4 Issues, Data Gaps and Baseline Data Collection Program

4. Issues, Data Gaps and Baseline Data Collection Program

4.1 Issues, Resource Values and Interests

Environmental and social/socioeconomic issues, resource values, and interests associated with the North Bala Hydro Project were identified through the following procedures:

- application of MOE environmental screening criteria (Appendix B)
- communications with all relevant provincial and federal agencies, particularly MNR, MOE, DFO, CEA Agency, and Transport Canada (Marine)
- communications with the Corporation of the Township of Muskoka Lakes and District Municipality of Muskoka
- invitations to other stakeholders to provide input, i.e., those directly or potentially affected, as well as the general public and local First Nations.

The first step in identifying environmental and socioeconomic issues for this project involved applying the MOE screening criteria checklist to determine potential impacts to the resource values listed prior to mitigation. The results of this exercise are presented on the completed MOE screening criteria form included in Appendix B.

The issues (areas of concern and potential impact), identified through communications with government agencies were generally already identified through application of the MOE screening criteria checklist. Additional comments from government agencies are presented in Section 3.5.3.

Issues identified through other stakeholder consultation activities are presented in Section 3 (Tables 3.6 and 3.8).

Resource values considered important for this project are the environmental components listed in Table 1.1 (Section 1.7). These environmental components were assessed in terms of potential impacts from the proposed project and the results are summarized in Tables 5.4 and 6.1 (Sections 5 and 6).

4.2 Baseline Data Collection and Data Gaps

Initial baseline data collection activities focussed on gathering information on the existing natural, social and socioeconomic environment from local sources and government websites.

The results of this exercise indicated there were baseline data deficiencies in the following areas:

- site-specific information for the project study area on fish species, potential fish spawning habitat, locations and timing of spawning
- site-specific information for the project area on benthic invertebrate diversity and habitat
- site-specific information for the project area on vegetation in the project area potentially affected
- site-specific information for the project area on surface water quality.

4.3 Baseline Field Investigations to Fill Data Gaps

In consultation with MNR and DFO, baseline fisheries/aquatic habitat/field investigations were undertaken as follows:

- aquatic habitat assessment and electrofishing survey – September 2007
- benthic invertebrate survey – November 2007
- spring spawning surveys – spring 2008
- surface water quality – September and November 2007, May 2008
- dam flow/fish spawning velocity study – June 2009.

Complete details regarding the above baseline field investigations are included in the existing environmental section of this screening report (Sections 2.1.9 to 2.1.11).

The results of baseline field investigations to identify existing vegetation in the project area are presented in Section 2.1.7. The results of the baseline field investigations to characterize existing surface water quality are provided in Section 2.1.6.2.

5 Effects Assessment, Proposed Mitigation and Residual Effects During Project Construction

5. Effects Assessment, Proposed Mitigation and Residual Effects During Project Construction

This section describes the activities that will occur during construction of the project, as well as the anticipated environmental effects and mitigation measures to minimize/eliminate adverse effects. Any residual effects following implementation of mitigation are also identified. This information is also provided in a summary table at the end of this section.

5.1 Construction Activities (Sources of Effects)

Construction of the facility is anticipated to occur over an approximately 18-month period, commencing in fall 2010 following the annual cranberry festival, with full facility operations to commence in spring 2012 prior to the start of the summer tourist season. The construction sequence is shown in Figure 5.1. The following are the major activities involved in construction of the proposed hydropower facility:

- site preparation, including staging area/works yard, and settling pond(s)
- site clearing, overburden excavation and rough grading
- local access road construction, road maintenance and drainage
- blasting, rock excavation and disposal
- working platform installation in the intake area
- cofferdam construction in the tailrace area
- construction of intake, powerhouse and tailrace
- installation of switchyard and distribution line
- water and wastewater management during construction
- waste management
- site cleanup and rehabilitation.

Each of these sources of effects is described in more detail in the following sections.

5.1.1 Site Preparation Including Staging Area/Works Yard

Site preparation activities in the proposed intake and powerhouse areas will include clearing of trees, grubbing (e.g., removal of stumps, other embedded woody debris and topsoil), soil excavation and grading and blasting and mechanical excavation of bedrock. A works yard (approximately 25 x 25 m) will be established on Crown land east of Muskoka Road 169 in order to provide areas for storage of equipment/supplies/materials, construction facilities such as temporary trailers and washrooms, and a working area from which the contractor will operate. Access to the work areas will be restricted by fencing for the duration of construction. One or two small settling ponds (approximately 20 to 30 m^2) will also be required to settle out sediment from water pumped from excavations prior to discharge to a watercourse.

5.1.2 Site Clearing, Overburden Excavation and Rough Grading

The east side of Muskoka Road 169 is lightly vegetated and predominantly composed of paved parking facilities. Clearing in this area will consist mainly of removing overburden in the area of the proposed intake facilities. Based on drilling investigations, the depth of overburden in the area of the intake is approximately 0.54 m.

The west side of Muskoka Road 169 is partially forested. Approximately 1100 m^2 of area will require clearing for powerhouse construction. Drilling investigations in this area identified overburden depths of approximately 0.5 to 1.06 m. Approximately 500 m^2 of land area will require full removal of overburden in preparation for powerhouse construction. A further 400 m^2 of land will require grading to provide vehicular access to the powerhouse and allow for parking facilities.

The conveyance channel will not require any clearing of vegetation. As subterranean structures will need to be installed, a section of Muskoka Road 169 will be cut open and replaced during the construction process. Temporary traffic diversion will be provided to maintain traffic flow through the duration of the project.

5.1.3 Local Access Road Construction, Road Maintenance and Drainage

Due to the proximity of the site to Muskoka Road 169, limited roadways are required to be constructed as part of the project. Construction of the intake facilities on the east side of the highway will utilize the existing Bala Falls Road. A short access road will travel through an existing parking lot in the vicinity of the proposed intake. The new construction access will measure approximately 50 m in length.

New access will be established on the west side of Muskoka Road 169 to access the powerhouse area. Removal of the existing vehicular guardrail, clearing and grading will be required in this area to establish proper construction access. The proposed access road will measure approximately 30 m in length.

Construction roads are expected to be gravel roads and have routine maintenance throughout construction to ensure safe access. Regrading operations will take place as required. Dust control will be implemented to minimize airborne particulate due to use of the access roads.

Proper grading will be used on all access roads to ensure drainage is maintained.

5.1.4 Blasting, Rock Excavation and Disposal

Precision blasting operations conforming to CP Rail requirements will be used for the excavation of existing granite through the project site. Vibration monitoring equipment will be used to ensure that velocities do not exceed government regulation thresholds. Adequate steps to protect nearby heritage buildings will also be taken. A rock-fill working platform will be installed in the intake area to allow blasting operations to proceed (Figure 1.2). A cofferdam will be used downstream of the powerhouse/tailrace to allow for blasting operations in this area in the dry. All government regulations regarding blasting in and near watercourses will be followed.

Where possible, excavated rock will be used for shoreline protection in the vicinity of the site. All other rock will be disposed of in accordance with government regulations.

5.1.5 Upstream Working Platform Installation

A working platform will be installed within the upstream area (Figure 1.2) to allow excavation of the intake channel in dry conditions (beneath the working platform). The type of working platform used will be left to the discretion of the contractor but will comply with all relevant government regulations. It is anticipated that the upstream working platform will be constructed of large rock fill with an impervious outer liner to prevent water infiltration into the core of the structure.

5.1.6 Downstream Cofferdam Installation

A cofferdam will be installed around the powerhouse and tailrace area (Figure 1.2) to allow construction of these facilities under dry conditions. The type of cofferdam used will at the discretion of the contractor but will comply with all relevant government regulations. It is anticipated that the cofferdam will be constructed of rock fill with an impervious core outer liner to prevent water infiltration into the core of the structure.

5.1.7 Construction of Intake, Powerhouse and Tailrace

The intermediate conveyance channel will be constructed while taking advantage of the natural rock in the area. Rock plugs will be utilized both upstream and downstream of the site to maintain a dry working condition.

Precision blasting techniques will be used to remove rock between the powerhouse and intake. Temporary road access will be provided for local commuters during this phase of construction.

The cofferdam downstream of the project will be utilized to permit construction of the powerhouse and tailrace in the dry. Blasting will be required to remove rock from the site. Overblasting of the rock will be minimized to the farthest extent possible. Concrete will be placed in the excavated zones to form both intake and powerhouse.

Additional rock excavation will be required in the intake approach channel. This will be undertaken within the confines of the upstream working platform.

On completion of the concrete works and tailrace excavation, the downstream working platform will be completely removed from the watercourse and materials disposed of in accordance with government guidelines.

5.1.8 Installation of Switchyard and Distribution Line

The proposed transmission line is shown in Figure 1.2. It will consist of a buried 44-kV line between the powerhouse substation (which will be contained within the powerhouse itself) and the interconnection point with the existing 44-kV distribution line, located on the east side of Muskoka Road 169 (Figure 1.2).

5.1.9 Water Management During Construction

There will be no requirement for specific surface water management during construction. The North and South Bala dams will continue to be operated as per the existing MRWMP throughout the duration of the construction period.

Water from excavations will be directed to a settling pond prior to discharge into a watercourse. Runoff will be directed through sediment traps prior to discharge.

5.1.10 Waste Management

Management of excavated waste rock and soils is discussed in Section 5.2.1.

Management of industrial liquids to be used on site during the construction process (e.g., fuels, lubricants, hydraulic fluids, paints, sealants) is discussed in Section 5.2.6.2.

Management of solid and sewage wastes generated during construction (including domestic waste such as food and sanitary waste and construction waste such as material packaging and scrap material) are discussed in Section 5.3.12.

5.1.11 Site Cleanup and Rehabilitation

On completion of the construction phase of the project, the contractor will be required to rehabilitate the site. The purposes of site rehabilitation will be to minimize the potential for soil erosion, enhance the aesthetic appearance of the site and restore safe public access to the surrounding area. Rehabilitation will include removal of all construction materials and wastes, and the grading and revegetation of all exposed sites that may be prone to erosion. Where natural erosion protection measures may not be possible or practical, suitable physical erosion protection methods will be used.

Further to basic site rehabilitation, a plan is proposed for extensive landscaping to be undertaken in the area west of Muskoka Road 169, the details of which will be finalized during final design.

5.2 Potential Effects and Mitigation – Natural Environment

5.2.1 Geology

Construction activities will result in the blasting and excavation of approximately 13,500 m^3 of bedrock from the intake, powerhouse and tailrace areas (Table 5.1). Bedrock excavation will occur via blasting and/or mechanical breakup (e.g., hoe-ram).

Table 5.1 Bedrock Excavation Requirements

Location	Bedrock Excavation (m^3)
Intake	5,000
Powerhouse	3,200
Tailrace	5,300
Total	**13,500**

Local geological features are not known to exhibit any significant geological or landform characteristics. Design and implementation of the blasting program will be the responsibility of the contractor and must be conformed with NRCan and DFO blasting requirements.

Excavated rock will be reused on site to the greatest extent possible. Rock will be used during access road construction and upgrading, as riprap along the overflow dam abutments and as base material for construction laydown, switchyard and parking areas (see Section 5.2.6.6 for discussion regarding the potential impacts of reusing bedrock materials on site). Excavated rock pieces will also be used for the final landscaping of the area west of Muskoka Road 169.

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Rock will also be crushed for use as required. If disposal of rock is required, this is to be done in discussion with MNR and the local municipality.

5.2.2 *Soils*

An estimated 3400 m^3 of surficial soils are expected to be removed during excavation and site preparation (Table 5.2).

Table 5.2 Soil Excavation Requirements

Location	Soil Excavation (m^3)
Intake	1,000
Powerhouse	1,200
Tailrace	1,200
Total	3,400

All stripped and excavated soils will be stockpiled on site for storage until they are ready for use during site restoration activities or removed for off-site disposal. Excavated earth and organic materials will be reused on site in areas to be rehabilitated and revegetated following construction, to the greatest extent possible.

5.2.2.1 *Sediment and Erosion Control Plan*

In addition to excavation, surficial soils will also be disturbed throughout the construction site due to vegetation clearing, topsoil and subsoil stripping, grading and use of heavy machinery. Soil disturbance and stockpiling have the potential to increase erosion of soil due to the effects of water (rain, river flow) or wind. In order to mitigate this potential, a sediment and erosion control plan is proposed below which is to be supplemented by a sediment and erosion control plan drawing prepared by the proponent's engineer or contractor. Further, work will be restricted to identified areas in order to minimize the amount of soil disturbance occurring on site. The sediment and erosion control plan will include, but not be limited to the following measures:

- Minimizing the size of the cleared and disturbed areas at the construction site, particularly those adjacent to the watercourse.
- Phasing of construction to minimize the time that soils are exposed.
- Restricting work areas to minimize the overall amount of soil disturbance during construction.
- Providing an adequate supply of erosion control devices (e.g., geotextiles, revegetation materials) and sediment control devices (e.g., in-water silt barriers, silt fences, straw bales) to be provided on site to control erosion and sediment transport and respond to unexpected events
- Diverting work area runoff through vegetated areas or into properly designed and constructed sediment traps or a drainage collection system to ensure that exposed soils are not eroded. Runoff velocities in ditches or other drainage routes, or along slopes, to be kept low to minimize erosion potential. Runoff outfall locations to be protected with erosion resistant material, if required.

- Excavation and cofferdam dewatering activities will require pumping water from the work areas to a setting pond away from the watercourse. Pumping will require a PTTW if the rate is in excess of 50,000 L/d. Dewatering discharge will require a Certificate of Approval (CofA) for Industrial Sewage Works under Section 53 of the Ontario Water Resources Act (OWRA).
- Use of only clean materials (i.e., free of fine sediment) in water (e.g., cofferdam and working platform construction), or shoreline works (e.g., embankment riprapping).
- Grading disturbed slopes or stockpiles to a stable angle as soon as possible after disturbance to eliminate potential slumping.
- Revegetating or stabilizing exposed sites as soon as possible after they have been disturbed, using quick growing grasses or other vegetation. Where revegetation is not possible other erosion protection methods, such as riprapping, bioengineering, or erosion matting to be used.
- Stockpiling of excavated erodible material in suitable designated areas away from the river (i.e., outside the floodplain, away from drainage channels) and install silt fences around the stockpiles to limit the transport of sediment.
- Monitoring the tracking of mud onto local streets during construction. If mud on streets occurs, the contractor will be required to implement a system to prevent transfer of this material to local storm drains. This could potentially include wheel washing areas at the exit from the construction site or end-of-day street sweeping to remove accumulated materials from local streets.

Implementation of these mitigation measures is anticipated to be effective in minimizing soil erosion and sedimentation as well as off-site transport from the construction area. Monitoring is to be conducted throughout the construction period to assess the effectiveness of mitigation measures and remedial requirements (see Section 10 – Environmental Monitoring).

5.2.2.2 Effects on Soil Quality due to Stockpiling

The following mitigation measures are to be implemented by the contractor to minimize adverse effects on soil (e.g., mixing, compaction, etc) during the construction period:

- topsoil and subsoil is to be stockpiled separately to avoid mixing
- the duration of stockpiling is to be minimized to the greatest extent possible through appropriate phasing of construction
- the height of topsoil stockpiles should be limited to the greatest extent possible, with heights of <1 m being preferred. Stockpiling to heights >1 m may result in adverse effects on the health of the soils at the base of the stockpile (Harris and Birch, 1989; cited in Strohmayer, 1999).

Mitigation is anticipated to be effective in minimizing the adverse impacts on soil, although some minor deterioration of the quality of stockpiled top soils will likely occur. This deterioration may have an impact on the success of site revegetation efforts. For this reason, monitoring is to be conducted following site restoration to ensure that adequate revegetation has occurred to prevent long-term erosion concerns (see Section 10.3). Remedial action will be undertaken as deemed necessary to ensure that revegetation is successful in preventing long-term erosion from the areas disturbed during construction.

5.2.2.3 Effects on Soil Quality/Composition Due to Temporary Additions of Gravel

If a gravel or granular base is to be added to temporary work areas or temporary access roads, it should be underlain with a layer of geotextile fabric to prevent mixing of the gravel/granular with the underlying soil. In this way, upon removal of the temporary facilities, there will be no mixing of gravel/granular which could affect soil structure and/or texture and other soil dependant processes (infiltration of surface water, vegetation growth).

5.2.2.4 Riverbank Stability

Riverbanks in the proposed intake and powerhouse/tailrace area will be disturbed during construction. However, the tailrace area will be constructed behind a cofferdam. Blasting of the intake plug will occur outside critical fish spawning and recreational periods and will be conducted in accordance with regulatory agency guidelines. Riverbank stability must be ensured though compliance with the sediment and erosion control plan (Section 5.2.2.1). Monitoring of riverbanks will be conducted throughout the construction period to assess stability (see Section 10 – Environmental Monitoring). Any bank areas disturbed during construction must be stabilized as quickly as possible with native plant material or other bioengineering/structural methods (e.g., riprap).

5.2.2.5 Soil Compaction

Soil compaction may result from the use of heavy equipment, stockpiling of heavy materials (e.g., excavated rock) or additional of granular fill to temporary work areas. Soil compaction occurs when heavy equipment or material causes the soil particles to be pushed together, thereby increasing soil density and reducing the pore space within the soil structure (DeJong-Hughes et. al., 2001). Excessive soil compaction can result in inhibited vegetation growth by impeding root penetration within the soil, reducing aeration, and altering moisture intake (i.e., decreased infiltration and due to decreased pore space within the soil structure) (DeJong-Hughes et. al., 2001). Decreased water infiltration into the soil could also potentially result in an increase in surface runoff which could increase soil erosion.

In order to minimize the amount of compaction that occurs around the construction site, all equipment and stockpiles must remain within identified work areas. Restoration efforts (e.g., discing or other soil loosening methods) will be undertaken as required to prevent significant long-term impacts due to excessive amounts of compaction. No significant long-term change in soil structure is anticipated following implementation of site restoration and associated mitigation to remediate significantly compacted areas, although minor amounts of compaction may persist in localized areas.

No long-term change in native soil texture (i.e., the relative proportion of different grain sizes within the soil matrix) within the construction area is anticipated to occur.

5.2.2.6 *Soil Contamination*

Soil contamination could potentially result from accidental spills[1] (e.g., due to improper handling and storage of chemicals, or due to unanticipated events such as equipment leaks) of pollutants[2] such as fuels, lubricants, paints, solvents, form oils and other chemicals associated with the construction process. The contractor will be required to have a spill prevention and contingency plan in place prior to commencement of construction activities at the site (Section 10.1). The plan will specify roles, responsibilities and appropriate procedures for chemical handling, spill response, reporting and cleanup, with reference to relevant legislative requirements.

5.2.3 Air Quality

5.2.3.1 *Fugitive Dust*

Minor impacts to local air quality could occur during the construction phase due to emissions of fugitive dust[3]. Dust may be mobilized due to vehicular traffic, heavy machinery use, drilling, blasting, and soil moving activities. Mitigation measures must be used, as required, to control dust including

- use of dust suppression on exposed areas including, stockpiles and works/laydown areas
- if required, dust suppression would be with water or non-chloride based chemical dust suppressants. If water is withdrawn from the river for dust suppression purposes at a rate >50,000 L/d, a PTTW from the MOE will be required
- hard surfacing of heavy machinery working pads and parking areas
- phased construction, where possible, to limit the amount of time soils are exposed
- earth-moving works not to be conducted during excessively windy weather. Stockpiles to be worked (e.g., loaded/unloaded) from the downwind side to minimize wind erosion
- stockpiles and other disturbed areas to be stabilized as necessary (e.g., tarped, mulched, graded, revegetated or watered to create a hard surface crust) to reduce/prevent erosion and escape of fugitive dust
- blast mats, utilized during blasting activities (if required) to control fly rock, will also help to control the release of airborne dust
- dust curtains to be used on loaded dump trucks delivering dust-prone materials to and from off site
- workers to utilize appropriate personal protective equipment (e.g., masks, safety goggles).

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[1] A *spill* is defined in the Ontario Environmental Protection Act as "a discharge into the natural environment, from or out of a structure, vehicle or other container, that is abnormal in quality or quantity in light of all the circumstances of the discharge: (MOE, 2007).

[2] A *pollutant* is defined in the Ontario Environmental Protection Act as a "contaminant other than heat, sound, vibration or radiation", where a *contaminant* is defined as "any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that causes or may cause an adverse effect" (MOE, 2007).

[3] Fugitive dust is defined as "any particulate matter becoming airborne, other than being emitted from an exhaust stack, directly or indirectly as a result of human activity" (Cheminfo Services Inc., 2005).

5.2.3.2 Vehicle Pollutants

A variety of construction, haulage and personnel vehicles will be used on site during the construction period. Use of such equipment will result in the release of combustion by-products.

The relatively small size of the workforce and the corresponding small increase in airborne contaminants anticipated due to vehicle/equipment exhaust levels will not result in any significant change in local or regional air quality. Adverse impacts on air quality will be temporary, very low in magnitude and localized in the construction area. As a best management practice (BMP), vehicles should be run only when necessary and exhaust equipment (e.g., pollution control devices) inspected regularly. The contractor is encouraged to limit idling of construction equipment to periods of no longer than 5 minutes, although exceptions will occur when idling is required to provide heating or to avoid cold starting.

5.2.4 Groundwater

It is possible that some infiltration of groundwater into the intake, powerhouse and tailrace excavations may occur, resulting in temporary, localized alterations in groundwater flow and level, particularly in the powerhouse area where artesian groundwater pressures were found during the geotechnical drilling investigations. Grouting will be undertaken prior to powerhouse excavation in order to minimize groundwater leakage due to the artesian conditions. Any groundwater entering project excavations would be pumped to a settling pond prior to discharge to the river. Appropriate approvals [e.g., MOE Certificate of Approval for Industrial Sewage and possibly a Permit to Take Water (PTTW) (if volumes are $>$50,000 L/d)] would be obtained prior to implementation of such an activity. Grouting and pumping of groundwater may have minor impacts on localized groundwater flow in the vicinity of the project works. However, it is not anticipated that this will have an impact on the overall groundwater resources in the local area.

5.2.5 Hydrology (Flow, Water Levels, Hydraulics)

There will be no change to hydrology in the Muskoka River (Moon River) during the construction period. The North and South Dams will continue to be operated as per the existing MRWMP throughout the duration of construction.

Construction activities will result in minor temporary changes to the local hydraulics (i.e., flow velocities and vectors) of the Muskoka River within the project area. Changes in these variables will be due to construction of the upstream working platform and downstream cofferdam, which will affect normal flow hydraulics. The upstream working platform will affect hydraulics within the adjacent river channel since the cross sectional area of the channel will be decreased while the working platform is in place. This will result in a temporary increase in flow velocity adjacent to the working platform, although normal hydraulic conditions will resume once flow passes the platform. Hydraulics will also be affected adjacent to the downstream cofferdam. The periphery of this area currently experiences direct flow on either side due to the outflows from both dams, under high flow conditions. The interior of the cofferdam consists of a low velocity gyre during high flow conditions. During low flow conditions, the area resembles a lacustrine like environment with low flow velocity.

The cofferdam and working platform will both be designed to accommodate the 1:20-yr spring flood flow of approximately 362 m^3/s without overtopping. The downstream cofferdam will be in place from December 2009 to February 2011.

Changes in local hydrology (i.e., surface runoff and water storage patterns), may also result from vegetation clearing, land grading and the increase in impervious surfaces at facilities, particularly in the proposed powerhouse working area. These activities have the potential to somewhat increase the rate and quantity of surface runoff to the river. Mitigation measures (rock-fill check dams, hay bales, in-line sediment traps, etc) will be used to address these potential impacts. However, given the very small affected area, these potential changes to hydrology are considered insignificant.

5.2.6 *Surface Water Quality*

During construction of the facility and associated components, there is potential to adversely affect surface water quality, through increased turbidity, release of sediments into the watercourse, and the potential for spills of fuels, lubricants, cement and other hazardous materials.

5.2.6.1 *Sediment in Watercourses*

Construction activities that could increase the rate and/or quantity of sediment transported to or within the watercourse include

- clearing and removal of vegetation, soil and subsoil at the intake and powerhouse areas
- stockpiling of excavated topsoil and subsoil
- cofferdam/working platform installation and removal at the intake and tailrace areas
- blasting (if required) and excavation during construction of the intake channel, powerhouse and tailrace channel
- tracking of mud onto local streets.

With regard to in-water construction works, the following mitigation measures are to be employed:

- avoid fish spawning/incubation period (see Section 5.2.7.1)
- use only clean material for the rock-fill working platform and cofferdam (e.g. pre-tested, washed or otherwise certified as being free of fine sediment and acid-generating constituents)
- install the cofferdam and rock-fill working platform as quickly as possible such that the amount of rock-fill aggregate being washed downstream is minimized
- use of impermeable geotextile membranes in cofferdams is preferable to use of silt, clay, till or other loose materials such as loam, organic soil and vegetation in order to prevent seepage of water through the cofferdam or downstream transport of fill materials during cofferdam installation
- spill response and emergency equipment and material (e.g., fill for cofferdams, gravel bags, oil absorbents) should be kept in close proximity to the cofferdam, such that in the event of an unanticipated cofferdam leak, repairs can be conducted in an expedient manner
- all working platform and cofferdam material should be removed from the riverbed and reused elsewhere or properly disposed of upon decommissioning of the cofferdam. No material is to be discarded within the watercourse or on the riverbanks.

The contract documents will reference and/or incorporate environmental protection standards for construction work in and along water bodies, including

- Ontario Provincial Standard Specifications (OPSS) 577 – Construction Specification for Temporary Erosion and Sediment Control Measures
- OPSS 182 – General Specification for Environmental Protection for Construction in Waterbodies and on Waterbody Banks
- OPSS 517 – Construction Specification for Dewatering
- OPSS 518 – Construction Specification for Control of Water from Dewatering Operations.

It is anticipated that conscientious implementation of these mitigation measures in conjunction with diligent construction monitoring will ensure effectiveness of the sediment and erosion control plan, and will minimize adverse effects on local surface water quality. However, it is unlikely that mitigation will be 100% effective for the entire duration of the construction period, so the possibility of some short term, low magnitude releases of sediment is likely. It will be the responsibility of the contractor to monitor local surface water quality conditions during construction and take appropriate actions if high levels of turbidity are observed (see Section 10.2 – Environmental Monitoring during Construction). Work activities may need to stop until corrective measures can be taken to control adverse effects.

5.2.6.2 Fuels, Lubricants and Other Hazardous Materials

Activities during the construction phase that could potentially result in transport of these materials to the watercourse include

- refuelling and maintenance (e.g., oiling, addition of hydraulic fluid) of equipment (e.g., accidental spills, improper disposal of waste fluids)
- use of equipment containing fuels, lubricants or other materials in the vicinity of watercourse (e.g., leakage from machinery, washing of materials from surface of machinery)
- storage of hazardous materials, including cement (e.g., accidental spills, leaching and/or runoff of materials)
- use of cement adjacent to watercourses.

Mitigation measures to be followed by the contractor during construction to minimize the potential for adverse environmental impacts associated with the storage, use and disposal of fuels, lubricants and other potentially environmentally hazardous materials are as follows:

- Establish designated refuelling and maintenance areas at least 5 m from watercourses and away from drainage ditches, channels or other wet areas. The refueling of small equipment such as Airtrack Drillers and compressors is to be undertaken on site with a small service truck equipped with a spill kit.
- Locate designated hazardous material storage areas at least 10 m away from watercourses, for all materials to be stored outside. Storage areas are to be above ground in double-walled tanks or enclosed by an impervious berm capable of holding the entire volume of the stored material, as well as some additional volume of rainwater. Bermed areas are to be pumped out as required to remove accumulated precipitation. Pumped liquids are to be properly disposed of by a licensed

hauler. Bermed areas are to be monitored throughout the construction period to ensure their integrity.

- Only machinery/equipment that is clean and well maintained (e.g., no leaks or fluid residue on surfaces) is to operate near watercourses or drainage areas. No equipment is to be operated directly within watercourses, except with MNR, MOE or DFO approval of the instream works. Backhoe buckets are to be cleaned prior to use in the watercourse. No washing of equipment is to take place within or near watercourses.
- Provide adequate spill clean-up materials/equipment (e.g., absorbents) on site. The contractor must prepare a spill prevention and contingency plan prior to commencement of work at the site.
- Cement is to be stored indoors, where possible. If outdoors, stored cement should be covered with waterproof sheeting and raised from the ground surface (e.g., on wooden pallets) to ensure no contact with surface water runoff. Empty cement bags are to be collected and spills of cement or concrete cleaned up as appropriate. Wastewater arising from cement/concrete work is to be collected and disposed of off site, or properly treated before release to the environment. Wash water from cement trucks is to be contained and disposed of or treated at an approved sewage works designed for that purpose, as per the requirements of the OWRA or the Ontario Building Code.
- Conduct all concrete work in dewatered areas. Dewatered work areas will not be flooded until concrete structures have adequately cured. Concrete spillage during powerhouse construction is to be contained, cleaned up and removed to an appropriate disposal area.
- Any accidental spills likely to cause the following impacts are to be reported immediately to the Ontario Spills Action Centre (1-800-268-6060):
  - impairment to the quality of the natural environment - air, water, or land
  - injury or damage to property or animal life
  - adverse health effects
  - safety risk
  - making property, plant, or animal life unfit for use
  - loss of enjoyment of normal use of property
  - interference with the normal conduct of business.

  (Source: MOE, 2007).
- No discharge of any fuels, lubricants and other hazardous materials to local storm sewers to be allowed.

It is anticipated that implementation of these mitigation measures in conjunction with construction monitoring will be effective in reducing the potential for spills. However, as with all construction projects where potentially contaminating fluids are used, the potential for accidents and other unforeseen events possibly leading to a spill will remain throughout the duration of the construction period. These mitigation measures are anticipated to be effective in minimizing the magnitude, geographic extent and duration of any spills that do occur.

5.2.6.3 Construction Debris

Construction waste such as metal debris, sawdust, concrete cuttings/debris and other fine waste materials could potentially be transported into surface waters. In order to prevent this occurrence, the contractor is required to adequately contain all debris materials within the construction area, and remove all debris as soon as possible to prevent movement into watercourses or the surrounding environment.

5.2.6.4 Sewage Effluent

No sewage effluent (e.g., human waste) is to be released to the environment during the construction process. All such waste is to be retained in aboveground holding tanks and transported off site by an approved hauler for disposal/treatment at an approved facility.

5.2.6.5 Treated Wood

No treated wood is anticipated to be used in or near water during construction. No wooden penstocks, wooden bridges or wooden in-water structures will be required. If treated wood is used on site during construction, the following mitigation is recommended to prevent leaching of toxic materials to the surrounding watercourse:

- use non-arsenic, non-chrome based treated wood in accordance with Canadian Standards Association (CSA) standards.
- clean up sawdust and wood debris from any treated wood immediately after generation and dispose at an approved location
- do not burn pressure-treated wood at site
- seal pressure-treated wood with paint, stain or sealant.

5.2.6.6 Acid Rock Drainage

Excavated rock will be reused around the construction site where possible (e.g., concrete, riprap). When rock containing sulphide and elemental sulphur is exposed to the weathering effects of oxygen and water, the water running off the rock could potentially have a lowered pH. This is termed 'Acid Rock Drainage' (ARD). If ARD were to occur, it could potentially have impacts on the water quality of receiving water bodies, resulting in more acidic conditions.

The proposed site is located within an area of Precambrian rock consisting primarily of granitic gneiss with a composition of quartz, feldspar and hornblende. The potential for acid rock drainage from this rock type is generally low since these minerals are alumino-silicate based and typically do not contribute to forming acid conditions. However, as with all rock masses, given the variability with depth and surface extent there may be small pockets of slightly different mineralization (e.g., sulphides), which may be leachable and have a very small contribution to forming acidic conditions.

To determine this, samples of bedrock from the excavations will be collected and submitted for a modified acid base accounting (ABA) test on the start of construction. This will confirm whether the rock is appropriate for reuse on the construction site.

5.2.7 *Aquatic Biota*

During the construction phase, impacts to aquatic biota could potentially include

- physiological or behavioural impacts caused by adverse water quality due to adverse levels of suspended sediment, waste debris or toxic chemicals
- disturbance of biota due to in-stream construction including working platform installation/ removal, rock plug removal and intake approach channel excavation
- physiological impacts associated with blasting in or near watercourses.

Mitigation measures to address surface water quality issues were previously discussed in Section 5.2.6. It is anticipated that implementation of appropriate mitigation (as documented in this EA, in contract specifications and as conditions of permits and approvals) will be effective in preventing or minimizing impacts on aquatic biota due to surface water quality impacts (e.g., increased turbidity or spills/leaks). Monitoring proposed throughout the construction period (Section 10.2) will verify whether mitigation measures are being implemented as specified and are having the desired effect and identify any unanticipated impacts for mitigation.

5.2.7.1 In-stream Construction

In-stream construction activities (e.g., cofferdam/working platform placement and removal, intake approach channel excavation) have the potential to affect aquatic biota (fish, invertebrates) by temporary disturbance of habitat, by the creation of barriers to movement, or by impacting habitat suitability during sensitive life stages (e.g., addition of fill over incubating eggs). MNR's Parry Sound District timing restrictions for in-stream construction activities state that no in-water work shall be conducted from April 1 to July 15 in order to protect warm-water species reproduction (i.e., spawning, egg incubation, and immediate post hatch fry development) in the Muskoka River (MNR, 2001). This timing restriction will serve to protect the reproductive period of walleye, smallmouth bass, northern pike, white sucker and other forage species within the study area. As no impacts to the water level of Lake Muskoka will occur due to construction, no impact on coldwater species (e.g. lake trout) in the lake is anticipated. Cold-water species in the lake are highly unlikely to utilize the area at the proposed intake for reproductive purposes, so the coldwater fish community timing restriction should not apply. Therefore, in-water works (e.g., installation and removal of cofferdam and working platform, removal of rock plugs, intake approach channel excavation) are scheduled between July 16 and March 31. Implementation of these measures will ensure that there are no net adverse effects on the reproductive process due to disturbance of aquatic biota associated with these activities. Monitoring is proposed throughout the construction period to verify that mitigation measures are implemented as specified, are having the desired effect, and that there are no unanticipated impacts.

5.2.7.2 Blasting

Blasting is anticipated for the powerhouse, tailrace and intake working areas. Blasting in the intake area will be undertaken by inserting blast charges down through the fill of the working platform, hence, blasting in this area will not be "in water". Blasting in the tailrace area will be undertaken within the confines of the downstream cofferdam. Blasting will be undertaken by a licensed blasting contractor, with experience in blasting adjacent to fisheries waters.

Blasting in and around water has the potential to result in disturbance, injury or death to aquatic biota (including incubating eggs), or cause adverse effects to aquatic habitat, including impacts on water quality (Wright and Hopky, 1998). Therefore, in order to protect fish and fish habitat, all blasting is to be conducted in accordance with the *Guidelines for the Use of Explosives in or near Canadian Fisheries Waters* (Wright and Hopky, 1998). These guidelines specify that

- no explosive should be used in or near fish habitat that could produce an instantaneous pressure change greater than 100 kPa in the swim bladder of a fish (appropriate setback distances or charge burial depths are specified in the Guidelines to ensure this is satisfied)
- no explosive should be detonated if it is likely to produce a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation (i.e., during the MNR in-water works timing restriction period of April 1 to July 15)
- no ammonium nitrate fuel oil mixtures should be used in or near water, as this could potentially result in surface water quality impairment.

To ensure that these requirements are satisfied, the project contract documents must note that the Contractor will be required to contact DFO to determine applicable approval requirements under the federal Fisheries Act. Monitoring will be conducted throughout the construction period to verify that mitigation measures are implemented as specified and are having the desired effect.

5.2.8 *Aquatic Habitat*

During the construction phase, impacts to aquatic habitat may result from

- increased erosion and/or transport and deposition of fine sediment into watercourses
- in-stream construction work at the facility (i.e., cofferdam and working platform placement/ removal, intake and tailrace channel excavation).

Mitigation measures to address potential impacts of sediment/water quality issues were previously discussed in Section 5.2.6. It is anticipated that implementation of appropriate mitigation, as identified in this section, will prevent or minimize impacts on aquatic habitat due to construction site erosion. Monitoring is proposed throughout the construction period (Section 10.2) to verify that mitigation measures are implemented as specified and are having the desired effect and that no unanticipated impacts are occurring.

Potential effects due to construction of instream structures (i.e., cofferdam/working platform, intake, tailrace) and alterations in flow hydraulics during construction are discussed in the following sections.

5.2.8.1 *In-Stream Structures and Construction*

Construction of temporary and permanent instream structures has the potential to result in an adverse impact on aquatic habitat due to loss of habitat area and/or alteration of habitat characteristics. Temporary structures (i.e., cofferdam and working platform) and associated dewatering result in a temporary loss of aquatic habitat due to the loss of wetted surface area beneath the structure footprint and within the dewatered area. Habitat is restored once the structure is removed from the watercourse and the dewatered area is reflooded.

Permanent loss of habitat can result from construction of instream structures with a footprint that occupies currently wetted habitat area, such that, following construction, the habitat will no longer be wetted. Permanent loss of habitat associated with this project will be minimal (5 m^3) since only the downstream end of the powerhouse will be situated in habitat that is currently wetted when water levels in Lake Muskoka and the Bala Reach are at the top of their normal operating zone.

Permanent alteration of aquatic habitat will occur in the intake and tailrace areas due to excavation (widening, deepening) and lining with erosion resistant material (if required). However, since intake excavation will occur at least partially in an existing terrestrial area, some increase in wetted habitat in this area will also occur.

The impacts of temporary and permanent structures on aquatic habitat at the proposed facility during the construction process are discussed in the following sections. Affected areas are depicted in Figure 5.2.

5.2.8.2 Temporary Impacts

Intake Approach Channel Working Platform
The proposed working platform area at the intake location is depicted in Figure 5.2. The working platform, which will be constructed of clean rock fill, will occupy an overall footprint of 906 m^2 at the high water mark of Lake Muskoka (i.e., below elevation 225.97 m). It is anticipated that the working platform will be in place from July 2011 to February 2012 while excavation of the intake approach channel is completed.

A portion of the outside edge of the working platform will remain wetted at the high water mark (240 m^2), but this habitat will be temporarily altered due to working platform fill placement (i.e., it will be shallower with substrate consisting of the rocky face of the working platform). The remainder of the working platform area (666 m^2) will cause a temporary loss of aquatic habitat since it will not be accessible by fish and benthic invertebrates during the period the working platform is in place (July 2011 to February 2012).

The existing function of the aquatic habitat that will be lost/altered by working platform construction and dewatering is predominantly residence and foraging habitat for a variety of fish species including smallmouth bass, pumpkinseed, rock bass and likely a range of common baitfish species. Pumpkinseed and rock bass were captured along the shoreline immediately downstream from the intake area in September 2007. An anecdotal report of smallmouth bass residing in the area was received from a local business owner. Rainbow smelt were also observed accumulating in the area in spring 2008, likely in preparation for spawning. Larger fish species such as smallmouth bass, northern pike and walleye may reside and/or forage in the deeper areas in the channel, which are in the order of 6 to 8 m deep. The area consists of predominantly exposed bedrock (occupying 60% of the substrate surface) with rocky material including boulders (20%), cobble (10%) and gravel (10%), scattered over the bedrock. The CPUE of fish in the littoral zone near the proposed intake area was the lower than within the rapids downstream from the North and South Bala Dams as well as in the proposed tailrace area in September 2007 (see Section 2.1.11). In addition, benthic invertebrate sampling in the littoral zone near the proposed intake in November 2007 found a relatively low density of common benthic species, compared to fast water environments at the base of the North and South Falls (see Section 2.1.12).

The area may provide spawning habitat for rainbow smelt, spawning and nursery habitat for sunfish species, and foraging and residence habitat for a variety of fish and benthic invertebrate species. However, adjacent areas that will be undisturbed by construction likely provide similar functions. Therefore, although fish will be restricted from utilizing the area during the construction period, the function provided by the habitat that will be temporarily lost will be provided by habitat throughout adjacent areas that will be unaffected by construction. The working platform will not be in place during the rainbow smelt and sunfish spawning periods, therefore, there will be no effects on reproduction of these species. The loss/alteration of habitat due to working platform construction at the tailrace is anticipated to have a minor temporary impact on local fish that directly utilize the area for foraging and residence, but no long-term impact on productivity is anticipated to occur. Therefore, no specific mitigation measures are being proposed to mitigate the short-term impacts on aquatic habitat productivity due to the temporary installation of the working platform.

Some of the area will be restored to its original condition following removal of the working platform and associated re-watering (656 m^2), although the remainder (250 m^2) will be permanently altered by intake channel excavation (see Section 5.2.8.3 regarding permanent alterations).

The working platform structure will alter local flow hydraulics in the vicinity of the structure during the time that it is in place. However, it is not anticipated that the presence of the working platform will have any effect on flow hydraulics (i.e., velocity and vector) downstream from the North Bala Dam.

Tailrace Channel Cofferdam

The proposed cofferdam area at the tailrace location is depicted in Figure 5.2. The cofferdam (which will be constructed of clean rock fill) and associated dewatered area, will occupy an overall footprint of 1491 m^2 at the high water mark of Bala Reach (i.e., below elevation 219.50 m). It is anticipated that the cofferdam will be in place from December 2010 to February 2012 while construction of the tailrace and powerhouse is completed.

