for Eastern Snapping Turtle. This species is designated as Special Concern federally and provincially and has been observed on the Ranney Falls GS property.

Based on the NHIC database, Butternut (*Juglans cinerea*), which is designated as Threatened federally and provincially, Northern Map Turtle and Eastern Snapping Turtle have been recorded within 1 km of the Ranney Falls GS property, whereas Eastern Musk Turtle, Blanding's Turtle, Black Tern, Eastern Meadowlark, Bobolink and Barn Swallow have been recorded within 5 km of the property (L. Spang, MNRF, 2014, pers. comm.). Golden-winged Warbler (*Vermivora chrysoptera*), designated as Threatened federally and Special Concern provincially, has also been recorded within 5 km of the property, but not observed in grid 18TQ70 (see Table 2.9). Environment Canada, CWS (2010/2011) distribution range mapping is not available for Golden-winged Warbler.

It should be noted that although Butternut has been recorded within 1 km of the Ranney Falls GS property, it was not observed on the property (see Table 2.7).

3.0 EFFECTS ASSESSMENT AND MITIGATION MEASURES

The available environmental baseline information and site-specific vegetation inventories provided the basis for an assessment of potential construction and operational effects on the terrestrial environment, e.g., due to noise, blasting, increased human activity, soil erosion and vegetation clearing.

Recommended mitigation measures for these effects on the terrestrial environment are based on the OWA (2012) "Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction", standard environmental construction guidelines (e.g., Cheminfo, 2005), relevant government guidelines for proposed hydroelectric power plant development (e.g., Milko, 1998; Lynch-Stewart, 2004), as well as government agency and other organization consultation.

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

3.1 ATMOSPHERIC ENVIRONMENT

3.1.1 Climate

Climatic data of relevance to construction activities include the occurrence of wet soils after prolonged wet weather events, the flooding of excavated areas after a period of heavy rainfall and the generation of fugitive dust emissions due to high winds during dry conditions. Soil moisture levels are anticipated to be low during frozen conditions in the winter and the dry summer months.

During periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying does not occur on the relatively steep slope connecting the upper and lower portions of the Ranney Falls GS property, as well as on the more gently sloping lower area (adjacent to the Trent River), and that excavated soils do not migrate off the work area. Eroded areas will be stabilized as soon as sufficiently dry conditions prevail and, where appropriate, excavated soils will be stabilized by the use of silt fencing enhanced with straw bales to be deployed prior to excavation. Additional information on mitigation of soil erosion is provided in Section 3.3.

Erosion associated with high winds, resulting in soil loss and nuisance dust, should be reduced or eliminated by stabilizing spoil piles with straw mulch. Dust generation will be controlled by watering dusty roads and the construction sites (Cheminfo, 2005). Additional information on mitigation of fugitive dust emissions is provided in the Socio-economics and Land Use TSD.

The mean start and end of the growing season occur in mid-April and late October, respectively (see Table 2.1); therefore, revegetation/reseeding should occur within this period or be postponed until the following spring.

The implementation of the proposed mitigation measures should reduce the effect of inclement weather and is predicted to result in no net effects on the terrestrial environment of the Ranney Falls GS property and adjacent lands and waterbodies.

3.1.2 Air Quality

During construction, exhaust emissions from construction equipment and fugitive dust emissions will have localized, short-term and transitory effects on the surrounding airshed. Typical combustion emissions include NO_x, CO, SO_2 and VOCs. NO_x can affect vegetation negatively by causing damage or death to leaves, altered photosynthesis, stunting, spindly growth, reduced fruit set and/or reduced yield (Taylor *et al*., 1975). CO is not readily taken up by vegetation (Bennett and Hill, 1975; Mudd, 1975). Soil microorganisms appear to be the major sink for CO (Bennett and Hill, 1975). Sulphur is an essential element for plant metabolism because it is an important component of amino acids, proteins and some vitamins; however, under acute SO_2 levels, foliage symptoms range from chlorosis to necrosis (Malhotra and Blauel, 1980). Elevated VOC levels can also result in foliage chlorosis and necrosis (Malhotra and Blauel, 1980). PM generally does not damage vegetation, possibly because the particles would be removed by rain before any adverse effect could occur (Lerman and Darley, 1975).

The contractor and subcontractors will be required to maintain equipment in good working condition to minimize combustion emissions to the extent practicable (Cheminfo, 2005). To reduce fugitive dust emissions, effective dust suppression techniques will be used. Additional information on mitigation of exhaust and fugitive dust emissions is provided in the Socio-economics and Land Use TSD.

The application of the recommended mitigation measures should minimize combustion emissions and limit fugitive dust emissions to the work area. As a result of the low concentrations of the atmospheric pollutants generated during construction, no adverse effects on terrestrial vegetation on the Ranney Falls GS property due to these emissions are anticipated.

Ambient air quality will not be affected during the operation of the proposed Ranney Falls G3 Project and monitoring is not deemed necessary.

3.1.3 Environmental Noise

The proposed Project will be a potential source of local noise during the construction phase. All work is expected to be completed using conventional construction methods. The noise associated with construction would most likely be a result of activities such as general site grading, foundation work, expanded forebay and tailrace excavation (including drilling and blasting), and site servicing. The proposed Project will be constructed using standard construction best management practices (e.g., Cheminfo, 2005).

Many wildlife species in urban settings are habituated to human activities and associated noise (Busnel, 1978). The construction disturbance should be sufficiently local that little displacement of wildlife is expected to occur. Any sensitive resident animals can relocate temporarily to avoid noise and disturbance associated with construction activities and return after construction activity cessation. In the unusual event of permanent displacement, other wildlife is expected to take advantage of the available habitat. Based on literature review, Kaseloo (2004) reported that small mammals do not appear to be adversely affected by road noise occurring in significant numbers in rights-of-way.

The behavioural response of wild birds to noise is variable. The response varies with species, sex, group, size, season, activities engaged in prior to disturbance, previous exposure to the noise source and distance from the noise source (Fitchko and Lang, 1999). Some species may be very sensitive and may abandon their nests because of anthropogenic noise or activities. Other species habituate to anthropogenic noise or activities, yet others may be attracted to them.

Kaseloo (2004, 2006) reported that a number of studies have indicated that road noise has a negative effect on bird populations (particularly during breeding) of a variety of species. This effect is based on increased bird densities with distance from the road with the effect distances increasing with increased traffic densities. Traffic noise has not been explicitly established as the primary causal factor for avoidance by these species. Moreover, not all species have shown this effect and some species show the opposite response, with increased numbers near roads. As indicated by Kaseloo (2004), there are large gaps in the existing knowledge of the impact of noise on wildlife populations with the need to determine why noise, the presumptive cause, has such variable effects and if the effect is attributable to noise alone or if other factors and/or interactions are present.

While a bird's first reaction to a new noise source appearing in a new ecological niche may be fear and avoidance, if its other sensory systems (optical, chemical) are not stimulated, the organism quickly learns to ignore the noise source (Busnel, 1978). However, avoidance of noise should occur if the organism is approached or chased by humans. For example, it is well known that flocks of crows and gulls will follow a tractor and tilling implement to feed on worms and insect larvae exposed by tilling, ignoring the noise from the tractor; however, they leave immediately if the driver stops the engine and walks away from the tractor.

Drilling activities to facilitate blasting will generate noise and vibration similar to any general construction operation. Potential effects due to noise and vibration will be minimized by proper maintenance and operation of drill rig equipment. In addition, noise baffling equipment can be provided, as recommended by the blasting engineer.

The abrupt loud noise associated with blasting may startle wildlife. In a review of the effects of sonic boom on wildlife, Bell (1972) and Cottereau (1978) reported that wild animals may show behavioural startle when they first experience a sonic boom; however, their reaction is usually slight and they seem to adapt readily to further boom. Lynch and Speake (1978) studied the

effect of sonic booms on the nesting behaviour of Wild Turkey and reported that sonic booms did not cause abnormal behaviour that would result in decreased productivity. Additional information on the effects of blasting is provided in Sections 3.2 and 3.5.

As most urban wildlife species are or quickly become habituated to human activities and associated noise, no mitigation is recommended, with the exception of those provided for migratory birds during the nesting season (see Section 3.7). Additional information on mitigation of environmental noise from a societal perspective is provided in the Socio-Economics and Land Use TSD.

3.2 GEOLOGY AND PHYSIOGRAPHY

As indicated in Section 1.3.1, drilling and blasting will be required to facilitate new powerhouse and expanded tailrace construction (Knight and Piésold Ltd., 2011a). The lower shale-poor bedrock domain is likely to be near the base of the excavation and the new powerhouse may be founded on this domain, or near the boundaries of the two domains, i.e., upper shale-rich and lower shale-poor.

Careful excavation methods, including controlled drilling and blasting, will need to be implemented especially near the excavation walls to ensure that disturbance to the walls and groundwater inflows are minimized (Knight Piésold Ltd., 2011a).

Blasting will be required during powerhouse construction and tailrace excavation. It has been estimated that peak particle velocities produced from blasting operations in excess of 600 mm/s will cause cracks and discontinuities in sedimentary rock up to a 5-m radial distance from the blast using the sophisticated techniques and control measures employed in modern blasting practice (L. McAnuff, VME/Explotech Associates Ltd., 1991, pers. comm.). It was also indicated that seams may open up between sedimentary strata within the 5 m blast radius. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer and the DFO blasting guidelines (Wright and Hopky, 1998).

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 contractor, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canada Explosives Act* and the *Transportation of Dangerous Goods Act*. The contractor will be required to retain a consulting engineer with technical expertise in blasting to provide advice on maximum loading of explosives for all blasting, as well as an engineering report indicating recommended charges and blasting methods to be used at specific locations. All blasting will occur in such a way as to be in compliance with federal regulations and directions. Excess rock will be removed from the excavated area behind the temporary cofferdams for suitable disposal. Sampling and analysis

of bedrock at the Ranney Falls GS property indicated that it is not acid generating (Knight and Piésold Ltd., 2011b).

It is expected that the material excavated from the upper shale-rich bedrock domain may be suitable for structural fill. It will be important to ensure that the excavated material is well graded and that it contains only a small proportion of thin, flat or elongated particles (which may come from the shale layers) if it is to be used for fill (Knight Piésold Ltd., 2011a). This material should be stockpiled at least 100 m from the Trent Canal and Trent River and protected against runoff-induced erosion.

