REPLACEMENT CLASS SCREENING REPORT FOR ROUTINE IN-WATER WORKS PROJECTS:

- **DEWATERING AND MINOR LOCK/DAM MAINTENANCE**
- **BRIDGE MAINTENANCE AND REPAIR**
- **BOATHOUSE REPAIRS AND REMOVAL**
- **DOCK INSTALLATION REPAIR AND REMOVAL**
- **LAUNCH RAMP INSTALLATION MAINTENANCEAND REMOVAL**
- **SHORELINE STABILIZATION**

ALONG THE RIDEAU CANAL
AND THE
TRENT-SEVERN WATERWAY

Prepared for: Parks Canada Agency

Prepared by: Kelli E. Saunders, M.Sc.
Resource Consultant

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ACRONYMS

ARVPO – Atlas of the Rare Vascular Plants of Ontario

CAs – Conservation Authorities

CEAA – *Canadian Environmental Assessment Act*

CEA The Agency – Canadian Environmental Assessment Agency

CEAR The Registry – Canadian Environmental Assessment Registry

COSSARO – Committee of the Status of Species at Risk in Ontario

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

DFO – Fisheries and Oceans Canada

EA – Environmental Assessment

EC – Environment Canada

FA – Federal Authority

HADD – Harmful Alteration, Disruption or Destruction

NWPA – *Navigable Waters Protection Act*

MNR – Ministry of Natural Resources

OMNR – the Ontario Ministry of Natural Resources

OMOE – the Ontario Ministry of the Environment

QRAP – Quinte Remedial Action Program

RA – Responsible Authority

RCSR – Replacement Class Screening Report

SAR – Species at Risk

SARA – *Species at Risk Act*

TSW – the Trent-Severn Waterway

TC – Transport Canada

VEC(s) – Valued Environmental Component(s)

EXECUTIVE SUMMARY

The Rideau Canal National Historic Site of Canada and the Trent-Severn Waterway (TSW) National Historic Site of Canada in Ontario were originally built for transportation, trade and in some cases defence. These two canals have now developed into places where the public can appreciate and enjoy the cultural and natural heritage through land- and water-based activities. The Parks Canada Agency (Parks Canada) administers both canals. Proponents must obtain permits through Parks Canada in order to proceed with various projects along each canal. Note that, in some cases, Parks Canada would be the proponent.

A number of repetitive projects occur along both canals: Dewatering and Minor Lock/Dam Maintenance; Bridge Repair; Boathouse Repairs; Docks; Launch Ramps; and Shoreline Stabilization. These repetitive projects are subject to screening under *the Canadian Environmental Assessment Act (*The Act*)* and they meet the six criteria of the applicability of a Replacement Class Screening detailed in Section 1.2. As Responsible Authority, Parks Canada initiated the preparation of this Replacement Class Screening Report (RCSR) in order to define a uniform approach to environmental assessment for these routine projects, which is consistent with the objectives of Parks Canada's environmental protection mandate and the requirements of the Act.

This RCSR includes six sub-classes of repetitive projects noted above and are described in Section 3.0. Given the number of sub-classes and the potential for many of these routine projects to occur anywhere along the two waterways, broad descriptions of the various types of environments within which projects may or may not occur are provided in Appendix A as reference information for Parks Canada's staff reviewing applications. Valued Environmental Components (VECs), which are components of the environment most likely to be adversely affected by these routine projects, were identified in Section 4.3.

In order to assess the potential project/environment interactions, tables were devised (See Tables 4.2-1 - 4.2-10 in Appendix E) outlining the potential environmental effect of each scoped project activity on the VECs, the recommended mitigation and a rating of the significance of potential residual effects. The mitigation measures reflect accepted environmental best management practices and standards for the construction (repair), operation and, where applicable, decommissioning of the sub-classes of routine projects included in this RCSR, while the rating of significance of residual effects following the application of effective mitigation measures was undertaken by considering the *magnitude, geographic extent, duration, frequency of occurrence, reversibility and ecological/historical context,* as defined in Table 4.5. In all cases, the recommended mitigation measures are known to reduce the potential adverse environmental effects to insignificant levels.

1.0 INTRODUCTION

The Rideau Canal National Historic Site of Canada and the Trent-Severn Waterway (TSW) National Historic Site of Canada in Ontario form extensive cultural and natural heritage corridors that link cities and towns and have drainage basins which encompass large geographical areas. The Rideau Canal is 202 kilometres long and stretches from Kingston, at the foot of Lake Ontario, to Ottawa, Canada's capital (see Figure 1). The TSW meanders 386 km across Central Ontario, linking Lake Ontario with Georgian Bay (see Figure 2).

Originally built for transportation, trade and in some cases defence, these canals have now developed into places where the public can appreciate and enjoy the cultural and natural heritage through land- and water-based activities. In addition, specific resources on certain historic canals have been declared to be of national historic significance. The locks, dams and blockhouses on the Rideau Canal are examples of resources that have been so designated. Various levels of government, as well as groups and concerned individuals, have a role in fostering public appreciation, enjoyment and understanding of the values represented by the historic canals. The Parks Canada Agency (Parks Canada) is the chief administrator of both canals, which means that the public must obtain permits through Parks Canada in order to proceed with various projects along either canal. In some cases, such as dam and lock maintenance, Parks Canada, or contractors working on their behalf, is the proponent. However any landowner proposing to, for example, build a launch ramp, can be the proponent of a project and must apply to Parks Canada for a work permit.

There are many repetitive projects that occur on the two canals including: dewatering and minor lock/dam maintenance; bridge maintenance and repair; boathouse repairs and removal; dock installation repair and removal; launch ramp installation and removal; and shoreline stabilization and removal. These projects are subject to an environmental assessment under the *Canadian Environmental Assessment Act (*the Act*)*. Parks Canada initiated the preparation of this Replacement Class Screening Report (RCSR) in order to establish streamlined planning and environmental assessment procedures for a number of repetitive projects conducted along the Rideau Canal and the TSW. By defining a uniform approach to environmental assessment, Parks Canada can be assured that repetitive projects and redevelopment are consistent with the objectives of Parks Canada's environmental protection mandate and the requirements of the Act. An environmental assessment under the Act is necessary as these projects are undertakings in relation to a physical work or an activity listed on the *Inclusion List Regulations*. Most of the repetitive projects that occur along both waterways are repetitive and typically result in environmental effects that are predictable, well understood and mitigable.

1.1 Class Screening and the Canadian Environmental Assessment Act

The Act and its regulations set out the legislative basis for federal environmental assessments. The legislation ensures that the environmental effects of projects involving the federal government are carefully considered early in project planning. The Act applies to projects which require a federal authority (FA) to make a decision or take an action, whether as a proponent, land administrator, source of funding or regulator (issuance of a permit or licence). The FA then becomes a responsible authority (RA) and is required to ensure that an environmental assessment of the project is carried out prior to making its decision or taking action.

Figure 1: Location of The Rideau Historic Canal

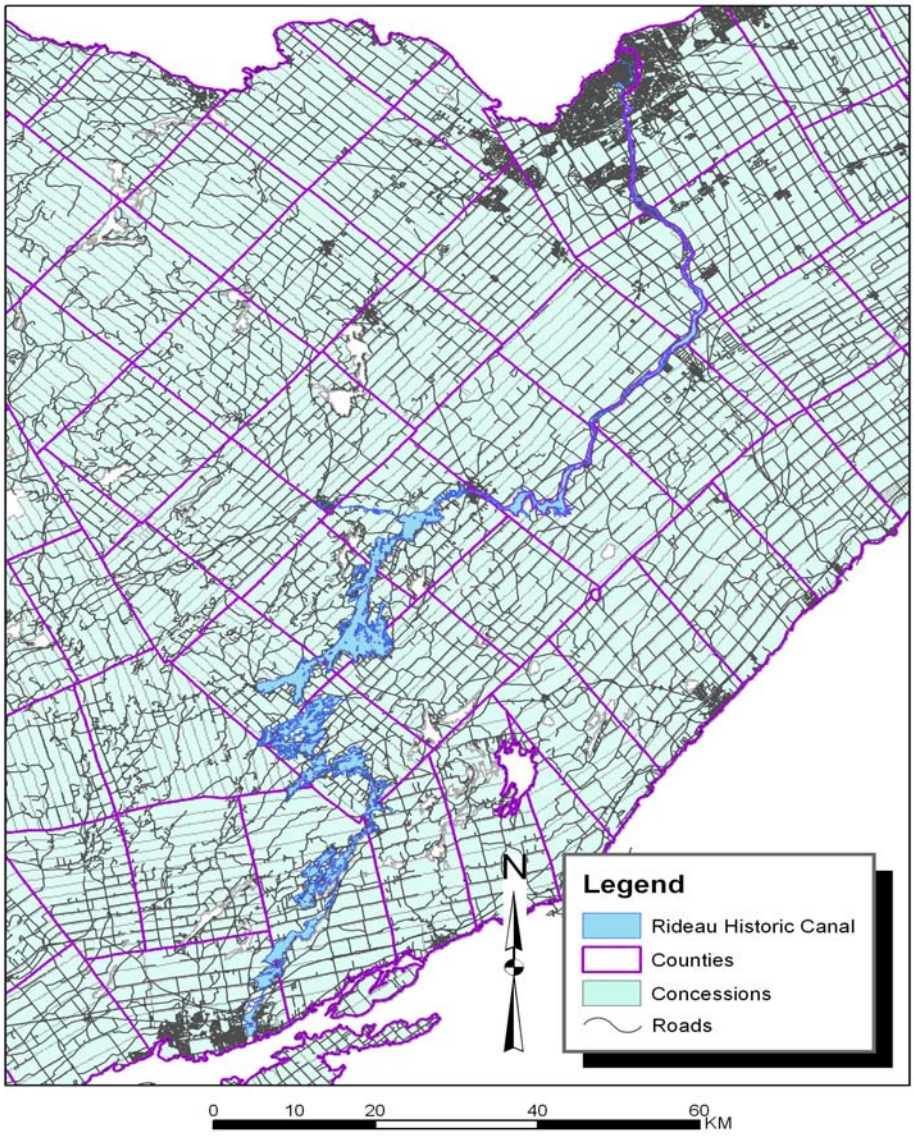
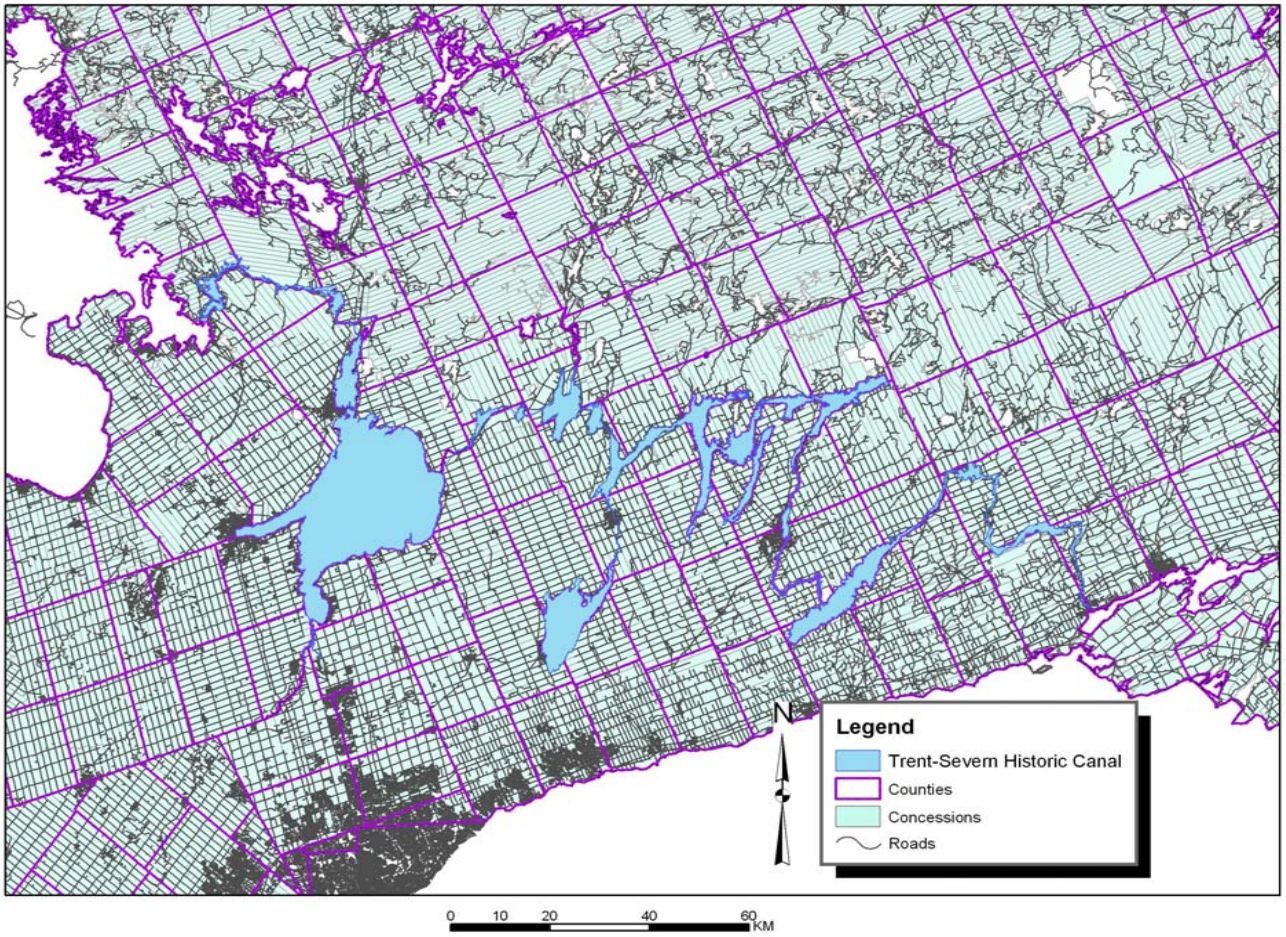


Figure 2: Location of The Trent Severn Waterway



Most projects are assessed under a screening level assessment. A screening systematically documents the anticipated environmental effects of a proposed project and determines the need to modify the project plan or recommend further mitigation to eliminate or minimize these effects. Screenings are conducted for projects which have not been excluded under section 7 of the Act (i.e. are not on the *Exclusion List Regulations*) or are not on the *Comprehensive Study List Regulations* and have not been identified as requiring mediation or an assessment by a review panel.