The cofferdam will be constructed in water up to 5.5 m deep (at the normal high water mark). A portion of the outside edge of the cofferdam will remain wetted at the high water mark (326 m^2), but this habitat will be temporarily altered due to cofferdam fill placement (i.e., it will be shallower with substrate consisting of the rocky face of the cofferdam). The remainder of the cofferdam area (1165 m^2) will incur a temporary loss of aquatic habitat since it will not be accessible by fish and benthic invertebrates during the period the cofferdam is in place (December 2010 to February 2012).

The existing function of the fish habitat that will be lost/altered by cofferdam installation and dewatering is predominantly residence and foraging habitat for a variety of fish species including YOY smallmouth bass, pumpkinseed, log perch and a number of cyprinids, all of which were captured in shallow littoral zone areas in September 2007. Larger fish species such as smallmouth bass, northern pike and walleye may reside and/or forage in the deeper areas at the downstream end of the tailrace, which are on the order of 4 to 5 m deep. The area consists of a range of rocky material [predominantly cobble (30%), gravel (20%) and boulder (10%)] over a shallow layer of sand with underlying and exposed bedrock (40%) throughout the area. The CPUE of fish in the proposed littoral zone of the proposed tailrace area was lower than the rapids downstream from the North and South Bala Dams but higher than in the vicinity of the proposed intake area in September 2007 (see Section 2.1.11). In addition, benthic invertebrate sampling in the littoral zone of the proposed tailrace in November 2007 found a relatively low density of common benthic species, compared to higher invertebrate density in fast water environments at the base of the North and South Falls (see Section 2.1.12).

The area does not appear to provide critical spawning, nursery or foraging habitat, but is utilized by a variety of fish and benthic invertebrate species. Adjacent areas that will be undisturbed by construction likely provide similar functions. Therefore, although fish will be restricted from utilizing the area during the construction period, the function provided by the habitat that will be temporarily lost will be provided by habitat throughout adjacent areas that will be unaffected by construction. Therefore, the loss/alteration of habitat due to cofferdam installation at the tailrace is anticipated to have a minor temporary impact on local fish that directly utilize the area for foraging and residence, but no long-term impact on productivity is anticipated to occur. Therefore, no specific mitigation measures are being proposed to mitigate the short-term impacts on aquatic habitat productivity due to the temporary installation of the working platform.

Some of the area will be restored to its original condition following removal of the cofferdam and associated re-watering (1296 m^2), although the remainder (190 m^2) will be permanently altered by tailrace channel excavation (see Section 5.2.8.3 regarding permanent alterations).

The cofferdam structure will alter local flow hydraulics in the vicinity of the structure during the time that it is in place. The placement of the cofferdam will result in flows downstream from the north falls being somewhat straighter (i.e., shifted slightly to the north with less eddies into the proposed cofferdam area). However, it is not anticipated that the presence of the cofferdam will have any effect on flow hydraulics (i.e., velocity and vector) at the known walleye spawning areas at the base of the North and South Dam flow channels.

Summary of Temporary Impacts

Installation of the upstream working platform and downstream cofferdam will result in the temporary loss of approximately 2156 m^2 of aquatic habitat (in the dewatered areas) and the temporary alteration of approximately 565 m^2 of aquatic habitat (in the wetted side slopes of the structures) for a total effected area of 2721 m^2. Alteration/loss of habitat in the intake area will occur from July 2011 to February 2012 and alteration/loss of habitat in the tailrace area will occur from December 2010 to February 2012. This temporary loss/alteration of habitat will result in disruption of normal habitat use by the local fish communities of the area. However, it is not anticipated that any critical spawning, nursery or foraging habitat will be affected and the affected population will be capable of utilizing similar undisturbed habitats in nearby locations. Habitat will be restored following removal of the temporary structures. No specific mitigation measures are being proposed to mitigate the short-term impacts on aquatic habitat productivity due to the temporary installation of the cofferdam and working platform.

5.2.8.3 Permanent Impacts

Intake Channel

The proposed intake channel is depicted in Figure 5.2. The intake channel will be excavated through the working platform. The area that will be permanently affected by the excavation will be approximately 430 m^2, of which approximately 247 m^2 will be within the high water mark of Lake Muskoka (225.97 m) and the remainder (183 m^2) will be on currently terrestrial lands. It is anticipated that the majority of the intake will be excavated within or to bedrock. The intake channel will consist of nearly vertical side walls and relatively flat invert to ensure that suitable hydraulic flow conditions are present in the intake area.

Therefore, it is anticipated that intake construction will result in an alteration of aquatic habitat. Overall, the intake channel will not result in any loss of surface area of aquatic habitat, but the habitat conditions in the existing wetted area will be significantly altered. The alteration will predominantly result from the removal of rocky surface material (cobble, boulder) that will result in an overall decrease in habitat heterogeneity in the intake channel. The resulting channel will be relatively flat and will provide less productive habitat with less cover and structure for fish and benthic invertebrates. Therefore, it is anticipated that aquatic habitat productivity in the intake channel will be decreased over a surface area of 247 m^2.

However, approximately 183 m^2 of the intake channel will be constructed on currently terrestrial lands that do not provide any fish habitat (i.e., above the Lake Muskoka high water mark elevation of 225.97 m). This will create additional fish habitat although it is anticipated that the habitat it will provide will be lower productivity than existing habitat that will be altered by the intake due to decreased habitat structure in the intake channel. Therefore, for the purposes of determining mitigation requirements due to the alteration of habitat associated with intake approach channel construction, new habitat created by the intake channel has been assumed to have no productive value.

Tailrace Channel

The proposed tailrace channel is depicted in Figure 5.2. The tailrace channel will be excavated in the dry behind the tailrace cofferdam. The area that will be affected by the excavation will be approximately 190 m^2, all of which will be within the high water mark of the Bala Reach (219.50 m). An additional 5 m^2 of aquatic habitat will be lost due to powerhouse construction (Figure 5.2). It is anticipated that the majority of the tailrace will be excavated within or to bedrock, although the downstream end of the tailrace, which will be graded to match surrounding channel bed elevations, will likely only be excavated in surficial bed materials (boulder, cobble, sand over bedrock). The tailrace channel will consist of nearly vertical side walls and relatively flat invert to ensure that suitable hydraulic flow conditions are present in the tailrace area.

Therefore, it is anticipated that tailrace construction will result in the adverse alteration of fish habitat. Overall, the tailrace channel will not result in any loss of surface area of aquatic habitat, but the habitat conditions will be significantly altered from existing conditions. The alteration will predominantly result from the removal of rocky surface material (cobble, boulder) that will result in an overall decrease in habitat heterogeneity in the tailrace channel. The resulting channel will be relatively flat and will provide less productive habitat with less cover and structure for fish and benthic invertebrates. Therefore, it is anticipated that aquatic habitat productivity in the tailrace channel will be decreased over a surface area of 190 m^2.

Summary of Permanent Impacts

Intake and tailrace construction will result in the permanent alteration of a total of 437 m^2 of aquatic habitat and powerhouse construction will result in the loss of 5 m^2 of aquatic habitat. Permanent alteration of this habitat will likely result in decreased productivity since habitat complexity on the bed of the river will be reduced. However, aquatic biota will still be free to utilize this habitat so it does not represent a loss of aquatic habitat.

In order to mitigate for this loss/alteration, SREL is proposing to implement several habitat enhancement projects including walleye spawning habitat enhancement at the base of the south dam flow channel (i.e., downstream from the Highway 169 bridge) and creation of a spawning/benthic invertebrate shoal on the periphery of the tailrace channel. Each of these projects is described in the following sections and all are depicted in Figure 5.3. The proposed habitat enhancements will be subject to detailed design and will be included in the eventual application for Authorization for Works Affecting Fish Habitat from DFO.

5.2.8.4 *Walleye Spawning Habitat Enhancement Downstream from South Dam*

Walleye have been observed during the spawning period on the south side of the South Dam outflow channel, downstream from Highway 169. The area currently consists primarily of riprap from the adjacent road embankment and only a relatively small area of suitable habitat is present (approximately 20 m^2) based on substrate, water depth and velocity conditions. Water depth through the majority of the proposed area is likely too deep for walleye spawning at the present time.

In order to enhance the amount of spawning habitat available in this location, SREL is proposing to install a rocky shoal off the existing point, as shown in Figure 5.3. The shoal will be created by adding large rock fill (consisting of excavated material from the intake channel and powerhouse excavation) topped with a 0.40 m thick layer of 10 to 15 cm diameter rounded river stone. The shoal will be graded so that the surface is approximately 0.8 m below the normal freshet water level. Walleye are known to spawn at depths of up to 2 m. It is anticipated that approximately 64 m^2 of suitable walleye and white sucker spawning habitat will be created. The rocky shoal will also provide habitat for benthic invertebrate production.

The detailed design of this habitat area will be subject to confirmation that suitable water depth and flow velocity conditions can be created over suitable spawning substrate. Hence, the area will be subjected to hydraulic modeling (River2D) during the detailed design process. Plan view and cross-section drawings of the proposed shoal will be prepared and included as part of the Fisheries Act Authorization application to DFO.

5.2.8.5 *Shoal Creation Adjacent to Tailrace*

No walleye or white sucker spawning habitat is known to be present in the proposed tailrace area at the present time. During the operational period, flows from the powerhouse will be relatively consistent, particularly during the high flow spring freshet months, which also coincide with the walleye and white sucker spawning periods. These relatively consistent flows provide the opportunity to create spawning habitat within the tailrace area and have it designed to meet depth, substrate and flow velocity requirements.

The proposed conceptual design for two spawning habitat structures, located on either side of the tailrace, is shown in Figure 5.3. Each structure will be constructed on the upper edge of the tailrace and will be formed by adding large rock fill (consisting of excavated material from the intake channel and powerhouse excavation) topped with a 0.40-m thick layer of 10 to 15-cm diameter rounded river stone. Each structure will be graded so that the surface is approximately 0.8 m below the normal freshet water level. The structure will be subject to relatively constant hydraulic conditions and will be designed to provide spawning habitat for walleye and white sucker. It is anticipated that the individual structures will enhance approximately 44 m^2 and 38 m^2 of habitat for a total enhanced area of approximately 82 m^2.

The detailed design of this habitat area will be subject to confirmation that suitable water depth and flow velocity conditions can be created over suitable spawning substrate. Hence, the area will be subjected to hydraulic modeling (River2D) during the detailed design process. Plan view and cross-section drawings of the proposed habitat structures will be prepared and included as part of the Fisheries Act Authorization application to DFO.

5.2.8.6 *Summary*

Intake and tailrace construction will result in the permanent alteration of a total of 437 m^2 of low diversity, non-specialized aquatic habitat and powerhouse construction will result in the loss of 5 m^2 of aquatic habitat. The permanent alteration will reduce aquatic habitat productivity in the tailrace and intake areas by reducing habitat complexity but it will not prevent aquatic biota from utilizing that habitat.

In order to mitigate for this decrease in productivity, SREL is proposing to construct several habitat enhancement/creation structures. In total, approximately 146 m^2 of habitat will be enhanced to provide greater productivity. The created/enhanced habitat will be designed to provide spawning habitat for walleye and shallow flowing water invertebrate production habitat. The enhanced habitat is anticipated to have a higher productivity value than the existing habitat in the intake and tailrace channels. In addition, the altered habitat in these channels will continue to provide permanent aquatic habitat.

The conceptual habitat enhancement/creation plans described above will be subject to detailed design to ensure that suitable habitat conditions can be achieved. The detailed design will be documented in the Fisheries Act Authorization application that will be sent to DFO.

It is anticipated that the productivity that will be gained due to implementation of the proposed habitat enhancement/creation projects will offset the decrease in productivity due to tailrace/intake construction. Monitoring will be conducted to assess fish and benthic invertebrate use of the new habitat areas following the construction period (see Section 10.3 for a description of the proposed monitoring activities).

5.2.9 Vegetation

Clearing of trees, brush and ground cover will be required within the intake and powerhouse areas on either side of Muskoka Road 169. Estimates of the amount of clearing required, as well as an indication of the species of trees to be cleared within each area, are provided in Table 5.3.

Table 5.3 Vegetation to be Cleared

Location	Area to be Cleared (m^2)	Species Present
Intake	130	White ash, white elm, eastern white pine, eastern white cedar
Powerhouse	1100	Red maple, white ash, red oak, white birch, willow sp., largetooth aspen, white elm, staghorn sumac
Total	**1230**	

Vegetation in the study area is typical of that of the surrounding undisturbed forests outside of the Town of Bala. Therefore, clearing of this vegetation will have no impact on the regional status of the species present. However, rehabilitation of the area disturbed during the construction of the powerhouse facilities on the west side of Muskoka Road 169 will use native vegetation species suitable for this area of Ontario. A formal landscape plan will be prepared by a landscape architect to rehabilitate the land around the proposed powerhouse. The introduction/use of invasive non-native vegetation species (e.g., birdsfoot trefoil, creeping red fescue) for restoration of disturbed areas will not be permitted.

All working areas and areas to be cleared are to be clearly identified (e.g., marked by site fencing, flagging tape) and all activities of the contractor restricted to the specified work areas in order to prevent damage to remaining vegetation. All trees are to be felled into cleared areas to minimize damage to the remaining stand. Clearing and grubbing will be kept to a minimum and the existing ground cover vegetation mat left in place wherever possible.

The study area is not located within an Emerald Ash Borer Regulated Area (Canadian Food Inspection Agency, 2007) and therefore, there are no restrictions on the preparation and removal of wood from the project site.

Impacts to vegetation could also occur due to accidental spills of hazardous materials. Mitigation measures for accidental spills of hazardous materials with respect to water quality, discussed in Section 5.2.6.2, will also reduce potential impacts on vegetation.

Impacts to vegetation could also occur due to excessive fugitive dust from the construction site. Mitigation measures to prevent excessive dust generation were previously discussed in Section 5.2.3 and are anticipated to be effective in preventing impacts on vegetation.

5.2.10 Wildlife

Impacts to wildlife during project implementation could result from habitat destruction/alteration due to vegetation clearing, facility development, direct contact and physical disturbance due to noise (e.g., blasting, heavy equipment use, general construction activities).

However, terrestrial wildlife and avian use of the study area, which is located within the Town of Bala immediately adjacent to Muskoka Road 169 is likely limited to those species that are tolerant of higher levels of human and habitat disturbance associated with urban and semi-urban environments. The minor loss of habitat associated with vegetation clearing will affect the local wildlife that may utilize the areas on a permanent or temporary basis, but there will be no effect on the status of any of these wildlife species in the general area.

Clearing and blasting activities are to be scheduled to avoid primary wildlife breeding and nesting periods as noted below for various habitat types:

- forest habitat – May 24 to July 31
- wetland habitat – May 16 to July 23
- open habitat – May 24 to July 23.

Tree clearing outside of these time periods will not result in significant disturbance to breeding wildlife populations. If clearing or blasting is required to be undertaken during the identified breeding periods, a nest survey is to be undertaken by a qualified avian biologist to clear the area or protect it if active migratory bird nests are found. Mitigation will involve a construction activity restriction within 100 m of the active nest site until vacated.

5.2.11 *Species at Risk*

A number of wildlife species at risk are known to be present within the general area (Section 2.1.13), although none have been confirmed as present within the project study area. Based on previously identified habitat associations of these species (Section 2.1.13) the proposed development should not adversely affect these species. Although there is no destruction of significant species at risk habitat expected, if any species at risk is encountered it will be reported to the MNR. According to the Endangered Species Act, no one may kill, harm, harass, possess, buy, sell, trade, lease or transport species that are listed as threatened or endangered.

5.3 Potential Effects and Mitigation – Socioeconomic Environment

Present activities noted by stakeholders to occur in the vicinity of Bala Falls include boating, canoeing, kayaking, fishing, seasonal residence, swimming, water skiing, hiking/walking, sightseeing, picnicking, biking, scuba diving, yoga, sunbathing, church services, snorkelling, shopping, photography, cross-country skiing, and cranberry festival activities. SREL is committed to providing, to the extent possible, safe, continued use by the public of the Bala Falls area, with the exclusion of the construction zone.

5.3.1 *Effect on Public Use and Access*

Public access to construction zone areas will be restricted (Figure 5.4), and include

- all land south of Bala Falls and west of Muskoka Road 169. However, highway access to Bala Falls from the south will be possible (Figure 5.4)
- land east of Muskoka Road 169, and west of Purk's Place Boat House and Marina; north to the shore and southeast to Bala Falls Road. The gravel parking areas (A) in Figure 5.4 will not be available for public use during construction.
- a portion of Bala Falls Road northwest of the Stone Church will be closed to public use during the construction period. However, access to the antique store located in the former church will still be available on Bala Falls Road to the south (Figure 5.4).
- a snow-covered path will be left open along the south side of Bala Falls Road to maintain snowmobile access throughout the snowmobile season.

Access to the construction area will be restricted to the public. However MNR will be permitted access as required to operate and maintain the Bala North Dam during the construction period.

5.3.2 *Public Safety in the Vicinity of the Project*

Construction of the proposed development poses public safety concerns, as the area is presently heavily used for both aquatic and land-based activities. Unrestricted access could potentially result in injury from construction equipment or activities such as blasting.

The following mitigation measures are proposed to protect public safety in the vicinity of construction activities:

- prevention of public access to the construction site through use of fences, gate(s), and security procedures.

- posting of signage to notify the public of construction and advise avoidance of the area.
- adherence by workers to prescribed procedures such as required cleared radius during blasting.
- development of proper procedures for construction traffic.

Prior to operation of the Project, the proponent will prepare an Operational Safety Plan inclusive of rescue procedures to be subject to review by appropriate government agencies.

5.3.3 *Construction Site Safety*

Safety is a concern on any construction site with the potential for injury.

The following mitigation measures are recommended to ensure the safety of all workers on the construction site:

- completion of safety training program by all workers
- strict adherence to the Ministry of Labour occupational health and safety regulations pertaining to construction sites regarding worker safety
- first-aid equipment, as appropriate to the activity to be maintained on site
- Material Safety Data Sheets (MSDS) for any hazardous material used on site to be available close to the location where the material is used and stored
- an accident and emergency spill response plan
- spill containment and clean-up materials on site
- training to deal with spill situations.

5.3.4 *Local Traffic*

Muskoka Road 169 is the main traffic artery through the Town of Bala and surrounding areas within the Muskoka region. There are no feasible detours that are close by which could be used during the period that the highway will be closed in the vicinity of the North Channel bridge (Muskoka Road 169 Bridge). It is therefore imperative to ensure that any road closures be kept to a minimum and occur at times of least impact to the surrounding community. The proposed traffic management plan is illustrated in Figure 5.1.

5.3.4.1 *Muskoka Road 169*

Construction activities will result in increased local traffic and temporary disruption along routes used, resulting in delays to the local community traffic, and increased traffic on Muskoka Road 169. During construction of the project there will be activities that require temporary disruption to traffic flow on Muskoka Road 169 including the delivery of large equipment to the site.

To mitigate traffic disruptions, the plan for traffic management during construction is proposed (Figure 5.1) which includes the following features:

- erection of a temporary two-lane Bailey bridge to be installed in early November, after the Bala cranberry festival and removed by mid April, prior to the tourist season. This bridge will be able to accommodate snow removal equipment during the winter.
- one-lane reduction for approximately 2 weeks while the Bailey bridge foundations are being prepared
- a night-time road closure while the preassembled Bailey bridge is being set into place (night shift on a Sunday night) in November
- a night-time road closure while the Bailey bridge is being removed and the road restored (night shift on a Sunday night) in April
- signs indicating a temporary road closure will be placed well in advance of the construction site on Muskoka Road 169 during the periods of road closure (Bailey Bridge installation and removal)
- municipal and local emergency services, Ontario Provincial Police (OPP), ambulance, etc will be notified well in advance of the planned road closures. This will allow emergency services to plan emergency response contingencies and travel routes, either in a northerly or southerly direction from Bala
- designated transportation routes to avoid tight turning areas and delays
- temporary removal or relocation of overhead lines as required with the appropriate utility being contacted
- use of a police or security escort to guide/accompany any transport conveys as necessary
- use of flagmen to facilitate traffic flow and control
- driving of construction vehicles in a proper manner and respect all traffic laws, regulations, and company policies
- repair/regrading of vehicle imprints or erosion gullies as necessary.

5.3.4.2 Bala Falls Road

During construction of the project, approximately 20 m of Bala Falls Road will be closed and unavailable for public use. This area is between Muskoka Road 169 and Burgess Memorial Bala Presbyterian Stone Church. The northern intersection of Bala Falls Road and Muskoka Road 169 will also be closed. Access to Bala Falls Road will be via the more southern of the two intersections of Muskoka Road 169 and Bala Falls Road, just south of District Road 38.

To alleviate disruption from traffic ingress and egress from Bala Falls Road onto Muskoka Road 169 via the southern intersection, the following mitigation measures are proposed (subject to agreement with the municipality or MTO):

- installation of a temporary traffic light to direct traffic
- discontinuation of the requirement for right turns only onto Muskoka Road 169
- signage providing detour directions to access Bala Falls Road to be prominently displayed
- designated transportation routes to avoid tight turning areas and delays
- temporary removal or relocation of overhead lines as required (the appropriate utility will be contacted)
- use of a police or security escort company to guide/accompany any transport conveys as necessary
- use of flagmen to facilitate traffic flow and control
- driving of construction vehicles in a proper manner, respectful of all traffic laws, regulations, and company policies
- repair/regrading of vehicle imprints or erosion gullies.

5.3.5 Noise and Vibration

Noise and vibration will be generated by equipment and activities at times during the course of construction.

Blasting is scheduled to occur intermittently from December 2010 until September 2011, and will be properly controlled following NRCan requirements for blasting activities and MOE guidelines for noise or vibration from blasting. The latter limits (MOE's publication NPC 119) are intended to protect structures from damage.

5.3.6 Aesthetics

Flows over Bala Falls and through the South Bala Dam will be unaffected during the construction period. Potential impacts on aesthetics (reduced attractiveness) during construction may arise from

- presence of signage and fencing in or around restricted access areas. These will likely be located at the perimeter of the construction areas shown in Figure 5.4
- presence of construction equipment in construction zone or laydown areas
- removal of vegetation in construction areas.

Feasible mitigation measures are limited, as construction equipment and activities mentioned are necessary and unavoidable components of construction. Construction effects will be limited to the approximately 18-month construction period.

5.3.7 Tourism and Recreation

Within the community of Bala, recreational opportunities are a major component of tourism. Seasonal tourist attractions (such as the Bala cranberry festival), and other tourist attractions (such as the Bala Museum, shopping, etc), combined with the many recreational activities (such as swimming, boating) make Bala a desirable destination for travellers. It is anticipated that any impact to recreation or tourism will also affect the other, and therefore careful mitigation has been incorporated into the design of the project itself, and is proposed for the construction period.

5.3.7.1 Local Tourism

Public concerns with potential effects on local tourism during project construction have been considered in project engineering and construction planning. Efforts have been made by SREL to mitigate many of these concerns by revising the project design and location, and in planning the construction schedule in an attempt to

- preserve both the scenic view of Bala Falls, and access south of the Bala Falls by moving the powerhouse south of the original location
- preserve public access to the area by designing a public park space with an underground powerhouse that will improve the visual landscape as compared with an aboveground powerhouse
- minimize traffic congestion during the construction period by designing and implementing a Traffic Management Plan (see Figure 5.1) which includes the installation of a Bailey bridge allowing continuous traffic flow during the tourist season (May 24th long weekend to weekend after Thanksgiving). The Bailey bridge will be designed to accommodate all size vehicles, including boat and camper trailers, RVs and snowplows.

Despite the above measures,

- temporary traffic delays in the vicinity of Bala Falls are anticipated during the 2011 tourist season
- there is a potential for a decrease in visitation to the Bala Falls area during Bala's 2011tourist season, although other factors may influence tourism visitation to a larger degree, such as the state of the economy.

5.3.7.2 Recreation

With construction of the project taking place in the vicinity of Bala Falls, some areas will not be available for public use in the interest of public safety (as discussed in Section 5.3.1).

Use and enjoyment of the Bala Falls area by local and season residents, as well as tourists, will be temporarily disrupted by construction activities. This will include disruptions related to scenic viewing of the falls as well as aquatic recreational activities in the immediate area (boating, canoeing, fishing, etc). Scuba diving and swimming will be temporarily unavailable during construction within those areas indicated in Figure 5.4. Following construction, some areas will remain unavailable for public use, such as scuba diving and swimming. These are discussed in Section 6.3.1.

The availability of the public docks for use, including the staging of the annual Bala Bay Regatta will be unaffected.

The current portage route (from the docks at Purk's Place to the relaunch, south of the falls) will be unavailable as a result of the Project. Alternate portage routes for crossing Muskoka Road 169 are available, including use of the existing public dock and public pathway along the north shore leading under the CP railway bridge to Muskoka Road 169.

During the winter months, snowmobilers who use Bala Falls Road and the Muskoka Road 169 bridge will have continued safe usage of this area via the two-lane Bailey bridge. SREL will also maintain a suitable path along Bala Falls Road between the construction staging area and the existing fence in front of Burgess Memorial Bala Presbyterian Stone Church to allow continued use of the existing snowmobile route. This designated path will be less than 100 m long and will be maintained with suitable snow conditions (no plowing), to the extent possible. Minimal interruption of snowmobile travel is anticipated during the construction period.

Mitigation measures proposed include the scheduling of key construction activities (e.g., bridge placement) to occur outside of the summer tourism season (May 24 to after the cranberry festival) to the extent possible.

5.3.8 *Effect on Local Businesses*

There are two local businesses that will be directly affected in the project area. These are the antique store located within the Stone Church on Bala Falls Road, and Purk's Place Boat House and Marina (PPBH&M).

Access to the antique store in the Stone Church will be available via Bala Falls Road as discussed in Section 5.3.4. However, in the event that the antique store suffers a temporary loss in business which can be directly attributed to construction activity in the area, SREL and the owners will conduct discussions.

During construction and operation of the Project, the docks at PPBH&M will no longer be available for use by the public including customers of PPBH&M. They will need to be removed toward the end of the construction period to allow for works to be undertaken for the intake channel and its connection to the intake. In addition, the gravel parking area adjacent to PPBH&M will also be unavailable. Access to PPBH&M would then have to be via Bala Falls road from the east, as discussed in Section 5.3.4. Negative economic effects to the owner of PPBH&M are expected to be mitigated through mutually agreed compensation by PPBH&M and SREL.

Minor temporary short-term delays in accessing other local businesses in Bala may occur. It is anticipated that any minor temporary adverse effects on local businesses due to construction traffic delays will be offset by the economic benefits to the local community as discussed in Section 5.3.9.

5.3.9 *Employment and Economy*

5.3.9.1 *Employment*

Construction of the project will require employment of both skilled and unskilled labour originating locally and non-locally based on qualification. It is estimated that the project will generate approximately 4000 to 6000 person days of labour requirements extending over a 12 to 18-month period. Given that the experienced labour forces in the Township of Muskoka Lakes have moderate strength in construction and manufacturing industries (17.7% and 6.4% respectively) it is anticipated that some of the qualified personnel will be supplied from these areas.

No mitigation measures are necessary as any effect to the local labour force is determined to be positive.

5.3.9.2 Economic Benefits

Local communities with the potential to benefit most from the project are the Township of Muskoka Lakes, and the larger District of Muskoka. These benefits are expected to be in the form of employment and income, as well as material expenditures.

Direct economic benefits would also include the utilization of local and regional suppliers to provide services, equipment and materials for the project such as accommodation, trucking, cement, fill, fuel, and equipment rental.

Indirect benefits would consist of expenditures in the local community on basic goods and services, e.g., accommodation, fuel, restaurant services and other goods and services.

Based on a budget estimate cost completed by Hatch Energy for the 4.3-MW North Bala Small Hydro Project the following economic benefits are anticipated based on a construction period of 12 to 18 months:

- total construction cost of approximately $14.5 million
- labour costs estimated to be $4.5 million
- 4000 to 6000 total person days of labour during the construction period
- an average of 15 workers on site during the construction period
- estimated construction equipment cost of $1.8 million
- equipment cost of approximately $5 million
- material cost of approximately $3.2 million.

Given the benefits mentioned above, no mitigation measures are necessary.

5.3.10 Effects on Existing Infrastructure

5.3.10.1 Local Hydroelectric Generation

The Burgess Generating Station is located approximately 300 m north of the project site (Figure 1.1). There are also two hydroelectric generating stations and five control dams downstream, i.e., Moon Dam, Ragged Rapids Dam, Big Eddy Dam, Go Home Lake Control Dam, and Go Home Lake Filter Dam operated by OPG and MNR (Figure 1.1). During the construction phase of the project, no changes in flow, and therefore no effects to upstream or downstream generating stations are anticipated. No mitigation measures are proposed.

5.3.10.2 Municipal Services

The construction of the Project within the North Channel will require the relocation of three existing municipal utility lines (conveyance). The relocation of these utilities will require municipal approval prior to commencement.

5.3.11 Waste Management

Solid waste generated during construction will include domestic waste such as food and sanitary waste and construction waste such as material packaging and scrap material. Sanitary facilities on site will include portable self-contained toilets and washroom facilities in a crew trailer. All solid and sewage wastes are to be contained and hauled off site by a designated hauler throughout the construction period. All municipal waste is to be transported to an MOE licensed landfill by an MOE licensed hauler.

The following mitigation measures are to be implemented to ensure the protection of on-site personnel, the public and the environment:

- proper storage of hazardous wastes in secure containers inside impervious berms until disposal off site at a registered facility
- proper storage of solid wastes on site prior to disposal off site at local registered disposal facilities
- recycling of items whenever possible
- secure containment of food waste to avoid a nuisance animal forager situation prior to disposal off site.

5.3.12 Cultural/Heritage Resources and Archaeological Sites

5.3.12.1 Local Cultural/Heritage Resources

There are two historic structures located in the vicinity of the proposed project that were determined in the Stage 1 Archaeological Assessment to be significant heritage resources, worthy of preservation. Purk's Place Boat House and Marina (Figure 2.5) is listed as significant by the Muskoka Heritage Committee, and Burgess Memorial Bala Presbyterian Stone Church (Figure 2.5) is designated under Part IV of the Ontario Heritage Act. Given that these heritage buildings are located in the vicinity of the proposed construction works the following mitigation measures are proposed, as recommended in the Stage 1 assessment (Appendix C7):

- a mitigation plan be developed to avoid impacts from shock or vibration from blasting.

In addition to the above, as part of the pre-construction monitoring program described in Section 10.1, a pre-blasting survey is to be undertaken on both buildings prior to construction to document their existing structural conditions (cracks, etc).In particular, blasting will occur in close proximity to Purk's Place (10 m). Additional mitigation to protect this structure will include controlled blasting, possible screening and safety precautions such as restricted access.

It was concluded by Historica Research Ltd. that the Bala Falls area is a "distinct cultural heritage landscape of water management, power generation, tourism and transportation" (2009) as recommended within the Bala Falls Cultural Heritage Landscape Study (Appendix C8). The following considerations will be incorporated into the design of the Project:

- **Design of Powerhouse and Intake –** The powerhouse and intake structure should be designed such that they are visually sympathetic to the cultural heritage landscape of the Bala Falls,
- **Bala Falls Interpretation –** Interpretive plaques should be designed and installed.

5.3.12.2 Archaeological Impact

The Stage One Archaeological and Heritage Impact Assessment completed within the project area indicates that, although portions of the study area have been extensively disturbed, there are several areas that have archaeological potential. These areas will be subject to a Stage 2 assessment (see below).

The Ministry of Culture has specified mitigation that must be undertaken in the event of discovery of human remains or other archaeologically or culturally significant material. The following conditions apply and must be adhered to during construction:

- It is an offence to alter any archaeological site without Ministry of Culture concurrence. No grading or other activities that may result in the destruction or disturbance of an archaeological site are permitted until notice of Ministry of Culture approval has been received.
- Should deeply buried archaeological remains be found during construction activities, the Heritage Operations Unit of the Ontario Ministry of Culture should be notified immediately
- In the event that human remain are encountered during construction, the proponent should immediately contact both the Ministry of Culture, and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Government Services, Consumer Protection Branch at (416) 326-8404 or toll free at 1-800-889-9768.

The Stage Two Archaeological Assessment for the Project found nothing of archaeological significance dating to either the historic or pre-contact time periods. No artifacts were recovered and no structural remains, industrial remains, or any other cultural heritage resources were discovered or indicated.

Advance Archaeology did caution the possibility that "deeply buried heritage resources or human burials can exist on site and were not identified during a standard archaeological assessment" (Advance Archaeology, 2008) and therefore offered mitigation which mirrored that provided by Archaeological Services Inc. (see above).

5.3.13 Effects on Resources Used for Traditional Purposes by Aboriginal Persons

No conflict with traditional use by First Nations resources in the project area is anticipated during construction activities.

5.4 Summary of Impacts and Mitigation during Project Construction

Table 5.4 provides a summary of the potential effects from construction activities, the proposed mitigation and any residual effects after mitigation.

5.5 Significance of Residual Effects

The next phase in the analysis involved an evaluation of the significance of any remaining residual adverse effects. MOE (2001) provides criteria for assessing significance, including

- value or importance of the resource affected
- magnitude of the effect
- geographic extent or distribution of the effect

- duration or frequency of the effect
- reversibility of the effect
- ecological/social context of the effect.

Table 5.5 provides the definitions for the levels of significance to meet federal and provincial requirements.

Table 5.4 Summary of Potential Effects, Proposed Mitigation and Residual Effects During Construction Phase

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
Geology	Excavation for intake, powerhouse and tailrace	Loss of bedrock due to excavation	• Blasting is to be undertaken in a controlled manner by a licensed blasting contractor in accordance with NRCan and DFO blasting requirements, with particular care to avoid impacts to two historical structures noted in Section 5.3.12.	Decrease in bedrock on site
Soils	Excavation for intake, powerhouse and tailrace, and associated infrastructure (access roads, works yard)	Disturbance to soils	• Stripped and excavated soils will be re-used to the extent possible during site restoration activities. Soils not for reuse will be removed for off-site disposal to a suitable location. Soils for off-site disposal will be tested to determine if contamination exists and the disposal location will be selected accordingly (i.e., hazardous or non-hazardous landfill).	No long-term residual effect with effective mitigation
	General construction activities resulting in exposure of organic and mineral soils	Soil erosion as a result of exposure to wind, precipitation and surface water flow	• Sediment and erosion control plan to minimize the potential for off-site soil transport. • Erosion and sediment control measures implemented prior to start of site construction and maintained until site restoration measures (e.g., revegetation, grading, stabilization) are sufficient to prevent any further erosion and sedimentation due to disturbance from the construction period • Minimize the size of the cleared and disturbed areas at the construction site, particularly those adjacent to watercourses. • Phase construction to minimize the time that soils are exposed. • Restrict work areas to minimize the overall amount of soil disturbance occurring on site. • Maximize the retention of the existing vegetation cover, including the forest floor ground cover, when trees are to be removed. Grubbing should only be conducted where absolutely required. • An adequate supply of erosion control devices (e.g., geotextiles, revegetation materials) and sediment control devices (e.g., in-water silt barriers, silt fences, straw bales) should be provided on site to control erosion and sediment transport and respond to unexpected events. • Divert site runoff through vegetated areas or into properly designed and constructed sediment traps or a drainage collection system to ensure that exposed soils are not eroded. Runoff velocities in ditches or other drainage routes, or along slopes, should be kept low to minimize erosion potential. Runoff outfall locations should be protected with erosion resistant material, if required. • Grade disturbed slopes or stockpiles to a stable angle as soon as possible after disturbance to eliminate potential slumping. • Revegetate or stabilize exposed sites as soon as possible after they have been disturbed, using quick growing grasses or other vegetation. Where revegetation is not possible other erosion protection methods, such as riprapping, bioengineering, or erosion matting should be used. • Excavated erodible material stockpiles should be placed in suitable designated areas away from the river or other watercourses (i.e., outside the floodplain, away from drainage channels) and properly constructed silt fences should be installed around the stockpiles to limit the transport of sediment. • Tracking of mud onto local streets should be monitored during construction. If mud on streets is observed to occur or the potential exists for it to occur due to muddy working conditions, the contractor will be required to implement a system to prevent transfer of this material to local roads and subsequently, storm drains. This could potentially include wheel washing areas at the exit from the construction site or end-of-day street sweeping to remove accumulated material from local streets.	Some limited loss of soils expected as a result of erosion
	Soil stockpiling	Adverse effects on soil quality	• Separate topsoil and subsoil and stockpile each separately to avoid mixing soil types • Minimizing duration of stockpiling by implementing construction phasing • Minimizing depth of stockpiles to > 1m where feasible	Minor deterioration in soil health due to stockpiling
	Access road, laydown and works area construction	Mixing of soils with gravel	• Geotextile fabric to be placed over existing soil prior to deposition of gravel base so that when facilities are decommissioned, underlying soils will be free of gravel which could affect soil structure and/or texture and other soil dependant processes (infiltration of surface water, vegetation growth)	Some short term disturbance of soils.
	Use of heavy equipment on riverbanks and riparian areas	Reduction in riverbank stability and potential increases in shoreline erosion	• Construction in vicinity of riverbanks that consist of finer materials to be restricted where possible. • Any bank areas disturbed during construction to be stabilized with native plant material or other bioengineering or structural methods (e.g., riprap).	Some short term disturbance of shoreline soils. No long term residual effect following effective mitigation
	Use of heavy equipment, storage of construction materials, soil stockpiling	Soil compaction	• All equipment and materials to remain within identified work areas to prevent soil compaction on areas outside the working zone. • Monitoring of the work area to be undertaken prior to site restoration to assess if compaction has occurred. • Restoration (e.g. discing or other soil loosening methods) to be undertaken as required.	Minor amounts of compaction likely to remain following mitigation
	Use of potentially contaminating materials on site (e.g., fuels, lubricants).	Soil contamination due to accidental spills	• Chemical handling procedures to be developed by the contractor so as to prevent/minimize the potential for spills due to improper handling. • All employees responsible for chemical handling to be trained in proper handling and emergency spills response procedures. • All chemical handling and storage to be conducted at designated sites well away from watercourses and outside of floodplain areas. • An adequate supply of spill containment and clean up material to be maintained on-site throughout the construction period. • The contractor to be informed of the requirement to contact the Spills Action Centre of the MOE in the event of any spill that could potentially cause damage to the environment. • All spills of potentially toxic materials to be treated as significant and cleaned up immediately, with contaminated soils removed from the site to a designated disposal area, if required. • Equipment to be monitored by the contractor throughout the construction period to ensure that it is well maintained and free of leaks.	Residual effect will be minimized by the effective use of spill containment and clean-up procedures.

Table 5.4 - Summary of Potential Effects, Proposed Mitigation and Residual Effects During Construction Phase - 2

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
Air Quality	Traffic along access road, soil moving and stockpiling, erosion from disturbed areas and other construction activities (e.g., crusher use, blasting).	Increased dust levels in work areas.	• Contractors to follow *"Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities"* (Cheminfo Services Inc., 2005). • Use of dust suppression (type to be approved by MOE) on exposed areas including access roads, stockpiles and works/laydown areas • If required, dust suppression would be with water or non-chloride based chemical dust suppressants • Hard surfacing (addition of coarse rock) of roads or other high-traffic working areas • Phased construction, where possible, to limit the amount of time soils are exposed • Earth moving works will not be conducted during excessively windy weather. Stock piles to be worked (e.g. loaded/unloaded) from the downwind side to minimize wind erosion. • Stockpiles and other disturbed areas to be stabilized as necessary (e.g. tarped, mulched, graded, revegetated or watered to create a hard surface crust) to reduce/prevent erosion and escape of fugitive dust. • Mitigation associated with the rock crusher activities could include the use of hoarding and watering around the unit. • Blast mats, utilized during blasting activities to control fly rock, will also help to control the release of airborne dust. • Dust curtains to be used on loaded dump trucks, delivering materials from off site but will not be used on heavy equipment at site. • Workers to use appropriate personal protective equipment (e.g., masks, safety goggles) as required. • Obtain Certificate of Approval for Air Emissions from rock crusher	Minor, short term, localized increases in fugitive dust emissions during construction; no long-term residual effect
	Use of combustion equipment (vehicles and machinery).	Short-term increase in local airborne contaminant concentrations due to combustion emissions.	• Maintain vehicles and emission systems • Use vehicles only when necessary • Reduce unnecessary idling	Short-term minor impairment in local air quality; no long-term residual effect
Groundwater	Excavations for powerhouse, intake and tailrace channels	Infiltration of groundwater into excavations	• Grouting will be undertaken prior to powerhouse excavation in order to minimize groundwater leakage due to the artesian conditions. • Groundwater entering project excavations to be pumped out of the excavated area, treated if required to meet water quality discharge criteria, and pumped back to the river or suitable on-land location for dispersal to the environment. • Appropriate approvals would be obtained prior to implementation of such an activity (e.g., PTTW, CofA).	Minor alterations in local groundwater levels and underground flow vectors due to grouting and pumping from excavations.
	Use of potentially contaminating materials on site (e.g., fuels, lubricants).	Groundwater contamination due to accidental spills	• Minimal infiltration anticipated due to low hydraulic conductivity of overlying bedrock. • Apply spill prevention and containment procedures (as per those identified with respect to soil contamination), including use of bermed storage and fueling areas, only clean, well-maintained machinery allowed on-site, adequate spill containment material on site. • Relatively low volumes of potentially contaminating materials will be stored and used on site.	Minor contamination of groundwater to potentially occur.
Surface Water Hydrology and Hydraulics	Working platform construction in the tailrace area.	Changes in local hydraulics (flow velocity and vectors) due to presence of working platform in riverbed.	• No mitigation possible to prevent changes in hydraulics due to the working platform. Hydraulic changes will not affect water levels in Bala Reach or Lake Muskoka. There will be no impact on river flow throughout the duration of the construction period. Flow management will continue as per the existing MRWMP.	Minor short-term change in immediate site areas; flows maintained during construction.
	Vegetation clearing, land grading, ditching, drainage improvements resulting in more impervious surfaces.	Potential increase in local runoff rates and quantity, and associated decreases in runoff duration.	• Effective implementation of erosion and sediment control plan and regular monitoring to assess effectiveness and make improvements as required.	Minimal residual effect with effective mitigation.
Surface Water Quality	General construction activities resulting in exposure of organic and mineral soils	Impairment to surface water quality due to increased turbidity and suspended solids due to erosion of terrestrial soils to watercourses.	• Effective implementation of sediment and erosion control plan as noted previously. • Divert working area runoff through vegetated areas or into properly designed and constructed sediment traps or a drainage collection system to ensure that exposed soils or fill granular materials are not transported into watercourses. Runoff velocities in ditches or other drainage routes, or along slopes, should be kept low to minimize erosion potential. Runoff outfall locations to be protected with erosion resistant material, if required. • Appropriate precautions to prevent movement of fine material into watercourses to be undertaken during any blasting adjacent to or within waterbodies (e.g., use of blast mats). Should the contractor be unable to undertake his on-shore blasting activities so as to prevent any adverse effects to fish or fish habitat, an Authorization under the Fisheries Act will be required from DFO. • Minimize the size of the cleared and disturbed areas at the construction site, particularly those adjacent to watercourses. • Phase construction to minimize the time that soils are exposed. • Maximize the retention of the existing vegetation cover, including the forest floor ground cover, when trees are to be removed. Grubbing should only be conducted where absolutely required. • Grade disturbed slopes or stockpiles to a stable angle as soon as possible after disturbance to eliminate potential slumping. • Revegetate or stabilize exposed sites as soon as possible after they have been disturbed, using quick growing grasses or other vegetation. Where revegetation is not possible other erosion protection methods, such as riprapping, bioengineering, or erosion matting should be used. • Construct a drainage collection system so runoff can be intercepted and treated or removed from the site through suitable control facilities (e.g., vegetation, straw bales, settling pond). • Excavated erodible material stockpiles should be placed in suitable designated areas away from the river or other watercourses (i.e., outside the floodplain, away from drainage channels) and properly constructed silt fences should be installed around the stockpiles to limit the transport of sediment. • Working platform to be constructed around the tailrace construction area to allow construction to proceed under a dewatered condition. Intake will be constructed behind a rock plug. • Only clean materials (e.g. free of fine sediment or other potentially contaminating materials, free of acid generating constituents) to be used for in-water (e.g., cofferdam construction, tailrace or diversion lining) or near water works (e.g., embankment riprapping).	Minimal entry of sediments into watercourses –with effective mitigation.