Following construction, no effects on geology are anticipated beyond the new powerhouse footprint and the expanded tailrace requiring blasting for construction.

Since seismic activity is not a concern, mitigation and protective measures have not been developed. However, design of the proposed Project will be compliant with Canadian Standards Association codes for seismic Zone 1.

As indicated in Section 2.3, the Ranney Falls GS property consists of generally flat upper (adjacent to Trent Drive) and gently sloping lower (adjacent to Trent River) areas with a relatively steep connecting slope (elevation difference of approximately 14 m) adjacent to both sides of the main powerhouse.

Topography will be altered to facilitate new powerhouse and expanded tailrace construction with requisite slope stabilization. A Site Development Plan will be prepared by the contractor, including planning considerations; site and design considerations; site development scheduling; selection of construction equipment; and site development details.

As the effects of site development are expected to be negligible on overall physiography, no mitigation measures are required beyond those set out in the Site Development Plan.

No effects on geology and physiography are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; therefore, no mitigation is required.

3.3 SOILS

Soils on the Ranney Falls GS property consist primarily of shallow loam with a depth of less than 0.3 m to bedrock (see Section 2.4).

As indicated in Section 2.4, soils within the construction area have elevated concentrations of metals, VOCs and/or petroleum hydrocarbons. As a result, the majority of any surplus overburden will require Environmental Compliance Approval (MOE, 2011) from the MOECC under the *Environmental Protection Act* for its transport and disposal. The excavation, removal and disposal of the disused septic tank located in the construction area and associated soils will also require Environmental Compliance Approval. As indicated below, a Hazardous Materials

Management Plan, which will include contaminated soils and septic tank handling and disposal measures, will be developed for the proposed Project as part of the broader Environmental Management Plan.

During construction, soil erosion generally results from water or wind action on the disturbed terrain surfaces as a result of the removal of vegetative cover, deposition of unconsolidated material, alteration of topography and improper restoration. All construction work will be conducted so as to avoid unnecessary disturbance of the ground by the placement or excavation of materials, the disruption of established natural surface and subsurface drainage, or the disturbance of natural vegetation cover that is to be preserved.

Till and gully erosion caused by channelized overland flow can be a major source of soil erosion. Sheet erosion can be an additional source of sediment.

As indicated in Section 3.1.1, during periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying does not occur on the relatively steep slope connecting the upper and lower portions of the Ranney Falls GS property, as well as on the more gently sloping lower area (adjacent to the Trent River), and that excavated soils do not migrate off the work area. Exposed areas should be minimized particularly during excessive rainfall conditions. Proper erosion controls (i.e. the use of silt fencing enhanced with straw bales, stockpile covers, berms, controlled compaction, etc.) will need be in place under all conditions.

Erosion associated with high winds, resulting in soil loss, will be reduced or eliminated by stabilizing spoil piles with straw mulch or more stable materials.

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 the 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;
- any storage of stripped materials is to be placed in stable locations which will prevent the movement of the materials (soils, sediments)" and that "any short-term storage of soil near shoreline is only to be done on a temporary basis and with appropriate controls in place to prevent any off-site movement;
- soils stripped near shore should be moved as fast as possible to stable locations;

- implementation of erosion control measures, e.g., rip-rap berms underlain by filter geotextile, straw bales used as filters, silt fencing along the shoreline and/or mulching for interim stabilization;
- diversion of runoff away from exposed areas;
- minimization of the length and steepness of slopes;
- maintenance of low runoff velocities;
- design of drainage works, such as ditches and outfalls, to handle concentrated runoff;
- diversion of the drainage culvert from the adjacent property out of the construction pit;
- 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.

The site-specific Erosion and Sediment Control Plan will be part of a broader Environmental Management Plan for the proposed Ranney Falls G3 Project. This will be provided to the TSW for review and comment.

After construction is completed the site will be rehabilitated. A Site Rehabilitation Plan including planning considerations, soil stabilization and revegetation will be prepared for the proposed Project.

Dust may be generated during the construction due to heavy equipment movement. Dust generation during dry, windy conditions can be controlled by water trucks and/or sprinklers as necessary to reduce dust to acceptable levels. Additional information on mitigation of fugitive dust emissions is provided in the Socio-Economics and Land Use TSD.

The implementation of the Erosion and Sediment Control Plan and the Site Rehabilitation Plan during construction and rehabilitation will obviate or minimize potential effects on soils.

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

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed for the proposed 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.

No effects on soils are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; therefore, no mitigation is required.

3.4 VEGETATION

A number of plant communities will be affected by construction of the powerhouse, as well as forebay and tailrace expansion. Powerhouse construction will result in the removal of a Cultural Woodland (ELC unit 2c on Figure 2.1) with the predominant overstorey consisting of Scotch Pine and Basswood (see Table 2.6). This woodland is not considered to be provincially significant by LTC (2001). Forebay expansion will result in the loss of lawn (ELC units 2a and 2c on Figure 2.1). Tailrace expansion will affect a number of vegetation communities including (see Figure 2.1 and Table 2.6):

- removal of a White Cedar coniferous forest patch (ELC unit 2g), not considered to be significant by LTC (2001);
- partial removal of a Cultural Meadow (unit 2f), White Birch Carbonate Talus (ELC unit 2j) and Cultural Thicket (ELC unit 2k); and
- removal of a Cultural Thicket (ELC unit 2h).

None of these vegetation communities are considered to be provincially significant by the NHIC.

A Tree Removal Permit from Northumberland County (2009) under By-law No. 54-09 pursuant to the *Municipal Act* will likely not be required for the White Cedar coniferous forest patch (ELC unit 2g on Figure 2.1) due to the small area to be cleared (less than 1 ha).

The lawn area (ELC unit 3b on Figure 2.1) will be used for laydown/assembly during construction. OPG is also pursuing approval from Parks Canada – TSW for laydown/assembly use of the lawn area south of Trent Road to the east and west of the existing forebay.

Based on vegetation surveys of the areas likely to be affected by construction activities, all of the native species are designated as S5 (secure), S4S5 (apparently secure to secure) and S4 (apparently secure). No significant or unusual areas of native vegetation were identified that would preclude or be affected by the construction of the proposed Ranney Falls G3 Project.

The cliff vegetation communities associated with the Trent River are classified as Bulblet Fern - Herb Robert Open Shaded Limestone/Dolostone Cliff Face Vegetation Type. This community type is ranked as provincially significant by the NHIC. A similar community has also developed

on the walls along the tailrace channel to the main powerhouse; however, as this community is artificial in origin, it is not considered to be of provincial significance. Tailrace expansion will result in removal of vegetation from the cliff habitat on the existing northern channel wall. The new cliff habitat of similar surface area created due to tailrace expansion will be quickly re-colonized with similar native vegetation as there is abundant seed sources available from nearby cliff habitats. As a result, overall impact on the cliff vegetation communities will be short-term in duration.

Vegetation clearing will adhere to standard construction practices as listed below:

- vegetation clearing will be restricted to the minimum necessary for construction activities;
- brush and trees will be felled into the area to be cleared to prevent damage to adjacent vegetation;
- branches overhanging the cleared area will be cut (pruned) cleanly and stubs should not be dressed;
- merchantable timber will be cut and neatly stacked for appropriate removal;
- specimen trees marginal to the cleared area will be identified prior to construction, flagged and protected from damage, where possible;
- all slash, brush, roots and stumps are will be raked into piles for appropriate disposal; and
- slash material will not be stored near the Trent Canal and Trent River.

After construction is completed, the cleared areas of natural vegetation that have not been displaced by permanent redevelopment infrastructure will be restored to their original condition or enhanced through the planting of native species beneficial to local wildlife based on the Site Rehabilitation Plan (see Section 3.6).

As indicated in Section 2.6, the remnant woodland on the Island Park Retirement Community property adjacent to the Ranney Falls GS property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been identified as Significant Woodlands by LTC (2001) (see Figure 2.1). The forested area in Ferris Provincial Park, on the opposite side of the Trent River, is also identified as Significant Woodland. MNRF considers all lands within 120 m of identified Significant Woodlands to represent adjacent lands (MNR, 2010). The PPS (OMMAH 2014) and municipal policies require that any proposed development or site alteration include an assessment of potential project impacts on significant natural heritage features such as woodlands. Such assessments typically include an Environmental Impact Study or are included within an EA (as in this TSD and the DIA for the proposed Ranney Falls G3 Project).

As indicated in Section 2.3.1, a site-specific assessment was undertaken of the Significant Woodlands adjacent to the northwest of the Ranney Falls GS property and in the eastern portion of the Ranney Falls GS property. A site-specific survey of the woodlands in Ferris Provincial Park was deemed not to be required as the Trent River provides sufficient buffer from the proposed Project. The Significant Woodland in the eastern portion of the Ranney Falls GS

property (see Figure 2.1) will be sufficiently distant from the construction activities and protected by the installation of silt fencing to the east of the access road and public parking area. Silt fencing will also be installed along the Significant Woodland adjacent to the northwest of the Ranney Falls GS property boundary at the exterior tree dripline to ensure no inadvertent intrusion during construction. With the implementation of these mitigation measures during construction, it is not anticipated that the proposed Project will have an adverse effect on the Significant Woodlands or their ecological functions.

Overall, with the implementation of the standard vegetation clearing construction practices, restoration/enhancement measures prescribed in the Site Rehabilitation Plan (including tree plantings) and the mitigation measures for the protection of proximate Significant Woodlands, the construction and operation of the proposed Ranney Falls G3 Project will have minimal effect on natural vegetation communities and associated plant species.

3.5 SIGNIFICANT NATURAL FEATURES

As indicated in Section 2.6, there are no PSWs, ANSIs or ESAs within 5 km of the proposed Ranney Falls G3 Project. Due to the geographic separation, the scale of the proposed Ranney Falls G3 Project will have no effect on these significant natural features.

The woodlands adjacent to the northwest of the Ranney Falls property within the Island Park Retirement Community property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been designated as Significant Woodlands by LTC (2001) (see Figure 2.1). The woodlands in Ferris Provincial Park on the opposite side of the Trent River are also designated as significant. Potential environmental effects of the proposed Ranney Falls G3 Project on these significant woodlands have been addressed in Section 3.4.