The screening of some repetitive projects may be streamlined through the use of a Class Screening report either through a Replacement Class Screening or a Model Class Screening. These kinds of reports present the accumulated knowledge of the environmental effects of a given type of project and identify measures that are known to reduce or eliminate the likely adverse environmental effects. The Canadian Environmental Assessment Agency (the Agency) may declare such a report appropriate for use as a class screening after taking into account comments received during a period of public consultation.

An RCSR consists of a single document that defines the class of projects and describes the associated environmental effects, design standards and mitigation measures for projects assessed within the report. It includes a conclusion of significance of environmental effects for all projects assessed by the replacement class screening. Once the Agency declares an RCSR, no further environmental assessment and decision regarding the significance of the environmental effects are required for projects within the class, provided that design standards and mitigation measures described in the report are implemented.

1.2 Rationale for Replacement Class Screening

The applicability of the RCSR to the projects is based upon the demonstrated ability of the class to meet the following six criteria:

1. *Well-defined Class of Projects:*

   The specified routine projects along the Rideau Canal and TSW are based on several common characteristics:

   - The projects are all located within linear waterways or connecting rivers and lakes that have similar, well-understood environmental settings and structural environments;
   - Many of the in-water works within this class occur at locks and dams, which are similar in structure (see Figures 1 and 2 for locations). The TSW has 44 lock stations and 125 water control structures in total. The Rideau Canal has 45 lock and over 40 dam structures.
   - The timeframes in which these projects can occur are well defined, given the type of work involved and the timing restrictions for the protection of fish life cycle concerns;
   - The environments in which they are ultimately allowed are well understood and the potential impacts have become predictable and are known to be mitigable.
   - While this class of project can potentially be found anywhere along the two systems, the project activities involved in all the sub-classes are well understood and repetitive.

2. *Well-understood Environmental Setting:* Parks Canada has been responsible for the management of the Rideau and TSW for decades, and is very familiar with each site's environmental setting. The commemorative integrity statements and management plans for both the Rideau Canal and TSW National Historic Sites describe the cultural resources, environmental characteristics and historical impacts of human activity along the two waterways, which provide a basis for the discussion of the types of environments within which these routine projects normally occur (see Section 4.3). Parks Canada staff visit those sites at which applications are made to undertake routine in-water works and it is at that time that a determination can be made as to whether the RCSR is applicable or not.

3. *Unlikely to Cause Significant Adverse Environmental Effects, Taking into Account Mitigation Measures*: Activities within the class of projects discussed herein occur along the waterbodies of the Rideau and TSW and effects on fish habitat, wetlands and other environmental resources are routinely minimal and/or mitigated with standard best management practices or well accepted techniques. Based on previous experience with this class of projects, no significant adverse environmental effects are likely to occur. Minor environmental impacts have occurred during the past and were successfully mitigated, using standard codes of practice and more site-specific measures, to ensure ecological and commemorative integrity. Any location-specific variations in environmental effects or mitigation measures are well-understood given the familiarity with the waterways and their environments. The mitigation is meant to keep the impacts to the extent predicted, that is short-term, minor, and reversible with no anticipated cumulative impact.

4. *No Project-Specific Follow-up Measures Required:* Project-specific follow-up programs are not required as there are no expected variations in predictions or effects to be monitored. Post-construction monitoring is often required to ensure that the property is returned to its original state following a project activity.

5. *Effective and Efficient Planning and Decision-making Process:* Routine in-water works projects involve activities that are straightforward and routine in nature, so planning is typically uncomplicated. As Parks Canada is usually the only RA involved in the assessments and the proponents (or the contractors doing the work for the proponent) are specialized and highly experienced in the delivery of such activities, the planning and decision-making processes are usually straightforward. In all cases, Parks Canada reserves the right to require or undertake a regular environmental screening should an unusual or occasional, but important, site-specific concern arise.

6. *Public Concerns Unlikely:* These routine projects tend to be very localized, with minimal if any disturbance to adjacent property owners. Occasional complaints may be voiced regarding noise emitted during construction or reduced aesthetics, for example, however mitigation measures outlined in the RCSR minimize public and biophysical disturbances within the context of municipal noise control guidelines and environmental best management practices.

1.3 Consultation

Inter-agency consultation of this document has occurred with Fisheries and Oceans Canada (DFO), Environment Canada (EC) and Transport Canada (TC). Any comments received from these agencies have been incorporated into this document.

Likewise, consultation with the Ontario Ministry of the Environment (OMOE), the Ontario Ministry of Natural Resources (OMNR) and local Conservation Authorities (CAs) bordering the TSW and Rideau Canal (as required) has been conducted and comments received have been incorporated into the document as well.

As required under the Act, the Agency conducted a 30 day public consultation on the RCSR. All comments received were taken into consideration by Parks Canada before its declaration.

1.4 Canadian Environmental Assessment Registry

The purpose of the Canadian Environmental Assessment Registry (CEAR, the Registry) is to facilitate public access to records relating to environmental assessments and to provide notice in a timely manner of assessments. The Registry consists of two components – an Internet site and a project file.

The Internet site is administered by the Agency. The RA and the Agency are required to post specific records to the Internet site in relation to a class screening report.

Upon declaration of the class screening report, the Agency requires RAs to post on the Internet site of the Registry, at least every three months, a statement of projects for which an RCSR was used. The statement should be in the form of a list of projects, and will include:

- the title of each project for which the RCSR was used;
- the location of each project;
- the date when it was determined that the project falls within the category of projects covered by the report and;
- contact name or number.

Note: The schedule for posting a statement is:

July 15 - (for projects assessed from April 1 to June 30)
October 15 - (for projects assessed from July 1 to September 30)
January 15 - (for projects assessed from October 1 to December 31)
April 15 - (for projects assessed from January 1 to March 31)

The RA must also provide annual confirmation of cumulative effects assessment conditions to ensure no new projects cause any significant adverse environmental effects.

The project file component is a file maintained by the RA during an environmental assessment. The project file must include a copy of the RCSR. The RA must maintain the file, ensure convenient public access, and respond to information requests in a timely manner.

Further information regarding the Registry can be found in “The Canadian Environmental Assessment Registry”, prepared by the Agency.

2.0 PROJECTS SUBJECT TO CLASS SCREENING

2.1 Projects Subject to the Act

For a project to trigger an environmental assessment under the Act, the project must either be an undertaking in relation to a physical work or an activity not in relation to a physical work captured in the Inclusion List Regulations of the Act. In addition, Parks Canada must either (s.5 of the Act):

- Be the proponent of the project (s.5(1)(a));
- Grant money or other financial assistance to a project (s.5(1)(b);
- Grant an interest in land to enable a project to be carried out (s.5(1)(c)); or
- Exercise a regulatory duty in relation to a project, such as issuing a permit, license or authorization that is covered under the Law List Regulations (s.5(1)(d)).

In some cases, such as with dam and lock maintenance, Parks Canada is the proponent of the project. In other cases, a private individual may propose work on the Rideau Canal or the TSW, which requires Parks Canada to issue or renew a land licence or lease for the purposes of enabling the project to be carried out in whole or in part. The issuance of a licence and/or lease for the purpose of development does trigger the Act.

Projects are exempt from environmental assessment if they meet all the criteria set out in the *Exclusion List Regulations.* If all components of the project are described on the *Exclusion List Regulations*, the project is exempted from an environmental assessment under the Act. If any component of the project is not described on the *Exclusion List Regulations*, an environmental assessment of the project, including all components, is required under the Act. Environmental assessment practitioners should review the most current version of the *Exclusion List Regulations* prior to initiating an environmental assessment.

2.2 Projects Not Subject to this Replacement Class Screening Report

The following are a list of projects that are not suited to this RCSR and will therefore require a separate environmental assessment under the ACT. Please note that these exceptions apply to ALL of the sub-classes of projects.

Projects that are not suited to this RCSR are:

- Those that require an authorization from DFO;
- Those that require an authorization under NWPA;
- Those that are located in provincially significant wetlands and/or significant fish habitat, a critical fraction of significant habitats (see glossary);
- Those in areas where the bed of the waterbody consists of quality gravels and/or rock rubble;
- Those that involve dredging;
- Those that involve beach creation
- Those that have a potential to impact on an archaeological resource
- Those where the work is being done on a level one cultural resource
- Those where there is a likely release of a polluting substance into a waterbody
- Those likely to have an adverse affect on species at risk and/or their habitat.

The Historic Canals Regulations under *the Department of Transport Act* provide the regulatory framework for the management, use and protection of the Rideau Canal and Trent-Severn Waterway in accordance with Parks Canada's policies and canal management plans. However, the *Fisheries Act* under the Department of Fisheries and Oceans requires the protection of fish habitat. Moreover, the *Navigable Waters Protection Act* under the Department of Transport protects the integrity and navigation safety of navigable waters. Thus, Fisheries and Oceans and Parks Canada agreed that the Historic Canals in Ontario have a responsibility to protect fish habitats (Fisheries and Oceans Canada & Parks Canada, 1998). This RCSR voices such agreement through public consultation and by assuring that redevelopment in both Canals is consistent with the requirement of the *Canadian Environmental Assessment Act*.

Parks Canada (for both the Rideau and TSW), through the written federal/provincial agreement, Protocol for the Fish Habitat Referral Process in Ontario (Fisheries and Oceans Canada et al., 2000) has authority to review all proposed works along their systems for potential impacts on fish habitat under Section 35 *Fisheries Act*. Under this protocol, initial requests for any in-water work proposals on the two canals are submitted to Parks Canada by proponents, contractors, Ministry of Natural Resources (MNR), DFO, and Conservation Authorities. Parks Canada reviews the project to determine if a Harmful Alteration, Disruption or Destruction of fish habitat (HADD) is anticipated. Upon the determination that a HADD is required, the RCSR **does not** apply and an individual assessment under the Act will be undertaken for the project. Parks Canada also has an agreement with Transport Canada whereby they may make a judgment as to whether a project has a NWPA requirement. If so, the RCSR would not apply.

For the purposes of this RCSR, species at risk include:

- species identified on the List of Wildlife Species at Risk set out in Schedule 1 of the *Species at Risk Act (SARA*), and including the critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act.*
- species that have been recognized as "at risk" by COSEWIC, COSSARO (Committee on the Status of Species at Risk in Ontario) or by provincial or local authorities.

If, after reviewing the project description using the class screening report, it becomes known or reasonably suspected that species at risk could be adversely affected by the proposed project, do not use the RCSR. The project requires an individual environmental assessment under the Act. Note, the contents of the RCSR may be used in the preparation of the individual screening report.

2.3 Projects Subject to this Replacement Class Screening Report

The projects subject to this RCSR are defined as Routine Projects along the Rideau Canal and the TSW and applies only to works on federally owned land. This class is comprised of six sub-classes that are described below. In each sub-class there is a list of projects that are specifically covered by the RCSR and a list of those that are not covered in that class for clarity purposes.

It is the responsibility of the proponent / project manager to ensure that a full description of all project components are identified and provided to the Environmental Assessment Co-ordinator for either the Rideau Canal or the TWS prior to project initiation. This shall include a written project description, a sketch of the proposed project and photos of the work area. **With this project information the Environmental Assessment Co-ordinator for either the Rideau**

Canal or the TWS will determine if the project is covered by this RCSR and will in turn inform the proponent/project manager on how to proceed.

Sub-Class 1: Dewatering and Minor Lock/Dam Maintenance

Projects covered by this sub-class include:

- Placement of coffer logs in the gains
- Dewatering of the Locks
- Maintenance and repair of a sill
- Minor maintenance and repair of an existing dam
- Maintenance and repair of a lock chamber
- Maintenance and repair of retaining wall
- Maintenance and repair of a sluice/valve
- Maintenance and repair of log check/gains
- Maintenance and repair of lock gates
- Maintenance and repair of railings
- Maintenance and repair of deck
- Maintenance and repair of log lifters
- Installation and maintenance of water gauges
- Painting of gates and railings
- Inserting steel into gains to provide better support
- Repairing concrete surfaces of dam by filling holes or replacing entire deck surface
- Dam and lock repairs including gravel fill/substructure, concrete, masonry rock or grouting repairs to any portion of the dam or lock structure conducted in the dry
- Chipping and pointing of wing walls in the dry
- Chipping and pointing of lock chamber in the dry

Note:
The following are **not** to be included in this RCSR:

- Sandblasting
- Dewatering associated with dam repairs

Sub-Class 2: Bridge Maintenance and Repair

The projects in this sub-class refer to existing bridge structures, including their internal fixed structures, over either the Rideau Canal or the Trent-Severn Waterway

Projects covered by this sub-class include:

- Resurfacing bridge deck including replacing wooden timbers (they cannot be replaced with creosote-treated timbers), asphalt or concrete
- Concrete and asphalt surface repairs include filling in potholes to replacing entire surface
- Painting bridge railings and beams underneath
- Reinforcing supports
- Resurfacing concrete abutments and supports in the dry that do not encroach onto the bed of canal

- Repairs to stone and masonry abutments and supports including chipping, pointing and grouting when done in the dry only.
- Repairs to abutments and supports that include parging small eroded surface areas of the concrete, cutting back the surface of the concrete and repouring back out to the same limit
- Repair and replacement of swing bridge motor and gears including the greasing of moving parts
- Parging small eroded surface areas of concrete
- Cutting back surface of concrete to repouring back out to same limit

Note:
The following are **not** to be included in this RCSR:
- If a project is likely to increase the height or footprint of the bridge
- Sandblasting

Sub-Class 3: Boathouse Repairs and Removal

The projects in this sub-class refer to existing boathouse structures that have a solid foundation (e.g crib and span) or those that penetrate the Rideau Canal or the Trent-Severn Waterway.