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
			• Tracking of mud onto local streets to be monitored during construction. If mud on streets is observed to occur, the contractor will be required to implement a system to prevent transfer of this material to local storm drains. This could potentially include wheel washing areas at the exit from the construction site or end-of-day street sweeping to remove accumulated materials from local streets.	
	Installation of the rock fill working platform	Adverse effects on surface water quality due to fine sediment mobilization	• Only clean material to be used for the rock-fill working platform (e.g. pre-tested, washed or otherwise certified as being free of fine sediment and acid-generating constituents) • The rock-fill working platform to be installed in the river channel as quickly as possible such that the amount of rock-fill aggregate being washed downstream is minimized (if flow velocity is sufficient to mobilize rock-fill material) • Use of impermeable geotextile membranes in cofferdams is preferable to use of silt, clay, till or other loose materials such as loam, organic soil and vegetation in order to prevent seepage of water through the cofferdam or downstream transport of fill materials during cofferdam installation • Spill response and emergency equipment and material (e.g. fill for cofferdams, gravel bags, oil absorbents) to be kept in close proximity to cofferdams, such that in the event of an unanticipated cofferdam leak, repairs can be conducted in an expedient manner • All working platform material to be removed from the riverbed and reused elsewhere or properly disposed of upon decommissioning of the cofferdam. No material to be discarded within the watercourse or on the riverbanks.	No residual effects, with effective mitigation
	Use/storage of hazardous materials (e.g., fuel, lubricants).	Impairments to surface water quality due to spills or use of machinery in watercourses.	• Establish designated refueling and maintenance areas at least 30 m from flowing watercourses and away from drainage ditches, channels or other wet areas. The refueling of small equipment such as Airtrack Drillers, compressors, lighting will be undertaken on site (on top or behind cofferdams) with a small service truck equipped with a spill kit. • Locate designated hazardous material storage areas at least 30 m away from watercourses, for all hazardous materials to be stored outside. Storage areas should be above ground and enclosed by an impervious secondary containment structure (e.g. berm or container) capable of holding the entire volume of the stored material, as well as some additional volume of rainwater. The area should be equipped with a drain so that it can be cleared of any spilled material or accumulated rainwater, which would be disposed of in a suitable manner. Secondary containment areas should be monitored throughout the construction period to ensure their integrity. • Only machinery/equipment that is clean and well maintained (e.g., no leaks) should operate in or near watercourses or drainage areas. No washing of equipment is to take place within or near watercourses. • Provide adequate spill clean-up materials/equipment (e.g., absorbents) on site. The contractor will prepare a spill clean-up procedure/emergency contingency plan, prior to commencement of work at the site. The plan will be forwarded to relevant agencies prior to commencement of works on site. • Cement is to be stored indoors, where possible. If outdoor storage is required, cement bags should be covered with waterproof sheeting and raised from the ground surface (e.g., on wooden palates) to ensure no contact with surface water runoff. Empty cement bags are to be collected as soon as possible after use and spills of cement or concrete cleaned up as appropriate. Wastewater arising from cement/concrete work is to be collected and disposed of off-site, or properly treated before release to the environment. • Washwater from cement trucks to be contained and disposed of or treated at an approved sewage works designed for that purpose, as per the requirements of the Ontario Water Resources Act or the Ontario Building Code. • Any accidental spills likely to cause the following impacts to be immediately reported to the Ontario Spills Action Centre (1-800-268-6060) • No material from the construction to be discharged to local storm sewers.	Minor contamination of water quality could potentially occur. Extent of impact to vary depending on scale, timing, and location of incident should an accident occur; however the residual effect will be minimized by the effective use of spill containment and clean-up procedures.
	General construction activities in proximity to watercourses	Impaired surface water quality due to release of construction debris (e.g., concrete dust, sawdust).	• Work site isolation, containment, clean-up and good general housekeeping practices implemented to prevent escape of debris	No residual effect with effective mitigation
	Release of sewage effluents	Impaired downstream surface water quality.	• None required - self-contained sewage facilities to be used on site with appropriate off-site disposal of waste. Approved MOE licensed sewage haulers utilized to transfer waste off site. Mitigation measures undertaken to prevent spills during sewage hauling and transfer. Spill response procedure to be in place and spill containment and clean up material to be on site at all times during construction.	No residual effect.
	Potential for Acid Rock Drainage (ARD)	Impaired surface water quality due to ARD	• ARD potential expected to be low based on area geology. Rock samples to be tested prior to use in sensitive environments (e.g. in vicinity of watercourses or wetlands). If rock has high ARD potential, contingency plan will be implemented.	No residual effect anticipated
	Use of treated wood in aquatic environments	Water quality impairment due to leaching of toxic chemicals from treated wood	• If treated wood is used, it is to be non-arsenic, non-chrome based in accordance with CSA standards. • Sawdust and wood debris from any treated wood to be cleaned up immediately after generation and disposed of in an approved location • Pressure treated wood not to be burned on site. • Pressure treated wood not to be sealed with paint, stain or sealant	No residual effect anticipated
Aquatic Biota	Impaired surface water quality due to fugitive dust deposition and/or erosion and sedimentation	Potential impacts on fish health or behavior due to surface water quality impairment.	• Mitigation measures identified previously are anticipated to be effective in minimizing potential for impaired surface water quality due to sediment releases, thereby minimizing potential impacts on aquatic biota	Minor, short-term effect on aquatic biota. No long-term residual effect
	Accidental spills or leaks of potentially hazardous materials (e.g., fuels, oils, cement, explosives)	Potential impacts on fish health due to surface water quality impairment	• Mitigation measures identified previously are anticipated to be effective in preventing spills/accidents and minimizing associated impacts	No residual effect with effective mitigation
	Instream and riparian construction activities.	Disruption of fish and locally increased turbidity resulting in injury to aquatic biota, altered foraging and/or behavior	• In-stream construction to avoid sensitive fisheries reproductive periods (April 1 to July 15). Instream work to be limited to the greatest extent possible through the use of the downstream working platform to isolate working areas and efficient construction planning and phasing to minimize in-water requirements.	Localized and temporary disturbance of fish and other aquatic biota during instream works

Table 5.4 - Summary of Potential Effects, Proposed Mitigation and Residual Effects During Construction Phase - 4

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
	Blasting in or near fisheries habitats	Fish mortality or injury due to blasting.	• Blasting in accordance with DFO guidelines (Wright and Hopky, 1998).	Short-term disruption to aquatic biota during blasting. Some potential for mortality due to instream blasting at the intake area.
Aquatic Habitat	Increased transport of fine sediment into watercourse due to construction activities (e.g. wind or water erosion and transport).	Sedimentation of riverbed; resulting in harmful habitat alteration	• Erosion and sediment control plan to be implemented for all construction activities. Conduct regular monitoring to assess effectiveness and make improvements as necessary to erosion and sediment control measures.	Minimal residual effect with effective mitigation.
	Installation of instream working platform and cofferdam to allow intake, tailrace and powerhouse construction to be undertaken in the dry.	Temporary loss of 1165 m^2 and temporary alteration of 326 m^2 of aquatic habitat within the tailrace cofferdam area. Temporary loss of 666 m^2 and temporary alteration of 240 m^2 of aquatic habitat within the intake working platform area.	• Working platform/cofferdam material to be completely removed from the watercourse following completion of construction. • Duration that cofferdam and working platform are in place to be minimized to the greatest extent possible. • Installation of cofferdam and working platform to occur within the allowable timing window to minimize impacts on fisheries habitat. • Cofferdam not to affect any known walleye/white sucker spawning habitats downstream from the North and South Bala Dams.	Short-term loss/alteration of habitat in cofferdam and working platform area. Loss of benthic community within disturbed areas. No long term change anticipated.
	Construction of powerhouse, intake and tailrace	Permanent alteration of 247 m^2 of aquatic habitat due to intake channel excavation, permanent alteration of 190 m^2 of aquatic habitat due to tailrace channel excavation and permanent loss of 5 m^2 of aquatic habitat due to powerhouse construction – overall alteration of 437 m^2 and overall loss of 5 m^2 of aquatic habitat	• Installation of habitat enhancement structures including walleye spawning shoals on either side of the tailrace (82 m^2 of enhanced habitat), walleye spawning habitat enhancement at the mouth of the South Dam flow channel (264 m^2 of enhanced habitat). Habitat enhanced and created may provide a number of ecological functions including walleye/white sucker spawning habitat, baitfish foraging areas and benthic invertebrate production areas. Altered areas in tailrace and intake will continue to provide aquatic habitat supporting some productivity, although likely at reduced level due to decreased substrate complexity. Habitat enhancements will provide higher productivity habitat than areas to be altered at intake and tailrace.	Permanent alteration of 437 m^2aquatic habitat, permanent loss of 5 m^2 of aquatic habitat and permanent enhancement of 346 m^2 of aquatic habitat. No net loss of habitat productivity anticipated.
Terrestrial Vegetation	Clearing of vegetation for facility construction	Clearing of 1230 m^2 of vegetation including 1100 m^2 in the powerhouse area and 130 m^2 in the intake area.	• A formal restoration plan is to be prepared by a landscape architect to restore the work area on the west side of Highway 169 into a naturalized park. Restoration to be conducted using native vegetation species suitable for this area of Ontario.	Permanent loss of existing vegetation communities. Restoration of native vegetation species in park following construction.
	Use/storage of hazardous materials (e.g., fuel, lubricants).	Loss of vegetation due to accidental spills and malfunctions	• Establish designated refueling and maintenance areas. • Locate designated hazardous material storage areas above ground and enclosed by an impervious secondary containment structure (e.g. berm or container) capable of holding the entire volume of the stored material, as well as some additional volume of rainwater. The area to be equipped with a drain so that it can be cleared of any spilled material or accumulated rainwater, which would be disposed of in a suitable manner. Secondary containment areas to be monitored throughout the construction period to ensure their integrity. • Provide adequate spill clean-up materials/equipment (e.g., absorbents) on site. The contractor will prepare a spill clean-up procedure/emergency contingency plan, prior to commencement of work at the site. The plan will be forwarded to relevant agencies prior to commencement of works on site. • Cement is to be stored indoors, where possible. If outdoor storage is required, cement bags to be covered with waterproof sheeting and raised from the ground surface (e.g., on wooden palates) to ensure no contact with surface water runoff. Empty cement bags are to be collected as soon as possible after use and spills of cement or concrete cleaned up as appropriate. Wastewater arising from cement/concrete work is to be collected and disposed of off-site, or properly treated before release to the environment. • Any accidental spills likely to cause the following impacts to be immediately reported to the Ontario Spills Action Centre (1-800-268-6060)	Minimal residual effect with effective mitigation.
	Construction activities resulting in fugitive dust emissions	Adverse impacts on plant photosynthesis and growth due to dust deposition	• Mitigation noted under "Air Quality" to prevent/minimize fugitive dust emissions will be effective in minimizing potential impacts on vegetation. Dust sources are anticipated to be minimal given the predominance of paved roads in the project study area, and limited size of the construction site.	Minimal residual effect with effective mitigation.
Wildlife	Facility construction	Loss of wildlife habitat due to vegetation clearing	• No mitigation possible to prevent short-term loss of habitat during construction. Habitat will be replaced in a park setting during site restoration. Landscape plan to incorporate native vegetation species important to local wildlife (e.g., birds and small mammals). • Current wildlife use of the site is limited due to its isolated nature, small size and high levels of human disturbance (e.g., highway 169, nearby rail bridge, pedestrian use).	Permanent loss of existing naturalized vegetation communities. Replacement of some vegetation in a park setting will provide long-term habitat for tolerant wildlife.
	General Construction Activities	Disturbance to breeding wildlife populations	• If possible, clearing of vegetation to be conducted outside of the spring and early summer months (generally mid-May through mid-August) to avoid disturbance of breeding wildlife. • If this is not possible, areas to be cleared or within 100 m of blast sites to be surveyed by a trained biologist to determine if bird nesting, bat maternity colonies, denning, or breeding evidence of other species in the area. If any of these activities are found to be present, work will either be delayed until the site is no longer in use, an alternate route around the feature (>100 m away) is identified, or other suitable mitigation identified in consultation with EC/MNR. The 100 m buffer zone would be extended for species where buffer requirements are specified by MNR, such as bald eagles or great blue heron.	Temporary retreat of sensitive species from adjacent work areas

Table 5.4 - Summary of Potential Effects, Proposed Mitigation and Residual Effects During Construction Phase - 5

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
	General Construction Activities	Effects to wildlife as a result of spills of contaminating materials	• Mitigation identified previously with respect to terrestrial vegetation will also be effective at mitigating potential impacts on wildlife.	None following effective mitigation
Public Use and Access	General Construction Activities	Construction activities will restrict access to the immediate construction zone and the areas required for laydown, storage or storage. Boaters will no longer have the dock at Purk's Place Boat House and Marina available for berthing.	• As the construction zone will restrict access for the purposes of public safety, no mitigation is proposed. Compensation for business closure during construction or relocation of the docks in front of Purk's Place to an alternate location is proposed to compensate for the loss of use at the existing location.	Restricted public access to construction area.
Public Health and Safety	General Construction Activities	Construction of the proposed development poses public safety concerns, as the area is heavily used for both aquatic and land-based activities. Possible impacts include injury from construction equipment or activities such as blasting.	• Prevention of public access to the construction site through use of fences, gate(s), and security procedures. • Posting of signage to notify the public of construction in the area. • Adherence by workers to prescribed procedures such as required cleared radius during blasting. • Development of proper procedures for construction traffic.	Risk of injury possibly arising from non-adherence to the mitigation measures.
Construction Site Safety	General Construction Activities	Potential injury to workers on site.	• Completion of safety training program by all workers. • Strict adherence to the Ministry of Labour occupational health and safety regulations pertaining to construction sites regarding worker safety. • First aid equipment, as appropriate to the activity to be maintained on site. • Material Safety Data Sheets for any hazardous material used on site to be available close to the location where the material is used and stored. • An accident and emergency spill response plan. • Spill containment and clean-up materials on site. • Training to deal with spill situations.	Potential for injuries and/or loss of work time or workers.
Local Traffic – Highway 169	General Construction Activities	Increased local traffic and temporary disruption along routes used, resulting in delays to the local community traffic, and increased traffic on Highway 169. During construction of the project there may also be activities that require temporary disruption to traffic flow on Highway 169 including the delivery of large equipment to the site, and the construction of the temporary Bailey bridge.	A detailed plan for traffic management during construction is proposed. It will include the following features: • Erection of a temporary Bailey bridge to be installed early November, after the Bala Cranberry Festival and removed by mid April, prior to the tourist season. This bridge will accommodate snow removal during the winter. • One lane reduction for approximately 2 weeks while the Bailey bridge foundations are being prepared. • A night-time road closure while the preassembled Bailey bridge is being set into place (night shift on a Sunday night). • A night-time road closure while the Bailey bridge is being removed and the road restored (night shift on a Sunday night). • Designate transportation routes to avoid tight turning areas and delays. • Check overhead lines to determine the requirement for temporary removal or relocation (the appropriate utility will be contacted). • Use a police or other security company to guide/accompany any transport conveys as necessary. • Use flagmen to facilitate traffic flow and control. • Drive construction vehicles in a proper manner and respect all traffic laws, regulations, and company policies. • Vehicle imprints or erosion gullies will be regraded.	Potential traffic disruption/delay during the 12 to 18 month construction period.
Local Traffic – Bala Falls Road	General Construction Activities	Approximately 20 m of Bala Falls Rd will be closed and unavailable for public use. This area is between Highway 169 and Burgess Memorial Church.	• Installation of a temporary traffic light to direct traffic. • Discontinuation of the requirement for right turns only onto Highway 169. • Signage providing detour directions to access Bala Falls Road will be prominently displayed. • Designate transportation routes to avoid tight turning areas and delays. • Check overhead lines to determine the requirement for temporary removal or relocation (the appropriate utility will be contacted). • Use a police escort or other security to guide/accompany any transport conveys as necessary. • Use flagmen to facilitate traffic flow and control. • Drive construction vehicles in a proper manner and respect all traffic laws, regulations, and company policies. • Vehicle imprints or erosion gullies will be regraded.	Potential for temporary traffic disruption or delay.
Noise and Vibrations	General Construction Activities	Noise and vibrations generated by equipment and blasting activities.	• Contractor to develop blasting plan and alert local municipalities and public prior to blasting. • Conduct pre-blast and post-blast surveys of two historic buildings (Purk's Place Boathouse and Burgess Memorial Church and mitigate any damages resulting from construction activities. • Limit construction and blasting activities to daylight hours. • Avoid construction activities on Sundays and holidays.	Some noise and vibrations during the 12 to 18 months construction period.
Aesthetics	Presence of signage and fencing in or around restricted access areas; presence of construction equipment; removal of vegetation in construction area.	Interruption of aesthetically pleasing landscapes.	• Mitigation not possible.	The ongoing construction in the area will represent a change in aesthetics from baseline conditions during the 2010 tourist season. Site to be restored with landscaping.

Table 5.4 - Summary of Potential Effects, Proposed Mitigation and Residual Effects During Construction Phase - 6

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
Tourism and Recreation	General Construction Activities	Interruption of scenic views; loss of public access in some areas in the vicinity of Bala Falls; temporary increase in local traffic and traffic delays during construction activities.	• Preserve both the scenic view of the Bala Falls, and access south of the Bala Falls by moving the powerhouse south of the original location. • Preserve public access to the area by designing a public park space atop many of the facility components (to be placed underground) • Reduce traffic congestion during the construction period by designing and implementing a Traffic Management Plan (see Figure 5.1) to include the installation of a Bailey bridge allowing continuous traffic flow during the tourist season (May 24th long weekend to weekend after Thanksgiving). The Bailey bridge will be designed to accommodate all size vehicles, including boat and camper trailers, RVs and snowplows.	• Temporary disruption and traffic delay in the vicinity of Bala Falls. • Decrease in the use and enjoyment of recreational property in the vicinity of the project during construction activities.
Local Businesses	General Construction Activities	Direct effects on two local businesses in the construction zone, i.e., Purk's Place Boathouse and Marina and the antique store in Burgess Memorial Church.	• Compensation as agreed with SREL if business adversely affected during construction.	Disruption to local businesses.
Employment	General Construction Activities	Construction of the project will employ both skilled and unskilled labour originating locally and non-locally based on qualification. It is estimated that the project will generate approximately 4000 to 6000 person days of labour requirements extending over a 12 to 18-month period.	No mitigation measures necessary.	Positive effect on local employment and local businesses.
Economic Benefits	General Construction Activities	Employment income and local expenditures on materials, equipment, and services (food, accommodation, gas).	No mitigation measures necessary.	Positive effect on the local economy during construction.
Waste Management	General Construction Activities	Solid wastes generated during construction will include domestic waste such as food and sanitary waste and construction waste such as material packaging and scrap material. Sanitary facilities on site will include portable self-contained toilets and washroom facilities in a crew trailer. Minor amounts of liquid and hazardous waste may also be generated (e.g., waste oils, hydraulic fluids).	• All solid wastes are to be properly contained on site until off-site disposal to a licensed landfill. • Store liquid and hazardous wastes in sealed containers until disposal off site by an MOE licensed hauler to a registered facility. • Practice reuse and recycling whenever possible. • Securely contain food wastes to avoid a nuisance bear situation prior to disposal off site.	No residual effects with effective mitigation.
Local Cultural/ Heritage Resources	General Construction Activities	Potential damage to two historic structures (Purk's Boathouse and Marina and Burgess Memorial Church), as determined in the Stage 1 Archaeological Assessment to be significant heritage resources, worthy of preservation.	• A mitigation plan be developed to avoid/minimize impacts from shock or vibration from blasting. • Conduct pre-blast and post-blast surveys and repair any damages.	Historic structures preserved and protected.
Archaeological and Heritage Impact Assessment	General Construction Activities	Deeply buried heritage resources or human burials can exist on site and were not identified during a standard archaeological assessment.	The Ministry of Culture has specified mitigation that must be undertaken in the event of discovery of human remains or other archaeologically or culturally significant material. The following conditions apply and will be adhered to during construction: • It is an offence to alter any archaeological site without Ministry of Culture concurrence. No grading or other activities that may result in the destruction or disturbance of an archaeological site are permitted until notice of Ministry of Culture approval has been received. • Should deeply buried archaeological remains be found during construction activities, the Heritage Operations Unit of the Ontario Ministry of Culture should be notified immediately • In the event that human remain are encountered during construction, the proponent should immediately contact both the Ministry of Culture, and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ministry of Government Services, Consumer Protection Branch at (416) 326-8404 or toll free at 1-800-889-9768.	Protection of archaeological resources.

Table 5.5 Residual Effects Significance Criteria and Levels

Residual Effects Criteria	Effects Level Definition		
	Low	**Moderate**	**High**
Value/Importance of the Resource Affected	Value/importance of resource is low (i.e., resource is common/ abundant or not considered of interest by stakeholders).	Value/importance of resource is moderate (i.e., resource is neither abundant, nor scarce, or stakeholders view of interest, but not significant).	Value/importance of resource is high (i.e., unique to the area, or scarce, or stakeholders view as significant).
Magnitude (of effect)	Effect is evident only at or nominally above baseline (existing) conditions.	Effect exceeds baseline (existing) conditions, but is less than regulatory criteria or published guideline values.	Effect exceeds regulatory criteria or published guideline values.
Geographic Extent (of effect)	Effect is limited to the project area (i.e., leased lands).	Effect extends beyond the project area limits into the adjacent local area (<500 m).	Effect extends beyond the local area and into the regional area (>500 m).
Duration and Frequency (of effect)	Effect is evident only during construction activities and occurs infrequently and for short durations.	Effect is evident during the operational period and occurs infrequently and/or for short durations.	Effect is evident during the operational period and occurs frequently and for long durations.
Ecological Context (of effect)	Effect occurs in a region with low fragility (i.e., high resilience to effect).	Effect occurs in a region with moderate fragility (i.e., moderate resilience to effect).	Effect occurs in a region with high fragility (i.e., low resilience to effect).
Likelihood (of effect)	Effect has a low probability of occurring.	Effect has a moderate probability of occurring.	Effect has a high probability of occurring.
Reversible/ Irreversible (of effect)	Defined as reversible (affected area returns to existing conditions (generally) immediately or over time) or irreversible (affected area never returns to existing conditions).		

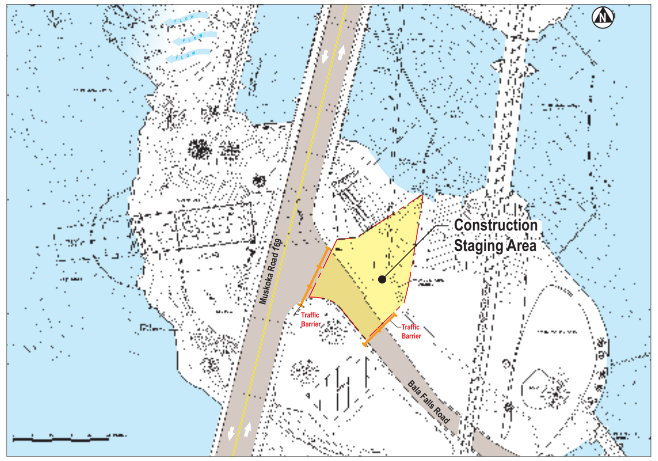
The evaluation of the significance of the residual adverse effects during the construction phase is presented in Table 5.6. Generally, construction effects are temporary and short term in duration, of low magnitude and reversible in many cases. Based on the criteria used to assess significance, none of the residual effects occurring during the construction period are considered significant.

Table 5.6 Assessment of the Significance of Residual (Net Adverse) Effects During Construction

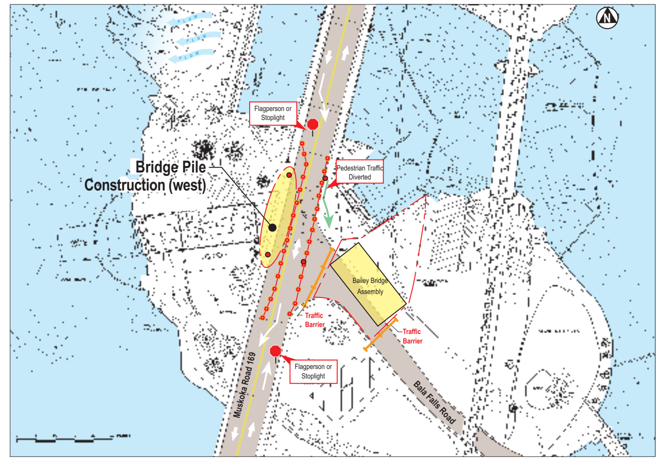
Environmental Component	Residual Effect	Value/ Importance	Magnitude	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social Fragility	Likelihood of Effect
Natural Environment								
Geology	Decrease in bedrock	Low	Moderate	Low	High	Irreversible	low	High
Soil	Small areas of erosion compaction, erosion soils mixed with gravel	Moderate	Low	Low	Low	Reversible	Moderate	Moderate
	Risk of soil contamination due to accidental spills	Moderate	Low	Low	Low	Reversible	Low	Low
Air Quality	Fugitive dust emissions from construction site	High	Low	Moderate	Low	Reversible	Low	Moderate
	Air emissions from construction equipment	High	Low	Low	Low	Reversible	Low	High
Groundwater	Alterations in groundwater flow vectors and levels due to excavations	Moderate	Moderate	Low	Low	Reversible	Low	High
	Risk of groundwater contamination due to accidental spills	Moderate	Low	Moderate	Low	Reversible	Low	Low
Surface Water Hydrology and Hydraulics	Minor changes in local hydraulics due to working platform	Low	Moderate	Low	Low	Reversible	Low	High
	Increased local runoff rates and minor alteration in drainage patterns	Low	Low	Moderate	Low	Reversible	Low	Moderate
Surface Water Quality	Impaired water quality (i.e., turbidity and suspended solids)	High	Low	Moderate	Low	Reversible	Low	Moderate
	Turbidity associated with rock-fill working platform installation	High	Low	Moderate	Low	Reversible	Low	Moderate
	Impairments to surface water quality due to accidental spills or release of other construction debris	High	Low	Moderate	Low	Reversible	Low	Low
Aquatic Biota	Potential impacts on fish health or behaviour due to water quality impairment from turbidity	High	Low	Moderate	Low	Reversible	Moderate	Low
	Potential impacts on fish health or behaviour due to water quality impairment from accidental spills	High	Low	Moderate	Low	Reversible	Moderate	Low

Environmental Component	Residual Effect	Value/ Importance	Magnitude	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social Fragility	Likelihood of Effect
	Disruption of aquatic biota during instream works	High	Low	Moderate	Low	Reversible	Moderate	High
Aquatic Habitat	Habitat alteration due to erosion and sedimentation	High	Low	Moderate	Low	Reversible	Moderate	Low
	Temporary alteration and loss of habitat in working platform and cofferdam areas	Moderate	High	Low	Low	Reversible	Moderate	High
	Permanent alteration of aquatic habitat in tailrace and intake	Moderate	Moderate	Low	High	Irreversible	Moderate	High
Terrestrial Vegetation including Wetlands	Loss of terrestrial vegetation during clearing	Moderate	Moderate	Low	High	Irreversible	Moderate	High
	Loss/alteration of vegetation due to accidental spills	Moderate	Low	Low	Low	Reversible	Low	Low
	Loss/alteration of vegetation due to fugitive dust	Moderate	Low	Moderate	Low	Reversible	Low	Low
Wildlife and Wildlife Habitat	Loss of habitat due to vegetation clearing	Low	Low	Low	High	Irreversible	Low	High
	Disturbance of wildlife during construction	Low	Low	Moderate	Low	Reversible	Moderate	Moderate
	Effects to wildlife due to accidental spills	Moderate	Low	Moderate	Low	Reversible	Low	Low
Public Use and Access	The residual effect of the project on public use and access will be restricted public access to construction area	Moderate	Moderate	Low	High	Reversible	Low	High
Public Health and Safety	Risk of injury possibly arising from non-adherence to the mitigation measures	Moderate	Moderate	Low	Low	Reversible	Low	Low
Construction Site Safety	Potential for injuries and loss of work time	High	Moderate	Low	Low	Reversible	Low	Low
Local Traffic – Muskoka Road 169	Temporary traffic delays during the 12 to 18 month construction period.	Moderate	Moderate	Moderate	Low	Reversible	Moderate	Low
Local Traffic – Bala Falls Road	Temporary traffic delays	Moderate	Moderate	Moderate	Low	Reversible	Moderate	Moderate
Noise and Vibrations	Some noise and vibrations during the 12 to 18 month construction period.	Moderate	Moderate	Low	Low	Reversible	Low	Moderate

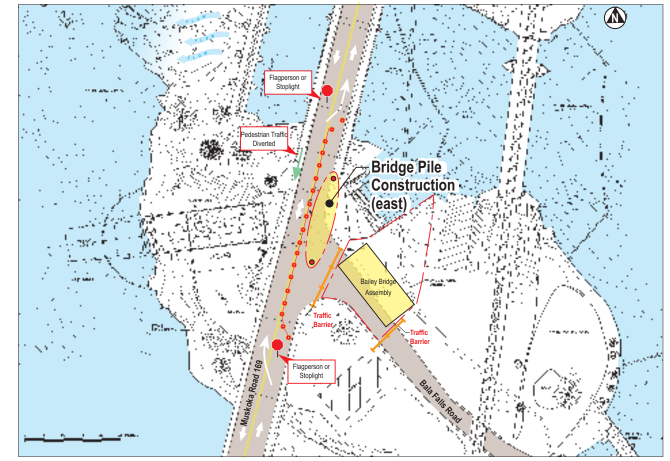
Environmental Component	Residual Effect	Value/ Importance	Magnitude	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social Fragility	Likelihood of Effect
Aesthetics	Change in aesthetics during the 12 to 16 month construction period.	High	Moderate	Low	Low	Reversible	Low	High
Tourism and Recreation	• Temporary traffic delays in the vicinity of Bala Falls • Decrease in the use and enjoyment of recreational property in the project area during construction (2010 summer season) • Temporary loss of public access to some view areas on the south side of Bala Falls	High	Moderate	High	Low	Reversible	High	High
Local Businesses	• Temporary direct effects to two local businesses adjacent to project site.	High	Moderate	Low	Moderate	Reversible	High	High
	• Traffic delays to reach local business in Bala	High	Low	High	Low	Reversible	High	Moderate



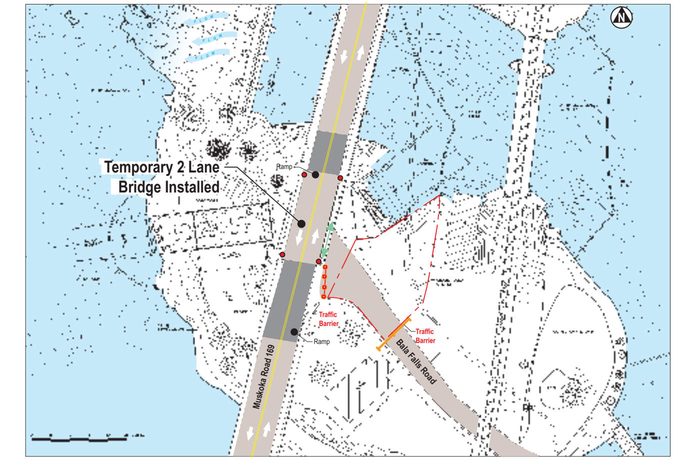
Stage 1
Mobilize and prepare construction staging area.



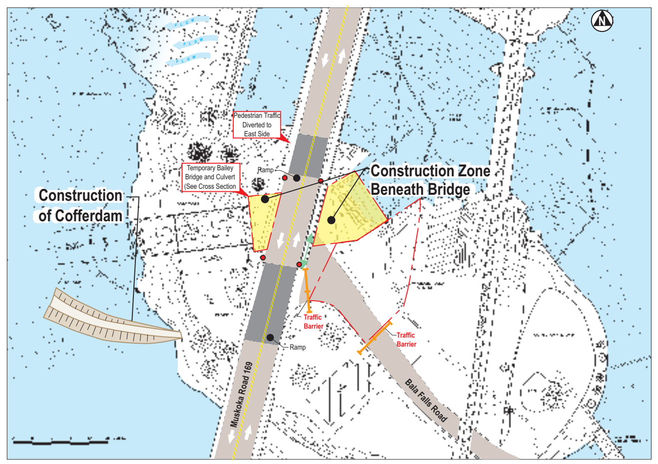
Stage 2a
Prepare Bailey Bridge west piles. Assemble Bailey Bridge on Bala Falls Road.
(approximately one week duration)



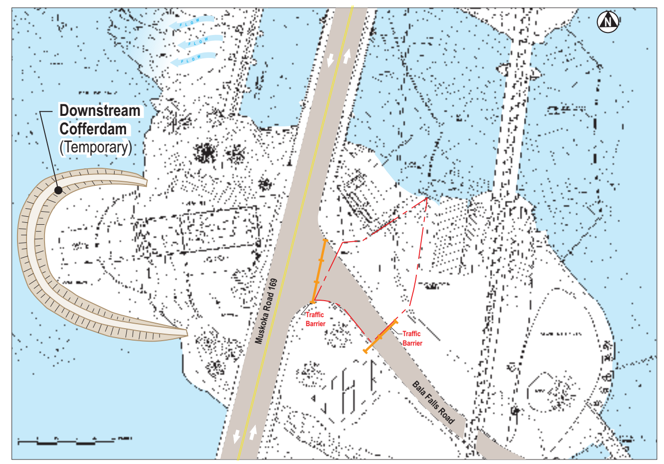
Stage 2b
Prepare Bailey Bridge east piles. Assemble Bailey Bridge on Bala Falls Road.
(approximately one week duration)



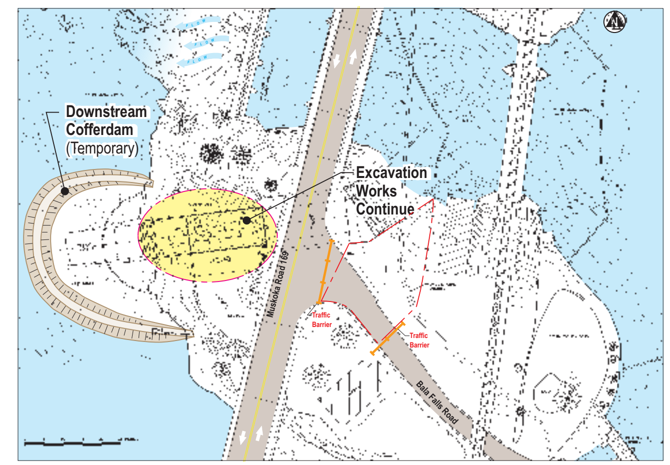
Stage 3
Crane places temporary Bailey Bridge on Highway 169 with end ramps.
(one night shift - closure)



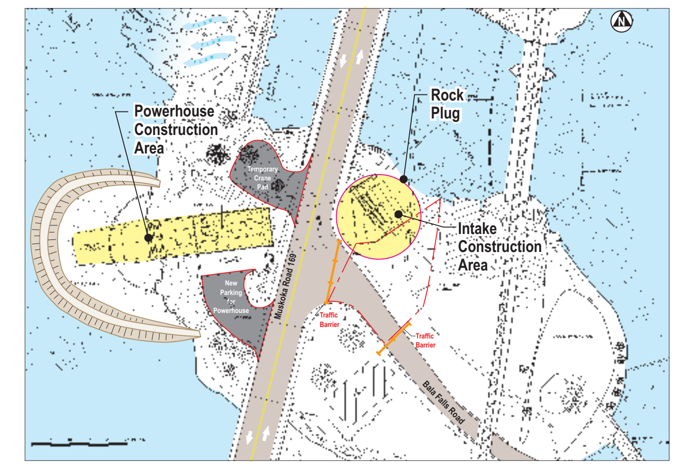
Stage 4
Construct box culvert beneath Bailey Bridge using cut and cover approach.
Excavated material to downstream cofferdam.



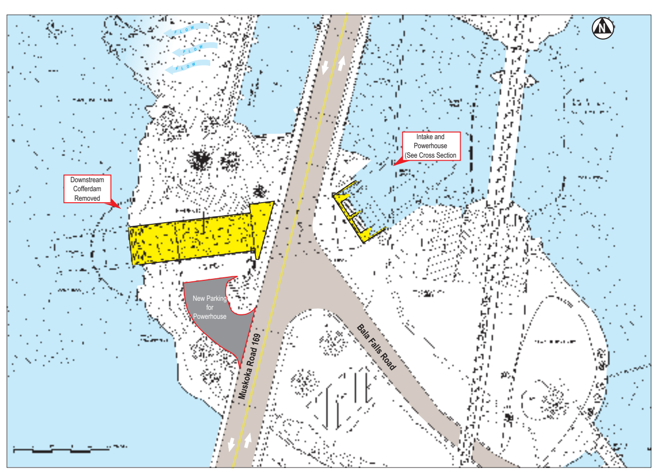
Stage 5/6
Crane removes temporary Bailey Bridge, final road fill placed. Highway 169 fully open for remainder of project. (1 night shift - closure ~ 4 hrs.)



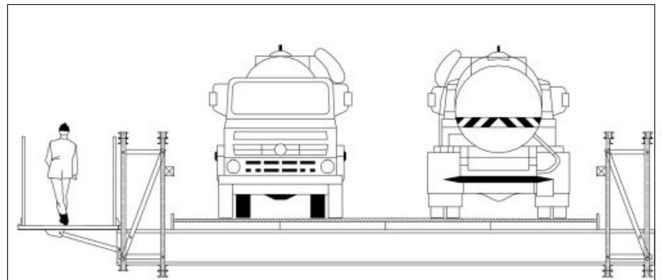
Stage 7
Excavate for powerhouse.