As indicated in Section 2.6, although Significant Valleylands have not been identified by LTC (2001), the Trent River and associated riparian environment would likely qualify as a Significant Valleyland. As indicated in the PPS (OMMAH, 2014), development and site alteration in Significant Valleylands and on adjacent lands is not permitted unless it has been demonstrated that there will be no negative effects on the feature or its ecological function. MNR (2010) provides evaluation criteria and standards for the designation of Significant Valleylands and has established an adjacent land width of 120 m from Significant Valleylands. Under the *Conservation Authorities Act*, the LTC regulates development and activities in or adjacent to the Trent River through a permitting process based on Ontario Regulation 163/06 under the Act. Proposed tailrace expansion is predominantly located on previously disturbed land with a high proportion of cultural vegetation community types (see Section 3.4). The displacement of turtle nesting habitat and potential snake hibernacula habitat will be offset by existing habitat enhancement on areas of the Ranney Falls GS property unaffected by the proposed Project, as well as on nearby TSW property (see Section 3.6). Proposed tailrace expansion will result in a slight increase in the total amount of permanent aquatic habitat (Coker *et al*., 2012). OPG will consult with Parks Canada – TSW to resolve any potential issues/concerns regarding this proposed development within the Trent River valley.

3.6 WILDLIFE

As indicated in Section 2.7, the local study area provides woodland, riparian and urban habitat for wildlife. In this area, most wildlife species are fully habituated to human activities with more sensitive species restricted to available specialized habitats.

The construction disturbance related to the proposed Ranney Falls G3 Project will be sufficiently localized that there will be little displacement of wildlife habitat. Any resident wildlife will relocate temporarily to avoid noise and disturbance associated with construction activities and return after construction completion. For example, Racey and Euler (1982) reported that Eastern Chipmunk, Northern Short-tailed Shrew and Deer Mouse were tolerant, Gapper's Red-backed Vole and Woodland Jumping Mouse were intolerant, whereas Red Squirrel was indifferent to shoreline cottage development which significantly altered vegetation composition and structure.

There are several bird species that may nest on the Ranney Falls GS property. As indicated in Section 2.7.2, only four common bird species were observed within the proposed Project construction footprint during the July 6, 2007 breeding bird survey: American Robin, Cedar Waxwing, Warbling Vireo and American Goldfinch.

Most migratory bird species are protected under the Migratory Bird Regulations of the *Migratory Birds Convention Act* (*MBCA*). Environment Canada is responsible for the implementation of the *MBCA* and recommends that vegetation clearing should not be undertaken during the breeding season of migratory birds in order to avoid the destruction or abandonment of any bird nests which would contravene the *MBCA*. Specifically, clearing should not take place between 01 May and 31 July in southern Ontario (R. Dobos, Environment Canada, 2006, pers. comm.). Should it not be possible to adhere to this schedule, then a breeding bird survey must be conducted by a qualified avian biologist and any nests found must not be disturbed by the clearing activity until the young have fledged. A buffer zone restricting active construction activities is generally applied around a nest. The buffer zone which is species-specific will ensure that the nest is not abandoned due to noise associated with construction activities.

To preclude the potential institution of a buffer zone that may affect construction activities, it is recommended that vegetation be removed prior to nesting season initiation, i.e., May 1, or after nesting season completion, i.e., July 31.

As indicated in Section 2.7.2, an artificial nesting structure for Chimney Swift, designated as a Threatened species federally and provincially, has been installed on the Ranney Falls GS property near (to the southeast) of the main powerhouse. This location will be used for laydown/assembly during construction. This nesting structure, which has not been used, was capped on March 19, 2012 (D. Brandt, OPG, 2012, pers. comm.) and will remain capped.

Due to its distance of approximately 400 m from the Ranney Falls GS property, use of the abandoned paper mill/tannery chimney as a roost by Chimney Swift will not be affected (M. Shaw, Environment Canada, 2011, pers. comm.).

Contractor personnel will be instructed that no harassment or harming of wildlife will be tolerated. During construction, any sightings of snakes and turtles will be reported to the Environmental Monitor.

Once construction of the proposed Ranney Falls G3 Project is completed, any displaced animals could reoccupy the habitat created on the rehabilitated areas of the properties and the habitat associated with the natural and cultural vegetation communities not directly affected by construction activities.

Most native mammal and avian species likely present in the local study area are ranked by the NHIC as S5 (secure) and S4 (apparently secure) in Ontario. However, Northern Map Turtle, Eastern Snapping Turtle and Monarch, designated as Special Concern federally (COSEWIC, 2012) and provincially (MNRF, 2014), have been observed on the Ranney Falls GS property (see Sections 2.7.3 and 2.7.4).

As indicated in Section 2.6, the Ranney Falls GS property supports a number of ecological functions and attributes that would potentially qualify portions of the property as significant wildlife habitat.

The provincially significant vegetation community, Bulblet Fern – Herb Robert Open Shaded Limestone/Dolostone Cliff Face Type, associated with the cliffs of the Trent River will not be affected (see Section 2.3.1). The similar community that has also developed on the northern wall of the existing tailrace will be lost, but due to its artificial origin is not considered to be provincially significant. Moreover, it is anticipated that the new tailrace wall with similar habitat area will be quickly re-colonized with a similar vegetation community as there are abundant seed sources available from nearby cliff habitats.

The River Otter feeding/denning site (specialized wildlife habitat) is located in vegetation community unit 3v (see Figure 2.1), approximately 180 m from the proposed laydown/assembly area (unit 3b on Figure 2.1) and 220 m from the main construction footprint. Due to this separation distance and the intervening deciduous forest, no adverse effects on the River Otter community are anticipated.

With respect to the three wildlife SAR that have been identified on the Ranney Falls GS property (habitat of species of conservation concern), i.e., Northern Map Turtle, Eastern Snapping Turtle and Monarch, species-specific habitat protection and enhancement plans will be completed in consultation with Parks Canada – TSW and the MNRF as part of the Site Rehabilitation Plan.

Although species of Special Concern and their habitat are not currently protected under the *ESA*, turtles are afforded protection under the *Fish and Wildlife Conservation Act*, which makes

it illegal to hunt, trap, keep, sell or purchase live specimens without a government permit. The plans to be developed for the two turtle species will include:

- development of effective mitigation measures to ensure no individuals are harmed or harassed and to minimize or obviate impacts on retained habitat;
- identification of timing windows for implementation of mitigation measures; and
- development of measures to enhance or create nesting habitat (specialized wildlife habitat).

Female Eastern Snapping Turtles and Northern Map Turtles generally lay their eggs in June. For Eastern Snapping Turtle, hatching occurs in late August or September. For Northern Map Turtle, hatching also occurs in the late summer, but may be postponed until the following spring, i.e., late April to early June, due to late egg laying in July (Bennett and Litzgus, 2008). Therefore, to mitigate construction impacts on Northern Map Turtle nests and hatchlings, silt fencing, as described by Bennett and Litzgus (2008), should be erected in the third week of May to exclude adult females from nesting in the construction zone. This timing presumes that construction will be initiated after fence installation and would allow any overwintering hatchlings to access the river. (Construction initiation prior to the third week of May will necessitate fence erection in the prior year). A 1-m high fence would also preclude female Eastern Snapping Turtles from nesting in the construction zone (Bennett and Litzgus, 2008). Other nesting habitat will be available on the Ranney Falls GS property and other proximate properties.

To compensate for the temporary loss of turtle nesting habitat during construction, additional habitat was created in the spring of 2015 on the Ranney Falls GS property and nearby Parks Canada – TSW property based on habitat creation and enhancement plans that have been developed in consultation with Parks Canada – TSW and Environment Canada, CWS (see Appendix A). Based on the mitigation plan, total nesting area present on the Ranney Falls GS property is approximately 154 m^2. The total nesting area that will be available during and after construction on both properties will be approximately 168 and 322 m^2, respectively. Additional benefits to the local populations of these species have been realized by improved access to nesting sites and provision of more suitable nesting substrates. The turtle habitat proved to be immediately successful with some turtles laying eggs in 2015.

During construction OPG will ask the contractor to have the environmental monitor daily check the area to ensure no turtles are going below the fencing. For whatever reason should a turtle nest beyond the fencing during the breeding season, the fencing will be moved back to let the hatchlings access the water.

Although the Monarch is designated as Special Concern federally and provincially, much of the concern regarding its status is the result of habitat loss in their Mexican wintering grounds. In southern Ontario, the monarch is considered to be apparently secure (NHIC rank of S4) and occurs primarily where milkweed and wildflowers are present. As indicated in Section 2.7.4, two of the Monarch's traditional host plants, i.e., Common Milkweed and Swamp Milkweed are present on the Ranney Falls GS property. Milkweed plants that are located in the construction

footprint of the proposed Project could be transplanted or new stock planted as compensation. Additional habitat supportive of these plant species could also be created on portions of the property not affected by the proposed Ranney Falls G3 Project.

As part of the Site Rehabilitation Plan, it is recommended that OPG and the contractor together with the TSW review and discuss this proposed habitat objectives during the construction phase of the Project. It is expected that the Site Rehabilitation Plan will utilize solely native species.

The movement corridor represented by the Trent River valley which supports connectivity functions for a variety of wildlife species at the landscape level will not be affected after construction.

During operation, noise will be generated from the proposed Project. As the steady noise from the proposed facility will be similar to that of the existing facility, it is not expected to elicit an adverse reaction from nearby habituated wildlife.

Overall, the construction and operation of the proposed Ranney Falls G3 Project is predicted to have minimal effect on significant wildlife habitat or local wildlife populations.

4.0 SUMMARY AND CONCLUSIONS

The proposed Ranney Falls G3 Project is being undertaken by OPG to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's CHPG. PFTSW (2008) concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue green energy generating potential along the TSW. Moreover, the proposed Project is consistent with the PPS, which recommends that the use of existing infrastructure and public service facilities should be optimized, whenever feasible, before consideration is given to developing new infrastructure and public service facilities (OMMAH, 2014). In early 2012, a public meeting was held by Northumberland-Quinte West MPP Rob Milligan to promote new waterpower development within the provincial riding.

During construction of the proposed Ranney Falls G3 Project, potential impacts on the terrestrial environment may occur due to soil erosion and fugitive dust, incidental spills, noise, human activity, vegetation clearing and wildlife habitat loss. As indicated in Section 3.6, turtle nesting habitat creation and enhancement plans have been developed in consultation with Parks Canada – TSW and Environment Canada, CWS (see Appendix A), which will be part of the Site Rehabilitation Plan. Based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term.

Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Project will have negligible effects on the terrestrial environment.

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

The Environmental Management Plan, with oversight by the Environmental Monitor, will ensure that environmental protection will be achieved by addressing government agency requirements, OPG policy, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan, Waste Management Plan, Site Rehabilitation Plan, as well as Access Management Plan and Traffic Management Plan (see Socio-Economics and Land Use TSD).

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

Table 4.1 Summary of Potential Effects on the Terrestrial Environment and Recommended Mitigation/ Remedial Measures

Effect	Recommended Mitigation/Remedial Measure	Net Residual Effect
Construction		
Fugitive dust and air quality	• Use of water trucks and/or sprinklers (Cheminfo, 2005). • Proper equipment maintenance (Cheminfo, 2005).	Negligible effect
Blasting	• Adherence to blasting engineer recommendations and DFO Guidelines (Wright and Hopky, 1998).	Negligible effect
Noise/vibration	• Proper maintenance and operation of equipment, with use of noise baffling, as appropriate.	Negligible effect
Soil erosion	• Adherence to site-specific 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
Vegetation clearing and cliff community loss	• Implementation of the Site Rehabilitation Plan. • Rapid re-colonization of new tailrace wall with similar vegetation communities anticipated.	Net benefit
Proximate significant woodlands	• Installation of silt fencing to ensure no inadvertent intrusion during construction.	Negligible effect
Displacement of nesting birds	• Vegetation clearing to be undertaken outside the migratory bird breeding season (01 May to 31 July); otherwise conduct of a breeding bird survey to identify any nests for protection until the young have fledged.	Negligible effect
Loss of turtle nesting habitat and potential snake hibernacula	• Development of nesting habitat creation and enhancement plans in consultation with TSW-Parks Canada and Environment Canada, CWS (see Appendix A), as part of the Site Rehabilitation Plan.	Net benefit
Operation		
Noise	• Noise levels to be similar to those of existing facilities.	Negligible effect
Incidental spills of oil, gasoline and other liquids during operation	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect

5.0 REFERENCES

Associate Committee on the National Building Code (ACNBC) 1980. *The Supplement to the National Building Code of Canada*. National Research Council of Canada. NRCC No. 17724: 293 p.

Atmospheric Environment Service (AES) 1982. *Canadian Climate Normals. Volume 6. Frost 1951-1980*. Environment Canada. 276 p.

Barnett, P.J. 1992. *Quaternary Geology of Ontario*, pp. 1011-1088. *In*: P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M. Stott [Eds.]. Geology of Ontario. Ontario Geological Survey, Special Volume 4, Part 2.

Bell, W.B. 1972. *Animal Response to Sonic Booms*. J. Acoust. Soc. Am. 51: 758-765.

Bennett, A. and J.D. Litzgus 2008. *Nesting Activity at the Ranney Falls Generating Station, May – August 2008*. Laurentian University, Department of Biology Report to Ontario Power Generation Inc.

Bennett, A. and J.D. Litzgus 2007. *Summary Report of Ranney Falls Turtle Data*. Laurentian University, Department of Biology Report to Ontario Power Generation Inc. 12 p.

Bennett, J.H. and A.C. Hill 1975. *Interaction of Air Pollutants with Canopies of Vegetation*, pp. 273-306. *In*: J.B. Mudd and T.T. Kozlowski [Eds.]. Responses of Plants to Air Pollution. Academic Press, New York, New York.

Bird Studies Canada 2006. *Ontario Breeding Bird Atlas*. www.birdsontario.org/atlas/atlasmain.html

Bostock, H.S. 1970. *Physiographic Subdivisions of Canada*, pp. 10-30. *In*: R.J.W. Douglas [Ed.]. Geology and Economic Minerals of Canada. Geological Survey of Canada, Economic Geology Report No. 1.

Brown, D.M., G.A. McKay and L.J. Chapman 1974. *The Climate of Southern Ontario*. Environment Canada, Climatological Studies No. 5: 50 p.

Busnel, R.G. 1978. *Introduction*, pp. 7-22. *In*: J.L. Fletcher and R.G. Busnel [Eds.]. Effects of Noise on Wildlife. Academic Press, Inc., New York, New York.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier [Eds.] 2007. *Atlas of the Breeding Birds of Ontario, 2001-2005*. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. 706 p.

Canada Land Inventory (CLI) 1971. *Land Capability for Forestry, Kingston – 31 C*. Canada Department of Regional Economic Expansion.

Canada Land Inventory (CLI) 1970. *Land Capability for Wildlife – Ungulates, Kingston 31 C.* Canada Department of Regional Economic Expansion.

Canada Land Inventory (CLI) 1968. *Soil Capability for Agriculture, Kingston 31 C.* Environment Canada.

Canadian Council of Ministers of the Environment (CCME) 2000. *Canada-Wide Standards for Particulate Matter (PM) and Ozone*. 10 p.

Catling, P.M. and V.R. Catling 1993. *Floristic Composition, Phytogeography and Relationships of Prairies, Savannas and Sand Barrens along the Trent River, Eastern Ontario*. Canadian Field-Naturalist 107: 24-45.

Cebek, J., A. Charbonneau and J. McLeod 2005. *Assessing the Status of Three At-Risk Turtle Species along the Trent-Severn Waterway*. Final Report for the Trent-Severn Waterway National Historic Site, Peterborough, Ontario. Contract # COFU-05-05: 29 p.

Chapman, L.J. and D.F. Putnam 1984. *Physiography of Southern Ontario*. Ontario Geological Survey, Special Volume 2: 270 p.

Chapman, L.J. and D.F. Putnam 1972. *Physiography of the South Central Portion of Southern Ontario*. Ontario Department of Mines and Northern Affairs, Ontario Research Foundation, Map 2226.

Cheminfo Services Inc. (Cheminfo) 2005. *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities*. Construction and Demolition Multi-stakeholder Working Group Report to Environment Canada, Transboundary Issues Branch. 49 p.

Clayton, J.S., W.A. Ehrlich, D.B. Cann, J.H. Day and I.B. Marshall 1977. *Soils of Canada.* Volume 1. Soil Report. Agriculture Canada. 243 p.

Coker, G. 2007. *Ranney Falls Generating Station Expansion Project Description*. C. Portt and Associates Draft Report to Ontario Power Generation Inc. 20 p.

Coker, G., C. Portt and J. Fitchko 2012. *HADD of Fish Habitat Risk Assessment for the Proposed Ranney Falls Generating Station G3 Expansion Project*. C. Portt and Associates/SENES Consultants Limited Report to Ontario Power Generation Inc.

Coker, G., C. Portt, K. Ursic and K. Konze 2008. *Ranney Falls Generating Station Expansion Environmental Impact Assessment*. C. Portt and Associates and Dougan & Associates – Ecological Consulting and Design Draft Report to Ontario Power Generation Inc. 47 p.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2012. *Canadian Wildlife Species at Risk, October 2012*. Ottawa, Ontario. 98 p.

Cottereau, Ph. 1978. *Effect of Sonic Boom from Aircraft on Wildlife and Animal Husbandry*, pp. 63-79. . *In*: J.L. Fletcher and R.G. Busnel [Eds.]. Effects of Noise on Wildlife. Academic Press, Inc., New York, New York.

Dobbyn, J. 1994. *Atlas of the Mammals of Ontario*. Federation of Ontario Naturalists, Don Mills, Ontario. 118 p.

Ecoregions Working Group 1989. *Ecoclimatic Regions of Canada, First Approximation*. Ecoregion Working Group of the Canada Committee on Ecological Land Classification. Environment Canada, Ecological Land Classification Series No. 23: 119 p.

Environment Canada, Canadian Wildlife Service (CWS) 2010/2011. Species at Risk Web Mapping Application. http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm

Fitchko, J. and A.L. Lang 1999. *Discussion Paper on Environment Canada's Requirement for Forest Clearing Timing Restrictions and Migratory Bird Nest Surveys*. Beak International Incorporated Report to TransCanada PipeLines Limited.

Gillespie, J.E. and C.J. Acton 1981. *Soils of Peterborough County*. Ontario Soil Survey Report No. 45: 60 p.

Gregory, D. 2010. *Central Hydro Plant Group Trent River Generating Stations Botanical Site Investigations*. Report to Ontario Power Generation. 73 p.

Hall, S.L. and R. Jones [Eds.] 1976. *Northumberland County Environmentally Sensitive Areas Study*. Trent University, Department of Biology, Peterborough, Ontario. 181 p.

Hatch Acres 2006. *Site Evaluation and Concept Alternatives for Ranney Falls Generating Station Expansion*. Final Report to Ontario Power Generation.

Hewitt, D.F. 1972. *Paleozoic Geology of Southern Ontario*. Ontario Division of Mines, Geological Report 105 and Map 2254.

Hoffman, D.W. and C.J. Acton 1974. *The Soils of Northumberland County*. Ontario Soil Survey Report No. 42: 117 p.

Johnson, M.D., D.K. Armstrong, B.V. Sanford, P.G. Telford and M.A. Rutka 1992. *Paleozoic* and *Mesozoic Geology of Ontario*, pp. 907-1008. *In*: P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M. Stott [Eds.]. Geology of Ontario. Ontario Geological Survey, Special Volume 4, Part 2.

Kaiser, J. 1983. *Native and Exotic Plant Species in Ontario*. *A Numerical Synopsis.* The Plant Press1: 25-26.

Kaseloo, P.A. 2006. *Synthesis of Noise Effects on Wildlife Populations*, pp.33-35. *In*: C.L. Irwin, P. Garrett and K.P. McDermott [Eds.]. Proc. 2005 Internat. Conf. Ecology and Transportation. North Carolina State University, Center for Transportation and the Environment, Raleigh, North Carolina.

Kaseloo, P. 2004. *Synthesis of Noise Effects on Wildlife Populations*. U.S. Department of Transportation, Federal Highway Administration, Publication No. FHWA-HEP-06-016: 40 p.

Knight Piésold Ltd. 2011a. *Ontario Power Generation Inc. Ranney Falls Project. Hydro Development Project Geotechnical Baseline Report.* OPG Report #R-QC10-10120-0002. 21 p.