Projects covered by this sub-class include:
- Replacement of rotted boards
- Straightening and re-nailing of cribs
- Replacement of boathouse timber or steel supports
- Repair or replacement of siding or roof
- Major repair of 1 or more cribs as long as it does not change the footprint

Note:
The following are **not** to be included in this RCSR
- Boathouse repairs resulting in the enlargement of the structures over the bed of the canal
- Boathouse repairs that require dewatering
- Repairs in wetland habitat
- Repairs that will disturb or cover rock rubble on the bed of the canal

Sub-class 4: Dock Installation, Repair and Removal

The projects in this sub-class refer to docks that have a solid foundation (e.g. crib and span) or penetrate the bed of the Rideau Canal or the Trent-Severn Waterway

Projects covered by this sub-class include:
- Dock abutments (concrete or rock) installed completely upland, above the high water mark
- Crib docks constructed upland and then placed carefully on the bed of the canal

- Pile docks where the dock frame is constructed upland and placed on top of secured drilled legs
- Replacement of boards
- Straightening and re-nailing of cribs
- Replacement of dock stringers
- Major repair of 1 or more cribs as long as it does not change the footprint
- Removal of crib docks that would include the removal of all wood and metal material as well as any excess rocks
- Removal of span docks that would include the removal of all wood and metal material as well as any excess rocks

Note:
The following are **not** to be included in this RCSR

- Any dock installation, repair or removal that would involve the relocation of rocks, logs or stumps on the bed of the canal
- Any work in a wetland
- Repairs resulting in the enlargement of the structure
- Repairs resulting in the enlargement of the footprint of the structure on the bed of the canal

Sub-Class 5: Launch Ramp Installation, Maintenance and Removal

The projects in this sub-class refer to launch ramps.

Projects covered by this sub-class include:

- Installation of launch ramps 8 to 10 feet wide using clean imported rock (gravel, rubble)
- Installation of upland portion of launch ramps made of concrete, interlock stone and wood
- The addition of new gravel to existing launch ramps, that would not increase the existing footprint
- Repairs to upland portions of launch ramps made of concrete, interlocking stone and wood
- Removal of launch ramps.

Note:
The following are **not** to be included in this RCSR

- Any work in a wetland
- Any launch ramp installation or repair that would involve the relocation of large rocks, logs or stumps on the bed of the canal.
- Any launch ramp installation that occurs in significant fish spawning and/or nursery habitat as defined or identified by the MNR.

Sub-Class 6: Shoreline Stabilization

Projects covered by this sub-class include:

- Installation of sloped rock revetments where the shoreline is excavated back beginning above the high water mark to obtain a slope not greater than 2:1 (horizontal:vertical)
- Bioengineered stabilization
- Repair and replacement of sloped rock revetments by replacing rocks which have been lost
- Repair and replacement of sloped rock revetments by removing existing rock and installing geotextile filter fabric and rock stabilization material within the existing footprint
- Repair and replacement of sloped rock revetments by resloping the bank above the upper control elevation level (high water mark) and replacing the filter fabric and rock stabilization material
- Replacement of rocks that have shifted or fallen onto the canal bed as a result of wave action or ice movement

Note:
The following are **not** to be included in this RCSR

- Repair or replacement of retaining wall that is armour stone, steel, concrete, or wood
- Creating a filled area on the bed of the canal as a result of the work
- Repair and replacement of revetments where the work would increase the footprint onto the bed of the canal
- Any work in a wetland
- Any work in areas effecting fish habitat

3.0 DESCRIPTION OF SUB-CLASS PROJECT ACTIVITIES

Provided below is a description of the activities typically involved during the phases of work related to the eight sub-classes. Standard mitigation measures are briefly mentioned in the following sections; however, more detailed mitigation measures are provided in the project/environment interaction tables presented later.

3.1 Dewatering and Minor Lock/Dam Maintenance

Site Preparation

Vegetation removal may be necessary along the shoreline areas of the dam site to allow heavy equipment access to the area.

If work is occurring within the lock chamber, the lock is dewatered by draining or pumping water out of the lock, and placing logs in the upstream and downstream gains. A cofferdam may need to be put in place to provide a dewatered area upstream or downstream of a lock or dam structure, if work is occurring in these areas. The cofferdam can be constructed from, for example, sand bags,

large water-inflated bladders, or sheet steel piling. If silt or sediments are a concern, the water will need to be pumped into a settling basin and treated before being discharged back to the waterbody. Any fish trapped within the dewatered area will also need to be captured and relocated within the lake or river. Pipes may need to be placed through the cofferdam to allow enough water to flow through the work area to provide adequate water levels downstream and prevent increased water levels upstream.

Site preparation may also involve setting up scaffolding around the dam or lock structure, and can also involve attaching drop cloths to the dam or lock to prevent any sandblasted materials, paints, concrete or construction debris from entering the water. At some sites it may be necessary to install a portable bridge to span the canal or river for heavy equipment access.

Construction

Repairs to concrete or stone and masonry portions of the dams and locks may involve removal of chipped concrete, parging small eroded areas of the concrete surface, repairing concrete or wooden sills, replacing grout, pointing stone, cutting back the surface of the concrete, forming and repouring back out to the original location, or total replacement of the section of concrete.

Repairs may need to be made to the lock gates and valves to provide a better seal and prevent leakage of water. The operating mechanisms (e.g. winches and chains) of manually-controlled gates and sluice controls sometimes need repairs or replacement. The gains or log checks may need to be reconstructed if they have deteriorated to a point where they are not holding the logs in place properly. Steel may be inserted into the gains to provide better support.

Repairs to the deck, railings or log lifters on a dam are often necessary. Old wooden decking may be replaced with new wood, or with new concrete. Concrete surface repairs can involve anything from filling holes to replacing the entire deck surface.

For painting work, the surfaces of the structure are usually scraped prior to the painting.

Site Restoration

Scaffolding and drop cloths are removed from the site. If a cofferdam has been put in place, all materials must be removed from the waterbody, including the silt accumulated behind the cofferdam. If a portable bridge was installed, it will need to be removed from the site. This involves the use of a crane on the shoreline to lift the bridge out of its location.

If the shoreline area was disturbed with heavy equipment, the area may need to be graded followed by reseeding, placement of sod or planting with native species of ground cover. If trees or shrubs were removed, the shoreline vegetation should be replanted with native species.

3.2 Bridge Repair

Site Preparation

Site preparation can involve setting up scaffolding around the bridge structure and/or attaching drop cloths to the structure to prevent any deleterious materials, paints, concrete, etc. from entering the water. In some cases, it may be necessary to remove vegetation from the bank to provide heavy machinery access. Sediment and erosion control measures are put in place prior to

the work where there is a chance of sediments entering the waterbody. A cofferdam may be necessary where work is occurring on an abutment or bridge support.

If work is occurring during the navigation season, special measures may have to be put in place to ensure navigation is not affected.

Repair Work

Resurfacing the bridge deck can involve replacing wooden timbers, asphalt or concrete. For concrete and asphalt surfaces, repairs can involve anything from filling potholes to replacing the entire deck surface. Creosote-treated timbers are not to be used for replacement purposes. For painting work, the surfaces are usually scraped prior to painting.

Repairs to bridge abutments and supports can involve in-water work. A cofferdam may need to be installed around the abutment or support and the water pumped out of the work area. The cofferdam can be constructed of, for example, sheet piling, sand bags or water-inflated bladder-type dams. If sediments are a concern, the water will need to be pumped into a settling basin and treated before being discharged to the waterbody. Any fish trapped in this area will also need to be captured and relocated outside the cofferdam.

Site Restoration

Scaffolding and drop cloths are removed from the site. If a cofferdam has been put in place, all materials must be removed from the waterbody.

If the shoreline area was disturbed with heavy equipment, the area may need to be graded followed by reseeding, placement of sod or planting with native species of ground cover. If trees or shrubs were removed from the shoreline, vegetation should be replanted with native species and the area restored as close as possible to its original state.

3.3 Boathouse Repairs and Removal

Site Preparation

Some shoreline vegetation may need to be removed to provide access for heavy equipment down to the shoreline.

Repair Work

Existing boathouses can either be found out on the bed of the canal or on the applicant’s property as an upland dry boathouse or as an inland wetslip boathouse. The boathouses on the bed of the canal can be supported by cribs, drilled legs, concrete piers, or can be floating structures anchored to the shoreline. Boathouses located on the bed of the canal usually have a dock on legs or supported by cribs along each side of the structure. The dry upland boathouses are usually situated on a concrete pad on grade and have a marine railway down into the waterbody. The inland wetslip boathouses can be supported by timber, stone or concrete walls around the edge of the wetslip.

Maintenance of the boathouse or associated docks may be required on an annual basis. Boards on the dock decks may need to be replaced if they have rotted. Cribs may need to be straightened and renailed in place if they have shifted due to ice movement.

More major repairs can involve replacing the boathouse timber or steel supports, repairs or replacement of the siding or the roof, or undertaking a major repair of one or more of the cribs. To allow for the replacement of the boathouse supports or for a major repair of the cribs, the boathouse frame can either be removed from the cribs or jacked up to allow for the repair. In some cases, a few of the crib boards will only need to be nailed back in place and the cribs topped up with clean rock, if rocks have spilled out. For more major repairs the entire crib may need to be removed and repaired upland and then reinstalled on the bed and refilled with rock.

For boathouses supported with cribs, the cribs are constructed of wood in an open fashion, with the openings not being less than the width of the wooden members. The cribs are square or rectangular in design, with the wooden pieces on each side overlapping and nailed to the perpendicular piece of the adjoining side to form spaces in between for water flow. Once the cribs are constructed, they are carefully placed on the bed of the lake at the appropriate locations and filled with clean imported rock, 4 to 12 inches in size.

Repairs to inland wetslip boathouses can involve the replacement of the boathouse support walls around the inside of the slip. The boathouse can either be jacked up for the repair or moved off to the side. The existing wall is removed and the new wall installed. Crushed stone is usually used as a base under the new wall and a geotextile filter fabric is installed behind the new wall. The boathouse is then put back in place over the new support wall.

The repairs to the boathouse cannot result in the enlargement of the structure over the bed of the canal. If the bed of the canal contains rock rubble, it cannot be disturbed or covered during the repairs to the boathouse. The repairs shall not disturb any wetland habitat in the area.

Site Restoration

If the shoreline area was disturbed with heavy equipment, the area may need to be graded followed by reseeding or placement of sod. Any trees or shrubs removed from the shoreline must be replanted with native species.

Should the applicant wish to remove a boathouse on the bed of the canal, this would involve the removal of all the wood and metal material from the waterbody. In most cases, it is required that the rock from the cribs be dispersed on the bed of the canal to provide fish habitat, as long as it would not be covering existing natural rock rubble or wetland habitat. The removal of inland wetslip boathouses or upland boathouses shall ensure that all debris is removed from the water and upland areas adjacent to the water.

3.4 Dock Installation, Repair and Removal

Site Preparation

The majority of the site preparation for these types of docks would be upland for the installation of the dock abutment if necessary. Parks Canada requires that the abutment (usually concrete or rock) be installed completely upland above the high water mark. This may involve some tree and shrub removal at the shoreline and some shoreline excavation to accommodate the installation of the abutment into the upland property.

In some cases, it is necessary for rocks, logs or stumps on the bed of the canal to be relocated to an area of similar water depth if they are within the area proposed for the dock or access to the

dock. This relocation requires approval from Parks Canada and is not included as an activity in this RCSR. This relocation can be by hand or more often with the use of a hoe.

Construction

If a large piece of limestone (armour stone) is being used for the abutment, the excavation is usually lined with clear stone prior to the placement of the rock. A geotextile filter fabric is used immediately behind the rock or concrete abutment to stabilize backfill material. If concrete is being used, forms are installed, rebar is inserted and the concrete poured. Once the concrete is dry, the forms are removed. Attachments are inserted into the concrete or drilled into the rock for securing the dock cables. Dock attachments can also be drilled into existing rocks, eliminating the need for the installation of an abutment.

Most components of the dock are constructed upland and then placed at the appropriate location on the bed of the canal. For crib and span docks, the cribs are constructed of wood in an open fashion, with the openings not being less than the width of the wooden members. The cribs are square or rectangular in design, with the wooden pieces on each side overlapping and nailed to the perpendicular piece of the adjoining side to form spaces in between for water flow. Once the cribs are constructed, they are carefully placed on the bed of the canal at the appropriate locations and are filled with clean imported rock, 4 to 12 inches in size.

For docks with drilled legs, the steel legs are drilled into the bed of the canal using a pile driver on a scow or in some instances a well drilling rig will be taken out on the ice.

The dock frame is constructed upland and then placed on top of and secured to the cribs or drilled legs out on the canal bed. The dock tops can be constructed in sections and then secured to the frame, or boards for the top of the dock can be nailed in place out on the bed of the canal. The dock is then secured to the abutment with cables as needed.

Maintenance

Some minor maintenance of the dock may be required on an annual basis. Boards on the deck may need to be replaced if they have rotted. Cribs may need to be straightened and renailed in place if they have shifted due to ice movement.

More major repairs can involve replacing the dock stringers or undertaking a major repair of one or more of the cribs. To allow for the replacement of the stringers, the deck boards are removed, the stringers replaced, and the deck boards nailed back in place. For a major repair of the cribs, the dock frame can either be removed from the cribs or jacked up to allow for the repair. In some cases, a few of the crib boards will only need to be nailed back in place and the cribs topped up with clean rock, if rocks have spilled out. For more major repairs, the entire crib may need to be removed and repaired upland and then reinstalled on the bed and refilled with rock.

The repairs to the dock cannot result in the enlargement of the structure.

Site Restoration

If an abutment has been placed on the shoreline, the disturbed area surrounding the excavation will need to be stabilized. This involves leveling of the area followed by reseeding or placement of sod. Trees or shrubs removed from the shoreline must be replanted with native species.