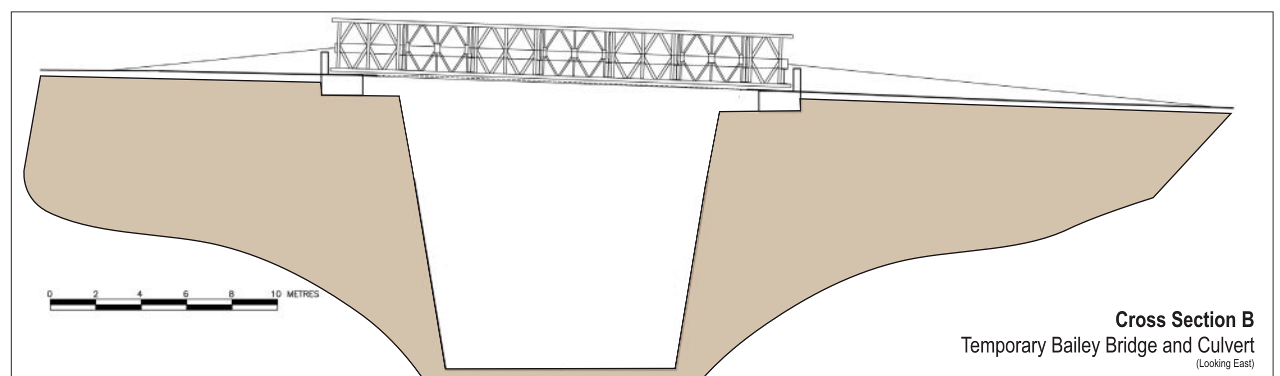
Stage 8
Construct Powerhouse and Intake.
(Intake channel to be excavated in water-blasting coinciding with rock plug removal)



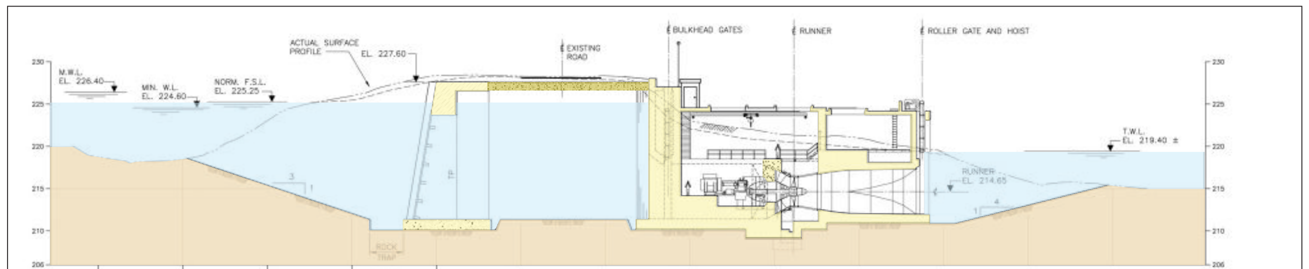
Stage 9
Commission generating facilities.



Cross Section A
2 Lane - Temporary Bailey Bridge.
(Looking South)



Cross Section B
Temporary Bailey Bridge and Culvert
(Looking East)



Cross Section C
Intake and Powerhouse
(Looking South)

Figure 5.1
Swift River Energy Ltd.
North Bala Small Hydro Project
Traffic / Construction Sequence

HATCH energy

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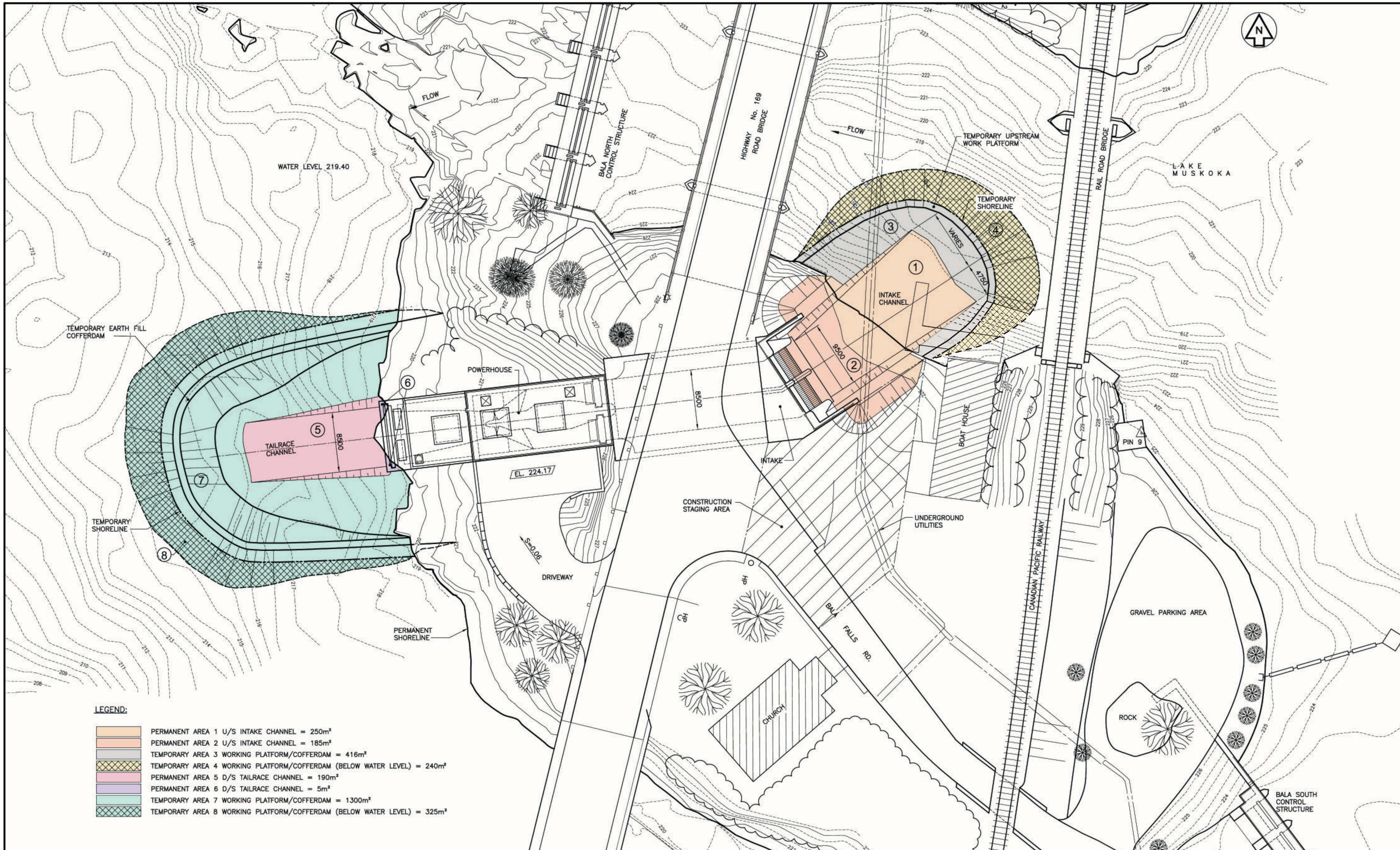


0 5 10 15 20 25 METRES

1:250

ALL DIMENSIONS ARE IN MILLIMETRES.
ALL ELEVATIONS ARE IN METRES.

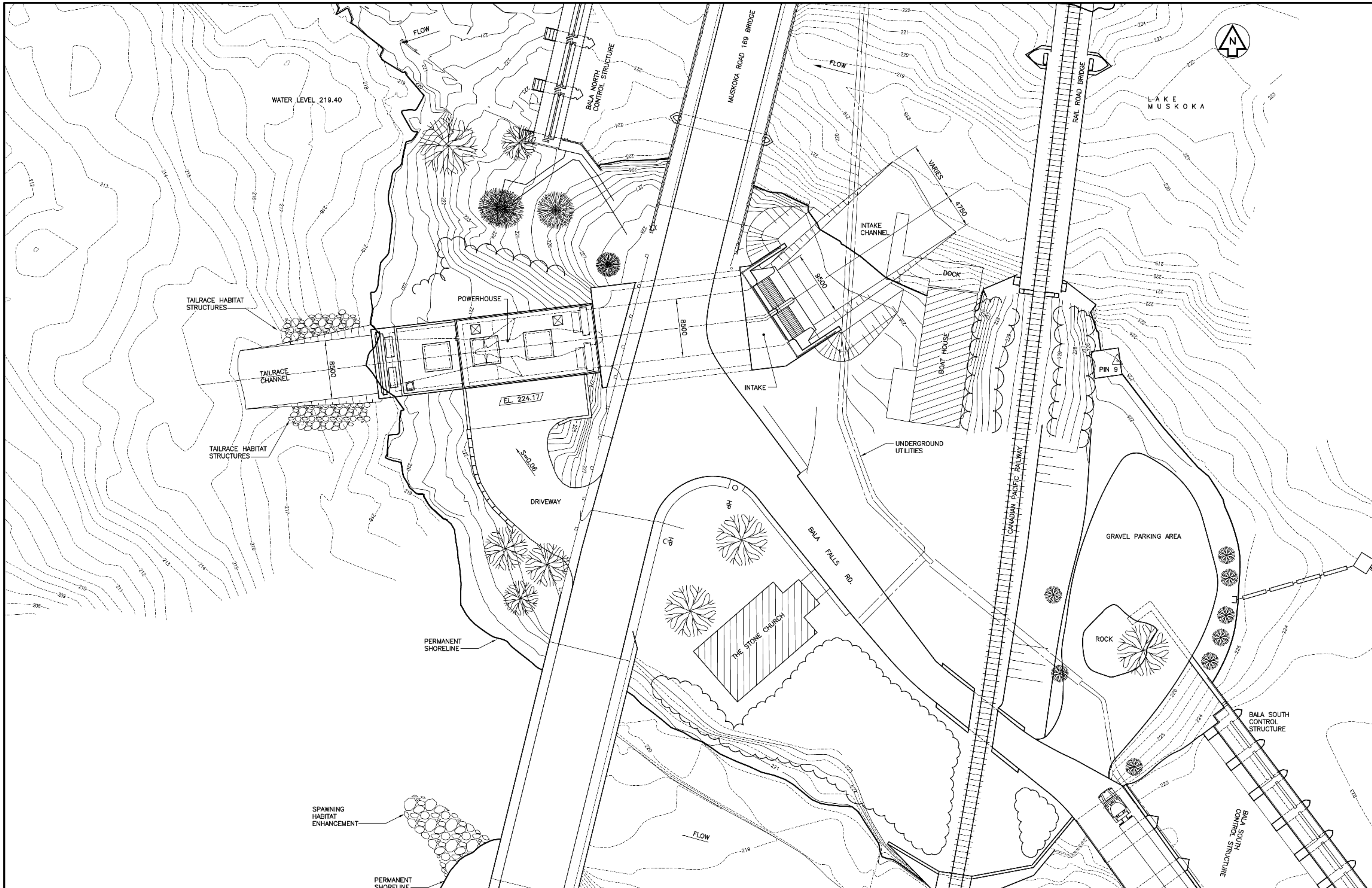
Figure 5.2

Swift River Energy Ltd.

North Bala Small Hydro Project

HATCH energy

Surface Area of Aquatic Habitat Impacts Due to Temporary and Permanent Structures



0 5 10 15 20 25 METRES
1:250

ALL DIMENSIONS ARE IN MILLIMETRES.
ALL ELEVATIONS ARE IN METRES.

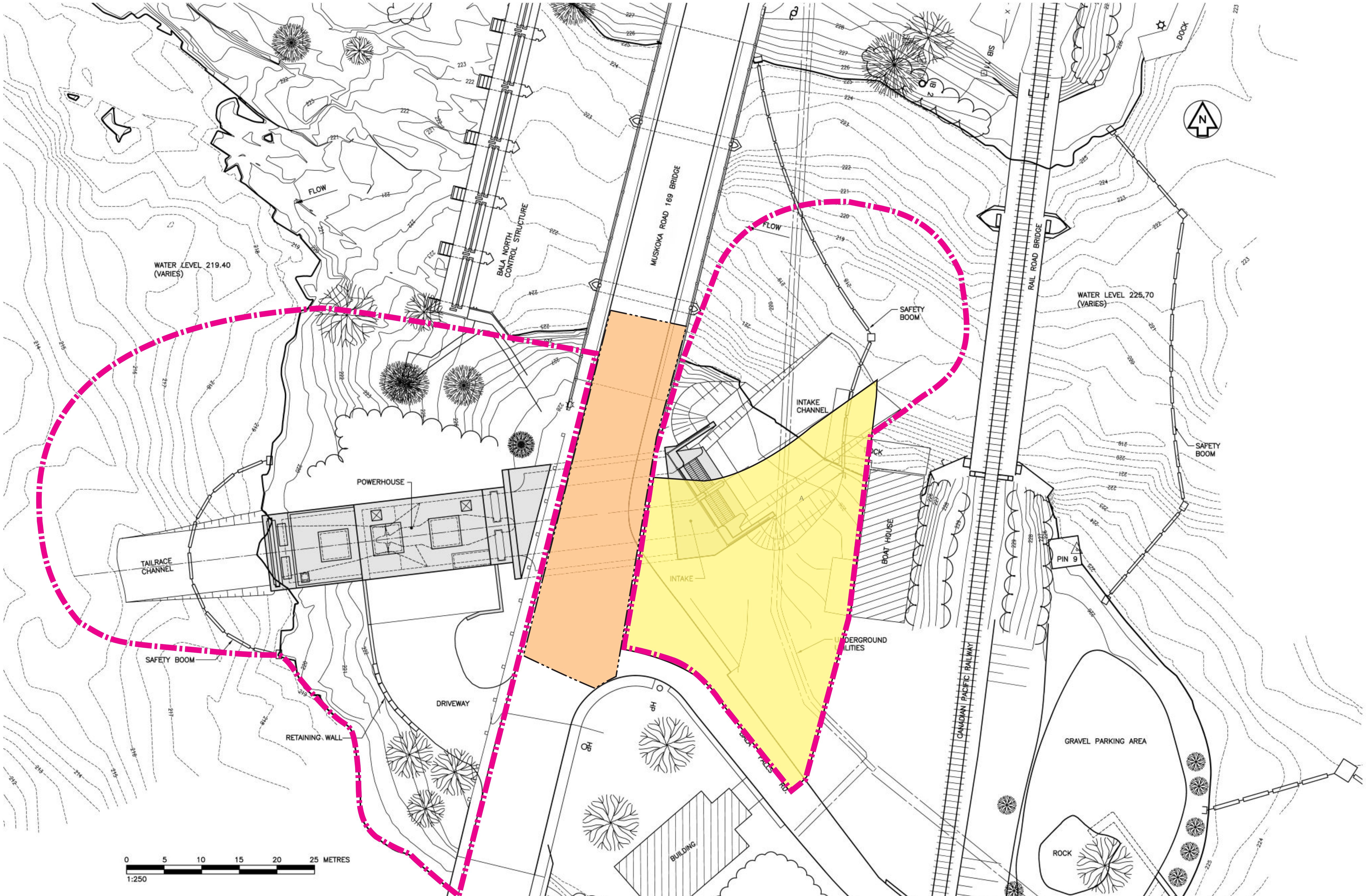
Figure 5.3

Swift River Energy Ltd.

North Bala Small Hydro Project

Aquatic Habitat Enhancements

HATCH energy



Legend

Construction Zone - Restricted Public Access

Construction Staging Area/Works Yard

Construction Zone - Temporary or Periodic (during installation and removal of bridge)

Figure 5.4
Swift River Energy Ltd.
North Bala Small Hydro Project
Areas Restricted During Construction

HATCH energy

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6 Effects Assessment and Proposed Mitigation and Residual Effects During Operations

6. Effects Assessment and Proposed Mitigation and Residual Effects During Operations

This section describes the potential interactions between the project and environment, and documents the anticipated environmental effects during operation of the facility for the preferred scheme as described in Section 1.6. The facility will operate in a run of river mode of operation, which is described in detail in Section 9. Mitigation measures that may be applied to minimize/ eliminate adverse effects are described, and any residual adverse effects remaining after mitigation are summarized in Table 6.1 and carried forward to Table 6.2 for an evaluation of significance.

6.1 Source of Effect

The source of effect is the operation of the Bala Falls Small Hydro Facility and all associated activities, including long-term maintenance works.

Operation of the facility will have no effect on daily water levels of Lake Muskoka above the generating station and flow rates in the Bala Reach downstream from the generating station, due to the run of river mode of operation. The facility, including the powerhouse and the north and south Bala dams, will be operated in an attempt to maintain the Target Operating Level (TOL) of Lake Muskoka as identified in the existing MRWMP. The sources of effects related to facility operation (i.e., water levels and flows) are described in detail in Section 6.2 below and Section 9.

6.2 Effects and Mitigation – Natural Environment

6.2.1 Air Quality

It is anticipated that a back-up diesel generator will be installed within the powerhouse in order to provide emergency power in the event of a local power outage. The generator would be tested regularly to ensure proper working, but otherwise, would only be run on an as-required basis. The specifications and design for this generator will be determined during the detailed design process and will need to meet MOE's requirements for a Certificate of Approval (Air Emissions). It is anticipated that the effect of operation of the generator on local air quality will result in minor, short-term impacts due to emissions of the by-products of diesel fuel combustion, including FPM, SO_2, NO_x, CO_2, volatile organic carbons and polyaromatic hydrocarbons.

6.2.2 Hydrology (Flows, Water Levels and Hydraulics)

6.2.2.1 Flow Rates

The facility will have a rated flow capacity of 96 m^3/s. It will be operated in a run of river mode in order to prevent adverse environmental impacts due to fluctuating water levels and flow rates due to facility operation. Figure 6.1 identifies the projected average weekly flow rates through the facility and over the North and South Bala Dams during the operational period, based on MNR dam flow records from 1982 to 1999. The graph in Figure 6.1 assumes that 4 m^3/s is being routed through the Burgess Generating Station at all times. During the average flow conditions depicted in this figure, the Bala Generating Station would be shut off periodically in August and September when outflow from the lake is not sufficient to provide the continuous flow of 6 m^3/s and enough flow to operate the turbine (14 m^3/s). The plant flow in Figure 6.1 depicts the average flows, which take in account periodic shutdowns due to low flows.

The approved WMP for Lake Muskoka and Bala Reach requires a continuous flow of 6 m^3/s to be passed through the three Lake Muskoka control facilities (Burgess Generating Station, North Bala Dam, and South Bala Dam). The main intent of the continuous flow is to preserve water quality and aquatic habitat, and to meet the Lake Muskoka water level objective while allowing Burgess Generating Station to generate power and prevent an out-of-range Low Flow Trigger within the Bala Reach. It is recognized that leakage through the Bala North Dam provides aesthetic value during low-flow periods. In the case that Lake Muskoka outflows exceed 6 m^3/s, 4 m^3/s is allocated to the Burgess Generating Station for power generation. As a result, a continuous flow of 2 m^3/s is assumed to pass through the North Bala and South Bala dams, split equally between the two structures. When flows are below 6 m^3/s, the Burgess Generating Station will not operate and the required minimum daily average flow of 6 m^3/s is assumed to pass through the Bala dams, once again split equally between the two dams. Therefore, on any day of the year, the flow available for power generation at the North Bala Generating Station will equal the amount of flow entering the Bala Bay, reduced by the continuous flow of 6.0 m^3/s.

Flows in excess of 6 m^3/s, up to the rated capacity of 96 m^3/s will be passed through the plant. The plant will be operated so as to maintain the TOL of Lake Muskoka which would result in the run of river mode of operation whereby the combined sum of inflow to Lake Muskoka equals the combined outflow from the powerhouse, Burgess Generating Station and the north and south Bala dams. It is anticipated that there will be some amount of generation every day, as shown by the weekly average flow graph in Figure 6.1. If the flow rate in the river is not sufficient to provide the minimum flows (Burgess Generating Station flow and minimum flow over North and South Dams), and the minimum flow required to operate the turbine (14 m^3/s) the Bala Generating Station facility will not be operated.

Flows in excess of 102 m^3/s (plant flow of 96 m^3/s plus mandated Burgess Generating Station and dam minimum flows totalling 6 m^3/s) will be passed using the South Dam, with the North Dam typically being operated only if the South Dam's spilling capacity is exceeded. Based on the average weekly flow record from 1960 to 2005, average flow over the North Bala Dam will be limited to the minimum continuous flow of 1 m^3/s over the majority of the year, with the dam only operated to help pass the spring snow melt and other high water events. The North Bala Dam may also be operated to ensure adequate flow over the existing walleye spawning habitat at the base of the north dam flow channel during the walleye spawning and incubation period (see Section 6.2.5.2 for additional discussion).

The historical weekly flow averages for the months of April and May were used to calculate the frequency and volume of surplus flows (above plant flow) expected to be available for passage over the Bala North and Bala South Dams during plant operation in these 2 months. As noted in Sections 2.1.6 and 2.1.10, walleye spawning typically occurs in the area between late April and mid-May, with the exact timing being dependent on water temperature. The flow frequency results for April and May are displayed in Tables 6.3 and 6.4. The available (surplus) flows referred to are total flows.

When all weeks in April are considered, if the plant were to operate at rated flow, there would be water available to pass dam flows other than leakage 86% of the time. Flows of 120 m^3/s or more will be available for passage over the dam(s) more than 51% of the time.

Table 6.1 Summary of Potential Effects and Mitigation During Operation Phase

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
Air Quality	Periodic back-up diesel generator use	Emission of diesel combustion by-products during operation	• Diesel generator emissions will meet MOE guidelines for emissions from stationary sources. Generator will only be run during short duration monthly testing periods, or as necessary when power for the station is required during local power outages, which is anticipated to occur very infrequently. • A Certificate of Approval (Air) will be required from MOE under Section 9 of the EPA.	Minor alteration in local air quality conditions during backup diesel generator operations.
Surface Water Hydrology	Diversion of flow for power production	Diversion of up to 96 m^3/s through the powerhouse will decrease flows over the North and South Bala Dams	• Minimum continuous flow of 1 m^3/s will be passed through each of the North and South Bala Dams at all times • Flows in excess of the powerhouse capacity will be spilled over the South Bala Dam • Flows in excess of the flow capacity of South Bala Dam and the powerhouse will be spilled over the North Bala Dam	Decreased flows over the South Bala Dam. Flow over North Bala Dam limited to minimum flow year round, based on average flow conditions.
	Lake Muskoka water level regime	Potential changes in water level regime due to operation of the facility	• SREL will operate the facility in a run of river manner within a narrow BMZ band around the TOL of the existing MRWMP. Band will vary seasonally, depending on the time of year, as per MNR requirements. The existing NOZ of the MRWMP will become the compliance limits for the facility • Finer control over the water level of Lake Muskoka will be possible due to operation of the facility (i.e., increasing or decreasing flow through the plant can result in a finer and more frequent change in water levels than operation of the stop logs at the North and South Bala dams), possibly improving the ability of the lake to remain at the TOL	No adverse effect on Lake Muskoka water levels.
	Bala Reach and farther downstream reach water levels (Moon River, Musquash River, Go Home Lake)	Potential changes in water level regime due to operation of the facility	• SREL will operate the facility in a run of river manner in accordance with the existing MRWMP. Bala Reach water levels will remain under control of OPG, who will continue to operate in accordance with the MRWMP>	No adverse effect on Moon River, Bala Reach, Musquash River or Go Home Lake water levels
	Diversion of flow for power production	Changes in local hydraulics downstream from the dams and tailrace	• Minimum continuous flow of 1 m^3/s to be passed through each of the North and South Bala Dams at all times – no other mitigation possible due to power diversion	Long term changes in local flow hydraulics due to power diversion.
Groundwater	Accidental spills	Groundwater contamination	• Proper storage of materials in leak-proof containers or contained areas in the powerhouse • Utilization of proper material handling procedures • Employees responsible for chemical handling to be trained in proper handling and emergency spill response procedures • An adequate supply of spill containment and clean-up material to be maintained on site. • All spills of potentially hazardous materials to be cleaned up immediately, with contaminated materials removed from the site to a designated disposal area, if required. • Contact the Spills Action Centre of the MOE in the event of any spill that could potentially cause damage to the environment.	No impacts anticipated with effective mitigation.
Surface Water Quality	Water management practices	Impaired water quality due to changes in flow management	• Minimum flows specified in the MRWMP to be maintained at all times	No residual effect anticipated due to flow management.
	Increased impervious surfaces around facilities	Increases in surface water runoff	• Installation of the buried powerhouse, creation of the park like setting, and associated landscaping and shoreline protection will limit any increase in amount of runoff entering the Muskoka River.	No impact in local runoff rate anticipated.
	Hazardous materials use at powerhouse	Potential for water quality impairment due to accidental spills	• Spill prevention and response plan to be prepared and operating staff trained in proper implementation. • All hazardous materials to be stored in designated containment areas in powerhouse. • Spill containment and prevention materials to be stored in powerhouse at all times. • Oil water separator to be installed in main sump of the powerhouse to prevent discharge of hazardous materials in the event of a spill in the powerhouse • Secondary containment provided around transformer.	No impacts anticipated with effective mitigation.
Aquatic Habitat and Biota	Hazardous materials use at powerhouse	Impacts on aquatic biota due to accidental discharges of hazardous materials	• Mitigation measures noted above to prevent/minimize discharge of hazardous materials are anticipated to be effective in preventing impacts on aquatic biota.	No impacts anticipated with effective mitigation.
	Flow diversion for power production – altered flows in bypass reaches	Decreased wetted area and altered hydraulics in North and South Dam rapids reaches	• Minimum continuous flow of 1 m^3/s to be passed through each of the North and South Bala Dams at all times to maintain wetted surface area in the bypass reaches and flow over the productive riffles downstream from the higher gradient bedrock dominated sections • Aquatic habitat creation and enhancements described in Section 5 to provide additional productive habitat to mitigate impacts.	Decreased habitat availability in bedrock dominated bypass reaches. Decreased seasonal flow fluctuations in productive riffles – no significant change in productivity anticipated.
	Flow diversion for power production – altered hydraulics	Adverse effects on walleye spawning habitat at base of North Bala Dams due to diversion of flow for power production	• A 200 m^2 spawning bed will be installed downstream from the south channel in order to provide replacement spawning habitat for walleye and sucker spawning, as well as invertebrate production.	Loss of existing spawning habitat at base of north dam, enhancement of same amount of habitat elsewhere. No long term effects on walleye spawning anticipated to occur.
	Water management on Lake Muskoka	Alterations in aquatic habitat availability due to water level management	• Facility will be operated in a run of river manner. Water level on Lake Muskoka to be managed within a narrow BMZ band around the existing TOL in the MRWMP. Existing NOZ will become the compliance zone for the facility.	No impact anticipated.
	Water Management	Alterations in flow at Moon Falls and potential impacts on walleye spawning	• Flow constraints identified in the MRWMP with respect to provision of flow during the walleye spawning period at Moon Falls will be maintained. Therefore, there will be no change from existing conditions.	No residual effect.

Table 6.1 - Summary of Potential Effects and Mitigation During Operation Phase - 2

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
	Intake and turbine operation	Impingement of fish on trashracks and potential for mortality in turbines	• Low intake channel velocity utilized to prevent impingement. Trashracks utilized to prevent entrainment of large fish into turbine flow. Kaplan turbines will limit the amount of mortality predicted to occur if fish do go through powerhouse.	Some minor amount of mortality may occur during project operation.
Terrestrial Biota/Vegetation	Water management on Lake Muskoka	Vegetation community change or wildlife/habitat disruption as a result of water level fluctuations	• Facility will be operated in a run of river manner. Water level on Lake Muskoka to be managed within a narrow BMZ band around the existing TOL in the MRWMP. Existing NOZ will become the compliance zone for the facility.	No adverse effects anticipated.
	Facility operation	Retreat of wildlife species from immediate vicinity of facility due to noise disturbance	• Not possible to mitigate.	Minor loss of wildlife habitat to species sensitive to human disturbances.
	Maintenance activities	Disturbance of wildlife species as a result of human presence within project area	• The facilities will be unmanned. • If possible, major maintenance activities to be scheduled outside of the breeding season (approximately May 16 to July 31).	Infrequent, temporary disturbance of local wildlife population.
		Accidental spills of hazardous materials may damage biota	• See mitigation above for surface water quality.	Minimal residual effect with effective use of spill containment and clean-up procedures.
Public Use and Access	Facility Operation	Following the completion of construction activities, access to Bala Falls will continue to be available, and there will be a viewing deck, with a public park constructed over the powerhouse and tailrace channel. There will be some areas which will be restricted from public access (via signage and floating safety booms) during operation of the facility.	Park Area (south of North Bala Dam and west of Hwy 169) • An initial plan for landscaping and public access to this area is illustrated in Figure 6.8 (Final design to incorporate public comments from Aug 2008 PIC). • This area will be wheelchair accessible to the extent possible Parking Area (east of Hwy 169 and north and inclusive of Bala Falls Rd). • Access to the shoreline and water between the Hwy 169 Road Bridge and CP Railway Bridge will be restricted within the boom area. • The docks at Purks Place Boat House and Marina will be relocated as agreed between Swift River Energy Ltd. and Purks Place Boat House and Marina. • Bala Falls Road will be re-opened following construction completion.	Restriction to waters within the safety booms at the intake and tailrace.
Public Safety During Plant Operation	Facility Operation	Potential risk to public safety within the boomed/restricted areas in the intake/tailrace.	• Proper barriers and warning devices to restrict public access to intake/tailrace areas, while facilitating safe public access to other areas. These will include safety booms at the intake and tailrace channels, and fencing and signage on land restricting access to hazardous areas. • Design for viewing deck to discourage diving/jumping.	Minimal risk to public safety in vicinity of intake and tailrace.
Worker Safety During Plant Operation	Facility Operation	Potential risk to workplace safety during the operation of the project	• Completion of safety training program by all workers. • Strict adherence to the Ministry of Labour occupational health and safety regulations pertaining to worker safety • First aid equipment to be maintained on site. • Material Safety Data Sheets for any hazardous material used on site to be available close to the location where the material is used and stored. • An accident and emergency spill response plan. • Spill containment and clean-up materials on site. • Training to deal with spill situations.	Minimal risk to workplace safety.
Sound Levels	Facility Operation	Effect on nearby receptors	Mitigation measures to reduce the sound emitted by the facility operation will involve: • Installation of the transformer within the powerhouse, underground. • Locating generator cooling fans to ensure exhaust directionality is toward existing sources of sound i.e. Highway 169 and the railway line. • C of A (air/noise) will be obtained from MOE and sound levels at nearby receptors will meet MOE guidelines	No residual effect on nearby receptors.
Aesthetics - Flow Over Bala Falls	Facility Operation	Reduced flows over falls possible.	No mitigation possible. Existing low flows over Bala Falls during an average winter will continue to be provided by leakage between the stop logs (assumed to be 1 m^3/s).	Reduced flows over falls during spring, fall and winter (see Section 6.2.2. - Hydrology). Summer low flows to be maintained for aesthetic viewing of falls.

Table 6.1 - Summary of Potential Effects and Mitigation During Operation Phase - 3

Environmental Component	Sources of Effect	Potential Effect	Mitigation Measures	Residual Effect
Aesthetics – Flow Via the South Dam	Facility Operation	Reduced flows via South Dam possible	No mitigation possible. The South Dam will experience less flow throughout the year as water is diverted through the powerhouse.	Reduced flows via the South Dam during spring, fall and winter (see Section 6.2.2. - Hydrology). Summer low flows to be maintained for aesthetic viewing of falls.
Aesthetics – Powerhouse and Site	Facility Operation	Visual impact of powerhouse and site	Mitigation has been designed based on public comments during the August 2007 and 2008 Public Information Centres. The plan proposed incorporates the following key features: • The powerhouse was moved from its original location further south, and away from the south edge of the waterfall ensuring continued safe access to Bala Falls and the surrounding area. • Powerhouse is now designed with virtually all station facilities below grade. • The orientation of the powerhouse is such that tailrace flows have minimal impact on the scenic falls area. • This design provided the opportunity to create a park-like setting in keeping with the site's natural beauty and character.	Improved aesthetics for public viewing of Bala Falls and Bala Reach area.
Tourism and Recreation	Facility Operation	Reduction in area available for in-water activities within boomed areas.	No mitigation measures possible to protect public safety.	Reduced area available for in-water activities at intake and tailrace (see Figure 6.7)
		Interference to public use of site	See mitigation for powerhouse site above.	Additional parkland available for public use
Employment and Economic Opportunities	Facility Operation	Employment opportunities and other benefits to local and provincial economy	Not required – positive effect. One full-time remote operator will be required. Local and provincial tax revenues from project. The energy produced by the project will be equivalent to that required to power approximately 1,750 homes.	Employment for one GS operator. Local and provincial tax benefits.
Infrastructure – Downstream Hydroelectric Facilities	Facility Operation	Effects to the five control structures downstream (and therefore hydroelectric generation) at Moon Dam, Ragged Rapids Dam, Big Eddy Dam, Go Home Lake Control Dam, and Go Home Lake Filter Dam.	Not required. The same amount of flow will be entering the Bala Reach. Once the flow from the three sources (i.e., powerhouse, North Bala Dam and South Bala Dam) combine, there will be no change in hydraulics in further downstream reaches. However, this will require diligent liaison between Bala Falls GS operator and downstream generator.	No residual effect on downstream infrastructure.

Table 6.2 Assessment of the Significance of Residual (Net Adverse) Effects During Operation

Environmental Component	Residual Effect	Value/ Importance	Magnitude	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social Fragility	Likelihood of Effect
Air quality	Air emissions during back up generator operation	High	Low	Low	Low	Reversible	Low	High
Hydrology and Hydraulics	Reduced flow through bypassed sections	High	Moderate	Low	High	Reversible	Moderate	High
	Changes in Lake Muskoka water levels	High	Low	High	High	Reversible	Moderate	High
	Changes in Bala Reach water levels	High	Low	High	High	Reversible	Moderate	High
	Altered flow velocities and vectors in tailrace	Moderate	Moderate	Low	High	Reversible	Moderate	High
Groundwater	Impairment due to accidental spills	Moderate	Low	Moderate	Moderate	Irreversible	High	Low
Surface Water Quality	Impairment due to accidental spills	High	Low	Moderate	Moderate	Reversible	High	Low
Aquatic Habitat and Biota	Reduced high velocity habitat and associated biota (i.e. falls, rapids)	Low	Moderate	Low	High	Reversible	Moderate	High
	Reduction in flow over walleye spawning areas	High	low	Moderate	Moderate	Reversible	Moderate	Moderate
	Fish mortality due to entrainment and turbine passage	Moderate	Low	Moderate	Moderate	Irreversible	Low	Moderate
Terrestrial Vegetation/ Wildlife	Disturbance of wildlife due to noise	Moderate	Low	Low	Moderate	Reversible	Low	Moderate
	Disturbance of wildlife due to human presence	Moderate	Low	Low	Moderate	Reversible	Low	Moderate
	Impacts due to spills	Moderate	Low	Low	Moderate	Reversible	Moderate	Low
Public use and Access	Restriction to waters within the safety booms at the intake and tailrace	High	Moderate	Low	High	Irreversible	Low	High
Public Safety During Plant Operation	RSR to public safety in intake and tailrace areas	High	Moderate	Low	Low	Irreversible	Low	Low
Public Safety During Plant Operation - Hydroelectric Facility Safety	Risk to worker safety	High	Low	Low	Low	Irreversible	High	Low
Aesthetics - Flow Over Bala Falls	Reduced flows over Bala Falls	High	Moderate	Low	High	Irreversible	High	High
Aesthetics - Flow Via South Falls	Reduced flows over Bala Falls	High	Moderate	Low	High	Irreversible	High	High
Tourism and Recreation	Reduced area available for in-water activities within boomed areas.	High	Moderate	Low	High	Irreversible	Moderate	High
	Minor changes in daily water level fluctuation	High	Low	Low	High	Reversible	Moderate	High

Table 6.3 Projected Frequencies of Available Total Spill Flow in April

Flow (m^3/s)	Relative Flow Frequency (All weeks in April) (%)	Relative Flow Frequency (Week 1) (%)	Relative Flow Frequency (Week 2) (%)	Relative Flow Frequency (Week 3) (%)	Relative Flow Frequency (Week 4) (%)
0 *	13.9	5.6	16.7	11.1	22.2
0-10	6.9	5.6	0.0	5.6	16.7
10-20	2.8	0.0	0.0	11.1	0.0
20-30	4.2	5.6	5.6	0.0	5.6
30-40	0.0	0.0	0.0	0.0	0.0
40-80	9.7	5.6	5.6	16.7	11.1
80-120	11.1	16.7	11.1	0.0	16.7
120-160	9.7	16.7	16.7	5.6	0.0
160-200	8.3	5.6	5.6	16.7	5.6
>200	33.3	38.9	38.9	33.3	22.2
	100.0	100.0	100.0	100.0	100.0

*Flow of 0 m^3/s represents occasions where the only flow passing through dams is due to leakage.

Table 6.4 Projected Frequencies of Available Total Spill Flow in May

Flow (m^3/s)	Relative Flow Frequency (All weeks in May) (%)	Relative Flow Frequency (Week 1) (%)	Relative Flow Frequency (Week 2) (%)	Relative Flow Frequency (Week 3) (%)	Relative Flow Frequency (Week 4) (%)	Relative Flow Frequency (Week 5) (%)
0 *	46.7	33.3	44.4	61.1	44.4	50.0
0-10	15.6	22.2	22.2	0.0	16.7	16.7
10-20	5.6	11.1	5.6	5.6	5.6	0.0
20-30	2.2	0.0	0.0	0.0	5.6	5.6
30-40	4.4	5.6	5.6	5.6	0.0	5.6
40-80	8.9	5.6	11.1	5.6	11.1	11.1
80-120	6.7	0.0	0.0	11.1	16.7	5.6
120-160	1.1	0.0	0.0	5.6	0.0	0.0
160-200	2.2	5.6	0.0	0.0	0.0	5.6
>200	6.7	16.7	11.1	5.6	0.0	0.0
	100.0	100.0	100.0	100.0	100.0	100.0

*Flow of 0 m^3/s represents occasions where the only flow passing through dams is due to leakage.

Each of the first 3 weeks of April when considered individually would have at least 130 m^3/s available as surplus for the majority (more than 50%) of the time. The last week of April would have flows of 50 m^3/s or more available for spilling at least 50% of the time. Each of the last 3 weeks of April would have only leakage through the dams more than 10% of the time with the last week having only leakage through the dams 22% of the time (Table 6.3).

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When all weeks in May are considered, if the plant were to operate at rated flow, there would be no surplus available 46.7% of the time, with only leakage passing through the dams. There would be less than 10 m^3/s surplus available for the majority (62.2%) of the time. Each of the weeks of May when considered individually would have less than 10 m^3/s available as surplus for the majority of the time. Four of the 5 weeks would be without surplus (i.e., leakage only) more than 44% of the time. Two of those weeks (third and fifth weeks of May) would be without surplus flow the majority (50% or more) of the time (Table 6.4).

6.2.2.2 Water Levels

Lake Muskoka

The run-of-river mode of operation will attempt to maintain the water level of Lake Muskoka at the TOL identified in the MRWMP. Therefore, maintenance of the TOL will ensure that the combined inflow to the lake approximates the combined outflow from the lake. However, in order to provide some operational flexibility to the plant in order to deal with changing inflow rates, the operational water level of Lake Muskoka will occur within a narrow band around the TOL called the Best Management Zone (BMZ), which varies on a seasonal basis, during the ice free seasons, and specifically during the summer recreation season. Figure 9.3 in Section 9 depicts the Lake Muskoka water level operating plan with the existing TOL and the proposed BMZ, as discussed in the following paragraphs.

Between January 1 and May 1, there will be no BMZ around the TOL. Lake Muskoka will be drawn down to a level of 224.90 on or before March 25 in order to provide adequate storage capability for the spring freshet. MNR may instruct SREL to achieve the drawdown level by a date earlier than March 25 and/or lower the lake further in order to prepare for the freshet and associated flood mitigation. This decision by MNR will depend on snow pack conditions, water content and other flood forecasting indicators and objectives.

From May 1 to May 31, a BMZ of up to 5 cm below the TOL will be applied. From June 1 to July 31, a $\pm$2 cm BMZ around the TOL (i.e., up to 2 cm above or 2 cm below the TOL) will be applied. From August 1 to September 15, the BMZ will be from 4 cm above the TOL to 2 cm below the TOL. From September 16 to October 15, the BMZ will extend to 5 cm above the TOL. The descending slope of this band will merge with the TOL on or around October 20. MNR may instruct SREL to alter the timing and duration of the fall drawdown based on the progress of the lake trout spawning period. From on or about October 20 to December 31, a BMZ band up to 6 cm below the TOL will apply.

SREL will be responsible for the operation of the Bala Generating Station and the North and South Bala Dams, for all flow and level objectives. Normally, the dams and generating stations would be operated as required to maintain Lake Muskoka water levels within the target ranges prescribed in the WMP. MNR may instruct SREL to vary the timing and extent of flow and level requirements for the purposes of the flood mitigation and fish reproduction. SREL will become the operator for both the Bala South and North Dams under the proposed lease arrangement and will operate the dams when flow release adjustments are beyond what the turbine can manage.

Bala Reach

The run of river mode of operation of the North Bala Generating Station will result in SREL having little to no control over the water level of the Bala Reach during high flow/flood periods that require flow releases in excess of the Bala Reach OPG High Flow Trigger. The Bala Reach water level will continue to be managed by OPG through operation of the Ragged Rapids Generating Station and Moon River Dam as per the existing MRWMP. Therefore, operation of the North Bala Generating Station will have no impact on the water level of Bala Reach during normal operating conditions.

6.2.2.3 *Hydraulics (Flow Velocity and Vectors)*

The facility will result in changes to flow velocity in the localized area downstream from the North and South Dams and the facility intake and tailrace. The facility will redirect flow up to the plant capacity of 96 m^3/s from the channel leading to the North Bala Dam, divert it through the powerhouse and release it back to the watercourse via the tailrace. This will cause a corresponding reduction of the amount of flow that would normally go over the North and South Bala Dams, as per the flow distribution graph in Figure 6.1. Once flow from the three sources (i.e., powerhouse, North Bala Dam and South Bala Dam) combines, there will be no change in hydraulics in further downstream reaches.

River2D hydraulic modeling was undertaken to ensure suitable hydraulic characteristics of the intake and tailrace. However, this modeling also predicts the changes in flow velocity and vector that will occur in the area. Modeling was conducted at a flow of 82 m^3/s, which included a power flow of 79 m^3/s and a continuous flow of 3 m^3/s over the North Bala Dam. This flow was modeled under existing conditions and again with the facility in place. Results are shown in Figures 6.2a to 6.2d.