Knight Piésold Ltd. 2011b. *Ontario Power Generation Inc. Ranney Falls Project. 2010 Ranney Falls Geotechnical Report.* OPG Report #R-QC10-10120-0001. 36 p.

Krishnappan, B.G. 2007. *Determination of Erosion Potential in the Trent-Severn Waterway Canal Upstream of the Ranney Falls Generating Station*. Environment Canada, Aquatic Ecosystem Impacts Research Division, Burlington, Ontario. 12 p.

KST Hydroelectric Engineers (KST) 1992. *Miscellaneous Hydraulic Studies Ranney Falls GS Concept Phase Study Final*. Report to Ontario Hydro. Work Order 0030, QC10-00120. 76 p.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray 1996. *Ecological Land Classification for Southern Ontario: First Approximation and its Application*. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch, SCSS Field Guide FG-02: 225 p.

Lerman, S.L. and E.F. Darley 1975. *Particulates*, pp. 141-158. *In*: J.B. Mudd and T.T. Kozlowski [Eds.]. Responses of Plants to Air Pollution. Academic Press, New York, New York.

Lower Trent Conservation (LTC) 2001. *Natural Heritage Report: Campbellford/Seymour/ Percy/Hastings - Quinte West - Belleville*. 41 p.

Lynch, T.E. and D.W. Speake 1978. *Eastern Wild Turkey Behavioural Responses Induced by Sonic Boom*, pp. 47-61. *In*: J.L. Fletcher and R.G. Busnel [Eds.]. Effects of Noise on Wildlife. Academic Press, Inc., New York, New York.

Lynch-Stewart, P. 2004. *Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada*. Lynch-Stewart & Associates Report to the Canadian Wildlife Service, Environment Canada. 63 p.

Malhotra, S.S. and R.A. Blauel 1980. *Diagnosis of Air Pollutant and Natural Stress Symptoms on Forest Vegetation in Western Canada*. Environment Canada, Forestry Service, Northern Forest Research Centre, Information Report NOR-X-228: 84 p.

Milko, R. 1998. *Migratory Birds Environmental Assessment Guideline*. Environment Canada, Canadian Wildlife Service.

Mudd, J.B. 1975. *Peroxyacyl Nitrates*, pp. 121-139. *In*: J.B. Mudd and T.T. Kozlowski [Eds.]. Responses of Plants to Air Pollution. Academic Press, New York, New York.

Northumberland County 2009. *Corporation of the County of Northumberland By-law No. 54-09 Being a By-law to Promote Good Forestry Practices and the Maintenance of Northumberland's Woodlands*. 9 p.

Oldham, M.J. and W.F. Weller 2002. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre. http://www.mnr.gov.on.ca/MNR/nhic/herps/obs.html

Ontario Government 1992. *Wetlands Policy Statement. A Statement of Ontario Government Policy Issued Under the Authority of Section 3 of the Planning Act 1983*. 15 p.

Ontario Hydro 1989. *Trent River Ranney Falls GS Geotechnical Evaluation of Foundation Conditions*. Civil Engineering and Architecture Department, Report No. 89150: 15 p.

Ontario Hydro 1992. *Small Hydraulic Assessment and Retrofit Program (SHARP), Ranney Falls Hydroelectric Generating Station (GS) Project, Concept Phase Environmental Evaluation*. Environmental Studies and Assessments Department, Technical Memorandum 92/3: 20 p.

Ontario Ministry of the Environment (MOE) 2004. *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act.* 39 p.

Ontario Ministry of the Environment (MOE) 2005a. *Transboundary Air Pollution in Ontario*. 114 p.

Ontario Ministry of the Environment (MOE) 2005b. *Summary of O. Reg. 419/05 Standards and Point of Impingement Guidelines & Ambient Air Quality Criteria (AAQCs)*. 16 p.

Ontario Ministry of the Environment (MOE) 2011. *Introductory Guide to Applying for an Environmental Compliance Approval.* 12 p.

Ontario Ministry of the Environment (MOE) 2012. *Air Quality in Ontario Report for 2010*.

Ontario Ministry of the Environment (MOE) 2013. *Air Quality in Ontario Report for 2011*. 60 p.

Ontario Ministry of the Environment and Climate Change (MOECC) 2014. *Air Quality in Ontario 2012 Report*. 17 p.

Ontario Ministry of Municipal Affairs and Housing (OMMAH) 2005. *2005 Provincial Policy Statement*. 37 p.

Ontario Ministry of Municipal Affairs and Housing (OMMAH) 2014. *2014 Provincial Policy Statement Under the Planning Act*. 50 p.

Ontario Ministry of Natural Resources (MNR) 1993. *Ontario Wetland Evaluation System Southern Manual*. NEST Technical Manual TM-002:178 p.

Ontario Ministry of Natural Resources (MNR) 2000. *Significant Wildlife Habitat Technical Guide*.139 p.

Ontario Ministry of Natural Resources (MNR) 2010. *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005*. Second Edition. 233 p.

Ontario Ministry of Natural Resources and Forestry (MNRF) 2014. *Species at Risk in Ontario (SARO) List.* Updated October 1, 2014. 31 p.

Ontario Nature (2013). *Ontario's Reptile and Amphibian Atlas.* http://www.ontarionature.org/protect/species/reptiles_and_amphibians/index.php

Ontario Power Generation Inc. (OPG) 2011a. *Ranney Falls G3 Expansion Project – Concept Study Report*. Hydro Engineering Division Report No. HED-PROG-2011-152: 201 p.

Ontario Power Generation Inc. (OPG) 2011b. *HEC-RAS Hydraulic Study of Ranney Falls Generating Station Expansion Hydroelectric Development.* Hydro Engineering Division, Report No.: HED-Projects-2011-001: 66 p.

Ontario Power Generation Inc. (OPG) 2011c. *Ranney Falls GS Expansion Project Flow-3D Modelling of Intake Vortices.* Civil Engineering Department, Report No. R-QC10-02711.1-0002: 20 p.

Ontario Power Generation Inc. (OPG) 2011d. *Computational Fluid Dynamics Modelling Report for Ranney Falls Expansion Project*. Performance & Testing Department, OPG Document #: R-QC10-02711.1-0001: 31 p.

Ontario Waterpower Association (OWA) 2012. *Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction*. 86 p.

Panel on the Future of the Trent-Severn Waterway, The (PFTSW) 2008. *It's all about the Water. Report of The Panel on the Future of the Trent-Severn Waterway – A National Historic Site of Canada*. 87 p.

Parks Canada 2000. *Trent-Severn Waterway. National Historic Site of Canada Management Plan*. 114 p.

Plourde, S.A., E.L. Szepesi, J.L. Riley, M.J. Oldham and C. Campbell 1989. *Distribution and Status of the Herpetofauna of Central Region, Ontario Ministry of Natural Resources*. Ontario Ministry of Natural Resources. 30 p.

Racey, G.D. and D.L. Euler 1982. *Small Mammal and Habitat Response to Shoreline Cottage Development in Central Ontario*. Can. J. Zool. 60: 865-880.

Rowe, J.S. 1972. *Forest Regions of Canada*. Canadian Forestry Service, Publication No. 1300: 172 p.

SENES Consultants (SENES) 2015. *Proposed Ranney Falls Generating Station G3 Expansion Project Detailed Environmental Impact Analysis Report.* SENES Consultants Report to Ontario Power Generation Inc.

SENES Consultants Limited (SENES) 2012a. *Phase I Environmental Site Assessment Update, Ranney Falls Generating Station, Campbellford, Ontario.* Report to Ontario Power Generation.

SENES Consultants Limited 2012b. *Groundwater Monitoring and Amended Environmental Site Investigation OPG Facility at Ranney Falls, Campbellford, Ontario*. Memorandum to Ontario Power Generation Inc. 10 p.

Sly, P.G. and C.F.M. Lewis 1972. *The Great Lakes of Canada – Quaternary Geology and Limnology*. Guidebook for Excursion A43, 24th Internat. Geol. Congress, Montreal, QC.

Taylor, O.C., C.R. Thompson, D.T. Tingey and R.A. Reinert 1975. *Oxides of nitrogen*, pp. 121-139. *In*: J.B. Mudd and T.T. Kozlowski [Eds.]. Responses of Plants to Air Pollution. Academic Press, New York, New York.

Trent Conservation Coalition Source Protection Committee (TCCSPC) 2011. *Amended Proposed Trent Assessment Report*.

Van Patter, M. and S. Hilts 1985. *Some Important Wetlands of Ontario South of the Precambrian Shield*. The Federation of Ontario Naturalists, Don Mills, Ontario.102 p.

Williams, H.R., G.M. Stott, P.C. Thurston, R.H. Sutcliffe, G. Bennett, R.M. Easton and D.K. Armstrong 1992. *Tectonic Evolution of Ontario: Summary and Synthesis*, pp. 1255-1332. *In*: P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M. Stott [Eds.]. Geology of Ontario. Ontario Geological Survey, Special Volume 4, Part 2.

Wright, D.G. and G.E. Hopky 1998. *Guidelines for the Use of Explosives in or near Canadian Fisheries Waters*. Canadian Technical Report of Fisheries and Aquatic Sciences 2107: 34 p.