The removal of crib and span docks would include the removal of all the wood and metal material from the canal.

3.5 Launch Ramp Installation and Maintenance

Site Preparation

The upland shoreline will normally need to be excavated to provide a gentle slope into the water for the launch ramp In some cases, a minimal amount of shoreline vegetation may need to be removed to accommodate the placement of the ramp.

Construction

Only clean imported rock (gravel, rubble) can be placed on the canal bed to provide the ramp base. This rock can either be placed by hand or with a hoe. The average length along the shoreline for rock placement would be 8 to 10 feet. Geogrid webbing can be used on the bed of the canal to contain the rock material.

Upland of the high water mark, the ramp can consist of gravel, rock rubble, concrete, interlocking stone or wood.

Maintenance

Periodically, new gravel or rock rubble may need to be added to the upland or in-water portions of the launch ramp to maintain the proper slope. If other materials are used for the upland portion of the ramp, they will eventually require repairs. If the upland portion of the ramp is concrete it may crack or break apart and need to be repaired or removed and repoured. Interlocking stone and wooden upland ramps will also need to be repaired or replaced in time.

Some maintenance is required to keep the upland and in-water portions of the ramp from growing in with vegetation. This can usually be done by hand.

Site Restoration

If the shoreline bank has been excavated, the area surrounding the ramp will need to be stabilized with grass, native groundcovers, shrubs or trees.

If a launch ramp is being removed, all upland and in-water material such as concrete, interlocking stone, rock rubble or wood should be removed from the site.

3.6 Shoreline Stabilization

Site Preparation

Site preparation often includes the removal of shoreline vegetation and excavation of the shoreline to obtain the proper slope for the rock placement and/or other bioengineering options.

Construction

For sloped rock revetments, the shoreline is excavated back, beginning above the upper control elevation level (high water mark), to obtain the proper slope. The slope of the rock should not be greater than 2:1 (horizontal:vertical). Filter cloth is placed upland on the sloped shoreline and rock (8 to 12 inches in size; imported and free of fine particulates) is placed on top of the filter cloth. The filter cloth prevents fine sediments from being washed out from behind the rock revetment. The rock is placed upland on the applicant's property and must follow the existing contour of the shoreline. A filled area on the bed of the lake cannot be created as a result of the rock placement. The area upland behind the sloped rock can be backfilled if necessary and then seeded and planted with native vegetation.

For bioengineered shorelines, root wads, stumps, brush bundles, fascines and other vegetative material are anchored into the shoreline to prevent erosion. Much of this material is quite large and can require heavy equipment for the installation.

Repairs/replacement of existing shorewalls can be for sloped rock revetments.. Sloped rock revetments can be repaired by replacing rocks which have been lost, by removing the existing rock and installing geotextile filter fabric and rock stabilization material, or resloping the bank and replacing the filter fabric and rock stabilization material. Rocks used for repairs should always be done with imported material free of fine particulates.

Maintenance

Rocks from sloped rock shorelines can be pulled into the lake from wave action or ice movement and need to be replaced periodically.

Site Restoration

In most cases, the shoreline area will be disturbed from the repair or replacement work and will need to be graded followed by reseeding or placement of sod. Trees or shrubs removed from the shoreline will be replanted with native species.

If an existing sloped rock shore stabilization or vertical wall is being removed, it will normally need to be replaced with some other type of stabilization. All materials from the original stabilization must be completely removed from the site. If a new wall or rock revetment is not being put in, the shoreline must be graded and stabilized with native groundcovers, trees and shrubs to help prevent erosion.

From the descriptions above, the following activities were selected as those, which may have a potential impact on the environment and have been used in the assessment of environmental effects in Section 4.5:

- Permanent Placement of Rock/Gravel on Lakebed
- Clearing of Terrestrial Vegetation
- Shoreline Excavation
- Pumping of Water
- Construction of Rock Access Road
- Stockpiling of Material
- Access and Operation of Heavy Equipment

- Repair/Replace Concrete/Wood
- Painting/Staining/Resurfacing
- Operation of Structure/Entity (Dock, Launch Ramp)

4.0 ENVIRONMENTAL REVIEW

4.1 Management of Historic Waterways

Parks Canada has a legislated mandate to protect the two National Historic Canals, the Rideau and the TSW, for all time. This protection mandate is strengthened by the Historic Canals Regulations, Parks Canada's Guiding Principles & Operational Policies (Parks Canada, 1994) and the federal *Species At Risk Act*. The routine activities covered under this RCSR must not, in any way, hinder the ecological or cultural integrity of the canals.

4.2 Boundaries

This RCSR pertains to projects that could affect the beds, shorelines, or water quality of the lakes and rivers located within each canal system. Ecological, cultural and socioeconomic boundaries have been considered during issues scoping and the identification of potential environmental effects. Significance ratings have been assigned based on consideration of the range or extent of the Valued Environmental Component (VEC) that could be affected by project development.

The project boundaries refer to the spatial and temporal extent of specific project activities, although many of the projects could potentially occur anywhere along the Waterway systems. Spatial project boundaries have been defined as the footprint area of the structure/entity, plus an additional buffer to account for adjacent properties, their residents and any potential aquatic/terrestrial habitats found there. Site visits are always conducted when an application is submitted and it is at that time that the characteristics of the adjacent properties are taken into consideration. Mitigation measures are designed to minimize or avoid environmental effects from occurring on-site or adjacent to the site.

Temporal boundaries include all of the project phases from site preparation through to site restoration or, if applicable, decommissioning, and are cognizant of provincially regulated in-water work timing restrictions for fisheries concerns (e.g. spawning seasons). All of the work involved in these project sub-classes typically takes less than two weeks to complete per project. However, this type of work is repetitive as long as there are property owners wishing to upgrade or make changes to Waterway property. Mitigation measures are designed to minimize or avoid any longer-term environmental effects from occurring on-site or adjacent to the site.

4.3 Environmental Setting and Valued Environmental Components

Given the number of subclasses and the potential for many of these projects to occur anywhere along the two waterways, specific project location descriptions are not possible to provide. Broad descriptions of the various types of environments within which projects may occur are provided in Appendix A: Typical Environmental Setting, as reference information for staff reviewing applications. The natural, social and cultural environments of the TSW and Rideau Canal are outlined therein. Appendix A also provides information on sensitive features known to occur within the two systems, including rare or endangered species, provincially significant wetlands and cultural/historical information. Appendices B and C list species found along the two waterways.

From the information provided in Appendix A and through discussions with Parks Canada, VECs were identified. These are components of the environment (natural, cultural and socio-economic) on which an environmental assessment of project activity/VEC interactions should be focused. From a comprehensive listing of potential VECs, only those shown below are carried forward in the assessment, given their importance to the shoreline/nearshore environment, the recreational significance of the two waterways, and the knowledge of how these VECs can interact with the activities within this class without mitigation. Each subclass activity scoped earlier in Section 3 can potentially interact with each of the VECs listed below:

- *Air and Noise Quality* (air and noise quality is important to local residents and municipal bylaws set standards that must be met)
- *Topography and Landscape* (alteration of the terrestrial landscape is an aesthetic issue and can affect surface water drainage on adjacent properties)
- *Soils* (soil quality is an important consideration for plant species, groundwater quality and terrestrial species)
- *Surface Water Hydrology* (surface drainage alterations can affect adjacent property owners or encourage erosion)
- *Surface Water Quality* (quality of water is linked to potability, recreational use and the health of aquatic life)
- *Aquatic Sediments* (quality of sediments and their potential disturbance can affect biota and their habitat and result in sedimentation downstream on adjacent properties)
- *Groundwater Quality and Quantity* (importance is linked to its impact on surface water quality and its supply as a drinking water source)
- *Aquatic Habitat/Species* (protection of habitat and species is important to the overall ecosystem as well as recreational use)
- *Terrestrial Habitat/Species* (protection of habitat and species is important to the overall ecosystem as well as recreational use)
- *Socio-economic Environment* (public concern for changes to the landscape, introduction of new structures, safety are considerations)
- *Cultural/Heritage Resources* (preservation of cultural resources has significance within the management plans and to the public)

While “Soils and Agriculture” were considered as a potential VEC, the decision was made to focus directly on soil microfauna and microflora given the absence of agriculture in the shoreline environments of this project class.

4.4 Issues Scoping

The scope of the environmental assessment for routine in-water projects must remain consistent with management directions already initiated with respect to ecological and cultural integrity and the quality of visitor experience as outlined and assessed in the management plans for the two canals as well as in Parks Canada’s draft “Rideau Canal and Trent-Severn Waterway national Historic Sites of Canada – Policies for In-Water and Shoreline Works and Related Activities (June, 2004). The mitigation identified within the RCSR will be consistent with the management plans, human use strategies and any other appropriate documents.

Section 3 of the RCSR identified all of the activities associated with each sub-class that have the potential to impact the environment (prior to mitigation). These are activities that may disturb the existing environment in some way (e.g. physically altering waterbody substrates or physically changing aquatic habitat) or that introduce new components to the existing environment

(e.g. noise, air emissions, increased boating activity). Section 4.3 listed the VECs that exist in the study areas. The “issues” are identified, from the potential interaction of the activities with the VECs. Section 4.5 contains the predicted environmental effects resulting from these interactions and a determination if there are residual environmental effects following the application of known and effective mitigation measures.

4.5 Potential Environmental Effects and Mitigation

Table 4.1 represents the range of effects that can potentially impact the VECs and is used as the basis to assess potential environmental effects by project activity and prescribe mitigation measures.

TABLE 4.1: Potential Environmental Effects

Valued Environmental Component	Potential Environmental Effect
Air and Noise Quality	• Decreased ambient air quality (i.e., due to dust or other particulate matter, exhaust from machinery)
	• Increased ambient noise levels
Topography and Landscape	• Changes in slopes, landforms and landscape diversity
	• Ground subsidence from soil thaw, poor excavation and backfilling practices; ground surface mounding/structure movement due to frost heave from inappropriate backfill material or shallow foundation depth.
	• Increased soil compaction due to heavy equipment
	• Increased soil exposure resulting in erosion, sedimentation, slope instability and risk of slumping
Soils	• Disturbance to soil microfauna and microflora
	• Contamination of soil through equipment leakage
Surface Water Hydrology	• Adverse modifications to physical drainage patterns, stream or shoreline morphology
Surface Water Quality	• Reduced water quality and clarity due to increased erosion, sedimentation, transport of debris, point or non-point sources of pollution (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater input, inputs of contaminants from construction activities and from surface runoff)
Aquatic Sediments	• Physical alteration of waterbody substrates and/or increased potential for release of sediments downstream, including contaminated sediments
Groundwater Quantity and Quality	• Groundwater contamination from point or non-point sources of pollution (e.g. disturbance of contaminated soils, land discharge of contaminated waters, leaks and accidental spills)
	• Changes in groundwater flow patterns, recharge and levels in aquifers and yields of wells due to dewatering or interception of aquifers, changes to infiltration, changed flow patterns or damage to wells.
Aquatic Habitat and Species	• Reduced fish biomass and diversity due to mortality from physical activities and/or releases of deleterious substances
	• Disruption to fish spawning and migration
	• Physical changes to aquatic biota and habitat (e.g. change in water levels and flow volumes, damage or loss of riparian habitat, base flows and water temperature)
Terrestrial Habitat and Species	• Physical damage and loss of vegetation and habitat (including riparian habitat)
	• Reduced terrestrial habitat quality (e.g. diversity, area, function) and/or increased fragmentation of habitat
	• Disruption to wildlife and vegetation from changes in surface water and groundwater quantity and quality, loss of cover
	• Bioaccumulation of contaminants by wildlife species
	• Introduction of non-native species, including opportunistic species, predators and parasitic nesters

In order to assess the potential project/environment interactions, tables, further discussed in Section 4.8, were devised outlining the potential environmental effect of each scoped activity on VECs, the recommended mitigation and a rating of the significance of potential residual effects.

The design practices and mitigation measures reflect accepted environmental best management practices and standards for the construction (repair), operation and, where applicable, decommissioning of the sub-classes included in this RCSR. A listing of sources for this information is provided in Appendix D and reflects provincial and federal regulatory requirements, criteria and guidelines. Additional mitigation measures were provided through discussions with Rideau and TSW staff and review of documentation provided by them.

4.6 Effects of the Environment on the Projects

Effects of the environment considered in this EA include weather-related events and climate change. The potential environmental effects of these occurrences together with mitigation measures are presented in Table 4.3. Given standard good management practices before and during all phases of the project activities, all are mitigable and adverse environmental effects are not likely to occur.

4.7 Effects of Accidents and Malfunctions

Accidents and malfunctions considered in this EA include vehicle collisions, fires and spills/leaks. The potential environmental effects of these occurrences together with mitigation measures are presented in Table 4.4. Given standard good management practices before and during all phases of the project activities, all are mitigable and adverse environmental effects are not likely to occur.

4.8 Analysis and Prediction of Significance of Residual Adverse Environmental Effects

Accounting for sub-class project activities, accidents and malfunctions and effects of the environment on the projects, potential adverse environmental effects and mitigation strategies (See Tables 4.2-1 to 4.2-10 in Appendix E) indicate the significance of any residual effects (final column in each table).

The assessment of significance was undertaken by considering the *magnitude, geographic extent, duration, frequency of occurrence, reversibility and ecological/historical context,* as defined in Table 4.5. Based on consideration of these definitions, each project/environment residual effect was rated as either negligible (N), a minor adverse impact (M), or a significant adverse impact (S), also defined on Table 4.5.

As can be seen in the tables, the majority of residual effects are considered negligible. In these cases, given the implementation of successful mitigation practices, the level of disturbance is considered low and the extent of that disturbance is limited to the footprint or specific project site. The duration of the effect is limited to the short-term for site preparation, construction and/or decommissioning phases only and the environmental effects have been determined to be one-time events. There is likely to be no risk to ecological or commemorative integrity.