Under the present condition (Figure 6.2a) the model was calibrated to assume that all flow comes over the North Bala Dam. The majority of the flow is in a southwest direction at the base of the falls, with some flow heading in a northwest direction along shore. Flow velocity at the base of the rapids below the dam reaches a maximum of approximately 3 m/s in several locations. Velocity in the main southwest plume is approximately 2 m/s and velocity in the northwest plume ranges from 1 to 2 m/s. Flow from the main plume creates a counter clockwise gyre in the area to the south. Flow velocity in the gyre ranges from approximately 0.5 to 1.0 m/s. A low velocity (0.0 m/s to 0.15 m/s) area is situated between the two plumes.

Under the proposed operational condition (Figures 6.2b to 6.2d), the majority of flow enters the Bala Reach in a westerly direction from the powerhouse tailrace. Flow velocity reaches a maximum of approximately 1.4 m/s at the downstream end of the tailrace. The flow plume from the tailrace exits the model boundary traveling in a westerly direction at a velocity of approximately 1.0 m/s. Flow at the base of the North Falls is concentrated into one small plume on the northern end of the falls. Velocity at the plume reaches a maximum of approximately 0.8 m/s and the plum continues in a westerly direction for <10 m before dissipating into the relatively calm waters of the Bala Reach (i.e., <0.15 m/s).

Therefore, based on the hydraulic modeling results, flow velocity and vector are significantly altered downstream from the North Bala Dam due to flow diversion through the powerhouse.

Projected frequencies of flows available for passage through the North and South Bala dams (i.e. in excess of plant flow) was estimated based on the 1982 to 1999 MNR dam flow records. Available

6.2.2.4 *Effects Due to Secondary Water Takings in the Powerhouse*

It is anticipated that water will be withdrawn from the watercourse at the turbine inlet or from the tailrace at a rate of 200 L/min (288,000 L/d) in order to cool the gear box oil (in the oil-water heat exchanger), the turbine shaft gland/seal and the turbine guide bearing and generator bearings (if required). The water would be pumped through cooling water pumps and distributed to the various machinery in the powerhouse. This would be a once-through cooling water system, with the flow being discharged to the facility's oil-water separator for treatment before final discharge to the tailrace (see Section 6.2.4.3 for a discussion regarding the effects and mitigation of this activity on Surface Water Quality). Since the cooling water requirement is in excess of the PTTW threshold of 50,000 L/d, a PTTW will be required for this operation. It is anticipated that one PTTW will be obtained to permit all water takings of the facility. Due to the once-through nature of the cooling water system, it will have a negligible effect on flow and water level in the watercourse.

It is not anticipated that a washroom facility will be installed in the powerhouse. However, a small wash sink will be installed, utilizing non-potable river water, pumped from the tailrace. The water will be pumped on an as-required basis to replenish a small holding tank in the powerhouse. Water from the sink will be treated to remove nutrients (e.g., phosphates from soaps) and then discharged to the oil-water separator prior to final discharge back to the tailrace. The flow requirements for the sink are not known at this time, but if the requirement is anticipated to be in excess of the PTTW threshold, this taking will be included in the overall facility application for a PTTW. Due to the minimal volumes anticipated to be required and the non-consumptive nature of the water taking, it will have a negligible effect on flow and water level in the watercourse.

6.2.3 Groundwater

Groundwater could potentially be adversely impacted by accidental spills of potentially toxic materials including transformer oil, hydraulic fluids and other pollutants used on site. Should a significant spill occur outside of the powerhouse, the material could potentially move down through the soil/bedrock to the local groundwater table, resulting in contamination. However, the use of potential pollutants is very limited at an operating waterpower facility, particularly outside of the powerhouse. Spills inside the powerhouse would not likely come into contact with groundwater since they would be contained within the powerhouse (see Section 6.2.4). However, regardless of the low potential for impacts on groundwater, appropriate mitigation measures, including proper storage of materials in leak-proof containers and appropriate precautions during use of these materials outside of the powerhouse will be implemented. A contaminant handling procedure will be developed for use during the operational period. As during construction, all employees responsible for chemical handling will be trained in proper handling and emergency spill response procedures. An adequate supply of spill containment and clean-up material will be maintained on site. All spills of potentially hazardous materials will be cleaned up immediately, with contaminated materials removed from the site to an MOE approved disposal site. The Spills Action Centre of the MOE will be contacted in the event of any spill that could potentially cause damage to the environment. Following implementation of this mitigation, the risk of an accidental spill impacting local groundwater resources is minimal.

6.2.4 Surface Water Quality

Surface water quality in the Muskoka River could potentially be adversely affected during the long-term operational phase by changes in water management practices (i.e., alterations in water level and/or flow), storm water runoff from the facility, facility effluent and accidental spills. Each of these potential impacts, and mitigation proposed to prevent/minimize adverse effects is discussed in the following sections.

6.2.4.1 Water Management Practices

No adverse effect on surface water quality is anticipated due to changes in the water management regime occurring as a result of operations of the project. Minimum flows required for aesthetics, aquatic habitat and water quality identified in the existing MRWMP will continue, therefore there will be no effect on these flows.

6.2.4.2 *Storm Water Runoff*

On completion of facility construction, restoration activities will occur around the site. These activities will include stabilizing slopes and banks, and providing erosion protection by physical (low gradient slopes, riprap, etc) or natural means (seeding, revegetation, bioengineering works, etc). When completed, stormwater runoff characteristics and rates are expected to be similar to preconstruction conditions.

Minor long-term changes in surface runoff patterns may result in the study area due to the presence of more impermeable or less permeable surfaces associated with impervious surfaces in the proposed parkland overtop the powerhouse and the associated drainage network.

6.2.4.3 *Hazardous Materials*

Potentially hazardous materials such as fuels and lubricants will be stored inside the powerhouse for use during regular maintenance of the facilities. Accidental spills of these materials within the powerhouse (e.g., spills during chemical handling or leaks from equipment) could potentially be discharged from the facility into the surrounding environment in the absence of mitigation, with adverse effects on surface water quality potentially occurring as a result.

Therefore, in order to minimize the potential for adverse effects resulting from accidental spills, it is recommended that an Emergency Spill Response Plan be developed and that all staff be trained in proper implementation of the plan in the event of a spill. Specific mitigation measures to prevent or minimize adverse impacts associated with a spill include the following:

- all potentially contaminating materials to be stored in leak-proof containers within bermed storage areas or other appropriate containment facilities (e.g., spill containment pallets) well away from watercourses and natural drainage pathways
- all equipment within the powerhouse to be adequately maintained to ensure that leaks do not occur within the powerhouse and the potential for a spill due to equipment failure is minimized
- spill containment and clean up materials to be kept in the powerhouse at all times and staff should be trained in their use and clean up
- all spill and hazardous waste residue to should be disposed of at a registered landfill site in accordance with MOE transport and disposal regulations
- all waste fluids from the facility to be disposed of as per provincial waste management regulations. SREL must obtain a waste generator number and submit a Generator Registration Report for each waste generated at the facility, as per the requirements of the General Waste Management Regulation (Ont. Reg. 347) under the Environmental Protection Act.

Preventing a spill from occurring is the primary mitigation measure designed to prevent/minimize adverse environmental impacts associated with a spill. However, as a secondary measure, the powerhouse will be equipped with an oil-water separator in the main sump of the facility. Therefore, any oil accidentally discharged inside the powerhouse will be filtered out of the plant discharge stream in the oil-water separator before discharge to the environment. A CofA for Industrial Wastewater Discharge under Section 53 of the OWRA will be required from the MOE for the operation of the oil-water separator.

The transformer for the facility will be a dry-type transformer with no oil and will be installed within the powerhouse. Therefore, there is no potential for surface water quality effects due to leakage of transformer oil.

It is anticipated that implementation of these mitigation measures will be highly effective in reducing the potential for spills. However, as with all industrial facilities where potentially contaminating fluids are utilized, the potential for accidents and other unforeseen events possibly leading to a spill will remain throughout the duration of the facility lifetime. However, in the unlikely event of a spill, these mitigation measures are anticipated to be effective in minimizing the magnitude, geographic extent and duration of any spills that do occur. Therefore, the overall likelihood for spills to occur is determined to be low and it is anticipated that if any spills do occur the magnitude of the adverse effect on surface water quality is anticipated to be low.

6.2.5 Aquatic Biota and Habitat

Effects on aquatic biota (e.g., fish and benthic invertebrates) and aquatic habitat arising from operation of the Bala Falls Hydro Project could potentially occur due to

- alterations in flow rate in the bypassed sections downstream from North Bala Dam and South Bala Dam
- changes in flow hydraulics (flow vectors and velocity) downstream from the facility
- alterations in Lake Muskoka water level regime
- entrainment and impingement at the facility intake.

Each of these potential effects, and the mitigation measures proposed to prevent or minimize potential impacts (where required), are discussed in the following sections.

Impacts on aquatic biota and habitat could also occur due to water quality impairment resulting from accidental spills of potentially toxic materials within the powerhouse. Mitigation measures to prevent/minimize impacts on surface water quality associated with accidental spills were previously discussed in Section 6.2.4. Implementation of these mitigation measures is considered sufficient to prevent/minimize impacts on aquatic biota due to impaired surface water quality.

Significant fisheries habitat was identified in the channel downstream from the Burgess Generating Station (see Section 2.1.10). There will be no change to the water management regime of Burgess Generating Station; therefore, there will be no change to aquatic habitat in these areas and the project will have no effect on this habitat.

6.2.5.1 Altered Flows in Bypassed Rapids Reaches Downstream from North and South Dams

During operation of the hydroelectric facility, up to 96 m^3/s of the flow passing from Lake Muskoka to the Moon River will be diverted through the intake upstream from the North Bala Dam, run through the powerhouse before being discharged through the tailrace into the Bala reach of the Moon River downstream of the facility. Therefore, the volume of water diverted through the plant will not flow over the North or South Bala Dams or through the rapids reaches downstream of the dams, as they presently do.

As discussed in Section 6.2.2.1, at least a continuous minimum flow of 1 m^3/s will be spilled and/or passed by stop-log leakage at each of the two Bala Dams at all times. This minimum flow will result in a decrease in wetted surface area in the rapids downstream from each of the dams during most flow periods, compared to the wetted surface area that presently exists.

Based on the average weekly flow distribution shown in Figure 6.1, flow over the North Bala Dam will be restricted to the minimum continuous flow of 1 m^3/s throughout the majority of the year, with the exception of extreme high flow periods and during the walleye spawning season (see Section 6.2.5.2).

Based on the average weekly flow distribution shown in Figure 6.1, the rapids downstream from the South Dam will experience decreases in flow and wetted surface area throughout the course of the year, due to diversion of flow through the powerhouse. Higher rates of spillage over the South Dam will primarily occur during the spring high flow period (March to June) and the fall high flow period (mid October to mid-December). Low flows (i.e., $< \sim 7$ m^3/s) will be experienced in winter (January and February) and during the summer and early fall (mid-June to early October).

The relatively high gradient reaches immediately downstream from each of the dams are dominated by exposed bedrock (see Figure 2.8 and Section 2.1.10) and relatively high flow velocities. Fish and benthic invertebrate use of these habitats is likely very limited. Fish access to these higher gradient reaches is very limited since during low flow periods, the bedrock ridges create an impassable barrier to upstream movement. During high flow periods, high velocity currents prevent further upstream movement. No critical fish habitat (e.g., spawning and/or nursery) was observed in these higher gradient, bedrock dominated areas. Some invertebrate species tolerant of such conditions likely reside in these areas, but the overall productivity of these areas is likely limited, compared to areas with more suitable habitats (e.g., smaller rocky material with lots of interstitial space and a variety of flow velocity niches) farther downstream at the base of each of the high gradient reaches. A reduction in wetted habitat in these areas is not anticipated to have a significant effect on overall productivity.

More productive habitats are present in the lower gradient reaches farther downstream and at the base of each of the rapids below the South and North Dams (see Figure 2.9 and Section 2.1.10). Benthic invertebrate and fish community studies found that rocky riffle areas below each of the dams/high gradient rapids reaches support a variety of baitfish and juvenile sport fish as well as a relatively diverse and abundant benthic invertebrate community, which likely contributes to the local fish forage base.

These areas are located in the lower gradient sections downstream from each of the rapids and are submerged at the normal range of the Bala Reach water level. Only during extreme low water periods (i.e., extended periods of low flow from Lake Muskoka outside the control of SREL) would these areas be potentially exposed. Therefore, it is anticipated that during periods when only the minimum flow is flowing over the North and South Dams, these areas will continue to be wetted and provide aquatic habitat similar to existing low flow conditions.

Productive habitats downstream from the South Dam will continue to experience seasonal changes in flow rate, wetted area and hydraulics due to spillage over the South Dam, although at a reduced rate due to the diversion of flow for power production. Productive habitats downstream from the North Dam will experience a reduced flow rate over the course of the year, as well as reduced seasonal fluctuation in flows. The North Dam will be managed to provide adequate flows for the walleye spawning period in spring. A productive benthic and forage fish community was found to be utilizing the areas downstream from the North Dam during the low flow period in August 2007, when only leakage was flowing over the North Dam. That observed flow situation will be similar to that which will occur over the course of a year (except during the walleye spawning period) during facility operation.

Therefore no substantial change in the high productivity riffles downstream from each of the dams is anticipated to occur due to facility operation. Accordingly, no substantial change to the benthic invertebrate or fish community in these areas is anticipated to occur due to changes in the flow regime. In order to verify this prediction of effect, benthic invertebrate and habitat monitoring will be undertaken during the operational period (see Section 10).

6.2.5.2 Altered Flow Hydraulics Downstream from Facility

Withdrawal of up to 96 m^3/s for hydropower generation and the reduction of spillage at the North Bala Dam (based on average flow conditions) will also result in changes to flow hydraulics (i.e., flow velocity and vector) at the base of the rapids reach downstream from North Bala Dam. Outflow from the powerhouse will be directed through the tailrace into Bala Reach, instead of flowing through the rapids and discharging at that location. This will result in altered hydraulics including flow vector and flow velocity at both the tailrace area and at the base of the rapids since the main point of discharge to the Bala Reach will be the tailrace instead of the North and South Bala Dams, as currently exists.

As discussed in Section 6.2.2.3, River2D modeling was conducted to assess these potential impacts at a flow rate of 82 m^3/s (i.e., plant flow of 79 m^3/s and minimum flow over the North Bala Dam of 3 m^3/s). The results showed that hydraulics downstream from the facility and the North Bala Dam would be substantially different at this flow rate. However, as discussed in Section 6.2.4.2, existing productive invertebrate and forage/juvenile fish habitats at the base of each of the rapids will remain wetted and will continue to experience some flow velocity due to the continuous minimum flow (or other flows in excess of the flow capacity of the facility). Therefore, as noted in Section 6.2.4.2, no change in the benthic productivity or juvenile/forage fish habitat functions of these rocky riffle areas is anticipated to occur. Monitoring will be conducted during the operational period to verify this prediction (see Section 10).

Altered flow hydraulics due to diversion of flow through the powerhouse have the potential to adversely effect habitat suitability (i.e., water depth, flow velocity and vector) in the identified walleye/white sucker spawning area downstream from the North Dam. During the spring spawning period, under average spring freshet conditions, in the absence of mitigation, flow over the North Bala Dam would be limited to the minimum continuous flow of 1 m^3/s. A study was undertaken in June 2009 to assess the velocity occurring in the identified walleye spawning habitats at the base of the North Dam under various flow releases from the North Dam in order to identify the flow rate which would be required to maintain existing spawning habitat in the area. It was determined that a flow of 9.5 m^3/s would be required to maintain this habitat. In addition, it was determined that a flow of 27.9 m^3/s would be required from the south Bala Dam in order to maintain identified spawning habitats in the south channel. Based on historical flow distribution during the walleye spawning period, it does not appear possible to provide adequate flow over the North Dam to maintain walleye spawning habitat function in all years. During low water years, insufficient water would be available, although during higher water years, spillage might allow the existing habitat to function properly. Therefore, in order to be conservative, it has been assumed that the 200 m^2 area (75 m^2 of which provides the most suitable habitat conditions, with the remainder having less suitable substrate and hydraulic conditions) would no longer be capable of providing suitable spawning habitat for species such as walleye and white sucker. SREL is committed to providing sufficient flow to maintain existing walleye spawning habitats in the south channel during the walleye spawning period.

Therefore, in order to mitigate this loss, SREL is proposing to install a 200 m^2 spawning area in the south channel, such that, in years where adequate flow is not provided over the North Dam, fish that would normally spawn there will have a similar amount of habitat to spawn in. The proposed habitat is shown in Figure 6.3. The habitat will be designed to be functional at all flow rates that would typically occur in the south channel during the potential spawning period and will be subject to detailed design prior to application for approval from DFO. Monitoring will be conducted to confirm that the habitat is functioning as designed.

6.2.5.3 Alterations in Lake Muskoka Water Level

As indicated in Section 6.2.2.2 and further discussed in Section 9.1.10, the water level of Lake Muskoka will be managed in accordance with the requirements of the existing MRWMP. Accordingly, SREL will attempt to maintain the Lake Muskoka water level within the BMZ band around the TOL, as discussed in Section 6.2.2.2 and show in Figure 9.3. The TOL was identified during the MRWMP process as the preferred level for Lake Muskoka to balance socioeconomic, power generation and natural environment considerations. Maintaining the water level within the proposed narrow band around the existing TOL will ensure that there is no significant change to existing water level conditions on Lake Muskoka.

Overall, no adverse impacts on aquatic biota or habitat are anticipated due to the operational regime of Lake Muskoka.

6.2.5.4 Alterations in Bala Reach Water Level Due to Operation of the Bala Generating Station

As indicated in Section 6.2.2.2 and further discussed in Section 9.1.10, the water level of the Bala Reach will continue to be managed by OPG in accordance with the Normal Operating Zone (NOZ) requirements of the existing MRWMP. Operation of the North Bala Generating Station in a run-of-river mode will have no effect on the water level regime of the Bala Reach; therefore, no adverse impacts on aquatic biota or habitat are anticipated due to the operational regime.

6.2.5.5 Moon Falls Walleye Spawning

According to the existing MRWMP, a minimum flow of 14 m^3/s is required at Moon Falls between April 15 and June 1 for the walleye spawning and egg incubation period. This spawning and incubation flow is provided from the Bala Reach, with the remainder going through the Musquash River OPG hydroelectric facilities. Consequently adequate flows must be passed from Lake Muskoka into the Bala Reach in order to allow the meeting of the Moon Falls requirement. According to the MRWMP, if overall watershed conditions indicate that 14 m^3/s cannot be sustained at Moon Falls through the utilization of storage in the upper lakes, continuous flows from Lake Muskoka may be reduced to 12 to 16 m^3/s, in order to provide 8 to 9 m^3/s at Moon Falls and 4 to 6 m^3/s at Ragged Rapids. As the proposed plant will be operated in a run-of-river mode, there will be no impact on flows downstream of the tailrace. As Moon Falls is well downstream, no adverse impact on walleye spawning at Moon Falls is anticipated to occur as a result of operations of the Bala Falls Generating Station.

In addition, MNR has indicated that flow discharge strategies in concert with Lake Muskoka water level objectives may be employed in some years to provide reasonably consistent flows to meet spawning requirements on the Moon River. This could potentially involve coordinating the Lake Muskoka water level and outflows just prior to and/or during the spawning and incubation periods to avoid large flow/level changes at the Moon River spawning location. MNR and its partners (e.g., Eastern Georgian Bay Stewardship Council) may provide direction as to the start of the walleye spawning period to allow such flow strategies to be considered or implemented.

6.2.5.6 *Fish Impingement, Entrainment and Turbine Mortality*

Entrainment and Impingement

Fish entrainment or impingement can occur at the intake of the facility. Entrainment occurs when fish are drawn into the intake flow and proceed to pass through the turbines or other components of the facility. Impingement occurs when fish are "pinned" against intake trashracks by the pressure exerted by the inflowing water. The primary determinants of the probability of entrainment or impingement include water velocity in the intake channel and at the face of the trashracks and the trashrack spacing.

The flow velocity in the intake area is the first determinant of the potential for entrainment, since fish moving in the vicinity of the intake channel would encounter the intake flow and would either be able to swim against the flow to move out of the intake channel, or be trapped in the flow and move toward the trashracks, if the velocity exceeds their swimming capability. Under existing conditions, flow velocity in the channel upstream from the North Bala Dam (at flow of 82 m^3/s) ranges from approximately <0.30 m/s along the channel margins to approximately 1.7 m/s between Highway 169 Bridge and the upstream face of the dam, based on the results of River2D modeling. Flow velocity in the centre of the channel between Highway 169 and the CPR bridge is approximately 0.60 m/s. The distribution of flow velocities in the intake area under similar flow conditions during operation of the proposed hydroelectric facility (82 m^3/s) is shown in Figure 6.2c. Water velocity in the intake channel and intake area have intentionally been kept relatively low under typical operating conditions) to ensure that ice cover develops within the intake canal during the winter period to avoid frazil ice formation. As shown in the figure, the intake velocity channel plume will extend from the trashracks to just upstream of the CPR bridge. The maximum flow velocity in the intake flow zone (0.78 m/s) will occur beneath the CPR bridge. Flow velocities upstream from the bridge will range from approximately 0.40 m/s to 0.60 m/s. Flow velocity downstream from bridge but upstream from the intake will range from 0.23 m/s in the edge of the intake flow to 0.70 m/s in the centre of the flow. The maximum flow velocity along the face of the intake trashracks will be approximately 0.68 m/s (in the centre of each trashrack) with velocities of approximately 0.45 m/s at the outer and inner edges of each trashrack. Also, it is important to note that the River2D model outputs surface velocities only; mid-depth velocities could be slightly higher and channel bed velocities would be significantly lower due to bed roughness.

Therefore, the proposed operational velocities in the intake channel area will be slightly higher than existing mid-channel velocities (~0.70 m/s during project operations compared to ~0.60 m/s under existing conditions). However, flow velocity in the intake flow will be significantly lower than existing flow velocities upstream from the North Bala Dam.

The proposed intake velocities noted above are considered suitable to allow adults of the primary species within the project area (walleye, northern pike and smallmouth bass) to escape entrainment into the intake flow. Fish would most likely utilize burst swimming capacity to escape entrainment in velocity plumes. Adult and older juvenile northern pike (>20.7 cm in length), are able to attain maximum swimming speeds in excess of 1.74 m/s (Webb, 1978; Harper and Blake, 1990; Frith and Blake, 1995; all cited in Peake, 2008), with critical swimming speeds (i.e., prolonged swimming speeds typically used to set appropriate flow velocity in fishways and culverts to facilitate passage) ranging from 0.38 to 0.47 m/s for smaller adults (0.42 to 0.62 m in length) (Jones et al., 1974; cited in Peake, 2008). Therefore, pike would be able to swim for prolonged periods against the flow velocity of the majority of the intake flow and if entrained into the higher velocity zones, they could use their burst swimming capacity to escape these areas. Walleye have been shown to be able to attain a burst velocity of 1.6 to 2.6 m/s for 15 to 20 seconds (Peake et al., 2000). Walleye have also been noted as having prolonged swimming capability (600 second duration) of between 0.38 and 0.84 m/s) (Katopodis, 1992). Normandeau Associates Inc. (2009), calculated that fingerling walleye would have a burst swimming speed of approximately 0.38 m/s and larger (80 mm long) juvenile walleye would have a burst swimming speed of up to 0.76 m/s. Smallmouth bass have been shown to ascend experimental raceways with velocities ranging from 0.40 to 1.20 m/s. Bunt et al., (1999; cited in Normandeau Associated Inc., 2009) noted that adult smallmouth bass (length 262 to 378 mm) had critical swimming speeds (speeds they could attain for 10 minutes) ranging from 0.48 to 1.18 m/s. Juvenile smallmouth bass have a 2-minute critical swimming speed between 0.40 and 0.54 m/s) (Webb, 1998; cited in Normandeau Associates Inc., 2009). Therefore, based on the swimming capabilities noted above, it is anticipated that healthy large fish would be able to use prolonged swimming capacity to swim against the majority of the intake flow zone and burst swimming capacity to avoid entrainment into the highest velocity portions of the intake flow. Juveniles of the species noted above would also be able to escape entrainment into a significant proportion of the intake flow, but may not be able to escape if they enter the highest velocity portions of the flow zone.

Small fish (e.g., baitfish, YOY of larger fish) may not be able to attain sufficient swimming speeds to escape entrainment into the intake flow should they come into contact with it. However, given the gradual transition from slow velocity at the upstream end of the intake flow to higher velocities in the middle point of the intake flow, it is felt that small fish would be able to determine the changing flow velocity regime in order to avoid swimming into the higher velocity plumes. However, if for some reason they do enter the higher plume areas (e.g., while escaping predation), they may become entrained through the powerhouse (see mortality discussion below).

The maximum trashrack bar spacing proposed for the facility would be 150 mm. However, actual spacing will be based on the minimum opening of the runner or maximum opening of the wicket gate (whichever is smaller) as furnished by the turbine manufacturer in order to prevent entrainment of debris into the turbine. Therefore, fish with a width less than 150 mm (or smaller, depending on the final bar spacing) would be able to pass through the trashracks and enter in the intake flow into the powerhouse. At a bar spacing of 150 mm, all but the largest northern pike and walleye would likely be able to fit through the trashracks. However, trashracks do provide a visual cue to fish that they are entering the intake, and need to swim to escape. Fish exist in a three-dimensional environment and utilize vision to detect movement and input from their lateral line system to assess localized pressure differentials and input from their air bladder to sense changes in hydrostatic pressure (Coutant, 2001). The ability of fish to escape entrainment is dependent on their ability to detect the intake structure and its associated accelerating water velocities. Fish can generally detect accelerating water velocity, a visible intake, vibrating trash rack bars or bow waves in front of intakes. Trashracks provide a reference point for the fish, and they will try to avoid collision with the bars if they are swept toward them. If possible, fish will move to an area outside the influence of the intake structure (MWH, 2003). Larger fish, having greater swimming capabilities, have higher probability of being able to overcome the intake velocity and avoid being entrained.

EPRI (1992) conducted an extensive review of fish entrainment and turbine mortality. It was noted that “An important consideration in evaluating the impacts of a hydro plant on resident fish populations is the size distribution of fish that are entrained. Of the studies that reported comprehensive size distribution information, small or YOY fish generally comprised a large proportion of the fish that were entrained. Over 90% of the fish captured (after passage through the hydro plant) in some studies were less than 100 mm in length, and in nearly all cases, over 90% were less than 200 mm in length. This is important from the standpoint that smaller fish passing through turbines can generally be expected to suffer low levels of mortality (usually $<6\%$) and that emigration of young from an impoundment usually constitutes a minimal impact to the harvestable component of the upstream population. One factor limiting the size of fish entrained at many projects is the spacing of trash racks, which generally ranges from 2.54 to 7.62 cm at most small to medium-sized projects. The predominance of fish less than 100 mm at most sites suggests that many of the larger fish that could physically pass through the trash racks avoid doing so or show a lower tendency toward downstream emigration than YOY fish."

Thus, based on the discussion above, it is anticipated that most fish (including small and large fish) will avoid entrainment through the trashracks by avoiding higher velocity intake flow zones or utilizing burst swimming capacity to escape these higher velocity zones. However, should small fish (including baitfish, YOY and small juveniles of larger fish species) enter into the portions of the intake flow that exceed their swimming capacity, they will likely be entrained through the trashracks and into the flow going through the turbines.

Turbine Mortality

Some small fish and larger fish that are in a weakened state (i.e., injured or diseased) may not possess sufficient swimming ability to avoid entrainment in the intake channel and hence, would pass into the intake flow. In this situation, it is likely that they would pass through the intake canal and turbine, and be discharged in the tailrace channel. Various authors (NYPA, 2005; Becker et al., 2003, Therrien and Lemieux, 2000; Cada, 2001; Popper and Carlson, 1998) have identified possible causes of fish injury and/or mortality associated with turbine passage, being

- contact with turbine parts resulting in injury due to strike (collision with turbine component or object in flow), abrasion (rubbing against turbine component or object in flow) or grinding (when a fish is drawn into an area with small clearance between turbine parts)
- sudden acceleration or deceleration resulting in turbulence and shear forces that could literally tear fish to pieces
- variation in pressure, either positive or negative, of up to three times reference pressure, potentially causing a rupture of the swim bladder. Usual pattern of pressure changes during passage includes an increase during entrainment, rapid decrease during passage into the turbine, and an increase during discharge
- cavitation, caused by collapse or implosion of gas bubbles, which could result in various injuries to fish
- turbulence (irregular motions of the water) in the power flow, turbine flow or discharge area may result in localized injuries or disorientation
- stress and other physical impacts associated with turbine passage could result in weakening, disorientation or changes in survival behaviour, which may make fish more susceptible to disease or predation.

Turbine mortality has been extensively studied over the past two decades, having been measured at operating facilities, and predicted by means of formulas (based on field study results). Trends associated with fish passage and turbine mortality include

- fish size, turbine type, turbine rotational speed and turbine size are the primary determinants of fish survival probability. Fish species does not tend to affect survival.
- survival is typically higher for small fish (i.e., <20 cm). Larger fish likely have a higher probability of striking turbine components.
- lower rotational speeds (i.e., <250 r/min) typical result in decreased mortality.

Winchell et al. (2000) summarized the studies of fish passage through Kaplan turbines, which is the turbine type proposed for the North Bala Small Hydro Project, based on the recommendation made in the Feasibility Study (Hatch Energy, 2008).. The results are presented in Table 6.5.

Table 6.5 Fish Mortality Due to Passage Through Kaplan Turbines

Runner Speed (r/min)	Hydraulic Capacity (m^3/s)	Fish Size (mm)	Average Immediate Survival (%) (all species combined)				Average 48-Hour Survival (%) (all species combined)			
			No. Turbines	Minimum	Maximum	Mean	No. Turbines	Minimum	Maximum	Mean
<300	18 to34	<100	3	94.1	98.0	95.4	1	84.9	84.9	84.9
<300	18 to 594	100-199	10	89.8	97.5	94.8	8	89.8	97.2	93.4
<300	18 to 62	200-299	5	77.4	97.4	87.2	4	77.4	86.4	83.9
<300	34 to 62	300+	2	86.8	100.0	93.4	2	79.0	100.0	89.5
>300	15	<100	1	81.3	81.3	81.3	0	-	-	-
>300	15	100-199	1	78.0	78.0	78.0	0	-	-	-

Source: Winchell et al. (2000)

The pit turbine proposed for the facility has four blades with a runner diameter of approximately 3.9 m, an operational speed of approximately 112.5 r/min (which will be stepped up by a gear box to match the speed of the high speed generator) and a hydraulic capacity of 90 m^3/s operating at 5.3 m head. This compares most closely with the physical and operational characteristics described in the second, third and fourth lines of Table 6.5 (<300 r/min and hydraulic capacity between 18 and 62 m^3/s, although actual hydraulic capacity of the proposed unit is somewhat higher at 90 m^3/s). Based on this comparison, it is predicted that 80 to 90% of fish in the ± 200 to 300-mm size range would survive passage through the turbine. Survival rates are lower for larger fish and higher for smaller fish since larger fish have a higher probability of being struck by the blades of the turbine. Figure 6.4 also illustrates the relationship between runner speed and fish length for Kaplan, Francis and next generation turbines being developed and tested by the US Department of Energy (Cook et al., 2003). As shown in Figure 6.4, Kaplan turbines typically have a much higher survival rate as opposed to Francis turbines. The Alden/Concepts NREC turbine shown has been included for information, but due to the fact that such turbines are not suitable for all hydro applications at this point in time, it does not appear feasible. As shown in Figure 6.4, Kaplan turbine survival is only marginally lower than the concept Alden turbine. Runner speed is also a factor, with survival increasing as runner speed decreases. Thus, the estimated survival rate noted above could be even lower as the operating speed of the Kaplan pit turbines proposed for these facilities is 112.5 r/min. Therefore, the selection of the Kaplan pit turbine with low operating speed is the most suitable turbine to minimize fish mortality while ensuring that it meets engineering and economic requirements necessary for the project.

Another approach to the evaluation of potential turbine mortality is provided by Therrien and Lemieux (2000) by means of the following formula.

$M = 45.38\ ((TL/D)\ H^{0.5})^{1.442} + 6.953\ NAP^{0.608} - 13.85$
M = Fish Mortality (%)
TL = Fish Total Length (mm) – 200, 300 or 400 mm as per Table 6.6
D = Turbine Diameter (m) – 3.9 m for proposed turbine
H = Net Head (m) – 5.3 m for proposed project
NAP = Number of Blades – 4 for proposed turbine.

Application of their equation provides the predictions of fish mortality in Table 6.6, which are in general agreement with the estimates of fish survival provided by Winchell et al. (2000).

Table 6.6 Fish Mortality

Fish Length (mm)	Estimated Turbine Mortality (%)
200	4.4
300	6.0
400	8.0
500	10.1

In summary, it is anticipated that most fish will be able to escape entrainment through the powerhouse due to the relatively low intake velocities and the presence of the trashracks. However, fish that are entrained, will go through the turbines. Based on data from other projects and the formula used to calculate turbine mortality, it is anticipated that survival will range from 95% (for fish <200 mm in length) to 89% (for fish 500 mm in length). Therefore, of the low numbers of fish predicted to go through the turbines, survival will be relatively high. There is not predicted to be any difference in the number of fish that are lost to Lake Muskoka due to going through the powerhouse post-construction or going over the North Bala Dam under current conditions. Given this, no additional mitigation is proposed.

6.2.6 Terrestrial Vegetation/Wildlife

Operation of the North Bala Generating Station in a run-of-river mode is not anticipated to have any effect on wildlife or vegetation in and around Lake Muskoka. Since the TOL identified in the water management plan will be followed to the greatest extent possible within the allowable BMZ band identified by MNR and the NOZ of the existing WMP will become the compliance zone for the facility, existing ecological features and functions around Lake Muskoka (e.g., wetlands, shoreline/ littoral zone-inhabiting wildlife) will not be impacted by operation of the proposed facility.

The run-of-river mode of operation will also ensure that there are no changes to the water level regime of the Bala Reach occurring as a result of operation of the facility. The water level of the reach will continue to be managed by OPG in accordance with the existing MRWMP, therefore existing ecological features and functions around Bala Reach (e.g., wetlands, shoreline/littoral zone-inhabiting wildlife) will not be impacted by operation of the proposed facility.

Noise resulting from operation of the facility (transformer hum, flow of water into the intake) is not expected to have any effect on the urban-tolerant wildlife species likely to be utilizing the area. No specific mitigation is required.

The facility will be unmanned; however, regular maintenance and inspections will occur that will result in human disturbances in the area. However, it is anticipated that the area around the powerhouse will become a heavily used park area, so human presence around the site will occur throughout a significant portion of the year. Wildlife inhabiting or utilizing this area will likely be those tolerant of human presence and semi-urban parkland conditions. Therefore, no effect due to human presence during maintenance and inspections at the site is anticipated.

Accidental spills of hazardous materials during facility operation and maintenance are unlikely but could affect terrestrial biota. Mitigation procedures are proposed in Table 6.1 to minimize the potential for hazardous material spills that could affect local wildlife.

6.2.7 Species at Risk

According to the Endangered Species Act, no one may kill, harm, harass, possess, buy, sell, trade, lease or transport species that are listed as threatened or endangered. As the facilities will be operated in a run-of-river mode of operation in accordance with the requirements of the existing approved MRWMP, there are no anticipated effects on wildlife species at risk during the operations stage. Although there is no disturbance or destruction of significant species at risk habitat anticipated, any species at risk encountered will be reported to the MNR.

6.3 Effects and Mitigation – Socioeconomic Environment

6.3.1 Public Access

Figure 6.5 illustrates all areas which will be restricted from public access (via signage and floating safety booms) during operation of the facility.

Following the completion of construction activities, access to Bala Falls will continue to be available, and there will be a viewing area, with a public park constructed over the powerhouse and tailrace channel. (An artist's rendering is included as Figure 6.6.) This rendering represents a preliminary plan for the area following construction. Public comments during the PIC of August 2008, and input from local residents via the 2009 advisory committee (See Section 3.5.12) will be considered in the final plan for this area. The following commitments will be considered as additional mitigation measures in planning for public access to the project area following construction.

- An initial plan for landscaping and public access to this area is illustrated in Figure 6.6
- Access to the shoreline and water between the Muskoka Road 169 Road Bridge and CPR bridge is to be restricted within the boom area.
- The docks at Purk's Place Boat House and Marina will not be able to be used during operations due to safety concerns. Discussions between Purk's Place Boat House and Marina and SREL are ongoing to determine a mutually acceptable compromise including the relocation of the docks to an appropriate area.
- Bala Falls Road will be re-opened following construction completion.
- This area is to be wheelchair accessible to the extent possible.

Given the commitments above, the residual effect of the project on public access to the Bala Falls area will be a restriction to waters within the safety booms at the intake and tailrace as seen in Figure 6.5.

6.3.2 *Public Safety during Plant Operation*

Public safety is always a primary concern and swimming is not compatible with hydro generating facilities. The proposed development area is heavily used by the public for both aquatic and terrestrial recreational activities including scuba diving. Critical areas of concern are the intake channel and tailrace. The following measures represent mitigation designed to protect the public during plant operations.

- The powerhouse for the project (as seen in Figure 6.6) will be underground, limiting public access.
- Barriers and warning signs are to be erected to restrict specific areas, while facilitating safe public access to other areas. These will include safety booms at the intake and tailrace channels, and may include fencing and signage on land restricting access to plant facility areas.
- Two "Tuff Boom" safety barriers are to be installed for the North Dam approach channel. The further upstream of the two booms would be placed to satisfy Transport Canada's navigational safety requirements. The second boom (closer to the dam) will be placed so as to provide additional safety protection in the event that users of the public path on the north side of the channel accidentally enter the channel.
- The design for any viewing deck must discourage diving/jumping.

6.3.2.1 *Water Velocity in the Vicinity of the Intake and Tailrace*

Throughout the public consultation process concern was raised regarding the rate of water flow in the vicinity of both the intake and tailrace.

Of most concern is intake velocity which will be up to 0.61 m/s (2 ft/s). For comparison purposes, the velocity experienced under the CPR bridge during March and April of an average year (existing conditions), is the maximum velocity expected during facility operation (in the same location).

At the tailrace, the velocity of water flowing out will be up to approximately 1.4 m/s in the immediate vicinity of the channel, decreasing with distance.

No mitigation is proposed given that the change in velocity associated with hydro generation is necessary.

6.3.2.2 *Hydroelectric Facility Safety*

The safety of workers within the hydroelectric facility is a priority for SREL. As such, procedures and policies will be adopted to ensure workplace safety.

The following mitigation measures are recommended to ensure the safety at the Bala Falls Small Hydroelectric Facility:

- completion of safety training program by all workers
- strict adherence to the Ministry of Labour occupational health and safety regulations pertaining to worker safety
- first aid equipment to be maintained on site
- MSDS's for any hazardous material used on site to be available close to the location where the material is used and stored
- an accident and emergency spill response plan
- spill containment and clean-up materials on site
- training to deal with spill situations.

6.3.3 Local Traffic

Following construction of the Project, the Bailey bridge will be removed and traffic will be restored to baseline conditions or better. No effects to traffic are anticipated during operation of the project and therefore no mitigation measures are proposed.

6.3.4 Sound Levels

Sound emitted from the project during operation will be in compliance with MOE's *Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)* [NPC-205] October 1995.

A Class 2 Area is one with an acoustical environment having qualities representative of both Class 1 and Class 3 in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 areas will typically be realized as early as 19:00 hours.

Other characteristics which may indicate the presence of a Class 2 area include

- absence of urban hum between 19:00 and 23:00 hours
- evening background sound level defined by natural environment and infrequent human activity
- no clearly audible sound from stationary sources other than from those under impact assessment.

As discussed in Appendix C1, for this project, the sound level measurements were taken in three locations. An estimate of the distance between the potential noise source and the survey locations and average Leq is provided below:

ID	Description	Approximate Distance to Source (m)	Average Measured Leq (dBA)
1	West of highway	20	62.8
2	South of control structure	20	61.9
3	North of falls	70	58.9

Two calculations were carried out in order to determine the noise level at the points of reception (POR) (see Acoustic Assessment Report – Appendix C1). First, the sound pressure levels corresponding to the interior of the powerhouse were calculated based on the sound power of the sources: the generator cooling fans and the transformer. For each source, the individual noise impact was computed based on the dimensions and sound absorption characteristics of the surrounding space, and then the sound levels were combined to estimate a total sound emission for the powerhouse.

For determining the noise levels at the receptors, it was assumed that the powerhouse emitted sound in all directions (hemispherical point source). In its path between the source and the receptors, the sound was only attenuated by distance, neglecting other factors like height changes, barriers, meteorological conditions and atmospheric air absorption.

The resultant sound pressure levels at the receptors are below the maximum requirements of the MOE (based on the data available) even when other sources of attenuation were not considered.

Mitigation measures to minimize adverse effects from noise during the operation of the plant include

- installation of the transformer within the powerhouse, underground
- locating generator cooling fans to ensure exhaust directionality is toward existing sources of sound i.e., Muskoka Road 169 and the railway line.

As discussed in Appendix C1, the POR located closest to the powerhouse is R-3 at approximately 107 m from the proposed facility (see Table 4.1in Appendix C1). At this location, the noise from the powerhouse is attenuated by 40.6 dBA due to distance, resulting in a sound level of 43.1 dBA. This value is well below the measured background noise levels. Therefore, the cumulative sound pressure levels will be very close to the measured background noise. As mentioned above, the ventilation openings will be positioned facing the highway (southeast), which would further contribute to reduce the effect of the source on the closest POR. The houses located to the northeast of the powerhouse are at least 200 m from the proposed location, where the resultant sound levels from the powerhouse will be below 40 dBA.