6.0 ACRONYMS/ABBREVIATIONS

Acronyms

≥	Greater than or equal to
&	And
=	Equal
~	Approximately
#	Number
AAQC	Ambient Air Quality Criterion
ACNBC	Associate Committee on the National Building Code
AES	Atmospheric Environment Service
ANSI	Area of Natural and Scientific Interest
B.P.	Before present
c.	Chapter
CAT	Compact Axial Turbine
CCME	Canadian Council of Ministers of the Environment
CEAA	*Canadian Environmental Assessment Act*
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CFD	Computational Fluid Dynamics
CLI	Canada Land Inventory
CHPG	Central Hydro Plant Group
CO	Carbon monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CUM	Cultural Meadow; Lawn
CUP3-3	Scotch Pine Coniferous Plantation
CUT	Cultural Thicket
CUW	Cultural Woodland
CWS	Canadian Wildlife Service
dba	(Tree trunk) diameter at breast height
DFO	Department of Fisheries and Oceans
DIA	Detailed Environmental Impact Analysis
EA	Environmental assessment
Ed.	Editor
e.g.	For example (exempli gratia)
EIA	Environmental Impact Analysis
ELC	Ecological Land Classification
ESA	*Endangered Species Act*
ESA	Environmentally Sensitive Area
et al.	And others (et alia)
etc.	And so on (et cetera)
FOC2-2	Dry to Fresh White Cedar Coniferous Forest

FOD2-4	Dry to Fresh Oak – Hardwood Deciduous Forest
FOD5-3	Dry to Fresh Sugar Maple – Oak Deciduous Forest
FOD5-6	Dry to Fresh Sugar Maple – Basswood Deciduous Forest
FOD7-1	Fresh to Moist White Elm Lowland Deciduous Forest
FOD7-2	Fresh to Moist Ash Lowland Deciduous Forest
FOD8-1	Fresh to Moist Poplar Deciduous Forest
FOD9-5	Fresh to Moist Bur Oak Deciduous Forest
FOM4-2	Dry to Fresh Bur Oak Deciduous Forest
GPS	Global Positioning System
GS	Generating Station
H	Horizontal
HADD	Habitat alteration, disruption or destruction
HEC	Hydrologic Engineering Centre
Hydro One	Hydro One Networks Inc.
i.e.	That is (id est)
Inc.	Incorporated
KST	KST Hydroelectric Engineers
LTC	Lower Trent Conservation
Ltd.	Limited
MAM3-0	Forb Organic Meadow Marsh
Max.	Maximum
MNR	Ontario Ministry of Natural Resources
MNRF	Ontario Ministry of Natural Resources and Forestry
MOE	Ontario Ministry of the Environment
MOECC	Ontario Ministry of the Environment and Climate Change
MPP	Member of Provincial Parliament
M.Sc.	Master of Science
N	North
NHIC	Natural Heritage Information Centre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NW	Northwest
O_3	Ozone
OMMAH	Ontario Ministry of Municipal Affairs and Housing
OMPIR	Ontario Ministry of Public Infrastructure Renewal
OPG	Ontario Power Generation Inc.
OWA	Ontario Waterpower Association
Parks Canada – TSW	Parks Canada – Ontario Waterways, Trent-Severn Waterway
pers. comm.	Personal communication
PFTSW	The Panel on the Future of the Trent-Severn Waterway

PM	Particulate matter
$PM_{2.5}$	Particulate matter smaller than 2.5 µ
PPS	Provincial Policy Statement
Project	Ranney Falls Generating Station G3 Expansion Project or Ranney Falls G3 Project
PSW	Provincially Significant Wetland
PTTW	Permit to Take Water
S	South
S2	Imperiled – due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making the species very vulnerable to extirpation from the Province
S2S3	Imperiled to vulnerable
S3	Vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making the species vulnerable to extirpation in the Province to apparently secure
S3?	Vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making the species vulnerable to extirpation in the Province, with the ? indicating that the rank is uncertain
S4	Apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors
S4S5	Apparently secure to secure
S5?	Secure – common, widespread and abundant in the Province, with the ? indicating that the rank is uncertain
S5	Secure – common, widespread and abundant in the Province
SAR	Species at risk
SARO List	Species at Risk in Ontario List
S.C.	Statutes of Canada
SENES	SENES Consultants or SENES Consultants Limited
SHARP	Small Hydroelectric Assessment and Retrofit Program
SNA	Not applicable – a conservation status rank not applicable because the species is not a suitable target for conservation activities
SO_2	Sulphur dioxide
sp.	One species
spp.	Two or more species
ssp.	Subspecies
SW	Southwest
SWD4-2	White Elm Deciduous Swamp
SWT2-2	Willow Mineral Thicket Swamp
SWT2-5	Red-osier Dogwood Thicket Swamp
SWT3-2	Willow Organic Thicket Swamp
TAT1-2	Dry to Fresh White Cedar Carbonate Talus

TAT1-3	Dry to Fresh White Birch Carbonate Talus
3D	Three-dimensional
TCCSPC	Trent Conservation Coalition Source Protection Committee
Trent Hills	Municipality of Trent Hills
TSD	Technical Support Document
TSW	Trent-Severn Waterway
U.S.	United States
V	Vertical
var.	Variety
VOCs	Volatile organic compounds
W	West

Measurement Units

º	degree
‘	minute
“	second
°C	degree Celsius
°F	degree Fahrenheit
cm	centimetre
dBA	A-weighted sound pressure level
GWh	gigawatt-hour
h	hour
ha	hectare
km	kilometre
km/h	kilometre per hour
kV	kilovolt
L	litre
L/s	litre per second
m	metre
µ	micron
µg/m^3	microgram per cubic metre
mm	millimetre
mm/s	millimetre per second
m/s	metre per second
m^3/s	cubic metre per second
MW	megawatt
Pa	pascal (unit of pressure)
ppb	part per billion
%	percent

7.0 GLOSSARY

Alvar	Naturally open areas of thin soils over essentially limestone, dolostone or marble rock, supporting sparse vegetation cover of shrubs and herbs.
Anthropogenic	Human-caused; due to human activities.
Argillaceous	Describing rocks or sediments containing particles that are silt- or clay-sized, <0.625 mm in size.
Avifauna	Birds.
Boreal	Of the north.
Brachiopod	A member of the phylum Brachiopoda, a group of bivalved, exclusively marine animals with shells composed of two valves.
Bryozoan	A member of the phylum Bryozoa which forms lacelike branching or spiral colonies as much as 60 cm across and are commonly found matted to shells, rocks and other objects.
Bulkhead	A steep or vertical wall retaining an embankment, often used to line shorelines and maintain embankment stability and absorb the energy of waves and currents.
Calcareous	Composed of or pertaining to calcium carbonate.
Cambrian Period	The oldest period of the Paleozoic Era; it began about 600 million years ago and lasted perhaps 100 million years. During this time, the seas teemed with primitive invertebrate fish.
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.).
Cavitation	The process of increased water velocities due to channel narrowing resulting in decreased pressure to maintain a constant total energy. If the pressure decreases to the pressure of water as a vapour, bubbles form. As the velocity decreases due to channel expansion, the water pressure increases and the bubbles collapse. The collapse causes shock waves in the water, which move out to the channel walls, causing pitting.
Cenozoic Era	The most recent geologic era beginning at the end of the Cambrian Period about 70 million years ago.
Class	A category used in the classification of organisms that consists of similar or closely related orders.

Coefficient of Conservatism	A numeric value between 0 and 10 which indicates the degree of faithfulness a plant species displays to a specific habitat or set of environmental conditions.
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.
Coniferous Forest	The largest terrestrial biome on earth (also known as the Taiga or boreal forest) extending in a broad band across North America, Europe and Asia to the southern border of the arctic tundra and usually dominated by one or two species of evergreen trees,
Cretaceous Period	The last period of the Mesozoic Era; it began approximately 135 million years ago, lasted about 70 million years and was characterized by widespread submergence.
Crinoid	A member of the class Crinoidea known as sea lilies.
Dam	A concrete or earthen barrier constructed across a river and designed to control water flow or create a reservoir.
Deciduous Forest	In the Northern Hemisphere, this forest type occurs to the south of the coniferous forest and is dominated by broadleaved deciduous hardwood trees typically with a five- to six-month growing period.
Dolomite	A mineral, calcium magnesium carbonate.
Dolostone	A sedimentary rock formed from calcium magnesium carbonate.
Draft Tube	The flared passage leading vertically from a water turbine to its tailrace.
Drumlin	A smooth, elongated, streamlined hill form by glacial ice and composed essentially of till.
Endangered	A species facing imminent extirpation (no longer existing in the wild in Canada, but occurring elsewhere) or extinction (no longer exists).
Esker	A long, narrow ridge of poorly stratified glaciofluvial sand and gravel, usually deposited by a subglacial stream between banks of ice.
Eustatic	Change in water levels due to changes in the volume of glacial ice.
Extirpated	A species that no longer exists in the wild of Ontario but still occurs elsewhere.
Family	A category used in the classification of organisms that consists of one or several similar or closely related genera.
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.
Gain	A cut or groove to receive a timber, as a girder or fastener.
Genus (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.
Glaciofluvial	Of glacial watercourses.
Habitat	The environment in which the life needs of a plant or animal are supplied.
Head	The difference in elevation between the water surface at the intake and tailrace.
Headworks (Headgate)	The gate that controls water flow into a hydroelectric powerhouse.
Headwater	The water that flows into a hydroelectric powerhouse from the section of river or stream with the highest elevation above sea level.
Herb (Herbaceous)	A non-woody vascular plant.
Herpetofauna	Amphibians and reptiles.
Hibernacula	A protected area with stable non-freezing temperatures, such as a burrow, where snakes survive the winter.
Holocene Epoch	The last (recent; postglacial) epoch of the Quaternary Period; it began at the end of the Pleistocene Epoch, about 10 million years ago and continues to the present.
Hydraulic	Of water conveyed through a pipe or channel.
Hydraulic Conductivity	Property of a soil or rock, in the vadose zone or groundwater, that describes the ease with which water can move through pore spaces or fractures.
Intake	A structure which regulates the flow of water into a water-conveying conduit.
Interstadial	A warmer period during a glaciation of insufficient duration (generally less than 10,000 years) or intensity to be considered an interglacial (greater than 10,000 years).
Isostatic rebound	The upward movement of the Earth’s crust following depression of the crust by the weight of ice during continental glaciation.