Few environmental effects are considered to be minor adverse effects. These are due to one or more of the significance criteria considered to be a “moderate” impact rather than a “low” impact. In these cases, the activity may extend beyond the footprint of the project site, but environmental effects on adjacent properties must be considered when deciding on mitigation measures. The

TABLE 4.3: EVALUATION OF EFFECTS OF THE ENVIRONMENT ON PROJECT SUBCLASSES

Environmental Condition	Potential Environmental Impact	Mitigation	Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	Significance of Residual Effects
Weather-related events (e.g. extreme rainfall, flooding, wind storms, ice jamming, drought	• damage or adversely affect the physical integrity of in-water works projects and the success of construction activities (may increase runoff and sedimentation) • A significant change in water flow/currents or ice movements can adversely affect the physical integrity and safety of certain water infrastructure and soil erosion could result in exposure of infrastructure, e.g. bridge abutments	• proper planning and consideration by the proponent of the viability of the operation, ensuring adequate design measures to take into account this possibility and restricting work during wet weather, if possible • proper design and siting and standard operation, maintenance and repair procedures are also critical	L	L	L	L	M	N
Climate Change	• Water level rise may implicate water infrastructure through changing water levels and water quality, weather patterns, temperature changes, and the likelihood of more extreme precipitation events	• proper planning and consideration in the design and siting stage to ensure the viability of the structure or operation under a variety of conditions	L	L	L	L	M	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.4: EVALUATION OF POTENTIAL EFFECTS OF ACCIDENTS AND MALFUNCTIONS ON PROJECT SUBCLASSES

Accident or Malfunction	Potential Environmental Impact	Mitigation	Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	Significance of Residual Effects
Vehicle Collisions with wildlife or humans	• injury to the public, to workers or to wildlife.	• post signs in areas of known wildlife habitat/crossings • avoid encroachment of activities near active nests, dens, burrows, etc. • keep within speed limits on roadways • minimize the number of vehicles on-site • ensure trucks and heavy equipment are equipped with back-up signals and indicators • use a flag person in heavy traffic areas	L	L	L	L	M	N
Spills/Leaks	• potential contamination of groundwater, surface water and aquatic/terrestrial resources • potential injury to workers and/or public	• follow Workers Compensation Board regulations and normal safety procedures • ensure refuelling and handling of contaminants occur well away from all aquatic habitats • prepare emergency response plans and maintain emergency equipment (spill kits) on site • capture, contain and clean up spills and leaks immediately. Immediately notify local authorities of a reportable spill	L	L	L	L	M	N
Fire	• decreased air quality • potential contamination of soils • loss of cover • potential injury to public, workers • disruption/loss of access to property	• maintain trained work force and compliance with all occupational health and safety requirements • eliminate sparking equipment near refuelling or fuel storage • provide adequate fire fighting equipment on-site • provide temporary alternative access to property • maintain contact with fire departments during construction; notify them immediately in event of a fire • after fire, clean up by disposing of burnt materials appropriately; incorporate ashes into soils and revegetate property with native species	L	L	L	L	M	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.5: SIGNIFICANCE CRITERIA DEFINITIONS

Criterion	Low	Moderate	High
Magnitude	• Low, baseline level of disturbance/ damage	• Moderate level of disturbance/damage (value or level less than that which may affect quality, quantity, value or use of VEC)	• High level of disturbance/damage (may measurably affect quality, quantity, value or use of VEC)
Geographic Extent	• Limited to project site/footprint	• Likely extends to areas adjacent to project site/footprint, but remains within Parks Canada lands	• Likely extends into areas beyond lands adjacent to project site/footprint or beyond Parks Canada lands
Duration/ Frequency of Effect	• Effect is most likely to be evident during site preparation, construction/repair and/or decommissioning only; conditions or phenomena causing the effect occur only once	• Effect is likely to be evident during site preparation, construction/repair, decommissioning and/or operations phase of project (or, if no operations phase, for a period of days to weeks); conditions or phenomena causing the effect may occur more than once, but infrequently	• Effect is likely to be evident beyond the life of the project or longer than one month; conditions or phenomena causing the effect are likely to occur at regular or frequent intervals
Reversibility	• Effects reversible over short term without active management	• Effects reversible over short term with active management	• Effects reversible over extended term with active management or effects are irreversible
Ecological/Histo r-ical Context	• Little or no risk to ecological and/or commemorative integrity	• Small impact to ecological and/or commemorative integrity	• Ecological and/or commemorative integrity at risk

"Negligible" Residual Effect (Not Significant) - those environmental effects assessed to have a "low" level of significance for the majority (i.e. at least 3 out of 5) of the criteria described above and not assessed as "moderate" or "high" for magnitude or reversibility.

"Minor" Adverse Residual Effect (Not Significant) - those environmental effects assessed to have "low" or "moderate" level of significance for the majority (i.e. at least 3 out of 5) of the criteria described above; any effect assessed as "moderate" or "high" for either magnitude or reversibility (but not both) is considered to be a minor adverse effect (not significant).

"Significant" Adverse Effect - those environmental effects with a magnitude approaching that which has a measurable effect on a VEC and:

- Effect extends into areas beyond those adjacent to the project site/footprint boundary;
- Effect is evident beyond the life of the project;
- Conditions or phenomena causing the effect occur at regular or frequent intervals; and Effect is permanent

effect may occur once or more than once and any anticipated environmental effects are either reversible with active management or mitigation. In all cases, the recommended mitigation measures are known to reduce the adverse environmental effect to insignificant levels.

4.9 Potential Cumulative Environmental Effects

Cumulative environmental effects are those that result from the interaction of multiple projects with each other and with the environment. Over the past 150 years, a diverse range of cumulative environmental effects have occurred on the natural, cultural and socio-economic environments surrounding the canals. The stressors that have caused these impacts include: the initial loss of forested land and wildlife habitat to flooding during canal construction; the subsequent loss of some aquatic wetland and island habitats, and creation or modification of other aquatic wetland and island habitats; dredging, water level management, shoreline residential development, residential and industrial discharges, tourism and recreation, resource consumption (e.g. aggregate extraction, forestry), farming, climate change, pollution (industrial, residential), introduction of exotic species (through transport by boats, landscaping efforts, use of fill, seeds from bird droppings, etc.) and fire control. These are a few of the past and existing stressors that have and currently, impact the integrity of the two national historic sites. Many of these identified stressors are expected to continue into the future as the waterways deal with increased pressure from larger projects such as subdivisions, marinas, golf courses, etc..

It is important to note that enhanced knowledge of management techniques, mitigation measures and planning strategies are integral components of Parks Canada's to manage cumulative environmental effects and to deal with users of the waterway systems. A number of the above-mentioned stressors and resulting cumulative environmental effects originate from adjacent land uses or from users of the Canal system. Throughout the years, the focus of planning and management within national historic sites has changed, through increased recognition of the importance of managing cultural and natural ecosystem resources, changes in demographics and leisure time preferences, changing mandates and increasing public education. Ongoing improvements to Canal and Waterway policies, including the recent update of shoreline policies, and input into municipal planning wherever possible, are ways in which these management techniques are implemented.

Historic site management plans are considered by Parks Canada to be the appropriate mechanism for the identification and management of cumulative environmental effects. Each historic site management plan establishes the context and vision for the site, guided by the *Canada National Parks Act.*

Each management plan identifies, in general terms, the influences that exist on the natural and cultural resources from both inside and outside the site boundaries. These were mentioned above. Strategic goals, objectives and actions are developed in the plans to address any negative effects of these influences, often termed “stressors”, along with the identification of indicators of change and valued components of the environment. Each management plan specifically addresses effective human use management and prescribes strategic goals, objectives and key actions to be implemented. All management plans are subject to strategic environmental assessment in accordance with the *1999 Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* before the plan is signed off by the Minister.

The VECs selected as part of the RCSR were either identified in the management plans of the TSW and Rideau Canal or through the scoping process, therefore reflecting all potential effects that may have the ability to cause cumulative environmental effects.

This RCSR has focused on six sub-classes that have negligible, short-term and mitigable environmental effects on the identified VECs. No *significant* adverse environmental effects were found between any VEC and a project activity. The environmental effects are most likely to be negligible and in a few cases, minor. In addition, the effects are reversible, which is a key component to restoring the environment to a condition similar to what it was before the disturbance.

The activities of repairing a bridge or boathouse; and/or dewatering (for the purpose of repairing a lock) are routine in nature and short-term in duration (2 weeks). As well, maintenance and operational activities do not introduce any new structure or entity to the existing environment, are routine in nature and a short in duration. The installation of docks, shoreline stabilization structures, or launch ramps has the potential to contribute to the larger-scale, ongoing development pressures on the two waterways. For that reason, the mitigation measures and restoration strategies presented in this document must be adhered to, in order to ensure that the predicted environmental effects are minor, reversible and short-term.

Following is a summary of the findings from Tables 4.2-1 to 4.2-10, organized according to each VEC. In each case, an explanation of any potential cumulative environmental effects is provided.

Cumulative environmental effects to Air and Noise Quality

Given the short duration (two weeks) of most of the projects, applicable municipal noise by-laws and standard codes of practice for minimizing air pollution, the effects anticipated from project activities have been assessed as negligible in all but one case. Where the effects are negligible, no assessment of cumulative environmental effects was completed. In rare instances, there may be the potential for minor cumulative environmental effects in the operation of docks and launch ramps, where the operation of additional boats on the waterway may have the potential for an increased overall effect on the visitor experience and, perhaps, the peaceful surroundings sought by residents and cottagers. Enhancing the distribution of educational materials to boaters regarding noise control and by working cooperatively with marinas, businesses that sell recreational vessels and cottaging/lake associations, would reduce the minor cumulative environmental effect to negligible.

Cumulative environmental effects to Topography and Landscape

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

Cumulative environmental effects to Soils

While most cumulative environmental effects were found to be negligible in relation to this VEC, there were a few activities assessed to have the potential for minor cumulative environmental effects. The activities that may have the potential for a minor cumulative environmental effect to *soil microfauna and microflora* include:

- Access and operation of heavy equipment
- Shoreline excavation
- Removal of terrestrial vegetation

The activities that may require some active management to reduce the cumulative environmental effects of *increased soil compaction due to heavy equipment* include*:*

- Shoreline excavation
- Construction of a rock access road
- Access and operation of heavy equipment

The activities that may require some active management to reduce the cumulative environmental effects of *increased soil exposure* include:

- Shoreline excavation

Mitigation measures prescribed in the RCSR, including maintaining a consistent access route and regrading/revegetating, will reduce these cumulative environmental effects to negligible levels. In some cases more active management may be necessary. This may require Parks Canada to ensure that the rehabilitation efforts be checked to verify that they are adequate and successful in restoring the site to its original condition. This may be specified in the permit.

Cumulative environmental effects to Surface Water Hydrology

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

Cumulative environmental effects to Surface Water Quality

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

Cumulative environmental effects to Aquatic Sediments

While most impacts were found to be negligible in relation to this VEC, there were a few activities assessed to have the potential for minor cumulative environmental effects. The activities that may have the potential for minor cumulative environmental effects to a waterbody's substrates and/or aquatic sediments include:

- Construction of rock access road
- Access and operation of heavy equipment

Mitigation measures prescribed in the RCSR including the installation of erosion control devices and having knowledge of the sediment types and habitat conditions on adjacent properties will reduce these cumulative environmental effects to negligible levels. In some cases more active management may be necessary. This may require Parks Canada to ensure that the rehabilitation efforts be checked to verify that they are adequate and successful in restoring the site to its original condition. This will be specified in the permit.

Cumulative environmental effects to Groundwater Quantity and Quality

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

Cumulative environmental effects to Aquatic Habitat and Species

While most cumulative environmental effects were found to be negligible in relation to this VEC, there was one effect assessed to potentially have a minor adverse impact - the anticipated *physical changes to aquatic biota and habitat* through the:

- Removal of terrestrial vegetation
- Shoreline excavation
- Operation and access of heavy equipment

While mitigation measures will help to minimize the effects of these activities, in some cases the disturbance will be unavoidable and it is in those cases that more active management at the site may be necessary to ensure that measures are successful. These activities are not permitted in areas where significant habitat is located, but if any habitat disturbance is anticipated, there are mitigation measures to ensure the site is restored.

Cumulative environmental effects to Terrestrial Habitat and Species

While most cumulative environmental effects were found to be negligible in relation to this VEC, there was one effect assessed to potentially have a minor adverse impact - the anticipated *physical damage and loss of terrestrial vegetation and habitat* through the:

- Removal of terrestrial vegetation
- Shoreline excavation

While mitigation measures including minimizing the extent of removal and replanting with native species will help to minimize these effects, in some cases the disturbance will be unavoidable and it is in those cases that more active management at the site may be necessary. This may require that the rehabilitation efforts be checked to ensure they are adequate and successful to restore the original site conditions. This will be specified in the permit.

Included in the cumulative environmental effects assessment is the consideration of species at risk and/or their habitat. Success in this regard will require a comprehensive database of rare species occurring within the Rideau and TSW systems and better integration of resource protection information and requirements into cultural management objectives**.** A preliminary inventory on the Rideau indicated less than 20 species at risk while the TSW indicated that there are more than 70 species at risk along their system.

Cumulative environmental effects to the Socio-Economic Environment

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

Cumulative Environmental Effects to Cultural and Heritage Resources

Any cumulative environmental effects anticipated in relation to this VEC were assessed to be negligible and, therefore, no assessment of cumulative environmental effects was completed.

In the context of cumulative environmental effects, project activities will not have the potential to impact to any historical and current stressors identified earlier in the RCSR. In fact, many of the restoration activities required by Parks Canada for work on their property either provides for positive environmental effects or improves the existing condition of the surrounding environment.

5.0 ROLES AND RESPONSIBILITIES

5.1 Federal/Provincial/Local Coordination

Parks Canada, as the only RA, will review all proposed projects and provide a response to the proponent as soon as possible. Given the specificity of projects that fall within this RCSR, it is expected that Parks Canada will be the only federal agency involved in the environmental assessment and approval of projects captured by this RCSR.