6.3.5 *Aesthetics*

6.3.5.1 *Flow Over Bala Falls*

The flow related environmental and legal obligations which apply to SREL's operation of the North Bala dam include those flows allocated within the MRWMP to be "spilled" over North Bala and South Bala Falls totalling 2.0 m^3/s, split equally between the two structures (1 m^3/s each). Currently, flow through the Bala dams occurs either via leakage or through stop-log manipulation, and is intended to maintain the aesthetics of the downstream water falls as well as to preserve water quality and fish habitat. The combined 2.0 m^3/s is the minimum flow which can occur in extended dry periods while attempting to maintain Lake Muskoka levels within the Normal Operating Range.

During operation, the North Dam will continue to release the minimum flow required by the MRWMP (1 m^3/s). As discussed in Section 6.2.2.1, flows between 6 m^3/s and 96 m^3/s will be passed through the plant. Flows exceeding 102 m^3/s will be spilled over the South Dam. This is anticipated to occur at times when flows are high, such as in spring.

Given the above, the effect of the operation of the project on water flowing over the Bala Falls will be a reduction to a consistent flow from leakage between the stop logs (assumed to be 1 m^3/s) directly comparable to that currently experienced in an average summer. In a normal operating year the water flow observed during the operation of the project (year-round) will be consistent with the flow currently observed in an average year from June to October.

Numerous stakeholders have expressed concern that the flow over the falls, which attracts many visitors to the Town of Bala during the tourist season (May 24 to the weekend after Thanksgiving), would be discontinued. However, given the above information on proposed water levels during project operation, flows during the majority of the tourist/summer season (June to October) will not experience any change.

6.3.5.2 Flow Over the South Dam

As discussed in Section 6.2.2.1, the South Dam will experience less flow throughout the year as water is diverted through the powerhouse. Spillage of excess flows will occur via the South Dam during spring high flows (March to June) and fall high flows (October to December). During the tourist season (May 24th long weekend to the weekend after Thanksgiving) a flow of 2 m^3/s is proposed to be passed over the South Dam.

6.3.5.3 Powerhouse Aesthetics

The landscape for the powerhouse area has been designed in consideration of public comments during the August 2007 and 2008 PIC's. The new plan proposed incorporates the following key features:

- the powerhouse was moved from its original location a considerable distance south, and away from the south edge of the waterfall ensuring continued safe access to Bala Falls and the surrounding area
- powerhouse is now designed with virtually all station facilities below grade
- the orientation of the powerhouse is such that tailrace flows have minimal impact on the scenic falls area
- this design provided the opportunity to create a park-like setting in keeping with the site's natural beauty and character.

An artist rendering by Forrec Ltd. of SREL's revised design is included as Figure 6.6 and represents a conceptual plan for site remediation on construction completion. Public comment regarding this plan during the August 2008 PIC was both positive and negative. SREL will consider all comments when making final design decisions in an effort to landscape the project area in a manner which appeals to the greatest number of community members to the extent possible. In addition, a local advisory committee comprised of local stakeholders is anticipated to be formed during the detailed design stage to determine the details regarding the landscaping, handrails and other aesthetic elements.

6.3.6 Tourism and Recreation

6.3.6.1 Effect on Areas for Public Use

As detailed in Section 6.3.1, public access to the water will be restricted in the vicinity of the intake and tailrace channels. Areas restricted from public access will be clearly marked by safety booms and appropriate signage. Recreational activities identified in Section 2.2.5.10 are noted to occur in the vicinity, and will be prohibited in the immediate vicinity of the tailrace and intake channels. These in-water activities include boating, canoeing, kayaking, fishing, swimming, water skiing, scuba diving, and snorkelling. Areas restricted from public access are illustrated in Figure 6.5.

With the completion of construction any temporary inconveniences caused by the project (such as the closure of Bala Falls Road) will be removed.

Any access restrictions during operation of the project are summarized in the following points:

- access to the water in the vicinity of the tailrace channel (as seen in Figure 6.5) will be changed due to landscaping. A stair will provide access to the south side of the north falls. Increased slopes, south of the powerhouse to the north side of the south channel will result in reduced access
- access to the water in the area between Muskoka Road 169 and the CPR bridge will be discontinued
- the docks presently located at Purk's Place Boat House and Marina will be permanently removed and may be relocated to an area mutually agreed by the dock owner and SREL

Flow velocities will increase within the North Channel; however these will be within the boomed areas, restricted from public access (see Section 6.3.1). Velocities at the Bala town docks will not be affected by the Project. This will allow the continued use of the public docks for all present activities including the Bala Bay Regatta.

The current portage route (from the docks at Purk's Place to the relaunch, south of the falls) will be unavailable as a result of the Project. Other portage routes for crossing Muskoka Road 169 are available, such as

- boating to public docks on north side of North Channel with public path to Muskoka Road 169
- boating to Divers point and then walking along Bala Falls Road to Muskoka Road 169
- possible future snowmobile/pedestrian bridge to be built by municipality between public docks and divers point.

The effect of operation of the project on tourism and recreational activities is a reduction in area available for in-water activities within boomed areas. No mitigation measures are proposed given that areas of increased water flow (at the intake and tailrace channels) are no longer available for public use due to public safety consideration.

The area restricted represents approximately 50 m of the shore line on the south side of the North Channel between the North Dam and east of the CPR bridge, and approximately 50 m of shoreline on the north side of the North Channel. In addition, there will be approximately 50 m of restricted shoreline south of the Bala Falls and west of Muskoka Road 169. However, there will be an abundance of shoreline in the vicinity of the project and continued access to Bala Falls, as well as an additional parkland area of approximately 1200 m^3 (see Figure 6.6) available for public use.

6.3.6.2 *Effects on Existing Water Levels*

A major concern expressed during the stakeholder consultation process was the effect of the project's operations on water levels above and below the dam. Pertinent to residents and cottagers on both the Moon River and Bala Bay (Lake Muskoka) water levels will be maintained in compliance with the approved MRWMP and the best management zone prescribed by the MNR. These requirements are discussed in detail within Section 6.2.2.2

6.3.6.3 *Property Values*

Concern has been expressed by members of the community that the operation of the project will result in a reduction in property values in the vicinity. Given the proposed operation of the project is within the prescribed water levels of the MRWMP and that the project is subject to permitting and approvals by various agencies, it is expected that likely causes of property value reduction such as increased risk of flooding or nuisance noise during operation, will not be an issue.

6.3.7 Employment and Economy

The equivalent of one full-time employee will be hired to operate the Bala Falls Generating Station, as well as the operation of the MNR Bala North and Bala South dams. The facilities will be remotely operated with periodic checks on operations and performance of maintenance activities.

The operation of the project will provide positive economic benefit in the form of renewable energy (4.3 MW) to the provincial power supply and water power rental fess to the provincial government.

The annual energy produced by the project will be equivalent to that required to power approximately 1750 homes. This is based on an average electricity consumption per household of 12,836 kWh each year (Enerdata, 2008) and a plant capacity factor for small hydro of 60%.

6.3.7.1 *Effects to Purk's Place Boat House and Marina*

The operation of the Project will have a long-term impact to PPBH&M and traditional use and access to the waterway due to high flow velocities during operation and safety boom locations. As discussed in Section 5.3.8 the docks at PPBH&M will no longer be available for use by the public including customers of PPBH&M. The relocation of Purk's Place water related facilities or complete business is currently proposed by SREL as mitigation. Mutual agreement by both parties will be required prior to the project proceeding.

6.3.8 Infrastructure

6.3.8.1 *Downstream Hydroelectric Facilities*

As discussed in Section 9, the facility will result in changes to flow velocity in the localized area downstream from the North and South Dams and the facility tailrace. The facility will redirect up to the rated capacity of 96 m^3/s from the channel leading to the North Bala Dam, divert it through the powerhouse and release it back to the watercourse via the tailrace. This will cause a corresponding reduction of the amount of flow that would normally go over the North and South Bala Dams. The same amount of flow will be entering the Bala Reach. Once the flow from the four sources (i.e., powerhouse, North Bala Dam and South Bala Dam, Burgess Pond) combine, there will be no change in hydraulics in further downstream reaches, and therefore no effect anticipated to the five control structures downstream (and therefore hydroelectric generation) at Moon Dam, Ragged Rapids Dam, Big Eddy Dam, Go Home Lake Control Dam, and Go Home Lake Filter Dam.

6.3.8.2 Transmission Line Interconnection

The interconnection of the facility will be via underground cabling from the powerhouse to the existing 44-kV Hydro One Networks Inc. distribution line. A connection impact assessment prior to interconnection will be required prior to the proposed interconnection.

6.3.8.3 CP Rail Bridge Abutments and Pier

An underwater survey will be conducted by CP Rail prior to construction of the project, to determine if the abutments and pier need upgrading in order to resist higher flows through the north channel. Future maintenance of the bridge structure should not be affected significantly by the relocation of the boom. It is proposed that future work on the bridge would be coordinated with the Project to ensure that work is completed during low flow periods similar to the existing conditions where possible.

6.3.9 Land and Resources Used for Traditional Purposes by Aboriginal Persons

No conflict with traditional use of the land or resources in the project area has been identified.

6.4 Summary of Operational Effects and Mitigation

The operational effects and proposed mitigation measures are summarized in Table 6.1.

6.5 Accidents and Malfunctions

CEAA requires consideration of the environmental effects of accidents and malfunctions during project operation.

Failure of the dam(s) is an extremely unlikely event, but could release a significant amount of water into the downstream reaches over a short period of time (likely no more than a few hours) under a total failure scenario. This could result in a significant short-term flow and a water level increase downstream from the facilities. Failure of the dam(s) would not be expected to impact facilities downstream of this location. A dam failure of this sort would preclude full operation of the facility(s) until the weir(s) could be replaced to reinstate the head pond and fully submerge the intake(s). High flow events after a failure of this type would not pose any additional risk to the facility, as it would be passed through the main river channel.

Failure of the transmission system, depending on location of failure, would isolate one, two, or all stations from the grid, and require the isolated stations to be shut down until repairs were undertaken. This would affect project revenues until repairs were completed.

As noted in the previous section, an Emergency Preparedness Response Plan will be prepared for the Bala Falls Generating Station, which outlines the actions required to respond to these potential events.

6.6 Facility Decommissioning

The lifetime of the Bala Falls Generating Station is expected to be more than 50 years. At that time, if continued operation of the facility is deemed impractical, infeasible or uneconomical, the project may be retired. The owner may choose to remove some or all facility components from the area. Should the facilities or part of the facilities require removal, rehabilitation of the site would be necessary to ensure that the environment will be suitable for plant, animal and human use. If facility decommissioning is to occur, an environmental assessment process based on the environmental knowledge, standards, and legislative requirements in place at that time would need to be undertaken.

6.7 Significance of Residual Effects

The next phase in the analysis involved the evaluation of the significance of any remaining residual adverse effects. MOE (2001) provides criteria for assessing significance, including

- value or importance of the resource affected
- magnitude of the effect
- geographic extent or distribution of the effect
- duration or frequency of the effect
- reversibility of the effect
- ecological/social context of the effect.

The evaluation of the significance of the residual adverse effects during the operation phase is presented in Table 6.2. The majority of the residual adverse effects are localized and the resources are not unique. Generally, operation effects are long term, but are of low magnitude and reversible in many cases. Based on the criteria used to assess significance, none of the residual effects occurring during the operations period are considered significant.

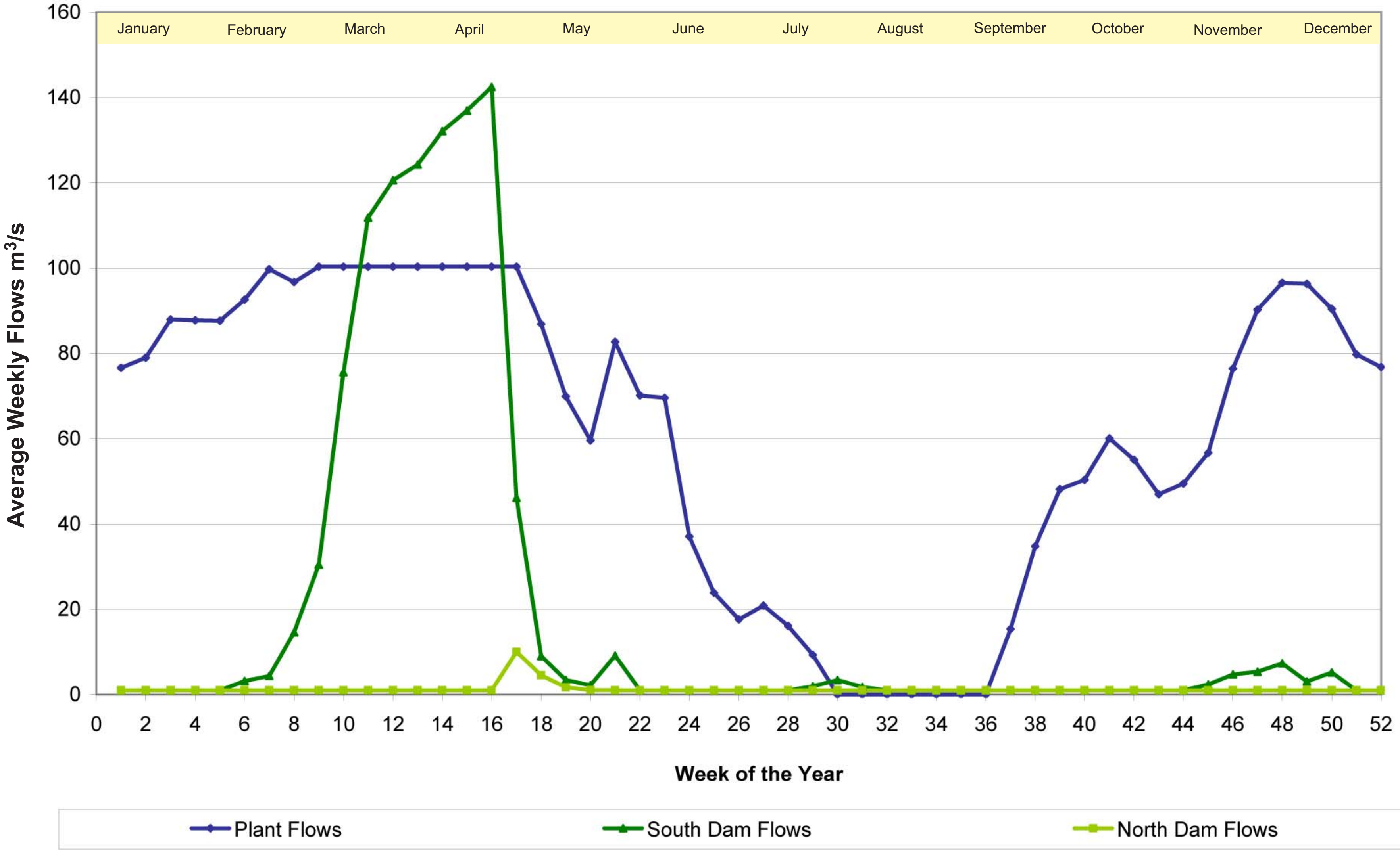

Figure 6.1
Swift River Energy Ltd.
North Bala Small Hydro Project
Projected Median (50% Probability) Weekly North Bala Plant and Dam Flows
Based on Historical Dam Flow Data for the Period 1982-1999

HATCH energy

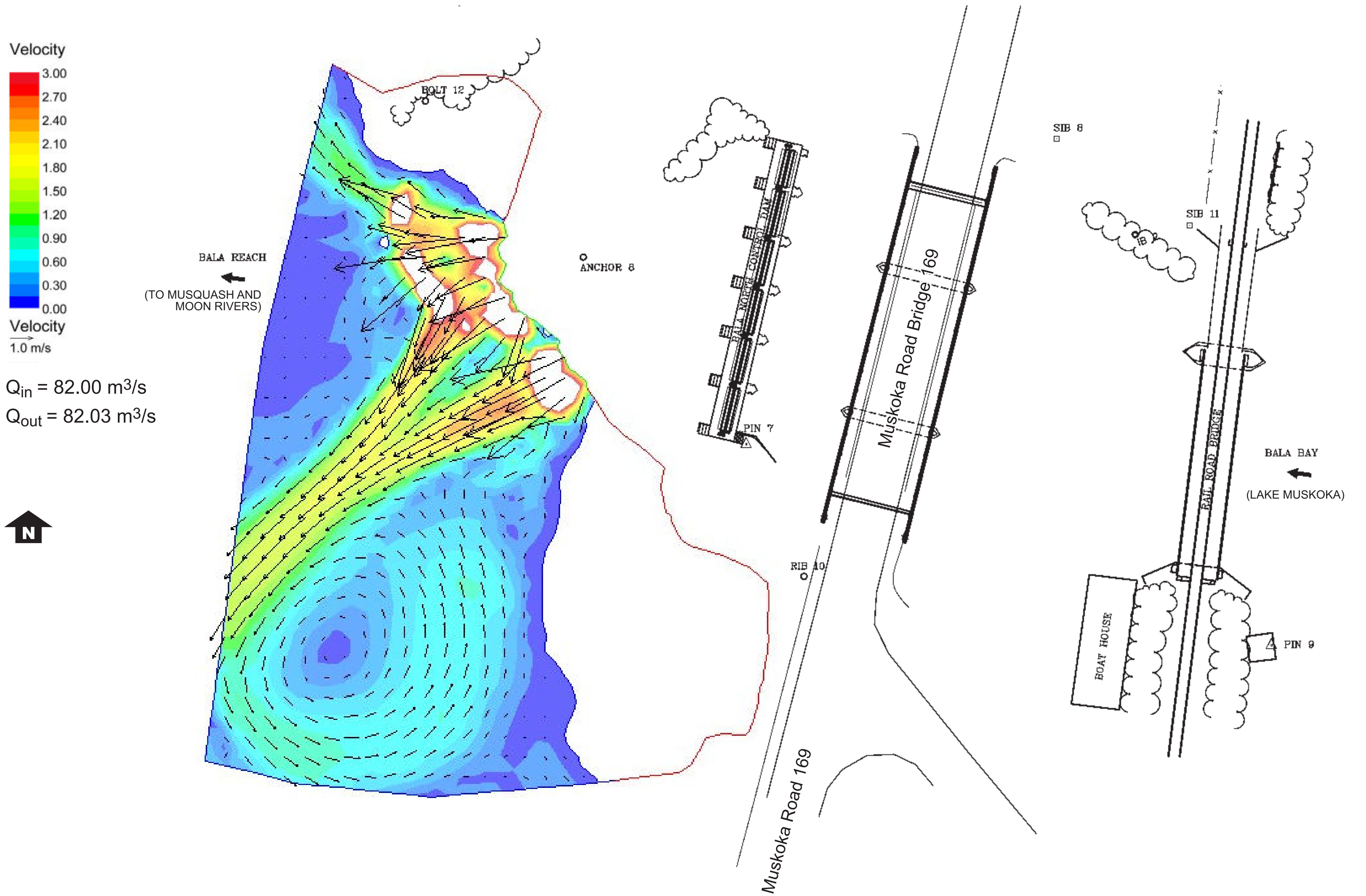

Figure 6.2a
Swift River Energy Ltd.
North Bala Small Hydro Project
Downstream Reach Existing Conditions - Power Flow + Bypass Flow

HATCH energy

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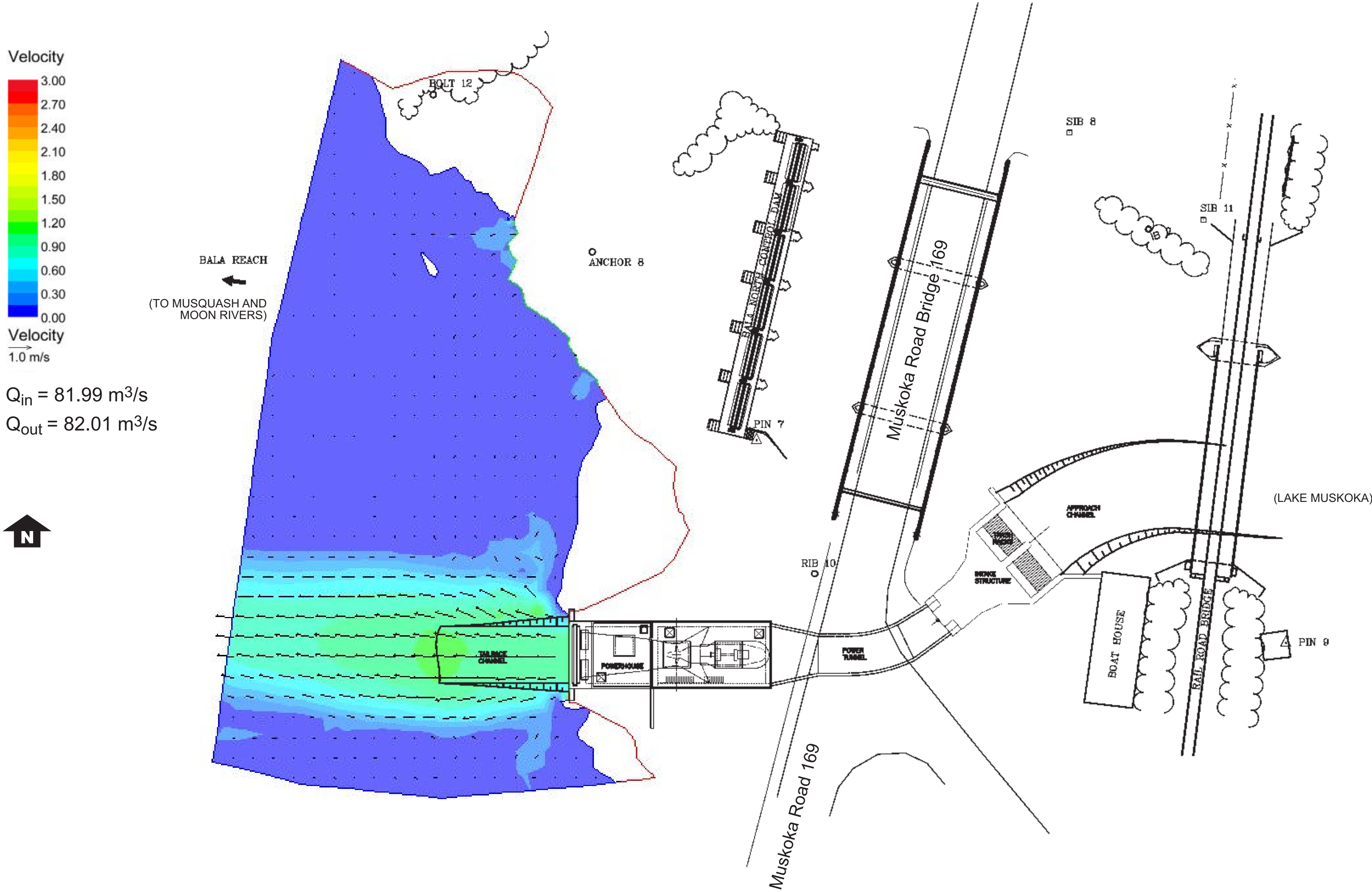

Figure 6.2b
Swift River Energy Ltd.
North Bala Small Hydro Project

Downstream Reach Post Development Conditions - Power Flow + Bypass Flow

HATCH energy

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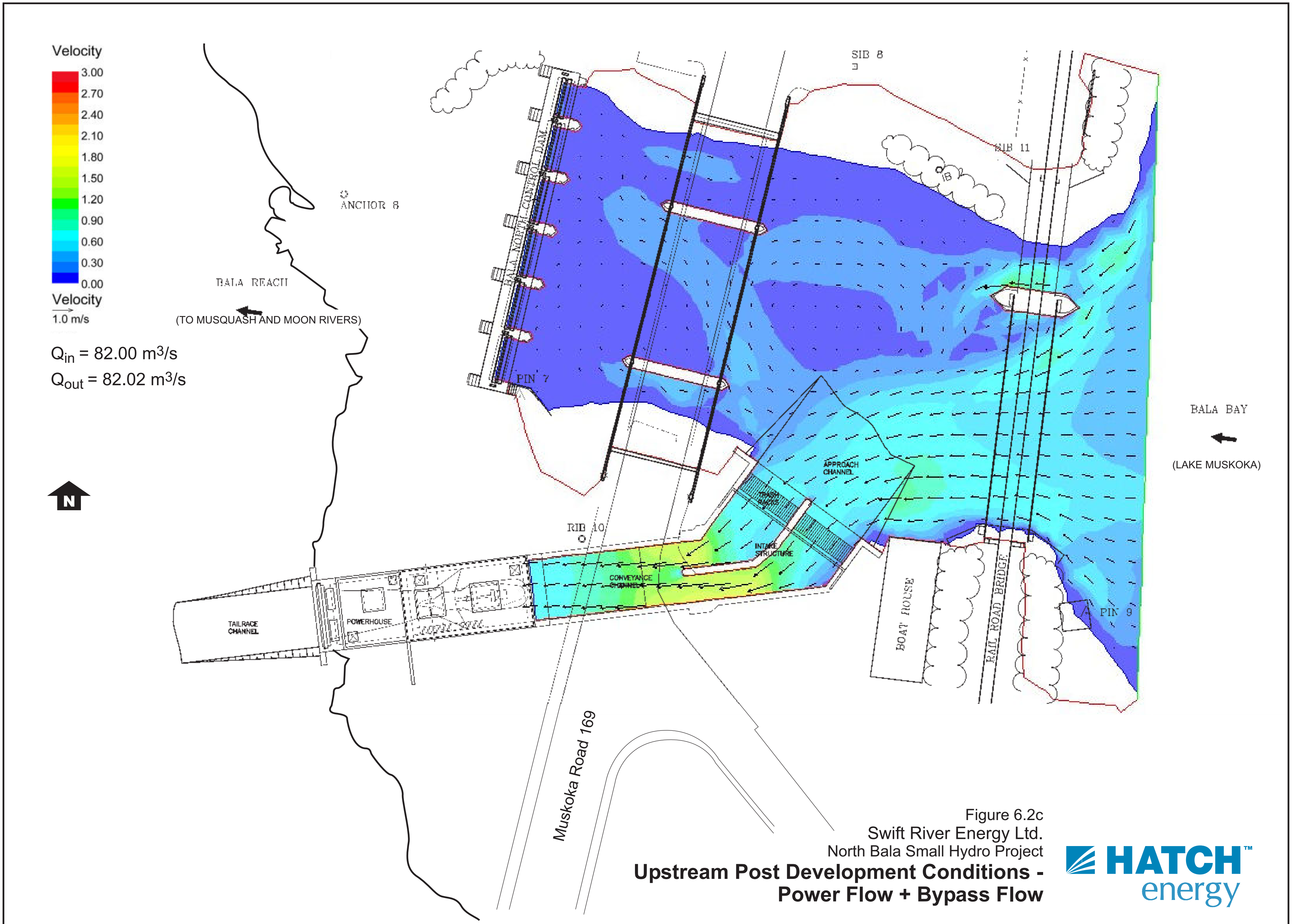


Figure 6.2c
Swift River Energy Ltd.
North Bala Small Hydro Project
Upstream Post Development Conditions - Power Flow + Bypass Flow

HATCH energy

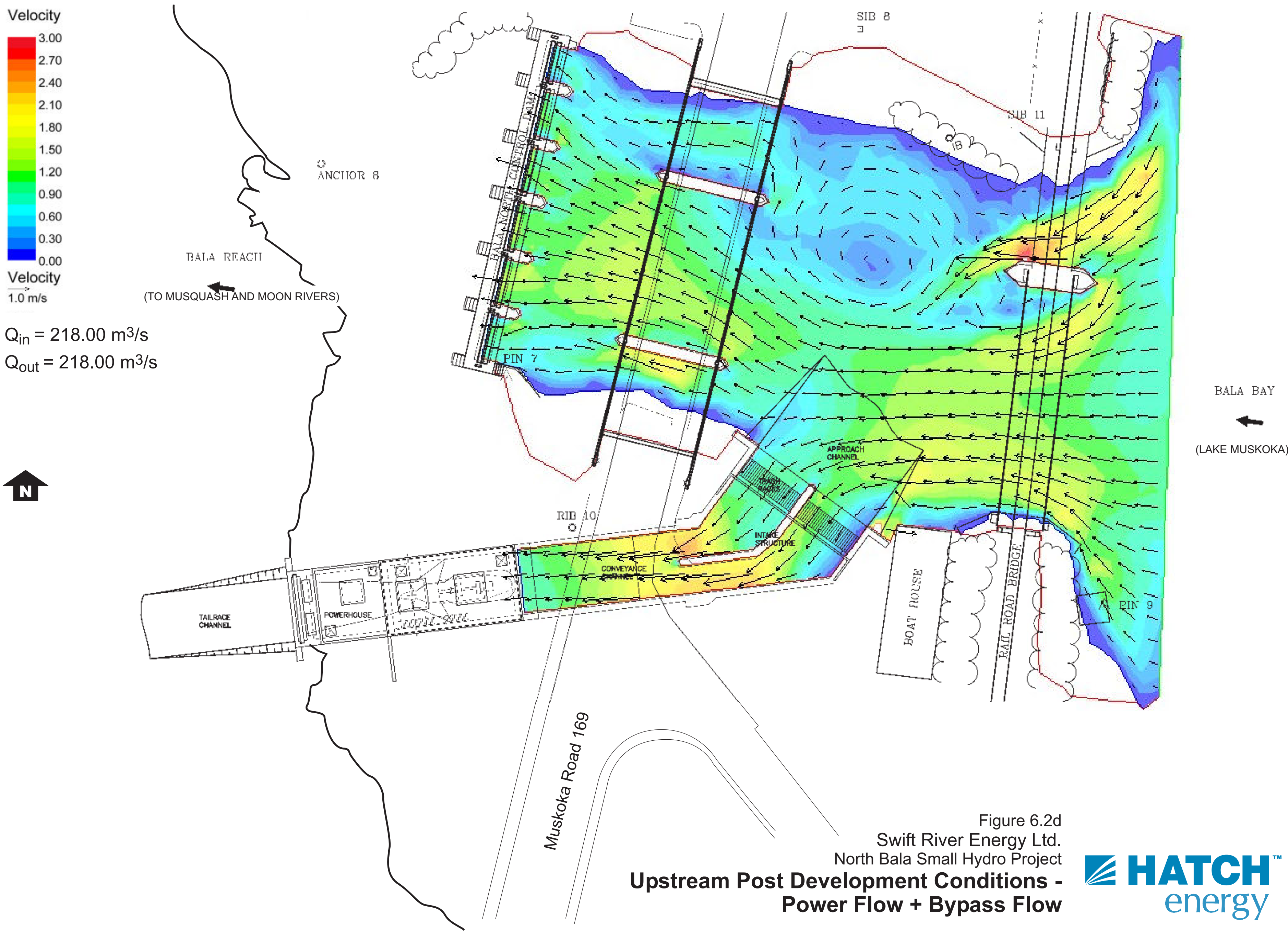


Figure 6.2d
Swift River Energy Ltd.
North Bala Small Hydro Project
Upstream Post Development Conditions - Power Flow + Bypass Flow

HATCH energy

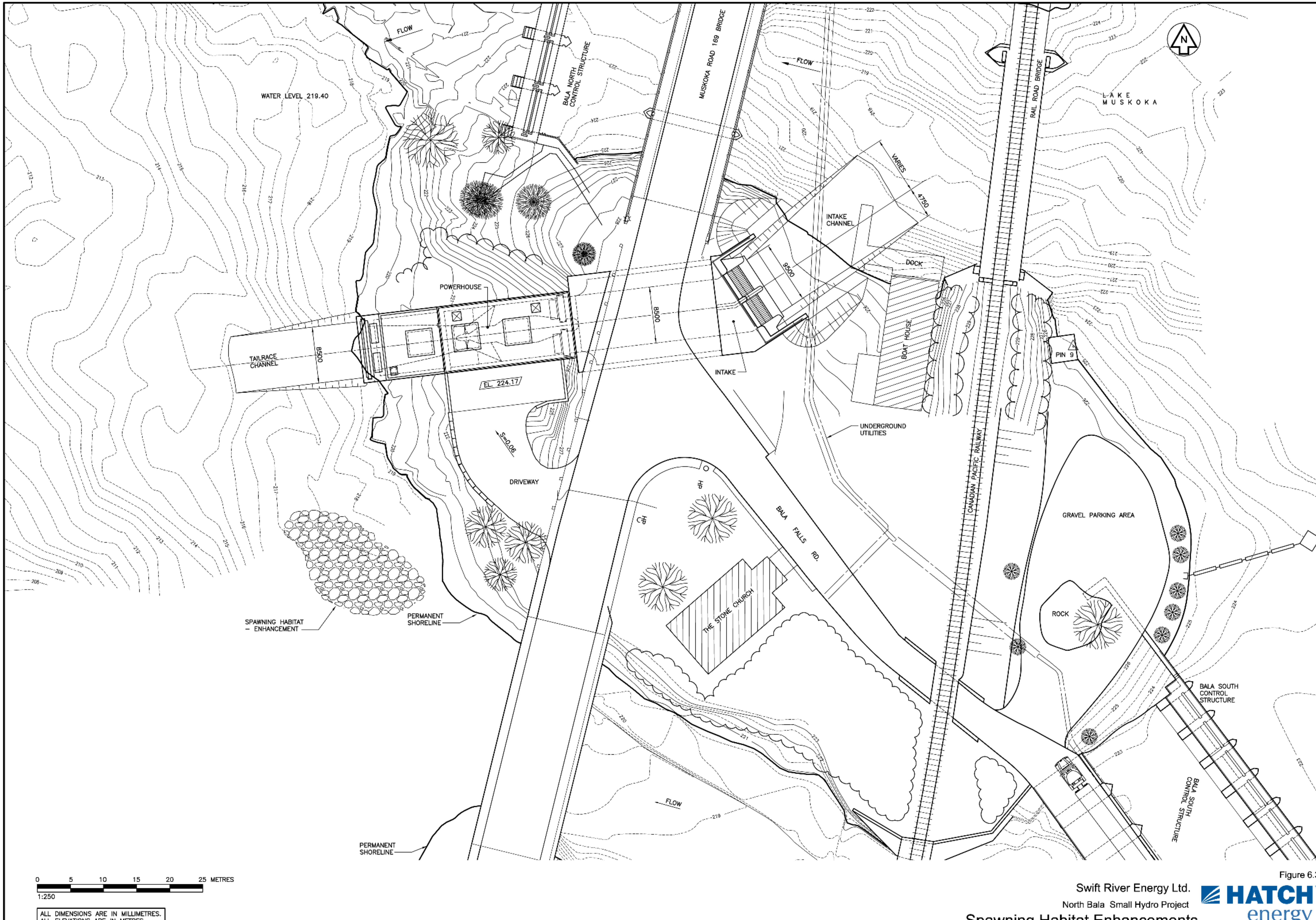


Figure 6.3

Swift River Energy Ltd.

North Bala Small Hydro Project

Spawning Habitat Enhancements

HATCH energy

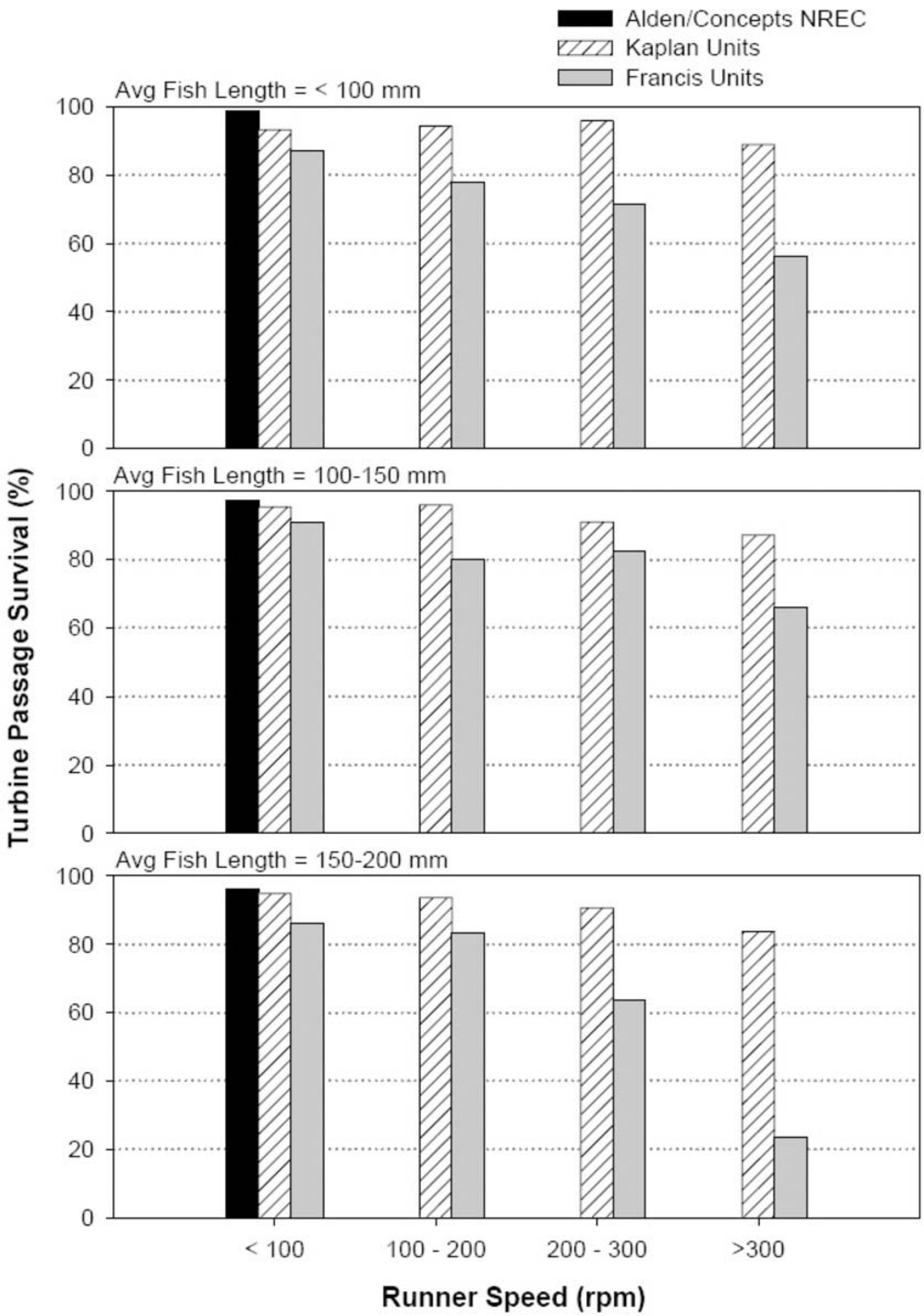
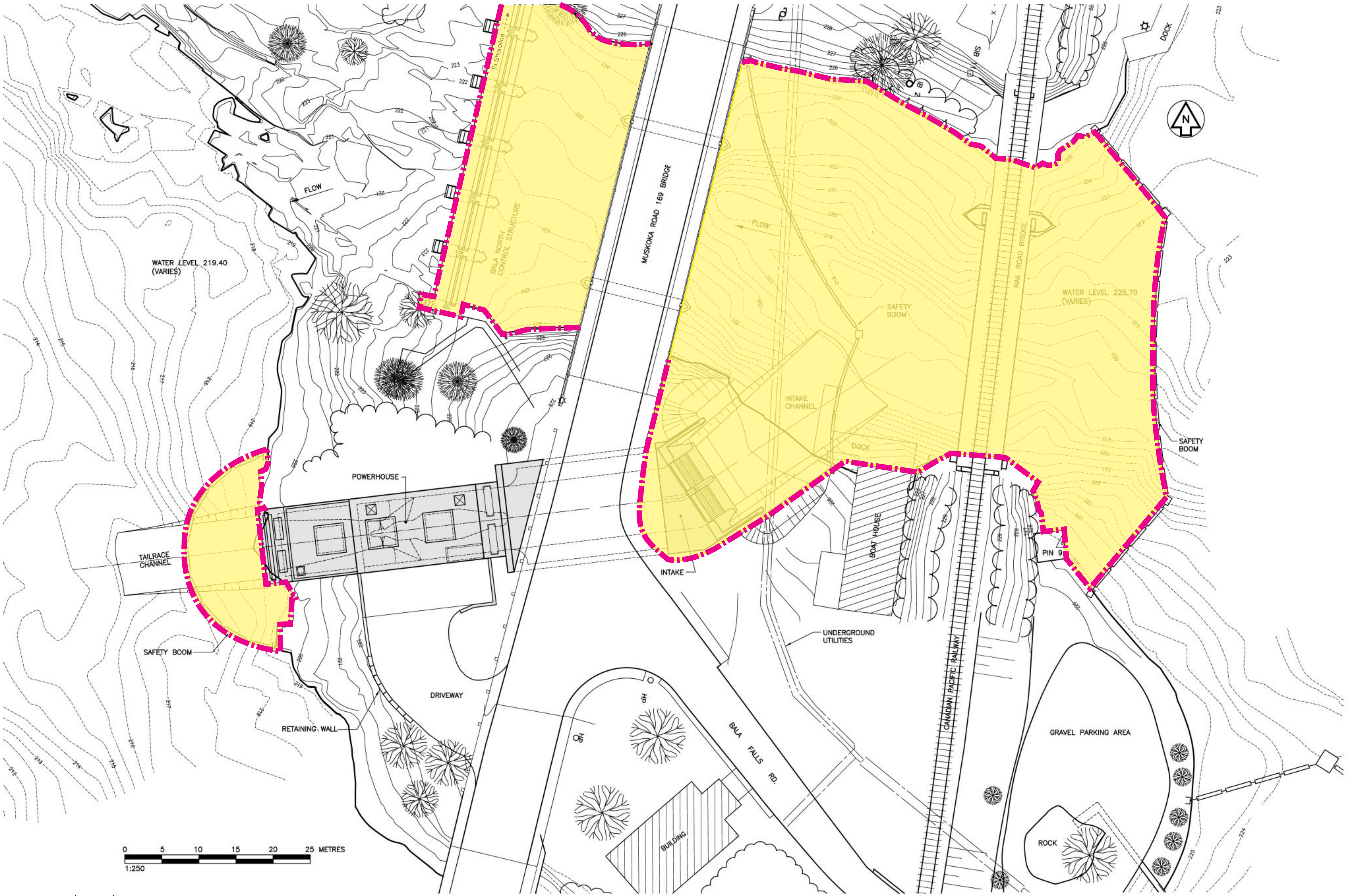


Figure 6.4
Swift River Energy Ltd.
North Bala Small Hydro Project
Relationship Between Turbine and Fish Mortality



0 5 10 15 20 25 METRES

1:250

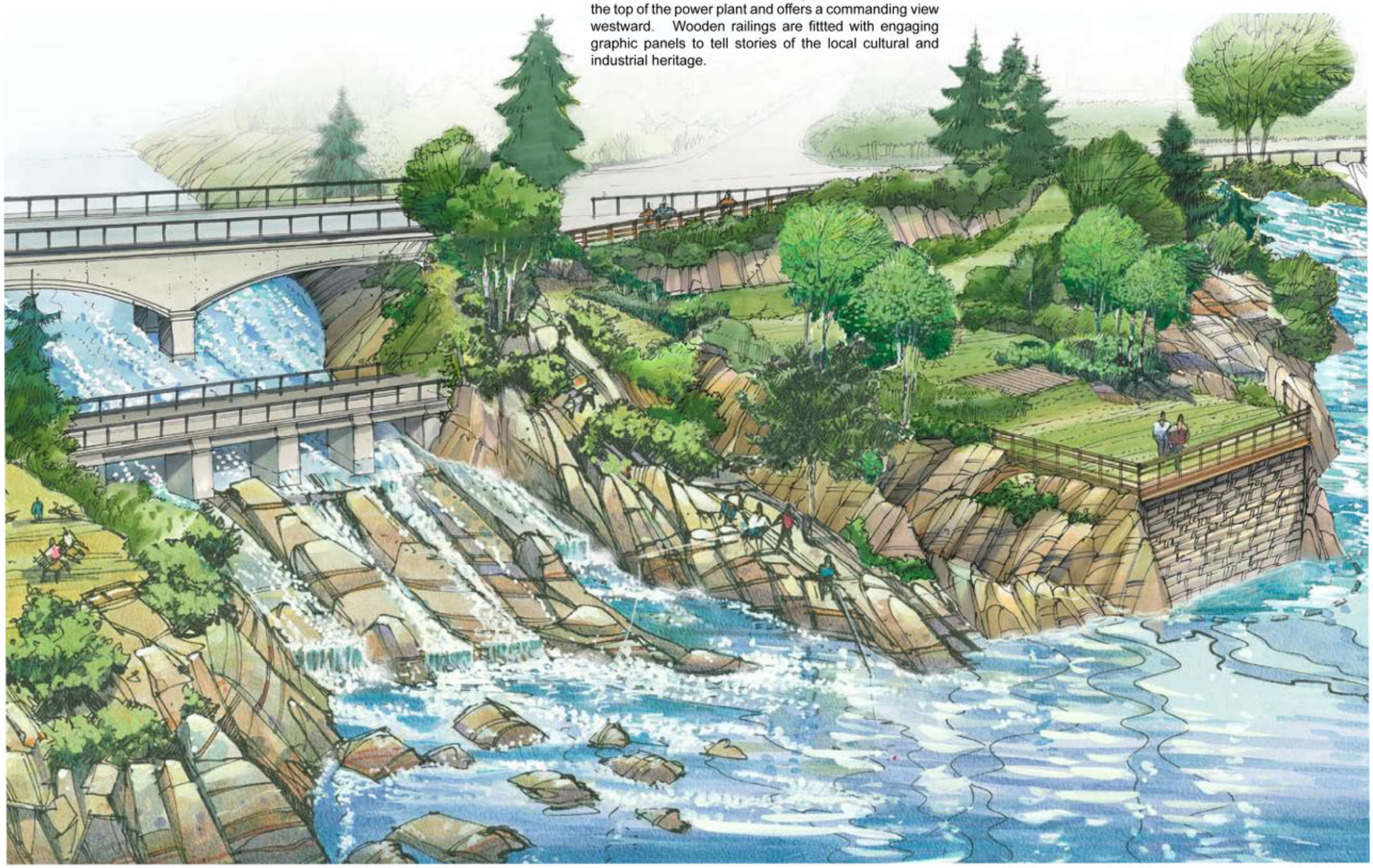
Legend

Areas to which access will remain restricted (by signage and floating safety booms) following construction.