Lacustrine	Of lakes.
Limestone	Sedimentary rock composed of carbonate materials, particularly calcium carbonate.
Lock	Structure designed to raise and lower boats vertically through the use of water-filled chambers hydraulically, mechanically, or pneumatically operated.
Mesozoic Era	The era of geologic time from the end of the Paleozoic, 225 million years ago, to the beginning of the Cenozoic, about 70 million years ago (called the “Age of Reptiles”.
Micritic	Of small (micron) size.
Odonata	Dragonflies and damselflies.
Operating Deck	Work platform.
Ordovician Period	The second oldest period of the Paleozoic Era, which started about 500 million years ago and lasted about 75 million years.
Orogenic	Process of mountain formation.
Overburden	The soil, rock and other material which lie on top of the underlying mineral or other deposit, e.g., bedrock.
Paleozoic Era	The era of geologic time from the end of the Precambrian, 600 million years ago, to the beginning of the Mesozoic Era, about 225 million years ago; the beginning of Paleozoic time, which marks the start of the first accurate records in geologic history, is characterized by the appearance and development of the major types of invertebrates.
Penstock	A structure associated with a hydroelectric station designed to carry water from the intake to the turbine.
Perennial	Continuing, enduring or growing through the year or through many years.
Phylum	A major division of the animal kingdom containing classes of animals.
Pier	As part of a hydroelectric station, an abutment extending from the station, either upstream or downstream, and lending foundation support and directionality to water passed through the structure.
Pleistocene Epoch	The earliest epoch of the Quaternary Period; it began 2 to 3 million years ago and lasted until the Holocene Epoch, approximately 10,000 years ago and was a time of widespread continental glaciation.
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.
Provincially Significant Woodland	A woodland area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or ecologically important due to site quality, species composition, or past management history (OMMAH, 2014).
Quaternary Period	The second and youngest period of the most recent Cenozoic Era (also called the Age of Mammals); the Quaternary Period began 2 to 3 million years ago and consists of two epochs, the Pleistocene and the Holocene (known also as Recent).
Riparian	Of or on a river bank.
Sandstone	A type of sedimentary rock that contains a large quantity of weathered quartz grains.
Sedimentary	Rock formed by the deposition, alteration and/or compression and lithification of weathered rock debris, chemical precipitates, or organic sediments.
Shale	Fine-grained sedimentary rock composed of lithified clay particles.
Siltstone	Fine-grained sedimentary rock composed of lithified silt particles
Silurian Period	The third oldest period in the Paleozoic Era; it began about 430 years ago and lasted some 30 million years.
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 of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
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).
Tailwater	The water from a generating station after it has passed through the turbine.
Tectonic	Formation of larger structural features of the earth's surface caused by deformation.
Terrestrial	Belonging, living on or growing in the earth or land.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Till	Material derived from bedrock and overlying unconsolidated material and deposited directly by glacial ice with its characteristics dependent upon the source rock.
Transformer	A device that changes electric voltage. In Ontario, electricity typically leaves the generator at 20,000 volts or less, is stepped up to 115,000, 230,000 or 500,000 volts to be transmitted long distances and then stepped down to lower voltages to be distributed to customers. Each change in voltage is accomplished with a transformer. Alternatively, the electricity is stepped up directly to the local distribution voltage.
Trashrack	Bar screen with larger space openings installed to prevent logs, stumps and other large solids from penetrating the intake.
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.
Vadose Zone	Also termed the unsaturated zone, the portion of the overburden between the land surface and the water table.
Vascular	Made up of vessels or ducts for conveying water.
Weir	A dam in the river to stop and raise the water.

APPENDIX A

Turtle Nesting Habitat Mitigation Plan

Ranney Falls G3 Expansion Project

Final
Mitigation Plan for Northern Map Turtle and Eastern Snapping Turtle Access and Habitat

August 13, 2012

Contents

List of Figures

1 Summary of Habitat Creation

Total nesting area prior to construction: < 154 m^2 (11 m x 14 m – transformer and poles)

Total nesting area during construction: = 168 m^2 (9 m x 10 m + (6 m x 26 m) / 2)

Total nesting area after construction: = 322 m^2 (11 m x 14 m + 9 m x 10 m + (6 m x 26 m) / 2)

2 Summary Access Creation

Total access routes prior to construction: 2

Total access routes during construction: 4

Total access routes after construction: 4

3 Details of Habitat and Access Creations

Area	Area ($m^{2)}$	Current Use	Use during Construction (temporary)	Use after Construction (permanent)	Notes
1	< 154 (11 m x 14 m – transformer and poles)	Nesting	Unavailable	Nesting	The fence, transformer and transmission poles will be removed after the construction. Removal of fence for better access to nesting areas. Removal of transformer and transmission poles to provide additional nesting areas within the 11 m x 14 m area. Area could also be expanded additionally through new gravel road to powerhouse. Scatter mounds of nesting substrate, if possible.
2		Access to nesting areas (test holes)	Unavailable	Unavailable	The loss of Area 2 will be compensated with Area 3, which is not currently an access route for the turtles
3		Not used	Access	Access	Area 3 will be turned into a permanent turtle access (i.e. cleared of vegetation and excavated to reduce the slope)
4	90 (9 m x 10 m)	Not used	Nesting	Nesting	Area 4 will be turned into a permanent nesting habitat (as per Figure 3-4 Typical Section of Nesting Habitat). Area could also be expanded additionally through new gravel road to powerhouse. Scatter mounds of nesting substrate, if possible.
5		Access	Access	Access	Areas 5 and 6 are being used as an access route and are not impacted by the construction.
6		Access to nesting areas (test holes)	Access	Access	
7	78 (6m x 26 m) / 2	Not used, but nesting habitat nearby	Nesting	Nesting	Area 7 is owned by Trent-Severn Waterway. Nesting habitat creation (as per Figure 3-4 Typical Section of Nesting Habitat) would be a partnership between OPG and TSW to promote public awareness of species at risk through signage.
8 & 9		Unknown	Access	Access	Turtle access for Area 7 will be enhanced / created in Areas 8 and 9, where riparian vegetation is sparse.