Parks Canada (for both the Rideau and TSW), through the written federal/provincial agreement, Protocol for the Fish Habitat Referral Process in Ontario (Fisheries and Oceans Canada et al., 2000) has authority to review all proposed works along their systems for potential impacts on fish habitat under Section 35 *Fisheries Act*. Under this protocol, initial requests for any in-water work proposals on the two canals are submitted to Parks Canada by proponents, contractors, Ministry of Natural Resources (MNR), DFO, Conservation Authorities. Parks Canada reviews the project to determine if a Harmful Alteration, Disruption or Destruction of fish habitat (HADD) is anticipated. Upon the determination that a HADD is required, the RCSR **does not** apply and an individual assessment under the Act will be undertaken for the project.

Parks Canada also has an agreement with Transport Canada whereby they may make a judgement as to whether a project has a NWPA requirement. If a NWPA permit is required the RCSR does not apply and an individual assessment under the Act will be undertaken for the project.

6.0 PROCEDURES FOR AMENDING THE REPLACEMENT CLASS SCREENING REPORT

6.1 Term of Application

The declaration period for this RCSR is 5 years.

6.2 Amendment Procedures

The purpose of an amending procedure is to allow the modification of the RCSR after experience has been gained with its operation and effectiveness. The reasons for such modification may include:

- clarification of ambiguous areas of document and procedures;
- streamlining or modifying the planning process in areas where problems may have arisen;
- minor modifications and revisions to the scope of assessment to reflect new or changed regulatory requirements, policies or standards; and
- new procedures and environmental mitigation practices that have been developed over time.

It should be noted that Parks Canada has a number of relevant ongoing initiatives, including: upcoming inventories of Species at Risk; updated and revised Parks Canada shoreline policies; and changes to the Exclusion List under the Act. Once these initiatives are available, this RCSR will be formally amended to include them.

The RA will notify the Agency in writing of its interest to amend the RCSR. It will discuss the proposed amendments with the Agency and affected federal and provincial government departments and may invite comment from stakeholders and the public on the proposed changes.

The RA will then submit the amended RCSR to the Agency, along with a request that the Agency amend the RCSR and a statement providing a rationale for the amendment.

The Agency may amend the RCSR without changing the declaration period if the changes:

- are minor;
- represent editorial changes intended to clarify or improve the screening process;
- do not materially alter either the scope of the projects subject to the RCSR or the scope of the assessment required for these projects; and
- do not reflect new or changed regulatory requirements, policies or standards.

The Agency may initiate a new declaration for the RCSR for the remaining balance of the original declaration period or for a new declaration period if the changes:

- are considered to be substantial; or
- represent modifications to the scope of the projects subject to the class or the scope of the assessment required for these projects.

7.0 REFERENCES

Fisheries and Oceans Canada & Parks Canada, 1998. Record of Agreement between the Department of Fisheries and Oceans and the Department of Canadian Heritage, Parks Canada.

Fisheries and Oceans Canada et. al., 2000. Protocol for the Fish Habitat Referral Process in Ontario.

Parks Canada. 1994. Guiding Principles and Operational Policies.

GLOSSARY OF TECHNICAL TERMS

Boathouse
A building usually built partly over water for the housing or storing of boats and often provided with accommodations for gear or general storage.

Canadian Environmental Assessment Registry (CEAR)
An electronic Internet listing of all environmental assessments conducted by all Responsible Authorities under the CEAA; the listing is called the Canadian Environmental Assessment Registry (CEAR) and is available to the public through the Agency's Internet site.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
Committee on the Status of Endangered Wildlife in Canada is a committee of experts that assesses and designates which wild species are in some danger of disappearing from Canada.

Committee of the Status of Species at Risk in Ontario (COSSARO)
Provincial Committee in Ontario integrated with the work of the Committee on the Status of Endangered Wildlife in Canada. In Ontario, species at risk may be listed either provincially or nationally, or both.

Cumulative Environmental Effects
The effect on the environment, which results from effects of a project when combined with those of other past, existing and imminent projects and activities; These may occur, over an extended period of time and distance.

Decommissioning
The sealing, dismantling, and/or removal of a physical work where the operation or use has permanently ceased and service has been discontinued; decommissioning is often regulated or carried out in accordance with standards or pre-defined conditions designed to ensure safety and security and to mitigate potential environmental effects.

Dewatering
Dewatering is the process of pumping water from the interior of a lock, or of excluding water from an excavation, by the use of pipes sunk round the perimeter, with continuous pumping.

Dock
A dock is the waterway extending between two piers or projecting wharves or cut into the land for the reception of ships.

Environment
The components of the Earth, including
a) land, water, air, including all layers of the atmosphere,
b) all organic and inorganic matter and living organisms, and
c) the interacting natural systems that include components referred to in (a) and (b).

Environmental Effect
a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as defined in SARA;
b) any activity of the project that changes the health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes by

aboriginal persons or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
c) any change to the project that may be caused by the environment.

Erosion
Erosion is the removal or washing away of soil and rock particles by the action of wind or running water.

Federal Authority
Federal authority is a Minister of the Crown, an agency or body accountable in right of Canada. Federal Authorities may provide expert advice to the Responsible Authorities for environmental assessments.

Fish Habitat
Under the federal *Fisheries Act,* "fish habitat" is defined as: spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their "life processes" . The *Fisheries Act* also defined "fish" to include all the life stages of "fish, shellfish, crustaceans, marine animals and marine plants".

Follow-up program
A program for verifying the accuracy of the environmental assessment of a project; and/or determining the effectiveness of any measures implemented to mitigate the potential adverse environmental effects of the project.

Footprint
The area of land occupied by a building or structure at ground level.

Groundwater
Water, which is found in the saturated subsurface zone where water completely fills all the soil or rock pores.

Historic Canal
An administrative term, which refers to canals operated by Parks Canada for purposes of navigation, as well as for protection and interpretation of their cultural and natural heritage values.

Launch Ramp
A launch ramp is an inclined plane facilitating the sliding of a boat from a trailer into water.

Lock
A lock is an enclosed part of a watercourse (canal, waterway, etc.) equipped with gates so that the level of the water can be changed to raise or lower boats from one level to another.

Migratory Bird Sanctuary
Federal lands that are protected under the Migratory Bird Sanctuary Regulations.

National Historic Site
Any place declared to be of national historic significance by the Minister responsible for Parks Canada. A place that is commemorated under section 3 of the *Historic Sites and Monuments Act* and is under the administration of the Parks Canada Agency

National Park
Federal lands or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation inimical to the purposes of designation of the area; and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Physical Work
Human-made structures/equipment/materials set in a fixed location. Physical works do not include constructed items that are portable (e.g. table, tractor).

Polluting Substance
A substance that, if added to a water body, is likely to degrade or alter or form part of a process of degradation or alteration of the physical, chemical or biological conditions of the water body to an extent that is detrimental to its use by human beings, animals, fish or plants.

Project
- In relation to a physical work, any proposed construction, operation, modification, decommissioning, abandonment, or other undertaking in relation to that physical work; or
- *Any proposed physical activity not relating to a physical work that is prescribed in the CEAA* regulations.

Residual Environmental Effects
Residual Environmental Effects are found when a project still has adverse effects even after mitigation is applied. Thus, residual effects are the effects remaining after mitigation.

Responsible Authority
A federal authority that is required to ensure that an environmental assessment is conducted for *a project, which has a CEAA trigger*.

Scope of Project or Assessment
Both the scope of the project and assessment need to be delineated in the environmental assessment. Scoping refers to determining the spatial and temporal boundaries i.e., what area is affected and for how long. Scope of the project refers to what activities or works are triggered *by CEAA. Scope of the assessment refers to the area and duration of environmental effects* considered within the assessment.

Sediment
Sediment is made of particles of earth from sources such as clay, topsoil or sand. Sediment can originate with agricultural irrigation, destruction of the riverbanks, or any other cause. Sedimentation in a river or other watercourse is said to occur when it has excessive quantities of sediment. Such sediment ultimately covers the bottom of the watercourse and can suffocate the aquatic organisms that live there.

Significant Adverse Environmental Effects
For the environmental assessment, adverse effects are judged as to whether they are likely and significant. Adverse effects occur if the project degrades the quality of the environment. Significance is determined by evaluating severity of impacts based on the duration and frequency, and the area affected by the project, including cumulative effects.

Significant Habitats
Significant habitats are areas of special interest or concern for a number of reasons: the existence of endangered or threatened species; unusual concentrations of wildlife or fish; or unusual or unique ecological associations or uncommon land forms. Such habitats often contain intensely concentrated resources meeting fish and wildlife needs within a limited geographic area. In many cases, significant habitats are a critical fraction of total species habitats. Their loss could affect species distributions or existence.

Species at Risk
The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) defines Species at Risk as

- species identified on the List of Wildlife Species at Risk set out in Schedule 1 of the *Species at Risk Act (SARA*), and including the critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act.*
- species that have been recognized as "at risk" by COSEWIC, COSSARO (Committee on the Status of Species at Risk in Ontario) or by provincial or local authorities.

Valued Ecosystem Component (VEC)
Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.

Water Body
For purposes of applying the Exclusion List Regulations, a water body means a water body, including a canal, ocean, and wetland, up to the high-water mark, but does not include' a sewage or waste treatment lagoon or a mine tailings pond.

Wetland
A swamp, marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year; For more clarity, wetlands can be defined in terms of the presence of wetland vegetation -- i.e., land that has the water table at, near, or above the surface or which is saturated for a long enough period to promote wetland processes that are indicated by the presence of wetland vegetation (e.g., reeds, rushes, cattails, and sedges).

APPENDICES:

Appendix A: Typical Environmental Setting

Rideau Canal

Natural Environment

The natural environment of the Canal Corridor, including wetlands and undeveloped shore lands, is important to the environmental health of the Rideau. Sixteen percent of the Canal's shoreline is wetlands (190 km), including 28 provincially significant wetlands. Over half of the Canal's shore land is still undeveloped. These areas contribute to the Canal's natural beauty, benefit the local tourism industry and help in maintaining a healthy environment.

Location and Access

The Rideau Canal corridor extends from Ottawa to the northeast to Kingston in the southwest and encompasses a chain of lakes, rivers and 19 km of constructed canal cuts (see Figure 1). The main channel is 202 km long and rises to the summit at the head of Upper Rideau Lake at Newboro, 407 feet above sea level. The main navigation channel north of and including Upper Rideau Lake is 137 km long and drops 273 feet via the Rideau River to the Ottawa River through 31 navigation locks. The navigation channel south of Upper Rideau Lake is 63 km long and drops 164 feet through 14 locks to the St. Lawrence River via the Cataraqui River. The total watershed area is 4,640 square km, including portions of the Cataraqui and Rideau River watersheds. The corridor winds through five counties (Carleton, Grenville, Lanark, Leeds and Frontenac) and numerous municipalities, each supporting a variety of land uses including agricultural, rural, urban, forest, recreational, commercial and industrial. It is bounded by the watersheds of Mississippi and Salmon Rivers to the west, the Ottawa River to the north, the South Nation and Gananoque rivers to the east, and the St. Lawrence River to the south (Acres Consulting Services Ltd., 1977). Access to the Canal is possible at all of the Canal's 24 lock stations and by way of marinas, resorts, public boat launches, parks and conservation areas. The Tay Canal, which provides a navigation route northwest to the town of Perth, also connects to the Rideau Canal (Saunders, 2002).

The Rideau watershed has a drainage area of 3,730 sq km to Hogs Back, Ottawa, and consists of two main sub basins: the lakes region upstream from Poonamalie lock near Smiths Falls with a drainage area of 1,270 sq. km; and the region downstream between Poonamalie and Hogs Back with a drainage area of 2,460 sq. km. The upstream basin contains four main reservoir lakes in the Rideau watershed (Upper Rideau, Big Rideau, Bobs and Wolfe Lakes). Downstream of Poonamalie, the watershed consists of small tributary streams with only limited water storage in the canal itself. The main tributaries in the Rideau basin are the Tay River, which flows into Lower Rideau Lake a short distance upstream from Poonamalie, and the Jock River and Kemptville Creek, which are located in the downstream part of the basin (Acres Consulting Services Ltd., 1977).

The Cataraqui watershed drains southward to the St. Lawrence and has a drainage area of 910 sq. km upstream from Kingston Mills. The basin contains ten reservoir lakes. The Rideau Canal regulates five of these (Newboro, Opinicon, Sand and Cranberry Lakes and the River Styx). The largest reservoirs of these five are Newboro Lake and Cranberry Lake, which have surface areas of 2,800 ha and 2,600 ha, respectively (Acres Consulting Services Ltd., 1977).

Physiographic Regions

The Rideau Canal Corridor is part of the St. Lawrence Lowlands ecosystem. There are four major natural landscapes within the Canal Corridor, each supporting distinctive vegetation and wildlife, and each lending itself to certain patterns of use. All four areas have their own unique patterns of topography, geology, and geomorphology as well. They are subdivisions of the land region and are separated principally upon their physiographic and geologic patterns.

At the Kingston end of the system, the Napanee Plain dominates. This district is a limestone belt with one of the most significant wetlands on the system – the Greater Cataraqui Marsh.

The Frontenac Axis extension of the Precambrian rock intrusions of the Canadian Shield dominates the rugged landscape between Rideau Ferry and Kingston Mills, giving it a wild and untamed appearance. The white pine and oak forests once fed a flourishing lumber industry. Deposits of deeper soils around Westport and south of Seeleys Bay allow for intensive agricultural activities. The flooding of low areas by Canal construction created large wetlands, especially in Newboro and Colonel By Lakes.

The Frontenac Axis dominates the landscape eastward between Merrickville and Rideau Ferry where the landscape then becomes the shallow, poorly drained soils and exposed limestone of the Smiths Falls Limestone Plain. The vegetation in this area consists of strands of eastern white cedar, red maple and ash. Drier sites support sugar maple, beech and elm. This area has some of the largest provincially significant wetlands of the Rideau River system, the Kilmarnock-Easton, Tay and Swale-Bacchus marshes being among the more extensive in the province.