Figure 6.5
Swift River Energy Ltd.
North Bala Small Hydro Project
Areas Restricted During Operation

H/327078_May_09_rm

An accessible upper level viewing platform is built into the top of the power plant and offers a commanding view westward. Wooden railings are fittted with engaging graphic panels to tell stories of the local cultural and industrial heritage.



Burgess Park with the North Bala Dam and the Muskoka Road 169 Bridge beyond

A gentle path steps visitors down to the old shore and rock face.

A gentle grassy slope brings visitors down to a rustic 'shield-like' landscape on the lower level. A protected viewing area is built to present a simple Muskoka-like look & feel at the water's edge.
Area is accessible for service vehicles when required. Removeable service hatches are fitted with recycled decking.

Figure 6.6
Swift River Energy Ltd.
North Bala Small Hydro Project
Artist Rendering of Site Restoration/Landscaping

HATCH™ energy

7 Cumulative Effects

7. Cumulative Effects

The CEA Act states that all federal screenings must include an assessment of the potential cumulative effects of the project. Cumulative effects are defined as "changes to the environment that are caused by an action (i.e., the 'project') in combination with other past, present and future human actions" (Canadian Environmental Assessment Agency, 2004).

The first step in assessing the potential cumulative effects resulting from this project was to define any past, present or future human actions that have occurred, are occurring or may occur in the future within the project area. The potential for interaction of other human actions with this project varies depending on geographic location of the other action and the nature of the valued ecosystem or socioeconomic component being considered (e.g., habitat range or area over which an activity occurs). Therefore, it is necessary to examine the potential for cumulative effects on a broad regional scale (e.g., within a fairly broad geographic region surrounding the actual project's footprint) in order to identify other projects which have the potential to result in cumulative effects.

The process used to assess cumulative effects involves

- identifying the potential projects and activities that may interact with the subject project
- assessing potential cumulative effects of the project in combination with the projects and activities identified
- identifying mitigation measures to prevent/minimize the potential for cumulative effects and then identifying residual cumulative effects remaining after implementation of mitigation
- determining the significance of the adverse residual cumulative effects
- determining necessary regional monitoring and follow-up measures, and effects management.

7.1 Identification of Other Projects and Activities

Past, existing and future projects or activities that have the potential to act cumulatively with the effects of the Bala Falls Small Hydro Project are identified in the following sections.

7.1.1 Past Projects and Activities

Past activities in the study area have included urban development in the Village of Bala, cottage development on Lake Muskoka and in the Bala Reach, construction of dams and hydropower facilities (including the former generating station at North Bala Dam), associated water management on the Muskoka River, and recreational activities in the area (fishing, scenic viewing, etc).

7.1.1.1 Village of Bala Development

The area of present day Bala was first colonized by European settlers around 1868, with the Village of Bala being incorporated in 1914 (Wikipedia, 2007). Past urban development around Bala has resulted in considerable environmental change from pre-development conditions including vegetation clearing, wildlife disruption and loss of habitat, changes in surface water hydrology and water quality (due to increases in imperviousness, road runoff, wastewater treatment and septic leakage and withdrawals for drinking water) and the reduction in air quality (due to local and regional industrial discharges and vehicle emissions).

7.1.1.2 *Cottaging on Lake Muskoka/Bala Reach*

The construction of cottages on Lake Muskoka and in the Bala Reach commenced in the late 1800's. The Muskoka Lakes Association, which represents shoreline property owners on Lakes Muskoka, Joseph and Rosseau, was first formed in 1889 to represent the interests of these groups. Cottage development has resulted in changes to the environment surrounding the study area including vegetation clearing, wildlife disruption and loss of habitat, changes in surface water runoff and hydrology (due to increases in impervious surfaces, wastewater treatment and septic leakage, withdrawals for drinking water).

7.1.1.3 *Construction of Dams and Hydropower Facilities*

The North Bala Dam was originally constructed in 1873 to facilitate the driving of logs from Lake Muskoka into the Moon River. The construction of both the North and South Bala dams resulted in a change to the aesthetics of the falls area.

A small hydroelectric generating station (2.3 kV) was built at the North Bala Dam in 1924 by Bala Electric Company. It was purchased by the Hydro Electric Power Commission of Ontario in 1929. It supplied power to the town of Bala until 1957. It was demolished in 1972. The intake, powerhouse and tailrace areas were in-filled, and are evident due to the fact that the in-fill material differs from the surrounding natural rock in the area.

Development of the various dams and hydroelectric facilities upstream and downstream of the site, and resulting water management regimes within the Muskoka River watershed have altered natural flow rates and water levels in the watershed.

7.1.1.4 *Recreational Activities*

Past recreational activities in the study area have included fishing, power boating, canoeing, scuba diving, hunting, hiking/walking, scenic viewing at Bala Falls, swimming and cycling.

7.1.2 Existing Projects and Activities

Activities that currently occur in the vicinity of the project area include water management (of water levels and flows in the Muskoka River), recreational/tourism activities, commercial activities, and cottaging on Lake Muskoka/Bala Reach.

7.1.2.1 *Water Management Planning*

Water management is undertaken by the owners of water power facilities and control dams in accordance with the approved MRWMP.

7.1.2.2 *Recreational/Tourism Activities*

Existing recreational activities include boating, canoeing, kayaking, fishing, swimming, water skiing, hiking and walking, sightseeing/scenic viewing at the falls, picnicking, biking, scuba diving, yoga, sunbathing, snorkelling, photography and cross-country skiing. Lake Muskoka (upstream of North Bala Dam) and Moon River (downstream of North Bala Dam) are popular boating, swimming, scuba diving and recreational fishing areas. The land alongside the falls is used for recreation and a number of benches are provided for public use. Many of these recreational uses take place at the base of Bala Falls. Within the District of Muskoka, 60 of the 122 tourist resort commercial accommodation properties are located within the Township of Muskoka Lakes where the larges lakes (Muskoka, Rosseau and Joseph) are located.

7.1.2.3 Commercial Activities

The Muskoka Lakes Chamber of Commerce Member Directory provides an on-line listing of approximately 100 businesses within the community of Bala. In close proximity to the Project (within 50 m) there are two local businesses. These are Purk's Place Boat House and Marina and an antique store, which is located within Burgess Memorial Bala Presbyterian Stone Church.

7.1.2.4 Cottaging on Lake Muskoka/Bala Reach (Seasonal Residents)

A large percentage of the local population in the vicinity of the project is seasonal, including numerous cottagers located on Lake Muskoka/Bala Reach. These seasonal residents have constructed docks, boathouses and other infrastructure on the water's edge, utilizing their property along the water's edge.

7.1.3 Future Projects and Activities

Activities anticipated to occur continue during the operation of the Bala Falls Small Hydro Project include water management (of water levels and flows in the Muskoka River), recreational/tourism activities, and further commercial and residential development.

7.1.3.1 Water Management Planning

Water management will continue to be in accordance with the approved MRWMP. Any additional development on the Muskoka River potentially affecting the approved MRWMP will be subject to an amendment to the plan.

7.1.3.2 Recreational/Tourism Activities

Future recreational activities in the study area will likely include the existing fishing, power boating, canoeing, scuba diving, hunting, hiking/walking, falls watching, swimming and cycling.

A snowmobile/pedestrian bridge to link the area close to Diver's Pond with the public docks on north side of the North Channel is under consideration. This would provide a better avenue for snowmobilers crossing the lake. This bridge would likely include the construction of support columns adjacent to the existing rail bridge columns

7.1.3.3 Further Residential and Commercial Development

Further residential and commercial development will continue to be guided by the Official Plan and Zoning By-laws of the Township of Muskoka Lakes. Development of the waterfront is encouraged to contribute to the attraction of visitors and residents (Township of Muskoka Lakes, 2006). Residential and commercial development will continue to be subject to permitting and approval processes by the municipality, ensuring that future development is consistent with the policies and strategies put forth by the Township.

7.2 Assessment of Potential Cumulative Effects, Identification of Mitigation Measures and Residual Adverse Cumulative Effects

Table 7.1 summarizes the potential cumulative effects of the North Bala Small Hydro Project and other projects and activities identifies potential mitigation measures and the residual adverse cumulative effects following mitigation.

7.3 Significance of Residual Adverse Cumulative Effects

The next phase in the cumulative effects assessment involved evaluating the significance of any residual adverse cumulative effects identified in Table 7.1. MOE (2001) provides criteria for assessing significance, including

- value or importance of the resource affected
- magnitude of the effect
- geographic extent or distribution of the effect
- duration or frequency of the effect.

The likelihood of the cumulative effect was also assessed.

The results are provided in Table 7.2. The residual cumulative effects are not anticipated to be significant as a result of the adverse effects of past, present or future activities acting in conjunction with the adverse effects of the Bala Falls Small Hydro Project. Most potential cumulative effects are of a low magnitude and have a low probability of occurrence.

Table 7.1 Cumulative Effects Assessment

Environmental Component	Project Phase	Net Project Effects following Effective Mitigation	Effects of Unrelated Activities on Environmental Components			Potential Interaction	Mitigation Measures	Residual Cumulative Effect
			Construction of Dams and Hydropower Facilities and Water Management Planning on Muskoka River	Development of the Village of Bala, Cottages/Residences on Lake Muskoka/Bala Reach, and Commercial Activities/Development	Local and Regional Recreation/Tourism Activities			
Air Quality	Construction	Minor dust and air emissions during construction	Construction and maintenance of dams and other hydropower facilities likely have a minor, temporary impact on local air quality due to periodic emissions associated with equipment.	Past and present construction, residential development, home heating and personal vehicle use have likely caused changes to local air quality in Bala	Recreation and tourism activities likely result in minor air emissions due to vehicle use	Air emissions during construction may cumulatively interact with local vehicle emissions	No additional mitigation proposed to prevent cumulative effect	Minor cumulative impact on local air quality during construction due to cumulative combustion emissions
	Operation	Periodic emissions from back up diesel generator				Air emissions during operation may cumulatively interact with local vehicle emissions	No additional mitigation proposed to prevent cumulative effect	Minor cumulative impact on local air quality during operation due to cumulative combustion emissions. This would be less than that likely to occur during construction.
Geology	Construction	Decrease in bedrock on site due to excavation	Past construction of other hydropower facilities has also likely resulted in losses of bedrock in the past – no ongoing effects	Past development activities in Bala have likely affected bedrock, though not in immediate project site – future development may continue to do so.	No effect	Cumulative loss of local area bedrock resources due to various projects where bedrock excavation is required	No additional mitigation proposed to prevent cumulative effect	Minor cumulative loss of local area bedrock resources due to various projects and activities
Soil Quality	Construction	Possible limited loss of soil due to erosion, minor impacts on soil health due to stockpiling, short term disturbance due to compaction	Construction of dams and hydropower facilities likely had an impact on soil resources in the vicinity of those structures.	Past site development has likely resulted in erosion of soil resources	No effect	Erosion during construction may cumulatively increase loss of local soils resources when considering losses due to previous construction projects – no ongoing erosion known to be occurring so no cumulative erosion in the same time period	No additional mitigation proposed to prevent cumulative effect	Minor cumulative loss of soil resources due to various projects and activities
Surface Water Hydrology	Construction	Short term changes to local hydraulics in vicinity of working platform and cofferdams	Existing water management practices for hydro power generation affect surface water hydrology – MRWMP has attempted to balance water management to enhance numerous competing activities	Local development has likely had a minor effect on surface water hydrology due to increases in impervious surfaces resulting in increased runoff rates	No effect	Local hydraulics in area impacted by project are affected by current water management practices and developments affecting surface water resources, therefore resulting in cumulative effect on local hydraulics	No additional mitigation proposed to prevent cumulative effect	Minor cumulative effects on local hydraulics due to various past and present activities acting cumulatively with proposed project
	Operation	Decreased flows over dams due to flow diversion Non consumptive water takings in the powerhouse				No cumulative effects anticipated due to run-of-river model of operation	None required	No cumulative effects anticipated
Surface Water Quality	Construction	Minor turbidity during construction, risk of spills during construction	Construction of dams and hydropower facilities likely had a short term effect on surface water	Local development likely affects surface water quality due to urban	Local recreational activities may result in minor turbidity due to	Unlikely to be any cumulative surface water quality impacts on the	No additional mitigation proposed to prevent cumulative effect	No cumulative effect anticipated

Table 7.1 Cumulative Effects Assessment - 2

Environmental Component	Project Phase	Net Project Effects following Effective Mitigation	Effects of Unrelated Activities on Environmental Components: Construction of Dams and Hydropower Facilities and Water Management Planning on Muskoka River	Effects of Unrelated Activities on Environmental Components: Development of the Village of Bala, Cottages/Residences on Lake Muskoka/Bala Reach, and Commercial Activities/Development	Effects of Unrelated Activities on Environmental Components: Local and Regional Recreation/Tourism Activities	Potential Interaction	Mitigation Measures	Residual Cumulative Effect
			quality due to erosion – no ongoing effects Existing water management practices may be resulting in some shoreline erosion due to water level fluctuations	runoff, leakage from septic systems	shoreline erosion from boat wake	same time and space during construction and operation		
Aquatic Biota	Construction	Short term localized effects due to in-water works, blasting	Construction and operation of dams and hydropower facilities and associated water management practices have had a significant effect on aquatic biota Mortality due to turbine passage at other hydropower facilities on the river	Local development has likely affected fish due to disturbance associated with in-water construction and adverse effects on shoreline habitat	Recreational fishing results in an effect on local fish communities in Lake Muskoka and Bala Reach	Disturbance due to project and other activities may have a minor cumulative effect on the local fish community	No additional mitigation proposed to prevent cumulative effect	Minor potential cumulative effects due to disturbance of local fish communities
	Operation	Mortality due to turbine passage				Turbine mortality not likely acting on same populations – cumulative loss of fish on a watershed basis	No additional mitigation proposed to prevent cumulative effect	Cumulative loss of fish on a watershed basis
Aquatic Habitat	Construction	Short term loss/alteration of habitat due to cofferdam and working platform Long term alteration of habitat due to intake/ tailrace and habitat enhancement and creation	Aquatic habitat loss and increased habitat availability (in flooded areas) and habitat alterations due to water management – current MRWMP has attempted to enhance water management practices to protect aquatic habitat while balancing other water needs	Local development has likely resulted in impacts on aquatic habitat due to shoreline alteration	Minor effects on aquatic habitat may occur due to shoreline erosion from boat wakes	Cumulative short-term disturbance to aquatic habitat – no change in productivity anticipated following habitat creation and enhancement	No additional mitigation proposed to prevent cumulative effect	No cumulative long-term effects on aquatic habitat anticipated
	Operation	Loss of spawning function at north channel, creation of new spawning habitat at south channel				No long-term change in aquatic habitat productivity – no cumulative effect anticipated	No additional mitigation proposed to prevent cumulative effect	No cumulative long-term effects on aquatic habitat anticipated
Terrestrial vegetation, wildlife and Habitat	Construction	Permanent loss of existing vegetation community and wildlife habitat in powerhouse and intake area Minor wildlife disturbance during construction	Construction and operation of dams and hydropower facilities and associated water management practices have had an effect on terrestrial wildlife and habitat, including wetlands Current hydropower and dam operations likely result in minor wildlife disturbance due to noise and human presence	Development in Bala and the surrounding area has affected wildlife and habitat due to vegetation clearing and human presence	Recreational activities likely result in some wildlife disturbance	Cumulative loss of terrestrial wildlife habitat and wildlife disturbance due to project during construction.	No additional mitigation proposed to prevent cumulative effect	Minor cumulative loss of local wildlife habitat and disturbance of local wildlife during construction
	Operation	Noise disturbance to local wildlife due to operation and human presence				Cumulative wildlife disturbance during project operation	No additional mitigation proposed to prevent cumulative effect	Minor cumulative disturbance of local wildlife during operation
Public Use and Access	Construction and Operation	Restricted public water access; enhanced land aesthetics for public use	Construction of dams and hydro power facilities has increased (flooding increases areas available for boating) and decreased (limited continuous routes for canoeing/kayaking) areas available for public use and access	As areas have been developed for various uses and lands were sold to private owners, the amount of land available for public use and access has decreased.	Public use areas and access points (i.e. boat ramps)	Loss of some areas from public use and access as illustrated in Figure 6.7. Aesthetic enhancement of land area for public viewing	No additional mitigation proposed.	Some loss of public water use and access for recreation; aesthetic enhancement of land area for public viewing of falls and Bala Reach.

Table 7.1 Cumulative Effects Assessment - 3

Environmental Component	Project Phase	Net Project Effects following Effective Mitigation	Effects of Unrelated Activities on Environmental Components			Potential Interaction	Mitigation Measures	Residual Cumulative Effect
			Construction of Dams and Hydropower Facilities and Water Management Planning on Muskoka River	Development of the Village of Bala, Cottages/Residences on Lake Muskoka/Bala Reach, and Commercial Activities/Development	Local and Regional Recreation/Tourism Activities			
Local Traffic – Highway 169 and Bala Falls Road	Construction	Potential traffic disruption/ delay during the 12 to 18-month construction period.	No effect	Increased traffic in the area as residential/commercial development increases in the area	Increased traffic in the area during tourist attractions such as the Bala Cranberry Festival.	Increased traffic resulting from development in the Bala area in combination with some traffic delay during the construction of the project may result in traffic delays.	No additional mitigation proposed.	The residual cumulative effect is a potential for slowing of the traffic flow during construction.
Sound Levels	Construction and Operation	Temporary noise emissions observed in the vicinity of the construction area during the 12 to 18-month construction period. Potential for increased ambient sound levels in the vicinity of the project during operation. These will remain below MOE's maximum requirements for stationary sources of sound within Class 2 Areas.	Temporary noise emissions would have occurred in the vicinity of existing hydropower facilities and dams during their construction. Increased noise levels likely occurred during the operation of plants which occupied the Bala Falls area in former years.	Development in the community of Bala, whether residential or commercial including cottages along Lake Muskoka/Bala Reach shorelines has resulted in increased ambient sound levels.	Increases in recreational/tourism visitors to the Bala area has resulted in seasonal increased ambient sound levels on the water and within the community.	Increased ambient sound levels from the project will represent an additional source of sound in the vicinity of the project.	No additional mitigation proposed.	Increased ambient sound levels within the vicinity of the project; however, these sound levels will meet MOE limitations for stationary sources of sound at nearby receptors.
Aesthetics	Construction and Operation	A change in aesthetics from baseline conditions during the 2010 tourist season, and into operation.	Construction in the vicinity of the Bala Falls, especially of the North and South dams resulted in a dramatic change in aesthetics from natural conditions.	Development of the Village of Bala, along with cottage and commercial development would result in an aesthetic change, especially along the waterfront areas.	Infrastructure created to accommodate recreation/tourism such as docks, boathouses etc. as well as recreational activities taking place in the area (i.e., rowing) has resulted in an aesthetic change to the area.	The construction and operation of the project represents an additional change to aesthetics in the project area.	No additional mitigation proposed.	Change in local aesthetics.
Tourism/ Recreation	Construction	A temporary disruption and traffic delay in the vicinity of Bala Falls and the potential for a decrease in visitation to the Bala Falls area during Bala's 2010 tourist season.	Water Management Planning on the Muskoka River/Bala Reach has resulted in the regulation of water levels in consideration of, among other area uses, tourism and recreation.	Development in the community of Bala has provided infrastructure for recreational visitors, as well as the development of tourist attractions	N/A	The development of tourist and recreational attractions has traditionally attracted visitors to the area. This may be adversely affected by the construction of the project, during the 2010 tourist season.	No additional mitigation proposed.	Potential for the following: • temporary disruption and traffic delay in the vicinity of Bala Falls • decrease in visitation to the Bala Falls area during Bala's 2010 tourist season.
Local Businesses	Construction	A potential for disruption to local businesses during this 12 to 18-month construction period.	No effect	Creation of various local businesses and services.	Recreational outfitters and suppliers as well as tourist attractions would become more viable and profitable as local and regional recreation and tourism activities were developed. In	A potential for disruption to local businesses during construction in areas where commercial, recreation and tourism development has occurred.	No additional mitigation proposed.	Temporary disruption to local businesses during construction in areas where commercial, recreation and tourism development has occurred.

Table 7.1 Cumulative Effects Assessment - 4

Environmental Component	Project Phase	Net Project Effects following Effective Mitigation	Effects of Unrelated Activities on Environmental Components			Potential Interaction	Mitigation Measures	Residual Cumulative Effect
			Construction of Dams and Hydropower Facilities and Water Management Planning on Muskoka River	Development of the Village of Bala, Cottages/Residences on Lake Muskoka/Bala Reach, and Commercial Activities/Development	Local and Regional Recreation/Tourism Activities			
					addition, local businesses providing support to these industries, such as hotels and restaurants would also experience growth.			
Archaeological and Heritage Assessment	Construction	Careful adherence to the above mitigation measures will avoid negative residual effects on cultural and heritage resources.	Construction prior to the requirement for an Archaeological and Heritage Assessment may have resulted in the loss of cultural resources.	Construction prior to the requirement for an Archaeological and Heritage Assessment may have resulted in the loss of cultural resources.	Construction prior to the requirement for an Archaeological and Heritage Assessment may have resulted in the loss of cultural resources.	No interaction is anticipated with the completion of Archaeological and Heritage Assessments for the area prior to construction, and the protection of heritage buildings during construction activities such as blasting.	No additional mitigation proposed.	Protection of local archaeological and heritage resources during construction.

Table 7.2 Significance of Residual Adverse Cumulative Effects

Parameter	Net Adverse Cumulative Effects	Value of Resource	Magnitude	Geographic Extent	Duration/ Frequency	Ecological Context	Likelihood of Effect	Reversible/ Irreversible
Air Quality	Cumulative effects due to vehicle emissions during construction	High	Low	Low	Low	Low	Moderate	Reversible
	Cumulative emissions during operations when back-up diesel generation used	High	Low	Low	Low	Low	Low	Reversible
Geology	Cumulative loss of bedrock resources	Low	Low	Moderate	Moderate	High	High	Irreversible
Soils	Cumulative erosion of soil resources in local area	Moderate	Low	Moderate	Low	Moderate	Moderate	Irreversible
Surface Water Hydrology	Cumulative effects on local hydraulics during construction	Low	Low	Low	Low	High	High	Reversible
Aquatic Biota	Cumulative disturbance of fish community during construction	High	Low	Low	Low	Low	High	Reversible
	Cumulative loss of fish due to turbine mortality throughout watershed	High	Low	Moderate	Moderate	Low	High	Irreversible
Terrestrial wildlife and habitat	Cumulative loss of wildlife habitat and vegetation	Moderate	Low	High	High	Low	High	Reversible
	Cumulative wildlife disturbance	Low	Low	High	High	Low	High	Reversible
Public Use and Access	Minor loss in public water use for recreation.	High	Moderate	Low	High	Low	High	Irreversible
Local Traffic – Muskoka Road 169 and Bala Falls Road	Temporary disruption of traffic flow during construction.	High	Moderate	Moderate	Low	Moderate	Moderate	Reversible
Sound Levels	Increased ambient sound levels within the vicinity of the project; however, these sound levels will meet MOE limitations for stationary sources of sound at nearby receptors.	High	Low	Low	Low	Low	Low	Irreversible

Parameter	Net Adverse Cumulative Effects	Value of Resource	Magnitude	Geographic Extent	Duration/ Frequency	Ecological Context	Likelihood of Effect	Reversible/ Irreversible
Aesthetics	Change in local aesthetics displeasing.	High	Moderate	Low	Moderate	Low	Moderate/ High	Irreversible
Tourism/ Recreation	• A temporary disruption and traffic delay in the vicinity of Bala Falls • Potential for a decrease in visitation to the Bala Falls area during Bala's 2010 tourist season.	High	Moderate	Moderate	Low	Low	Moderate	Reversible
Local Businesses	Temporary disruption to local businesses immediately adjacent to site during construction.	High	Moderate/ High	Low	Low	Moderate	Moderate/ High	Reversible

8 Effect of the Environment on the Project and Consideration of Accidents and Malfunctions

8. Effect of the Environment on the Project and Consideration of Accidents and Malfunctions

The CEAA requires an assessment of the potential effects that the environment may have on the project's construction and operation. Potential effects of this nature that could occur may be due to inclement weather conditions such as excessive precipitation and associated flooding in the river/lake, extremely cold winter weather, normal and extreme icing conditions and extremely hot summer weather. Other events that could potentially occur include earthquakes and forest fires. The potential for long-term impacts on the project due to climate change are assessed in Section 8.5.

8.1 Precipitation and Flooding

Unusually high flows (as a result of precipitation and/or snow melt) in the Muskoka River watershed during construction could potentially result in overtopping of the cofferdam and subsequent inundation of working areas, in addition to providing hazardous working conditions for the labour force working in the vicinity of the river. The temporary cofferdam and working platform around the tailrace will be designed and constructed to sufficiently handle a 1:20-yr flood event (i.e., not be overtopped). The contractor will be required to have an emergency response plan in place to deal with high water levels and flows which should floods approach the 1:20 yr one occur during construction (see Section 10.1) may require temporary evacuation of working areas.

Prior to operations, SREL will be required by MNR to have detailed Flood Emergency Procedures in place to deal with high water levels and flows during plant operations.

8.2 Extreme Winter Conditions

Construction is planned to proceed throughout the year, including the winter period. The project area can experience extremely cold conditions (see Section 2.1.1 for climate data). Extreme cold conditions could result in health and safety risks to the labour force (e.g., frost bite, hypothermia, etc) and inefficient or inoperable equipment. Extreme cold may also affect particular activities such as concrete pouring and proper setting. Contractors and workers to be employed for this project are expected to be predominantly from the regional area, accustomed to working under these conditions. They are expected to take the necessary actions to ensure proper concrete setting (appropriate winter clothing) to minimize winter weather effects.

Extreme winters could increase the potential for ice jams which are undesirable during operation and would make manipulations of stop logs impossible. However, the facility intake will be designed to enhance stable ice formation.

Ice storms, such as the significant storms that occurred in eastern Ontario and Quebec in 1998, could significantly affect on-site construction activities. Impacts could include loss of power to the site, unsafe working conditions and damaged/inoperable equipment, structural failure and ice damming, leading to flooding/inundation of the work area. However, ice storms of the severity of those experienced in 1998 are a very rare event, although storms of less severity may still have the potential to impact working conditions.

The contractor will be expected to have an emergency response plan in place to deal with worker safety relating to icing condition during construction. SREL will also develop emergency response procedures to deal with ice conditions during operation.

8.3 Extreme Summer Conditions

Extremely hot summer conditions may also pose health and safety risks to the labour force (e.g., sunburns, sun stroke, heat exhaustion during construction). Contractors will be expected to deal with this situation in developing their emergency response plan (e.g., recommending sun protection first and availability (see Section 10.1).

8.4 Earthquakes

The project area is located in the southern Ontario seismic zone, which has a low to moderate level of seismic activity (Earthquakes Canada, 2007a).

The 2005 National Building Code of Canada (NBCC) Seismic Hazard Calculation (Earthquakes Canada, 2007b) was used to determine the seismic hazard at the site. In this calculation, spectral and peak hazard values are determined for firm ground (NBCC 2005 Soil Class C – average shear wave velocity 360 to 750 m/s).

Seismic hazard is determined through consideration of spectral-acceleration (Sa) values at periods of 0.2, 0.5, 1.0 and 2.0 seconds. Sa is a measure of ground motion that takes into account the sustained shaking energy at a particular period. All parameters are expressed as a fraction of gravity. Ground motion probability values are given in terms of a 2% probability of exceedance over 50 years. This means that over a 50-yr period there is a 2% chance of an earthquake causing ground motion greater than the given expected value (Earthquakes Canada, 2007c).

Seismic hazard values for the study area are presented in Table 8.1. These values are to be considered with respect to the seismic hazard rating for the proposed structures (powerhouse and intake channels), as identified during pre-construction assessments.

Table 8.1 Seismic Hazard Values for Project Area

Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)	PGA (g)
0.185	0.112	0.056	0.018	0.084

Dam safety assessments will be completed using current seismic loading parameters based on current MNR standards and the incremental hazard classification for the dam. All new structures will be designed in accordance with the Ontario Building Code, CSA standards and/or MNR requirements as appropriate.

8.5 Climate Change and Other Weather Related Effects

Scientists estimate that global mean temperatures will warm an average of 2°C to 6°C by the year 2100. It is currently expected that warmer temperatures will result in an increase in droughts, floods, and the disruption of the environment via severe storms.

(See http://atlas.nrcan.gc.ca/site/english/maps/climatechange/1 for additional climate change related information.)

Given the location of the North Bala Hydro Project one might expect that the potential temperature increases will result in wetter winter conditions and potentially more extreme summer storm events.

These conditions could result in higher flows in the Muskoka River watershed, which would provide more water and financial benefits to the project. The engineering design for the project will be based on a 1-in-10,000-yr flood event (critical structures not overtopped), which is normal engineering practice for a facility of this type.

Other weather related environmental conditions that could affect the project include drought and lightning strikes. Sustained drought within the watershed would result in reduced river flow, and a decreased quantity of water available for power generation (more flow passed over the falls if the river flow is below the minimum station capacity). This could adversely affect the economic viability of the project. Lightning strikes to electrical equipment could damage or incapacitate the equipment. Depending on the severity of the event, it could affect the ability of the station to transmit power to the provincial grid until repairs are made.

8.6 Accidents and Malfunctions

CEAA requires consideration of the environmental effects of accidents and malfunctions during project operation.

Failure of the dam(s) is an extremely unlikely event, but could release a significant amount of water into the downstream reaches over a short period of time. This could result in a significant short-term flow and a water level increase downstream from the facilities. Failure of the dam would not be expected to impact facilities downstream of this location. A dam failure of this sort would preclude full operation of the facility(s) until the weir(s) could be replaced to reinstate the head pond and fully submerge the intake(s). High flow events after a failure of this type would not pose any additional risk to the facility, as it would be passed through the main river channel.

As noted in Section 8.1 a detailed Flood Emergency Response Plan is required by MNR to be prepared by SREL. This plan would also address failure of the dam as, in all likelihood, other mitigation measures would already be activated (i.e., notifications to OPG and emergency personnel due to high water levels or flows) prior to dam failure.

Failure of the transmission system would require that the station be shut down until repairs were undertaken. This would affect project revenues until repairs were completed.

As noted in the previous section, a detailed Emergency Preparedness Response Plan will be prepared for each facility, which outlines the actions required to respond to these potential events.

9 Water Management Plan Amendments

9. Water Management Plan Amendments

Operation of the Bala Generating Station will require an amendment to the existing MRWMP. MNR has recently recommended a coordinated approach between the environmental screening process and water management planning to avoid duplication of effort (MNR, 2007), whereby some of the requirements of the WMP amendment requirements can be addressed in the Environmental Screening Report with an Amendment Request/Information Summary being submitted to MNR following completion of the Environmental Screening/Review Report. This coordination of processes is optional, with the decision resting with the proponent. SREL has decided to coordinate the two processes. This section has been prepared in accordance with MNR's WMP Guidelines for Water Power (2002c).

The MNR, with recommendation from the MRWMP Standing Advisory Committee (SAC), will determine if the amendment is an administrative, minor or major one, following the MNR's final approval of the proposed operating plan. With incorporation of water management planning into the EA process, it is now possible to include the details of the amendment to the latter WMP in this document.

As per Section 17.2 of the MRWMP, the amendment request must contain the following information:

- a brief description of the proposed amendment
- the rationale for the proposed amendment and a discussion of its significance
- if new operations are proposed
    - a brief description of the proposed operation and a description of the previously approved operations in the WMP that will be changed by the proposed amendment (if any)
    - an outline of the applicable planning requirements for the proposed operations including public consultation, based on the planning requirements for similar operations in the WMP.

The public, agency and First Nation consultation requirements of the WMP process have been incorporated into the consultation undertaken as part of the EA process. The existing WMP SAC has been informed of the project and will review the information contained within this document and the subsequent stand-alone amendment document. The SAC will then make a recommendation regarding the proposed amendment to the WMP Steering Committee (SC).

9.1 Introduction and Zone of Influence

MNR states in their Water Management Planning Guidelines (MNR, 2002), that the goal of water management planning is to contribute to the environmental, social and economic well-being of the people of Ontario through the sustainable development of waterpower resources and to manage these resources in an ecologically sustainable way for the benefit of present and future generations.

MNR has outlined the following key principles to guide the water management planning process:

- strive to maximize the net environmental, social and economic benefits to society
- strive for riverine ecosystem sustainability through the management of water levels and flows
- use best available information in water management planning

- conduct a thorough assessment of water management options
- use adaptive management to reduce areas of uncertainty, build on successes and make adjustments to limit adverse impacts
- act on study findings in a timely manner where an environmental, social or economic benefit may be realized without adversely affecting the waterpower industry's operating revenues
- undertake water management planning without prejudice to the rights of Aboriginal people and treaty rights
- public participation is required to ensure accountability and transparency in the planning process.

The zone of influence for the North Bala Dam project is defined as the Bala Bay area at the western end of Lake Muskoka and downstream through the Bala Reach in the Lower Muskoka watershed. The broader study area for the environmental screening included Lake Muskoka as well as the Moon and Musquash rivers downstream of the Bala dams, including the MNR Go Home Lake Dam and all downstream generating stations to Georgian Bay (Figure 1.1).

The key objective of this specific facility WMP is to manage water levels and flows associated with the proposed North Bala Hydro Project in such a manner as to maintain existing water levels and flows in Lake Muskoka and downstream in accordance with the approved MRWMP (Acres, 2006).

9.2 Physical and Biological Description of Riverine Ecosystem

See Section 2.1 of the Environmental Screening Report.

9.3 Socioeconomic Description Related to Riverine Ecosystem and Water Management

See Section 2.2 of the Environmental Screening Report.

9.4 Waterpower Facilities, Water Control Structures, and Current Water Management Strategies

The relevant existing regulated lake (Lake Muskoka), waterpower facilities and water control structures potentially affected by this project are described below, including current water management strategies as outlined in the approved MRWMP.

Lake Muskoka

Lake Muskoka is the largest lake within the Muskoka River watershed, with a surface area of 120 km^2 and average depth of 15.5 m. Its maximum depth is 67 m. Its shores have numerous seasonal and permanent residences as well as businesses mainly associated with tourism or recreation. There are over 1800 boathouses and 3700 docks along the 285.3-km long shoreline of Lake Muskoka (Acres, 2006). The water levels in Lake Muskoka are regulated under the MRWMP and controlled by the operations of the North and South Bala dams, both presently owned and operated by the MNR. The normal range of annual water level fluctuation is 1.15 m, between elevations 224.6 and 225.75 m above sea level. The proposed facility will operate in accordance with the existing WMP in relation to Lake Muskoka levels and flows into the downstream Bala reach of the Moon River.

Lake Muskoka water levels are presently managed by the operations of the North and South Bala dams as prescribed in the approved MRWMP:

Target Operating Level Range:	224.9 to 225.6 m
Normal Operating Zone Range:	224.6 to 225.75 m
Absolute Range:	224.55 to 225.97 m
Summer* Range (Typical):	225.28 to 225.65 m
Winter Drawdown:	225.52 to 224.9 m
Flood Allowance (lake/river):	225.75 to 225.97 m/368.1 m^3/s (spring)/283.0 m^3/s (summer)
Maximum Daily Flow:	309.6 m^3/s
Minimum Daily Flow:	6 m^3/s summer target (inclusive of 4 m^3/s from Burgess Generating Station)
Natural Environment Constraints:	• Above winter limit drawdown to protect lake trout spawning shoals • Spring flows for walleye spawning at Moon Falls (see next page)
Social Constraints:	• Above water level limits to protect extensive high value shoreline development with infrastructure ranging from 225.64 to 226.44 m • Protect against spring ice damage to infrastructure. • Protect navigation access at Port Carling locks. • Protect flooding of Marinas on Indian River
Other:	Winter drawdown undertaken for downstream hydropower production

*Summer period defined as June 1 to September 15.

The existing MNR-approved Lake Muskoka operating strategy is shown graphically in Figure 9.1.

North Bala Dam

The North Bala Dam is located on the brink of Bala Falls. The falls is a popular recreational site, particularly during summer when low flows allow people to walk or sit along the rocks of the falls. The area immediately abutting the falls to the north is fitted with benches for recreational sightseeing and picnicking. Interpretive plaques are placed on the northern shore of the falls. North Bala Dam and the neighbouring South Bala Dam control flows from Lake Muskoka downstream into the Bala Reach and Moon Chute of the Moon River (Figure 1.1).