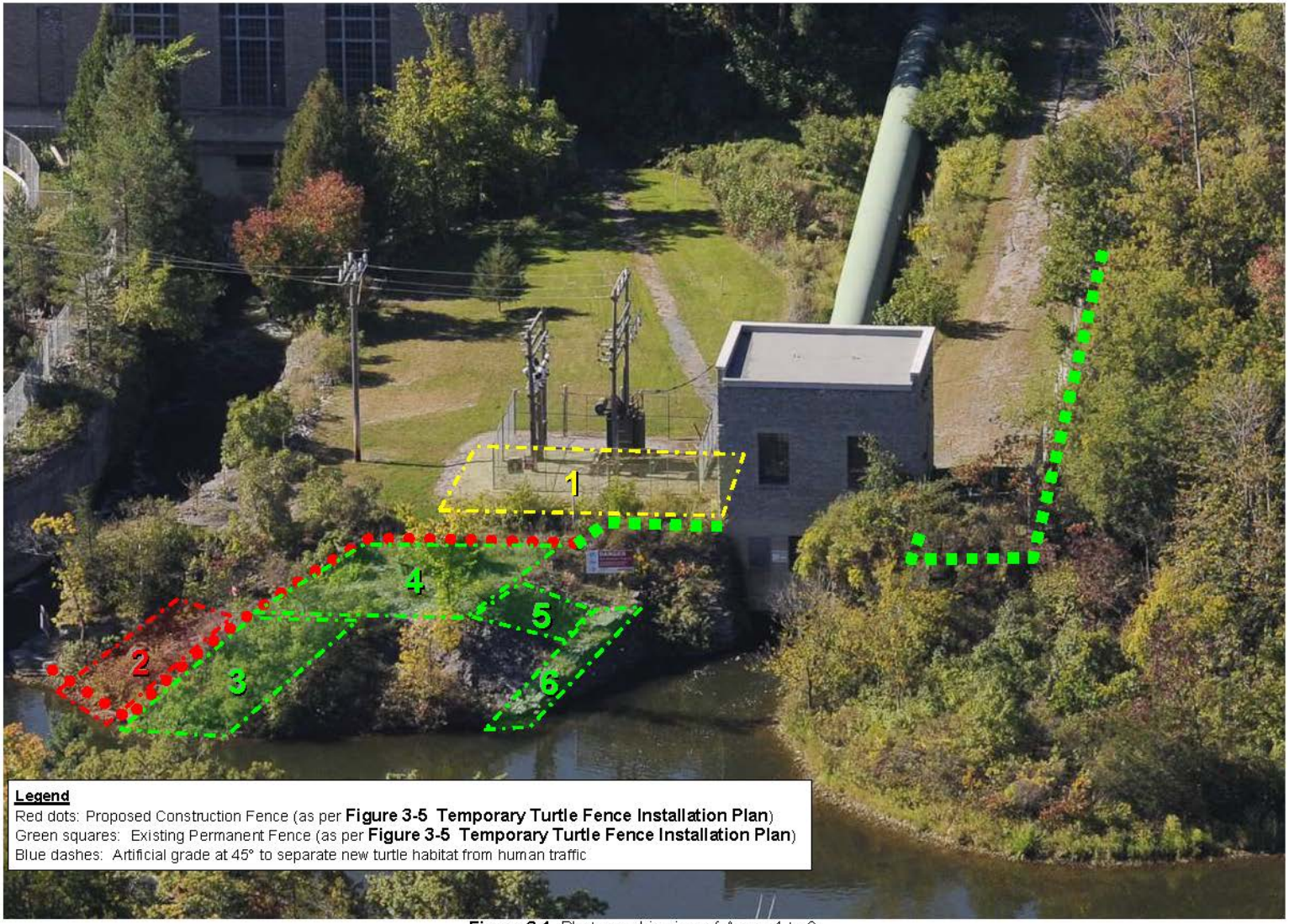


Figure 3-1 Photographic view of Areas 1 to 6

Figure 3-2 Photographic view of Areas 7 to 9

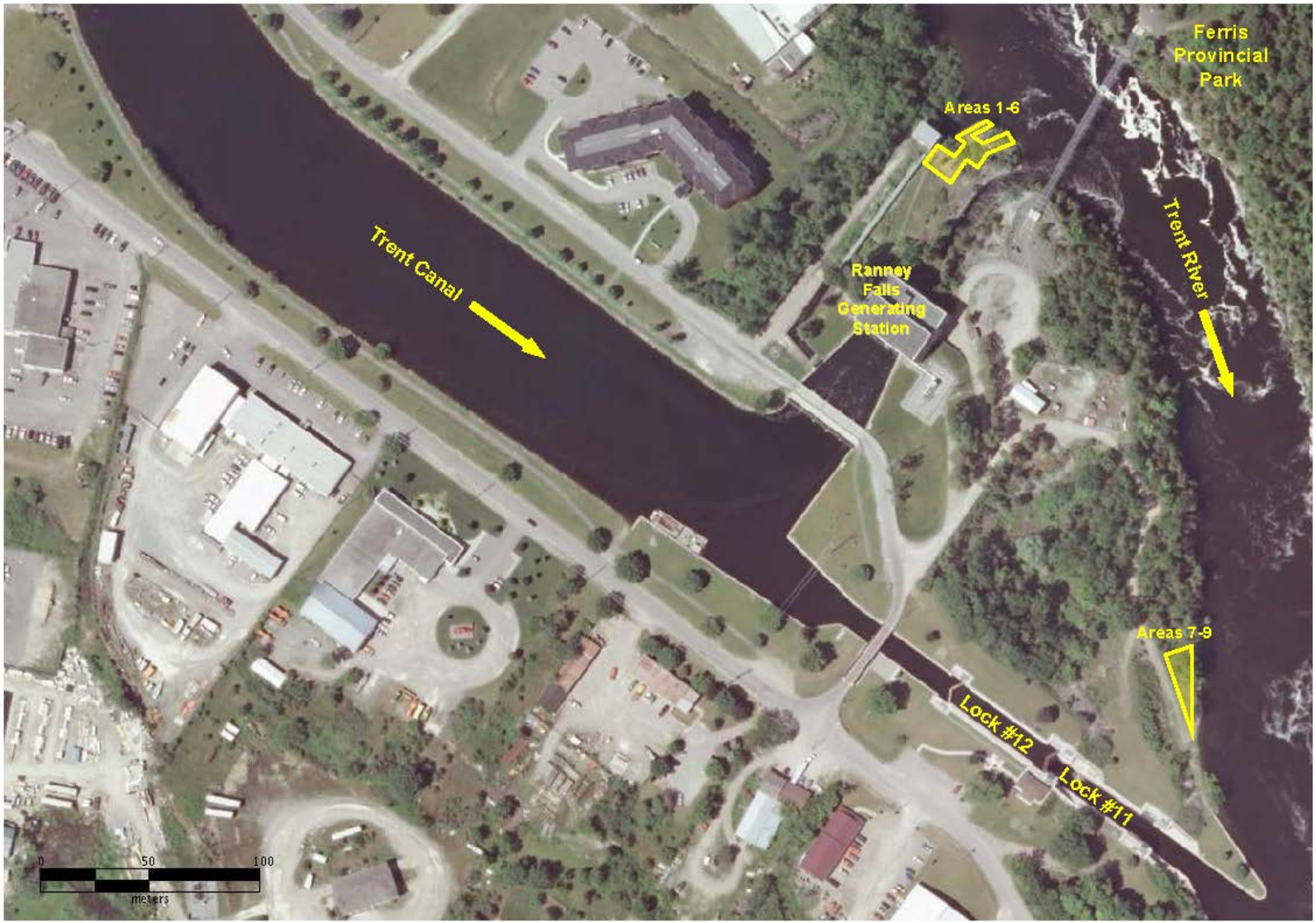


Figure 3-3 Areas 1 to 9 in relation to Ranney Falls Generating Station and Locks # 11 and 12

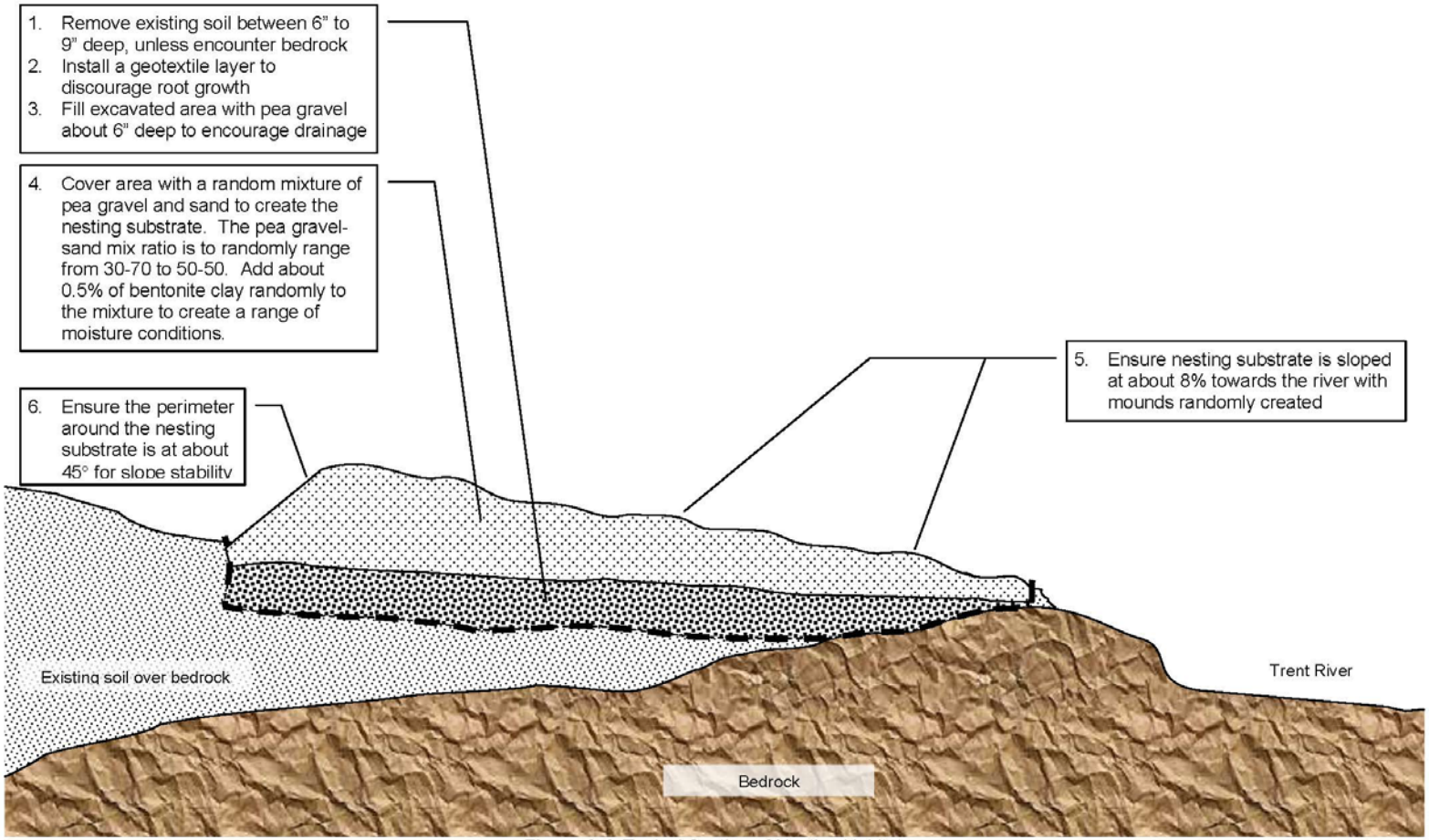


Figure 3-4 Typical Section of Nesting Habitat

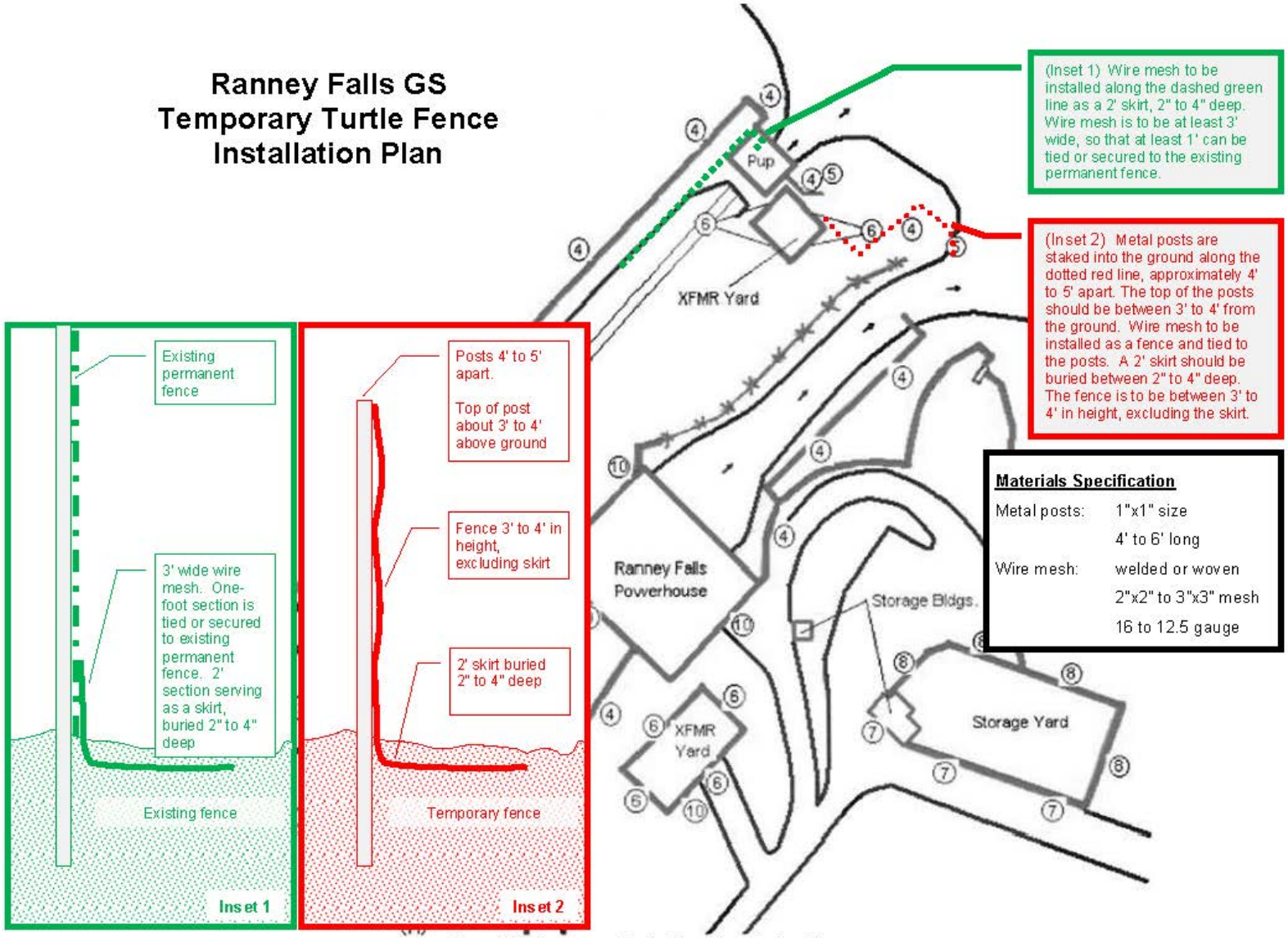


Figure 3-5 Temporary Turtle Fence Installation Plan