The Ottawa Clay Plain between Ottawa and Merrickville dominates the final stretch to the east of the corridor. This area is a flat, glacial till plain that is overlain in lower areas by sand and clay. The vegetation consists of sugar maple, elm and basswood on the upland sites, and ash, white cedar and alder in lowland areas. Wetlands once lined much of the shoreline, but adjacent land development has reduced the number and extent of these habitats.

Hydrology

The Rideau waterway is extensively regulated. There are competing demands for the water in the system – navigation, flood control, recreation, hydroelectric power, fish and wildlife, water supply and water quality. The water levels are maintained above minimum levels by a combined total of over 40 control structures (dams, waste weirs, etc.) through the navigation season. Flow through the system is regulated to optimize use of the Waterway (Ecologistics Ltd., 1984).

The most significant aspect of the hydrology of the Rideau and Cataraqui basins relates to differences in peak runoff rates in the major sub basins, due mainly to variations in the degree of flow regulation afforded by natural lakes and/or reservoirs.

Geology

The Rideau Waterway corridor lies along the western side of the Ottawa-St.Lawrence lowland. Within the corridor, the dominant types of bedrock are the Palaeozoic sedimentary formations and the crystalline Precambrian rocks. The flat-lying sedimentary bedrock can be found in the area from Smiths Falls to Ottawa and around Kingston. The formations are Ordovician in age and are mainly dolomitic limestone, sandstone and limited areas of shale. The Precambrian rocks are mostly metamorphic, with large areas of crystalline limestone and metasediments. There are also

some large plutons in the area, which are best exemplified by the rock Dunders near Jones Falls. The most prevalent formations in the Smiths Falls to Ottawa section are the March and Nepean sandstones. South of the Frontenac Axis, the Black River-Trenton group, composed of the Rockliffe shale and sandstone and Ottawa limestone, is most prevalent. Within the area of the Precambrian Shield, the predominant rock types fall into two groups: the Grenville rocks, composed of igneous granites, gabbro and syenites, and the Grenville metamorphic series including marble skarn, quartzite, gneiss and granulites (Arbour, J. & Hodges, J. A., 1979).

Water Quality

Prior to the construction of the Canal, the water of the two watersheds supported an abundance and diversity of fish and wildlife. Some lakes like Big Rideau have always been cold, clear and low in nutrients, while others such as the Upper and Lower Rideau are naturally warm and high in nutrients. The flooding of the land for the Canal accelerated the natural process of eutrophic change by releasing vast amounts of nutrients into the water, still affecting the water quality today on Upper Rideau, Newboro, Opinicon, Whitefish, Cranberry, Dog and Colonel By Lakes (Rideau Canal Management Plan, 1996), as well as the Cataraqui & Rideau Rivers.

Water quality within the Rideau Canal corridor is considered to be relatively good and supports a diversity of plant and animal life according to the scientists who participated in the Rideau River Biodiversity Project (Poulin, M., et al. 2001). It is acceptable for contact recreation and adequate for warm water fish and wildlife. The water, however, does not meet permissible limits for public water supply without treatment (Poulin, M., et al. 2001). Trends in dissolved oxygen, temperature, nitrates, phosphates, suspended solids and bacterial contamination for both Rideau and Cataraqui watersheds are similar. Generally, the levels are below what might be considered normal in relation to plant growth in the Waterway.

Water Quantity

The Rideau Canal is part of two watersheds: the Rideau River, which flows northeast to Ottawa, and the Cataraqui River flowing south to Kingston. Water management has been an integral part of the operation of the Canal for over 170 years. Water levels on the Canal are regulated to ensure sufficient draft in the navigation channel during the operation season. A system of reservoir lakes supplies water to the Canal when necessary. These lakes are “drawn down” as required throughout the summer and lowered substantially in the fall. This procedure provides storage for the spring freshet waters, reduces flooding potential downstream and ensures sufficient water for the next season (Rideau Canal Management Plan, 1996).

Water management is a delicate balancing act as it is not always possible to meet all the demands placed on this limited resource, especially during dry periods. Water levels must be managed to provide for through navigation while accommodating the diverse needs of natural resource management, recreation, flood abatement, municipal requirements and, where appropriate, hydro-electric power generation (Rideau Canal Management Plan, 1996).

Soils

The major soil types that occur along the Rideau corridor are:

- Orthic Melanic Brunisol
- Gleyed Humo-Ferric Podozol
- Gleyed Grey-Brown Luvisol

- Orthic Humic Gleysol
- Organic Soils

The Orthic Melanic Brunisol soils develop under deciduous trees on calcareous material with good to imperfect drainage. These soils are 40-50 cm deep and are good for dairy farming if drainage is enhanced. They occur between Smiths Falls to approximately Burritts Rapids and between Jones Falls and Burritts Rapids (Ecologistics Ltd., 1989). Gleyed Humo-Ferric Podzol soils develop under coniferous or mixed hardwoods and coniferous vegetation in poorly drained conditions. This soil occurs from Burritts Rapids to above Kars (near Osgoode) and south of Jones Falls to the banks of the St. Lawrence River (Ecologistics Ltd., 1989). Gleyed Grey-Brown Luvisol soils occur under deciduous or mixed forest on calcareous materials under imperfectly drained conditions (Ecologistics Ltd., 1989). Orthic Humic Gleysol soils also occur under deciduous vegetation in areas of poor drainage. They occur near Osgoode to Ottawa (Fitchko, J., 1986). Organic soils are generally mesic to humic in nature, seldom more than 1 m deep and are generally found in undrained depressions (Fitchko, J., 1986).

Most of the lands adjacent to the Rideau River between Kilmarnock and Merrickville have Class 2 soils with moderate limitations that restrict the range of crops or require moderate conservation practices, or both, due to excess water because of poor drainage. They also have Class 6 soils that are capable of only producing perennial forage crops, and improvement practices are not feasible due to shallowness (less than 1 m) to solid bedrock. Smaller areas are present with Class 1 soils with no significant limitations in use for crops, as well as Class 3 soils with moderately severe limitations due to stoniness, excess water or shallowness to bedrock, and Class 4 soils with severe limitations due to inundation (Fitchko, J., 1986).

Along the reach from Nicholson's to Burritts Rapids, the lands adjacent to the Rideau River have primarily Class 2 soils and Class 6 soils. Smaller areas are present consisting of Class 1 and Class 4 soils. The lands adjacent to the Rideau River along the reach from Burritts Rapids to Manotick have relatively equal representation of Classes 1 to 6 soils, as well as organic soils. Small pockets of Class 2 soils occur interspersed between areas of Class 6 and Organic soils north of Smiths Falls and Perth. Soils adjacent to the Old Slys site are Class 1 with the surrounding area to the east and south predominantly Class 6. These Class 6 soils continue east of the Rideau corridor form Smiths Falls to just north of Jones Falls (Fitchko, J., 1986).

The Tay site is surrounded by low capability, Class 6, 7 and 0 soils. South of the Tay site and west of the Rideau Corridor, Class 7 soils dominate. At Westport, along the south side of the Upper Rideau Lake, a pocket of good capability soils occur which range from Class 2 to Class 4. The surrounding area, including the Chaffey's Lock site consists of Class 7 soils (Ecologistics Ltd., 1989).

The Jones Falls site is within a small pocket of Class 4 soil. Adjacent and to the north is a small pocket of Class 2 soil and a larger pocket of a Class 1 and 4 complex. West and southwest of Jones Falls are Class 7 soils. Complexes of Class 1 to Class 4 soils predominate to the east and south of Jones Falls (Ecologistics Ltd., 1989).

A summary of the Class type soils in the Rideau corridor and their limitations are provided below:

- Class 1 with no significant limitation;
- Class 2 with moderate limitations due to excess water or adverse soils conditions;
- Class 3 with moderately severe limitations due to stoniness, adverse soil conditions or excess water;
- Class 4 with severe limitations due to adverse soil conditions or excess water;
- Class 5 with very severe limitations due to excess water;
- Class 6 capable only of producing perennial forage crops, and improvement practices are not feasible due to shallowness to bedrock; and
- Class 7 soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
- Organic soils (not placed in capability classes) (Fitchko, J., 1986).

Terrestrial Vegetation

The vegetation of the Rideau Waterway Corridor is within the Great Lakes-St. Lawrence Forest Region. This is a mixed-forest region that has developed from species having wide ranges of climatic tolerance. In the northern portion are species such as jack pine (*Pinus banksiana*) and balsam fir (*Abies balsamea*) suited to the rigors of moist, sub-arctic conditions, while to the south grow the walnuts (*Juglans nigra, Juglans cinerea*) and hickories (*Carya cordiformis, Carya laciniosa*) requiring deep soils and warm temperatures. Between, there is a dynamic intermeshing of northern species growing to their southern limits, and southern species at their northern-most advance in the wake of the most recent glacial retreat. At the southern end of the corridor, deep soils and more moderate climate have produced a predominantly deciduous forest dominated by sugar maple (*Acer saccharum*), elm (*Ulmus sp*.) and oak (*Quercus sp*.), with some individual white pine (*Pinus monticola*). The increasing altitude and exposure on the Precambrian-rock uplifted area increases the response of coniferous species, especially white pine, with accompanying sugar maple, basswood (*Tilia sp*.), and the oaks. On the thin soils of the plain from Smiths Falls to the Ottawa River, white cedar (*Thuja occidentalis*) becomes common as it does also in the moister low-lying areas. On the deeper and better-drained soils of the glacially modified landscapes, sugar maple, white elm (*Ulmus americana*) and basswood dominate. The absence of extensive white pine appears to relate to past logging practices, while plantations emphasize red pine (*Pinus resinosa*) stands, which in turn are now being replaced by hybrid species of poplar (*Populus androscoggin*) (Arbour, J. 7 Hodges, J. A., 1979).

The vegetation existing at present is the combined result of natural conditions for development and forces of disruption, and of man's activities both disruptive and restorative. In most of the corridor, the natural vegetational development has been set back. On the uplands, forestry practices have removed many individuals of pine, oak and maple (*Acer sp*.), and have allowed restoration to occur both by natural successional stages and artificially in managed woodlots and plantations. Vegetation patterns develop and change as individual species' populations wax and wane with altered environmental conditions (Arbour, J. 7 Hodges, J. A., 1979).

Aquatic Vegetation

Aquatic submergent vegetation growth has increased along the Rideau Waterway over the past 25 years. The corridor contains a wide range of plant diversity in most locations along its 202 km length (see Appendix B). As in other areas in southern Ontario, Eurasian milfoil (*Myriophyllum*

spicatum) has become the dominant invasive submergent aquatic plant species in many parts of the Rideau system, thus leading to serious problems with aquatic weeds in some sections of the canal navigation channel, and an increase in demand to control the extent of aquatic plant growth for recreational, aesthetic and navigational reasons.

There are also many species of shrub and trees such as Black Willow (*Acer nigrum*), Red and Silver Maples (*Acer rubrum* and *Acer saccharinum*) that inhabit the margins of swamps, marshes and other wetlands located on the Rideau Waterway.

Fish and Wildlife

Operating procedures for the various Rideau Canal structures are influenced by the need to preserve and enhance fish and wildlife habitat and populations in and around the various lakes and rivers. To date, primary attention had been given to lake trout (*Salvelinus namaycush*), walleye or yellow pickerel (*Stizostedion vitreum*), bass (*Micropterus sp.*) and various furbearing mammals in the watershed.

The principal trout lakes are Big Rideau (including Lower Rideau) and Devil Lake. Lake trout also exist in Dog, Loughborough, Buck, Kingford, Birch, Desert, Knowlton, Holleford and Canoe Lakes. Walleye occur primarily in Bobs, Wolfe and Upper Rideau Lakes as well as the Rideau River. Bass, northern pike (*Esox lucius)*, and other warm-water species exist in the Rideau and Cataraqui Rivers, as well as the shallow portions of most other lakes in both the Rideau and Cataraqui watersheds. Appendix B contains a listing of fish species found in the Rideau River between Ottawa and Smiths Falls in 1998 and 1999)

Muskellunge ((*Esox sp*.) are found in the middle section of the Rideau River. Around many of the lakes, there is suitable habitat for furbearing animals (especially beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mink (*M. vison*), weasel (*Mustella sp*.) and otter (*Enhydra sp*.)). Other areas of special environmental sensitivity in the Rideau and Cataraqui system include the Tay Marsh area upstream from Beveridges Lock (fish and muskrat); Lost Lake behind Colonel Bye Island; the Merrickville Bird Sanctuary & Marsh in the Rideau River; and fish sanctuaries in areas such as the northeast end of Newboro Lake. In addition, Westport Sand Lake is maintained at a constant level year round by the Ontario Ministry of Natural Resources for the benefit of the Westport fish hatchery.

As the landform changes between Kingston and Ottawa, so does the wildlife found along the canal. This change is most noticeable in the reptiles and amphibians where several species reach the northern extent of their range along the canal. The best-documented example of this trend is the black rat snake (*Elaphe obsoleta obsolete*), which is only found as far north as Westport and Colonel Bye Island and Murphy's Point Provincial Park in Big Rideau Lake. Other species that reach the northern extent of their range along the canal include the musk turtle (*Sternothaerus odoratus*), map turtle (*Graptemys geographica)*, five-lined skink (*Eumeces fasciatus*), and eastern ribbon snake (*Thamnophis sauritus*) (Weary, G. C. & Wegner, J. F., 1977). Amphibians and reptiles known to inhabit the Rideau Canal waterway are listed in Appendix B.

Birds found in the Cataraqui Marsh include red-winged blackbird (*Agelaius phoeniceus*), long-billed marsh wren, swamp sparrow, common gallinule, common and least bitterns, Virginia rail, sora, and blue-winged teal. In the fall, the shore of the Cataraqui River provides excellent vantage points for seeing migrating ducks. A listing of waterfowl identified in 1998 and 1999 along the Rideau Waterway is found in Appendix B.

Near the Seeley's Bay area, an active great blue heronry is located 2.5 miles west of Traverse Lake. A great blue heronry is also located in an elm swamp forest surrounded by a white oak ridge forest and aspen regeneration forest near Morton. The black rat snake is found in this area as well. The yellow-bellied sapsucker, an uncommon species in this area, breeds at Jones Fall and the fish sanctuary located here is a highly productive area harbouring thousands of bass, bluegill and pike.