The area adjacent to the North Bala Dam previously housed a small hydroelectric generating station (2.3 kV) built in 1924 by Bala Electric Company. It was purchased by the Hydro Electric Power Commission of Ontario in 1929 and supplied power to the Town of Bala until 1957. It was demolished in 1972. The intake, powerhouse and tailrace areas were in-filled, which is evident by the in-fill material that differs from the surrounding natural rock in the area.

South Bala Dam

The South Bala Dam is an eight stop-log bay concrete dam located approximately 150 m south of the North Bala Dam and is the same height (4 m) as the North Dam. It is approximately 24 m in length. Together, the Bala Dams control the upstream Lake Muskoka water levels, the Muskoka River up to Bracebridge Falls and the Indian River to the Port Carling Dam.

Burgess Dam and Burgess Generating Station

The Burgess Dam which is integrated with a small hydroelectric generating station (Burgess Generating Station) is located at the most northerly outlet from Lake Muskoka, a narrow channel approximately 300 m north of the North Bala Dam (Figure 1.1). This generating station is owned by Algonquin Power. The allocated maximum flow to the Burgess Generating Station is 4 m^3/s and there is no spilling capacity. As a result, all flood flows passing from Lake Muskoka are routed through the North and South Bala Dams. Downstream of Bala, the river forks into the Moon and Musquash Rivers after approximately 5 km (Acres, 2006).

Bala Reach, Ragged Rapids and Moon Dam - OPG

The Bala Reach operating strategy, which is implemented through operation of the Moon Dam and Ragged Rapids Generating Station, is as follows, based on the approved MRWMP:

Normal Operating Zone:	219.0 to 219.3 m summer 219.2 to 219.5 m spring, fall and winter
Summer* Range (Typical):	219.0 to 219.3 m
Winter Drawdown:	None
Flood Allowance:	None. However, the facility has limited discharge capacity and cannot control river levels beyond the specified High Flow trigger. Levels may exceed the upper extent of the Normal Operating Zone (NOZ) at this time.
Maximum Daily Flow:	88.9 m^3/s
High Flow Trigger:	85 m^3/s (at Bala dams) (when high water level may be exceeded)
Minimum Daily Flow:	None

Low Flow Trigger:	3 m^3/s (when low water limit may be exceeded)
Natural Environment Constraints:	Flows for walleye spawning at Moon Falls (April 15 to June 1) of 14 m^3/s target when flows >20 m^3/s; when flows are <20 m^3/s, target flows are 8 to 10 m^3/s in the Moon River and 4 to 6 m^3/s in the Musquash River. Summer flow in the Moon River of approximately 1 m^3/s via leakage through Moon Dam.
Social Constraints:	High water levels in Bala Reach may affect septic beds and inundate docks and cottage crawl spaces. Low water levels in Bala Reach may restrict access to docks and properties.
Other:	Moon Chutes, located at the downstream end of Bala Reach, restricts outflow from Bala Reach at flows in excess of 85 m^3/s resulting in progressively higher levels as flows continue to increase. Flows and levels in Bala Reach are managed jointly by MNR and OPG. Optimum flow withdrawal for waterpower generation at Musquash stations (Ragged Rapids and Big Eddy) is 85 m^3/s.

*Summer period defined as June 1 to September 15.

The Bala Reach operating strategy is shown graphically in Figure 9.2.

Moon Dam

This is a water control structure located on the Moon River approximately 6 km downstream of the North Bala Dam. The Moon River eventually empties into Georgian Bay. The Moon Dam is owned and operated by OPG in coordination with operations at Ragged Rapids Generating Station.

Ragged Rapids Dam and Generating Station

The Ragged Rapids Dam is associated with the OPG-owned Ragged Rapids hydroelectric generating station and is located on the Muskoka (Musquash) River approximately 6 km downstream of the North Bala Dam (Figure 1.1).

Big Eddy Dam and Generating Station

The Big Eddy Dam is associated with the OPG-owned Big Eddy hydroelectric generating station and is located on the Muskoka (Musquash) River approximately 13 km downstream of the North Bala Dam (7 km downstream of Ragged Rapids) (Figure 1.1).

Go Home Lake Control Dam

Go Home Lake receives the flow from the upstream section of the Musquash River and empties into the downstream section which flows into Georgian Bay (Figure 1.1). The Go Home Lake Control

Dam is owned and operated by MNR to control outflows from Go Home Lake into the lower Musquash River.

Go Home Lake Filter Dam
The Go Home Lake Filter Dam is located on the west side of Go Home Lake at the Go Home Chute (Figure 1.1). Its function is to maintain lake levels and is not operated, but is intentionally designed to pass leakage.

9.5 Issues, Resource Values and Interests

See Section 4 of the Environmental Screening Report.

9.6 Baseline Data Collection Program

See Sections 4.2 and 4.3 of the Environmental Screening Report.

9.7 Option Development and Preferred Option

Several alternative layouts for the proposed North Bala Small Hydro Project were considered as outlined in Section 1.5 and Appendix A2 of the Environmental Screening Report. The reasons for rejection of five of these alternatives are also provided in Section 1.5. The preferred scheme is shown on the drawing for Alternative 2D (Appendix A2).

The options considered for managing water levels and flows for the proposed North Bala Generating Station were as follows:

- A daily peaking regime with the facility generating at maximum capacity and passing maximum capacity flows of between 96 m^3/s (rated capacity) to 100 m^3/s (maximum capacity) during peak times. Any inflows to Lake Muskoka which were not required for maintaining or restoring lake water levels to the target level would be passed during the off-peak period.

- A two-tiered plan for operation of the North Bala Generating Station using the existing Bala Reach trigger flow of 85 m^3/s as a cap for peak period flow releases from all Lake Muskoka water control facilities, i.e., North Bala and Burgess Generating Stations, South Bala Dam and North Bala Dam when inflows to Lake Muskoka are less than 85 m^3/s.

- A run-of-river regime with the facility generating power according to the inflows and corresponding water levels in Lake Muskoka. The facility would pass up to 100 m^3/s through the turbines during flood conditions, but would generate at lower capacity or in some cases not at all during lower flow periods.

OPG and MNR both expressed concern about the proposed unrestricted peaking and two-tiered operation regimes and the resulting downstream water level and flow fluctuations in Bala Reach, the head pond of Big Eddy Generating Station, and Go Home Lake. More specifically, MNR was concerned that any daily peaking operation would result in larger water level fluctuations in Go Home Lake and Bala Reach than the residents at these two locations had come to know and expect, as well as increase operational demands at Go Home Lake Dam (MNR). OPG was concerned that the release of peak flows above the natural inflow rate and above the Bala Reach high flow trigger of 85 m^3/s would cause them to incur higher spill loss or reduced generation at the Ragged Rapids plant downstream.

In consideration of these concerns, the run-of-river operation described above was chosen as the preferred option.

9.8 Environmental Effects of Preferred Option

Prior to confirming the preferred water management strategy for the proposed North Bala Generating Station as described in Section 9.9, the environmental effects of construction and operation were assessed and the results are provided in Sections 5 and 6 of the environmental screening report.

9.9 Operating Plan for the North Bala Generating Station

The proposed North Bala Small Hydro Project facility will operate within the existing approved Lake Muskoka operating plan as is presently outlined in the MRWMP. This means that the plant will be operated to maintain its headwater (Lake Muskoka) at the TOLs in the MRWMP, with the NOZ being adopted as the plant compliance levels. An operational band around the TOL is proposed, which for the purposes of the plan will be referred to as the Best Management Zone (BMZ) band. The BMZ zone will be entirely within the NOZ which presently exists in the MRWMP. Figure 9.3 depicts the operating plan with proposed BMZ band. Between January 1 and May 1, there will be no BMZ around the TOL. Lake Muskoka will be drawn down to a level of 224.90 on or before March 25 in order to provide adequate storage for the spring freshet. MNR may instruct SREL to achieve the drawdown level by a date earlier than March 25 and/or lower the lake further in order to prepare for the freshet and associated flood mitigation. This decision by MNR will depend on snow pack conditions, water content and other flood forecasting indicators and objectives.

From May 1 to May 31, a BMZ of up to 5 cm below the TOL will be applied for flood risk reduction. From June 1 to July 31, a ± 2 cm BMZ around the TOL (i.e., up to 2 cm above or 2 cm below the TOL) will be applied. From August 1 to September 15, the BMZ will be from 4 cm above the TOL to 2 cm below the TOL. From September 16 to October 15, the BMZ will extend to 5 cm above the TOL. The descending slope of this band will merge with the TOL on or around October 20. MNR may instruct SREL to alter the timing and duration of the fall drawdown based on the progress of the lake trout spawning period. From on or about October 20 to December 31, a BMZ band up to 6 cm below the TOL will apply.

The WMP for Lake Muskoka and Bala Reach requires a minimum daily average flow of 6 m^3/s to be passed through the three Lake Muskoka control facilities (Burgess Generating Station, North Bala Dam, and South Bala Dam). Generally 4 m^3/s is allocated to the Burgess Generating Station for power generation and, a minimum daily average flow of 2 m^3/s is assumed to pass through the North Bala and South Bala dams, split equally between the two structures. For the purposes of improving fish habitat, maintenance of water quality, and channel aesthetics in the South Channel during the low flow periods of summer, the flow passage through the South Dam may be increased to 2 m^3/s. Flow through the Bala dams is assumed to occur either via leakage or through log manipulation.

Flows in excess of the minimum turbine flow of 14 m^3/s will pass through the plant up to a maximum unit flow of 100 m^3/s. Due to the considerable storage provided by Lake Muskoka, it is anticipated that there will be some amount of generation every day.

Normally for periods not including the walleye spawning period, inflows to Lake Muskoka in excess of 106 m^3/s (plant rated flow plus mandated Burgess Generating Station and dam aesthetic flows) will be passed using the South Dam, with the North Dam being operated only if the South Dam's spilling capacity is exceeded. Lake Muskoka levels will thereby be maintained within the NOZ. When inflows are below 106 m^3/s, correspondingly lower flows will be passed through the plant. During the spawning period (typically late April to early May), adequate flows will be passed over the North Bala Dam to allow continued use of existing spawning areas downstream of the North Bala Falls rapids. The flow and the exact timing of its release will be determined through dialogue with the DFO and MNR.

As is the case presently, flows to Burgess Generating Station will be limited under instructions from MNR when there is insufficient water to allow for its operation (typically when both dams are closed and water levels are falling below the NOZ. As flows from Lake Muskoka increase, it is proposed that the flows be sequentially allocated to Burgess Generating Station (up to 4 m^3/s), then to the North Bala Hydro facility, up to its maximum capacity of 100 m^3/s. This assumes the remaining 3 m^3/s will be passing via leakage or through log manipulations at the North (1 m^3/s) and South (2 m^3/s) Bala Dams. With additional flows above the 106 m^3/s, the further sequential allocation will be to the South Dam, then the North Dam. Under declining flows, the priorities would be reversed.

The existing Lake Muskoka operating strategy in the approved MRWMP will be adopted by the proposed facility. It is currently implemented through operation of the Bala North and South Dams. The new hydroelectric facility will be included in the implementation of the operating strategy.

The seasonal changes in the TOLs for Lake Muskoka as required by the approved MRWMP are summarized in Table 9.1. The plant will adopt the existing TOL as its operating TOL, with a BMZ band, complying with the water level direction changes as described in the MRWMP.

Table 9.1 North Bala Generating Station – Lake Muskoka – Seasonal TOLs

Component	Operating Characteristics	MRWMP Values	Seasonal Period	North Bala GS Operating Plan
Spring Water Level (freshet to May 30)	Upper NOZ (m) Lower NOZ (m) TOL (m) Peak Date TOL Change WL* Direction	225.75 224.6 – 225.28 225.6 – 225.48 May 1 0.12 Down	Jan 1 to Apr 31	No BMZ during this time period (TOL to be adhered to)
			May 1 to May 31	BMZ band = TOL -5 cm BMZ band width = 5 cm
Summer Water Level (June 1 to Sept 15)	Upper NOZ (m) Lower NOZ (m) TOL (m) TOL Change WL Direction	225.75 – 225.52 225.28 225.48 – 225.35 0.13 Down	Jun 1 to Jul 31	BMZ band = TOL ±2 cm BMZ band width = 4 cm
			Aug 1 to Sep 15	BMZ band = TOL+4 cm /-2 cm BMZ band width = 6 cm
Fall Water Level (Sept 16 to Nov 30)	Upper NOZ (m) Lower NOZ (m) TOL (m) TOL Change (m) WL Direction	225.52 – 225.61 225.28 – 225.12 225.35 – 225.25 0.1 Down, then natural rise to 225.52 by Dec 1	Sept 16 – Oct 15	BMZ band = +5 cm BMZ band width = 5 cm
			Oct 20 to Dec 31	BMZ band = -6 cm BMZ band width = 6 cm
Winter Water Level (Dec 1 to March 15)	Upper NOZ (m) Lower NOZ (m) TOL (m) TOL Change (m) WL Direction	225.61 – 225.1 225.12 – 224.6 225.52 – 224.9 0.62 Down	Jan 1 to Mar 15	No BMZ during this time period (TOL to be adhered to)
*Water Level				

Bala Reach

Bala Reach water levels are presently managed by flow releases at the North and South Bala Dams in coordination with discharges at OPG-owned Ragged Rapids Generating Station and Moon Dam. OPG's operations at these dams are normally directed by the compliance limits for water levels within Bala Reach. The operating plan for these OPG facilities is presented in Section 9.4. The North Bala Hydro facility will be required to pass flows which do not inhibit OPG's ability to remain in compliance at Bala Reach, while at the same time having no negative impact on OPG's generation. This can be achieved only through coordination with OPG. It is therefore proposed that as part of operations there be an agreed method of effective communication between the operators of the North Bala Generating Station and OPG Ragged Rapids Generating Station.

The Bala Reach operating strategy presented in Section 9.4 will be adopted by the proposed facility, which will operate in a run-of-river mode.

9.10 Compliance Considerations

The NOZ for Lake Muskoka, as identified in the existing MRWMP will become the legal operating range (compliance zone) for the proposed North Bala Generating Station. SREL will be out of compliance if they operate outside the NOZ, with the exception during extreme high and low water events as described in Section 13.3 of the MRWMP, and summarized below.

A *Low Water Indicator* would occur when the North Bala Generating Station and the North and South Bala Dams have been operated to provide the minimum flow of 6 m^3/s (i.e., both the dams and powerhouse have been shut down) and the water level of Lake Muskoka falls below the NOZ. If this situation occurs, SREL would not be out of compliance with the MRWMP. MNR reserves the right to instruct SREL to reduce Bala flows to the minimum when Lake Muskoka levels fall toward the lower portion of the NOZ. This would involve first shutting down the North Bala Generating Station, followed by shutting down Burgess Generating Station and placing all stop logs in the North and South Bala Dams.

The *High Water Indicator* takes into consideration the recognized downstream flood constraints with the Bala Reach, allowing SREL to maintain the level of Lake Muskoka above the NOZ under certain high flow circumstances. For example, as Lake Muskoka levels or rate of rise begin to significantly increase above the BMZ and toward the upper portion of the NOZ, efforts will be made to prevent flows into the Bala Reach from surpassing 200 m^3/s, (which corresponds to bank full flows and the point where high water concerns commence), while addressing Lake Muskoka level objectives. If Lake Muskoka levels are expected to rise above the NOZ due to high inflow conditions, the discharge into the Bala Reach can be increased to 280 m^3/s.

Under watershed-wide flood conditions, flow discharge into the Bala Reach may surpass 280 m^3/s in order to equitably balance the negative effects of flooding in Lake Muskoka and the Bala Reach/Moon River.

As per the Compliance Monitoring and Reporting Section of the MRWMP, SREL will be required to submit an Event Report whenever Lake Muskoka water levels rise above, or fall below the NOZ. Under the High Water Indicator and Low Water Indicator situations described above, SREL would not be out of compliance with the MRWMP.

9.11 Effectiveness Monitoring Program

A post-construction environmental monitoring program is outlined in Section 10 of the environmental screening report to assess the impacts of the project and the effectiveness of mitigation proposed. In addition, consultations will be ongoing with OPG to ensure that their downstream generating station operations are not adversely affected by the new North Bala generating facility. Consultation will also be ongoing with MNR to ensure that their downstream Go Home Lake Dam operations are not adversely affected by the Bala Generating Station or OPG facilities.

9.12 Compliance Monitoring and Reporting Program

It is understood that the North Bala Generating Station will be subject to the same general compliance and reporting requirements as described for other water power operators in the approved MRWMP (Acres, 2006) including the following:

- one instantaneous discharge (flow) reading per hour, on top of the hour
- one instantaneous Lake Muskoka water level reading per hour, on top of the hour.

For total instantaneous discharge readings, this would be a combination of gauged/measured flows from the North Bala Generating Station and calculated discharge from the North and South Bala Dams.

For the purposes of compliance monitoring, Lake Muskoka water level will be monitored from the main body of the lake (not within Bala Bay immediately upstream of Bala). SREL will be required to record Lake Muskoka water level data on a daily basis, determined to be the average of the 24 hourly values. Hourly flow data will be recorded separately for the North Bala Generating Station, Bala North Dam and Bala South Dam, in addition to the total Bala discharge. This information will be reported annually by January 31 as required for other small water power operators in the MRWMP.

An out of operating range situation will require the submission of an Event Report as described in the MRWMP (Section 13).

9.13 Provisions for Plan Reviews, Amendments and Plan Renewals

Since this WMP will form an amendment to the approved MRWMP, it will be subject to the same plan term (i.e., expiry March 31, 2016). It will also be subject to the conditions for plan amendments, reviews and renewals as specified in the MRWMP.

9.14 Public and First Nation Consultation

Public and First Nation consultation for the proposed North Bala Small Hydro Project and WMP is included in Section 3 of the environmental screening report.

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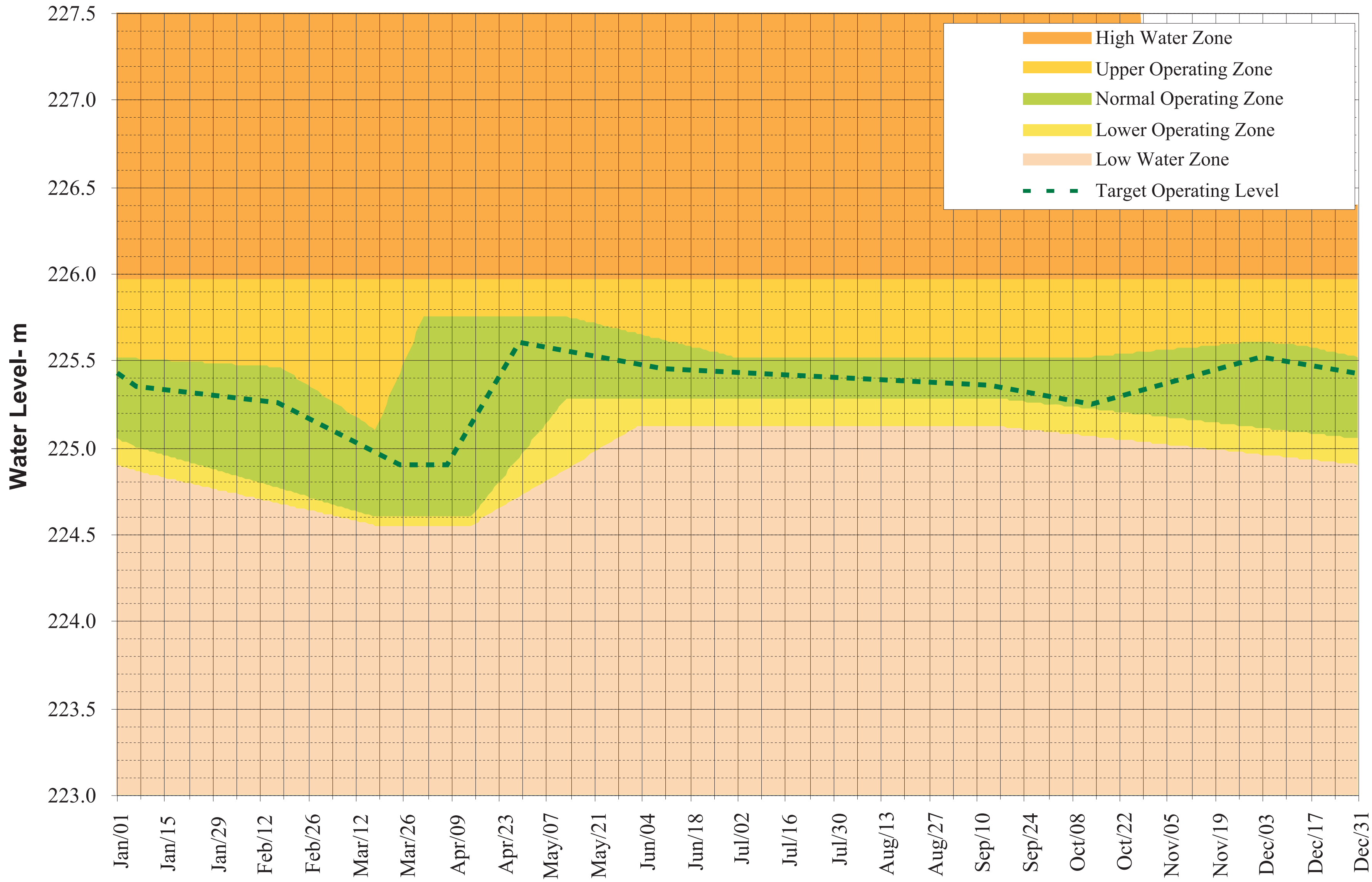

Figure 9.1
Swift River Energy Ltd.
North Bala Small Hydro Project
Existing Lake Muskoka Operating Plan

HATCH energy

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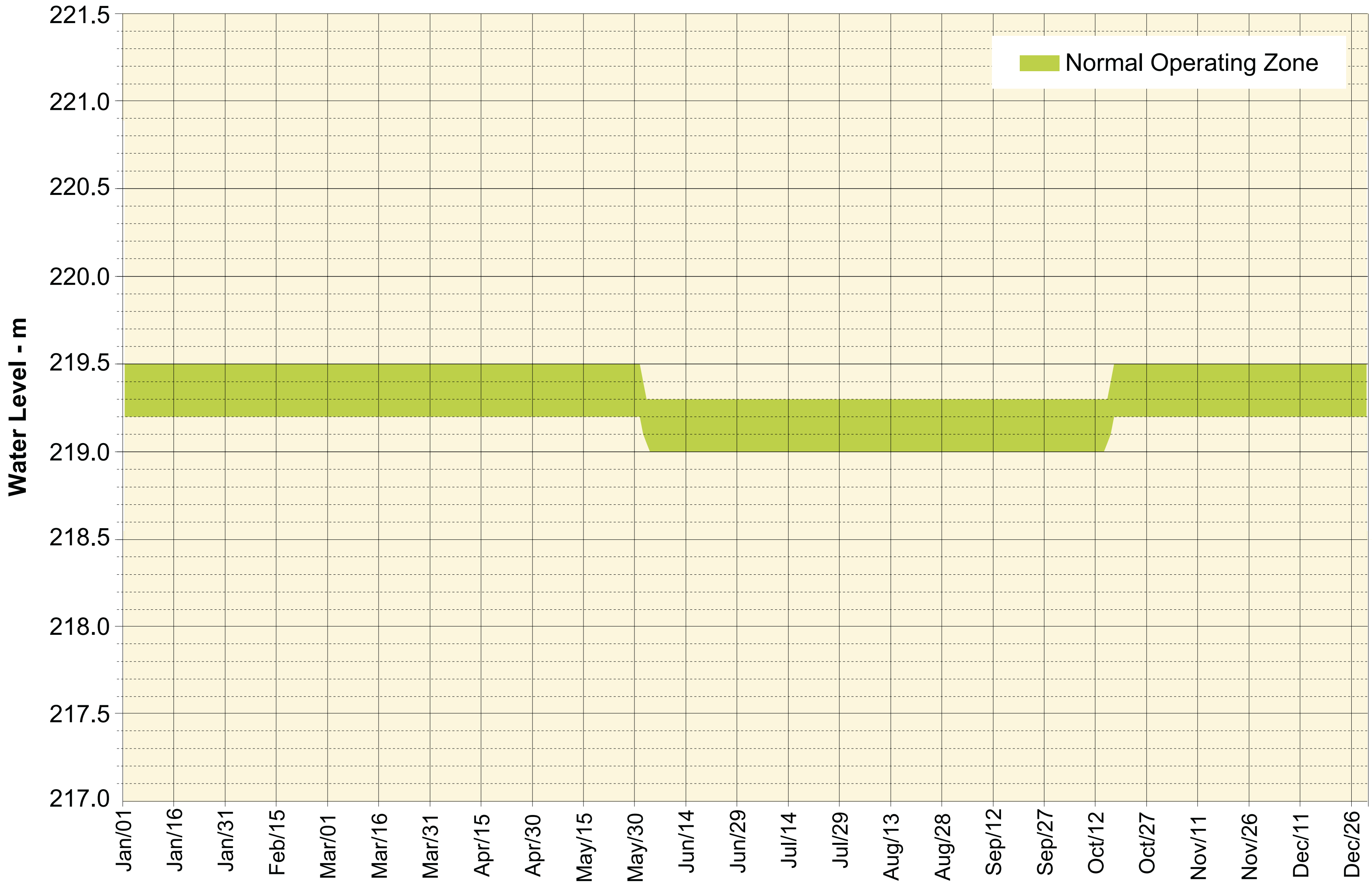

Figure 9.2
Swift River Energy Ltd.
North Bala Small Hydro Project
Existing and Proposed Bala Reach, Ragged Rapids and Moon Dam Operating Plan

HATCH energy

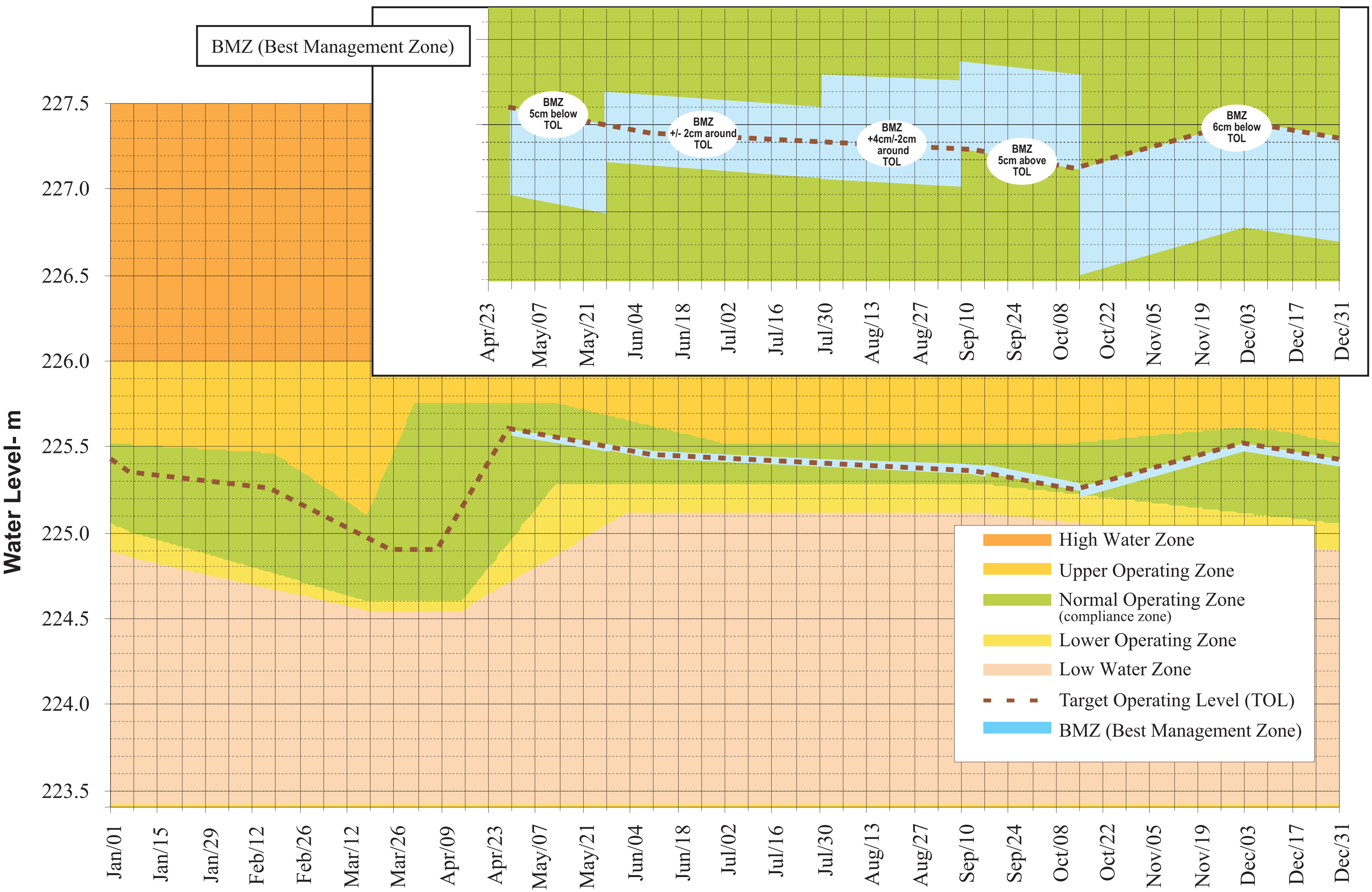

Figure 9.3
Swift River Energy Ltd.
North Bala Small Hydro Project
Proposed Operating Plan for Lake Muskoka

10 Environmental Monitoring Programs

10. Environmental Monitoring Programs

The following subsections present pre-construction, construction and post-construction monitoring programs.

10.1 Pre-construction Planning and Monitoring

Preconstruction monitoring provides data on the environmental baseline conditions which exist in the project area prior to the commencement of any construction activity. The information from preconstruction monitoring will be used as a reference for comparison with data collected during post-construction to assess effects of the project. Additional activities in this phase involve ensuring that the requisite approvals and permits are procured by the appropriate parties and proper procedures such as emergency response plans are documented and in place.

Table 10.1 lists the activities which are included in the pre-construction monitoring phase.

10.2 Construction Monitoring

The purpose of the construction monitoring program outlined in Table 10.2 is to

- ensure that construction activities are being undertaken as per the contract plans and specifications and that mitigation measures are being applied as per the EA commitments and as defined in applicable permits and approvals
- verify that construction activities and/or mitigation measures are not creating unintended, adverse environmental effects (e.g., if proposed sediment control measures are not providing the desired level of environmental protection, work would be stopped or alternate procedures applied
- identify the need for corrective or alternate mitigation measures
- provide a record of construction monitoring results. Typically, the site inspector would provide weekly reports detailing progress, issues and actions taken to resolve those issues.

At the end of the construction period, site restoration and clean-up activities will be part of the Contractor's responsibilities at site. It is anticipated that final inspection of construction works and restoration activities will result in the preparation of a list of deficiencies, to be addressed by the Contractor, prior to final payment. Monitoring and documentation of that process is typically undertaken by the site inspector in conjunction with the project engineer or Owner. SREL will be responsible for the review and acceptance of the constructed works, including site restoration measures, prior to project turnover.

Table 10.1 Pre-Construction Monitoring Program

Item	Description	Responsibility	
		Owner	Contractor
Environmental Baseline Monitoring	- Ensure all baseline field investigations are complete (completed as per Sections 2 and 4 of screening document)	X	
Environmental Permits and Approvals	- Ensure all necessary permits and approvals are in place prior to commencement of relevant construction activities - See list of required permits and approvals in Section 11	X	X
Tender Specifications	- Incorporate all environmental protection and mitigation obligations as per the EA document	X	
Contractor Obligations	- Ensure contractor is aware of all environment and safety commitments prior to construction	X	
Finalize Land Ownership and Tenant Agreements	- Ensure agreements in place with all owners and/or tenants prior to construction as necessary	X	
Ministry of Labour Notice of Project	- Submit "Notice of Project" to the Ministry of Labour		X
Historic/ Archaeological Sites	- Ensure Stage 1 and 2 heritage assessments have been completed	X	
Blasting	- Obtain NRCan Temporary Magazine Licence prior to blasting - Obtain approval from DFO for blasting (if required) - Conduct pre-blasting survey of Purk's Place and historic church buildings	 X	X X
Photographic record	- Prepare photographic record of existing environment prior to construction	X	
Sediment and Erosion Control Plan Drawing	- To be prepared and implemented prior to the commencement of site works that may cause sediment and erosion		X
Spill Response and Clean-up Plan	- To be prepared prior to the commencement of site works and equipment/materials readily available on site; workers to be trained in spill response and clean-up.		X
Emergency Response Plan and Training	- Plan to be prepared prior to the commencement of site works covering responses to accidents, injuries, spills and extreme weather events (floods, cold, ice, etc) and readily available on site. ERP training to be conducted for all construction workers.		X
Site Preparation	- Flag work area boundaries prior to commencement of site works		X
Acid Rock Drainage	- Conduct acid base accounting on rock samples prior to commencement of site works to determine management of excavated materials.		X
Municipal Services	- Conduct locates for water and sewer lines prior to construction		X

Table 10.2 Construction Monitoring Program

Issue	Description of Monitoring Activity
General Environmental Protection Monitoring	
EA commitments	- Ensure EA mitigation commitments are met by the Contractor as applicable.
Photographic record	- Prepare photographic record of construction activities.
Spills and Emergencies	- Monitor and verify compliance with Spill Response and Cleanup and Emergency Response Plans (i.e., Contractor has adequate cleanup materials on site, staff are trained in use and application of materials and procedures, etc). - Verify reporting and clean up of spills (per Emergency and Spill Response Plans).
Sewage and solid waste disposal	- Verify that appropriate sewage and waste disposal practices are applied throughout the construction period.
Fuel oil storage/solvents	- Verify on-site storage is per mitigation recommendations (i.e., bermed storage areas away from watercourses and drainage paths, etc). Monitor on-site storage areas throughout the construction period. - Monitor equipment throughout the construction period to ensure that it is well maintained (i.e., not leaking or prone to leaking). - Inspect work area following construction for the visual presence of potentially contaminated soil (e.g., fuel marks on ground).
Sediment/runoff control, erosion and sedimentation	- Monitor to verify compliance with Sediment and Erosion Control Plan and Drawing, and effectiveness of mitigation measures; undertake remedial actions as required to address deficiencies. - Monitor bank and slope stability at potentially affected areas throughout the construction period and recommend improvements where necessary. - Monitor soil compaction conditions around the work site and assess requirements for remediation following construction
Site restoration	- Monitor/verify site cleanup and restoration activities (i.e., seeding/ landscaping activities, etc). - Monitor/verify site recovery/post-construction restoration progress (as per expectations noted in contract specification).
Natural Environment Component Monitoring	
Air quality	- Regular inspection of vehicle and machinery exhaust equipment to ensure efficient operation. - Visual monitoring of dust generated in the project area during construction to establish the need for mitigation requirements, and assess the effectiveness of applied mitigation.
Water quality	- Verify adequacy of Contractor's in-water and on-land sediment and erosion controls (use applicable guidelines such as MNR's Instream Sediment Control Techniques Field Implementation Manual). - Visually monitor instream turbidity levels during construction. Stop work or apply alternative mitigation if high turbidity levels observed. - Samples of rock excavated from sites will be submitted for a modified acid base accounting (ABA) test at the start of construction.
Aquatic habitat and biota	- Verify that in-stream work occurs within approved timing windows, unless otherwise approved by MNR/DFO. - Verify approval for blasting in or near water (as required) and verify that blasting is undertaken in accordance with conditions of approval. - Verify that fish are removed from dewatered areas in accordance with the commitments in this EA. Ensure appropriate license from MNR is obtained.

Issue	Description of Monitoring Activity
	- Verify that fish habitat mitigation measures are constructed and undertaken as per conditions of DFO Authorization.
Vegetation and Wildlife Habitat	- Site inspector to monitor clearing activities to ensure compliance with contract specifications. Ensure tree clearing is conducted outside of the bird nesting season.
Social Environment Monitoring	
Health and Safety	- Verify contractor's Temporary Magazine Licence conditions. - Monitor to verify Contractor's use of a standard warning code during blasting operations. - Monitor signage and fencing to maintain public safety relative to construction activities and equipment (Contractor responsible for signage and fencing as per contract specifications).
Archaeological Resources	- Site inspector to ensure that all archaeological resources uncovered during construction are adequately handled as per Ministry of Culture requirements.

10.3 Post-Construction Operational Period

Post-construction monitoring occurs after all the infrastructure is in place and the facilities are operational. Information obtained from this phase of monitoring serves to verify predicted operational impacts and also serves to evaluate the effectiveness of implemented mitigation measures. Table 10.3 summarizes proposed post-construction monitoring and will be the responsibility of SREL's environmental consultant. Compliance monitoring to be undertaken as part of the MRWMP is discussed in Section 9.1.13.

Table 10.3 Operational Monitoring Program

Issue	Description of Monitoring Activity	Year		
		1	**3**	**6**
Walleye spawning	- Monitor walleye spawning and spawning habitat characteristics throughout the study area	X	X	X
Fish community	- Monitor fish community in the study area (repeat baseline electrofishing survey)	X	X	X
Benthic Invertebrates	- Monitor benthic invertebrate community in the study area (repeat baseline survey)	X	X	X
Sound Levels	- Monitor sound levels in the study area as per the requirements of the Certificate of Approval (Air)	X		
Ragged Rapids GS Operations	- Ongoing liaison between North Bala GS operator and OPG Ragged Rapids GS operator to ensure no adverse effects on downstream generators	Ongoing		
Moon River Walleye Spawning Flows	- The effectiveness of attempts to maintain consistent spawning flows under changing watershed conditions, as watershed conditions permit, in conjunction with minimum flow needs	Ongoing		
Flow Distribution Plan/Strategy	- Monitoring of flow distribution will be ongoing to assess effectiveness in meeting flow objectives (e.g., scenic flows, fish spawning/incubation)	Ongoing		
Flood Mitigation	- Monitoring will be conducted on an ongoing basis to assess the effectiveness of flood mitigation strategies given the additional Lake Muskoka/Bala Bay discharge capacity	Ongoing		

In addition to the above-noted monitoring requirements, dialogue will be ongoing with MNR and OPG in order to communicate and coordinate flow releases upstream of Lake Muskoka by MNR and downstream flow releases from Lake Muskoka by SREL to downstream hydro facilities of OPG.

11 Environmental Permits and Approvals

11. Environmental Permits and Approvals

The following table provides a preliminary listing of the environmental and other permits/approvals required for this project. There may be a need for additional permits, pending more information on construction details.

Permit/ Approval	Description	Owner	Contractor
MOE environmental screening/federal environmental screening	Completion required before other permits and approvals granted	✓	
Transport Canada –Approval under Section 5(1) of the *Navigable Waters Protection Act*	Maintain safe navigation conditions throughout construction and operation	✓	
DFO Authorization for Works Affecting Fish Habitat	Fish Habitat Mitigation Plan to ensure No Net Loss of Habitat	✓	
DFO Authorization for Destruction of Fish by Means Other than Fishing	Required if blasting in or near fish habitat		✓
NRCan Temporary Magazine License	Required for the purchase and storage of explosives. Required for blasting		✓
MNR Work Permit	Required for construction on Crown land including works on shorelands	✓	✓
MNR LRIA Approval - Plans & Specs Approval	Authorization of engineering design specs required from MNR	✓	
MOE Permit to Take Water (required when more than 50,000 L/d of water is taken from a watercourse)	Diversion for hydroelectric power production May be required during construction (e.g., excavation pumping, cofferdam dewatering)	✓	✓
MOE Certificate of Approval for Industrial Sewage Works	Required for settling pond discharges		✓
MOE Certificate of Approval for Air Emissions	Back-up diesel generator	✓	
Ministry of Culture Approval	Based on recommendations in archaeological assessment (see Appendix C7)		
Ministry of Labour (MOL) Notice of Project	Required prior to start of construction		✓
MNR License of Occupation (Public Lands Act)	Licence of occupation of Crown Land	✓	
MNR Waterpower Lease	Waterpower Lease required to operate facilities	✓	
Muskoka River Water Management Plan Amendment	Amendment to incorporate new facility into existing plan. Amendment required prior to start of operation.	✓	

12 Conclusions and Recommendations

12. Conclusions and Recommendations

12.1 Screening Conclusion

The conclusion of the environmental screening is that the project is not likely to cause significant adverse environmental effects after effective mitigation measures are applied.

12.2 Mitigation, Monitoring and Permitting Recommendations

SREL (the project Owner) agrees that the mitigation recommendations contained in this document will become part of the Contractor's obligations for this project as applicable.

SREL will appoint an environmental inspector at the project site to ensure implementation of the preconstruction and construction monitoring programs. SREL and its environmental consultant will be responsible for the post-construction monitoring program.

SREL will also assign a permitting coordinator to the project whose role will be to ensure that all necessary permits and approvals for the project are obtained.

12.3 Statement of Completion

In the event that no Part II order request is received to elevate the project to a more detailed environmental assessment under the Ontario Environmental Assessment Act, or the request is resolved without elevation of the project, then a Statement of Completion will be prepared and filed with MOE and the project may proceed subject to receiving all necessary permits.

12.4 Water Management Plan Amendment

The facility operating plan information contained in the WMP section of this environmental screening document (Section 9) will be provided to the SC and SAC of the MRWMP to enable completion of the amendment process for the MRWMP.

13 List of References

13. List of References

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