Near the Chaffeys Lock area, map turtles and Blanding's turtles (a rare species) are especially common in both Sand and Opinicon Lake. Fish sanctuaries have also been established at the northeast and southwest corners of Opinicon Lake. Species found in this lake as well as in Indian, Benson and Mosquito Lakes include northern pike, and largemouth and smallmouth bass. Snapping turtles are very common in Indian Lake, as they are in many areas of the system. Rat snakes and their hibernacula are scattered throughout exposed bedrock areas throughout the north shore (and other areas) of Opinicon Lake, where considerable research on them has been carried out by graduate students and staff at the Queen's University Biological Station near Chaffeys Lock.

In the Portland area, at MacDonalds Bay, the common crayfish (*Orconectes virilis*) is found here and has a striking blue colour instead of the usual greyish green colour. Wildlife found northwest of Rideau Lake includes typical species like ruffed grouse, whitetail deer, wolf, red fox, and otter.

Other noteworthy species occurring here and elsewhere along the Rideau system are pileated woodpecker and great horned owl.

Significant Features

There are few truly rare submergent plant species located on the Rideau Waterway. Variable Milfoil (*Myriophyllum heterophyllum*) is considered locally rare and a few plants were observed at Brewers Mills. Three species of Bladderwort (*Utricularia vulgaris*) are considered locally rare. Naked Bladderwort (*Utricularia cornuta*) was identified in the Smiths Falls area and Creeping Bladderwort (*Utricularia gibba*) was identified in the Cataraqui Marsh and is rare in the Kingston area and uncommon in Ontario. Lesser Bladderwort (*Utricularia minor*), located in a cattail (*Typha*) marsh in the Cataraqui Marsh study, is rare in the Kingston region but has been identified in Lake Opinicon (Aquatic Management Services, 1992).

Horned Pondweed (*Zannichellia palustris*) washed ashore in the Cataraqui Marsh study and, therefore, has an uncertain origin. However, it is considered rare in the Kingston area and it has also been identified in Lake Opinicon. Southern Bushy Pondweed (*Najas guadalupensis*), located in the upper Cataraqui River, was considered rare in the Kingston area and uncommon in Ontario. This plant has been identified at Sand Lake, Lake Opinicon, Kingston Mills, Burritts Rapids, Smiths Falls and River Styx. Water Marigold (*Bidens beckii*), which is also referred to as *Megalodonta beckii,* was considered rare in the Kingston area, however, it has been identified in Smiths Falls and Chaffey's Locks (Aquatic Management Services, 1992).

Narrowleaf Waterplantain (*Alisma gramineum*) is an emergent aquatic species considered rare in Ontario. The presence of this aquatic species and southern bushy pondweed in the Rideau Waterway is the most northerly extension of these species, which normally grow in the southern regions of the United States (Aquatic Management Services, 1992).

Near the Ottawa area, in the Jock River, a pair of red-headed woodpeckers (a rare species in the Ottawa area) have nested in the open woodland at the north end of the small sugar maple-beech woodlot found here.

The MNR has designated 13 Areas of Natural and Scientific Interest within the Rideau Canal corridor, 8 of which are located directly adjoining the Rideau Canal. One of the most impressive sites is "Rock Dunder", a dramatic cliff consisting of a series of exposed rock outcrops overlooking Morton Bay, part of Whitefish Lake.

According to a preliminary inventory, there are less than twenty species at risk recorded along the Rideau Canal as shown in the following table.

Preliminary List of Species at Risk along The Rideau Canal

Scientific Name	**Common Name**	**COSEWIC Status**	**Provincial**
Elaphe obseleta	Eastern Rat Snake	THR - June 2007	
Leptogium rivulare	Flooded Jellyskin	THR	
Sternotherus odoratus	Stinkpot	THR - Jan 2007	
Ixobrychus exilis	Least Bittern	THR - June 2007	
Graptemys geographica	Map Turtle	THR	
Fontinalis sullivanti	A Moss		S1 G3G5
Carex typhina	Sedge		S2
Chenopodium foggii	Fogg's Goosefoot		S2 G3?
Hieracium paniculatum	Panicled Hawkweed		S2
Myotis leibii	Small-footed Bat		S2S3
Pinus rigida	Pitch Pine		S2S3
Pellaea atropurpurea	Purple-stemmed Cliffbrake		S3
Moxostoma valenciennesi	Greater Redhorse		S3
Polygonella articulata	Coast Jointweed		S3
Celithemis eponina	Halloween Pennant		S3
Alisma gramineum	Grass-leaved Water Plantain		S3S4 - Low
Chlidonias niger	Black Tern		S3B, SZN - NAR
Nyctophilus bifax	Northern Long-eared Bat		S3?

There are many more species listed as rare or under watch by ARVPO & OMNR respectively within the Rideau corridor listed in Appendix B (Snetsinger et al, 1998 and pers. comm., S. Lunn, 2004). Historically, the species considered "endangered" by COSEWIC along the Rideau corridor have included the Loggerhead Shrike (*Ladius ludovicianus)*, Prickly Pear Cactus (*Opuntia humifusa)*, the King Rail (*Rallus elegans)* and the Black Rat Snake (*Elaphe obsoleta)*. However, in the summer of 2001, Parks Canada staff and Ecological Services inventoried locations at which these species were thought to occur. In the case of the King Rail, no birds were detected. In the case of the Loggerhead Shrike, no suitable habitat of sufficient size was found on canal lands. No evidence of the Prickly Pear Cactus was found either. No actual Black Rat Snakes were seen during the inventory, but shed skins were observed and it was obvious that this species still inhabits the Waterway.

Socio-economic Environment

The Rideau Canal is extensive in size, diversity of land uses and opportunities and, as such, supports a varied social and economic environment. Since the late 1870s, the Rideau Canal has been a popular recreation destination and today, tourism is the single most important economic activity on the Canal (Parks Canada, 2000c). Land based visitors to the lockstations are estimated at over one million per year while another 1.4 million people use the Canal during the winter. According to an economic impact analysis carried out for the Rideau Canal National Historic Site, the Rideau Canal itself contributes over $24 million to national GDP and supports over 600 full-time jobs. The figures for tourism within the Canal may very well be considerably higher, and the costs of running the Canal are not small – approximately $8.7 million in operating and capital expenditures is spent annually (Saunders, K. E., 2002).

The Canal is closely tied to the activities and decisions ongoing within each municipality. The variety of jurisdictional boundaries and mandates (e.g. National Capital Commission, Parks Canada, Public Works, municipalities, Ontario Ministry of Natural Resources, Ontario Ministry of Environment and Energy, Conservation Authorities, Fisheries and Oceans, etc.) lends itself to mutual but at times conflicting interests, priorities and levels of understanding. Parks Canada has had mixed success at encouraging municipalities to recognize natural and cultural values of the Rideau Canal in their planning policies (Saunders, K. E., 2002).

The tourism and recreational opportunities offered within the Canal corridor stem from the heritage, natural and commercial resources available to the public. Tourists can enjoy boat cruises, watch the lockstations in operation, bike along the Canal roadways and picnic at scenic lockstations or nearby restaurants, visit the museums and other cultural exhibits along the corridor and take in the many attractions within the cities of Ottawa and Kingston. Recreational and resource uses within the Canal corridor are typically fishing, boating, hunting, fur-bearer trapping, hiking, jogging, cycling, cross-country skiing, snowmobiling, picnicking, sightseeing, and nature viewing. Boaters can enter the canal at Ottawa and, once through a series of locks over the 202 km journey to Kingston, can find themselves in Lake Ontario. While commercial traffic on the Canal ceased in the early 1900s, the Canal sees tens of thousands of recreational boaters each year and records 80-90,000+ vessel passages each year through it's 24 lock stations. The Tay Canal links boaters to the historic Town of Perth (Saunders, K. E., 2002).

Water levels are regulated and the Canal is managed to provide safe and adequate navigation. The primary function of the Canal has historically been for navigation purposes and the management strategy of Parks Canada is to provide this essential function while at the same time balance the concerns and expectations of shoreline owners, municipalities and hydro-electric generation requirements with the need to conserve the environmental resources (flora, fauna, etc.) along the Waterway (Saunders, K. E., 2002).

Cultural Environment

The Rideau Canal was first commemorated as a national historic site in 1926. Today, it is managed by Parks Canada as a national historic site in recognition of its contribution to Canadian heritage and as a 19th century operating canal. The canal was conceived during the unsettled period following the War of 1812 and was built by British military as part of its defence strategy for the Canadian colonies. Under the supervision of Lt. Colonel John By of the Royal Engineers, the Canal was constructed to join the Ottawa River to Kingston on Lake Ontario. Through a series of canal cuts, embankments, dams, along with 47 locks, the Canal linked the lakes and

rivers of the Cataraqui and Rideau systems to provide a secure transportation route away from the American border (Rideau Canal Management Plan, 1996).

The Rideau Canal and its associated landscape is one of the most fascinating areas of heritage value. The partly man-made, partly natural channel and the nearby lands through which it passes contain a network of historic themes illustrative of the early phases of settling and building of Upper Canada set within a significant natural context. Moving through the Rideau is moving through time, from awareness of the defensive preoccupations of our forefathers to the struggle of early settlement and farming. But moving through the Rideau is also moving through the landscape of Shield, lake and forest that shapes the idealized vision of nature that Easterners consider their birthright (Adams, N., Humphreys, B., Jacques, D., Oliver, M., Snetzinger, R., & Stovel, H., 1998).

Although there has been an interest in the Aboriginal history of the Rideau Canal area since 1895, actual archaeological knowledge of the area remains limited. The Rideau Canal Corridor and adjacent lands show evidence of occupation from as early as 5,000 B.C. (the Archaic period). The route of the Rideau Canal was previously traversed by various Aboriginal cultures long before the arrival of Europeans (Rideau Canal Management Plan, 1996).

The cultural landscape, characterized by concession roads, evenly spaced farmsteads and small fields surrounded by rail fences, is still evident in many parts of the Canal Corridor. The Canal corridor contains some well-preserved 19th century architecture, most notably the one and a half storey centre gable farmhouses built in stone, brick or wood. Remnants of early commercial and industrial structures remain intact in communities such as Merrickville. These landscapes and structures impart a sense of timelessness to the area, contributing to its charm and appeal (Rideau Canal Management Plan, 1996).

There is no comprehensive inventory of Level I terrestrial or underwater archaeological sites along the Rideau Canal. A series of underwater archaeological surveys have been carried out by Parks Canada over the past three years, from which additional marine artifacts have been documented. The evaluation approach is to treat all archaeological sites dating from the construction and military periods as level one cultural resources.

Examples of known archaeological sites of national significance include:

- The ruins of the engineers' building, the remains of the lime kilns, the remains of the Sapper's Bridge and the blacksmiths' shop - all at Ottawa Locks;
- The original dam at Merrickville (underwater site);
- The construction camp at Newboro;
- The remains of the submerged bridge at the Jones Falls dam (underwater site);
- The guardhouse remains at Jones Falls;
- The guardhouse remains at Morton Dam.

An inventory of archaeological sites within the Rideau Canal Waterway is available. Canal staff must ensure they refer to this listing prior to using the RCSR.

The Trent-Severn Waterway

Natural Environment

Location and Access

The TSW is a 386 km inland corridor of lakes and rivers in southern Ontario permitting continuous navigation from Lake Ontario, through rolling farmland along the Trent River, up through the chain of Kawartha Lakes, and north to the rugged coast and islands of Georgian Bay. The canal follows the course of the Trent, Otonabee and Severn Rivers, which now connect a chain of lakes, linked by artificial and improved river channels with levels controlled by dams and navigation locks. The high point on the canal is Balsam Lake from which the drainage is east to Lake Ontario via the Otonabee and Trent Rivers. The Severn River basin lies west of the high point and drains into Georgian Bay (Dept. of Indian & Northern Affairs, 1973).

The Waterway consists of four major components:

1) A combined drainage basin of the Trent and Severn Rivers covering approximately 18, 600 sq km;
2) A 386 kilometre navigable system of lakes, rivers, and artificial channels linking Georgian Bay and the Bay of Quinte, including approximately 75 water control dams, 37 conventional locks, two pairs of flight locks, two marine railways, 15 swing bridges and two hydraulic lift locks,;
3) A 44 kilometre secondary channel through Lindsay and Lake Scugog to Port Perry; and
4) A northern reservoir system in the Haliburton Highlands, including approximately 50 water control structures on the Gull, Burnt, Eels, and Mississauga drainage systems (Geomatics International Inc. & Beak Consultants Ltd., 1994)

In addition, the Waterway encompasses five counties, five cities, three towns, sixteen townships, five regional municipalities and one district municipality. Active within the corridor are federal, provincial and municipal governments, six conservation authorities, six First Nations Reserves, numerous organizations, and thousands of landowners.

From Trenton to Healey Falls, the Waterway connects a simple chain of lakes, which have largely uncontrolled tributaries. The major tributary is the Crowe River, which enters the Trent River downstream of Healey Falls. The Crowe River causes no backwater effect upstream of the falls. Downstream of its confluence, spillway capacities are adequate, and no serious flooding or operational problems are reported. Between Heeley Falls and Peterborough, the land is relatively flat, and flooding often occurs in spring around Rice Lake and in the Otonabee River downstream of Peterborough. This flooding is in direct relation to the flow of the Otonabee River.

From Rice Lake upstream to Balsam Lake, the Waterway and its tributaries include some fifty lakes and reservoirs, which are interconnected by channels in a complex system.

The Kawartha Lakes, namely Rice, Katchewanooka, Stony, Clear, Lovesick, Lower Buckhorn, Upper Buckhorn, Chemong, Pigeon, Little and Big Bald Lakes, Sturgeon, Cameron and Balsam, along with Scugog, Canal, Mitchell, Simcoe, Couchiching and Sparrow form a continuous chain of lakes along the Waterway. They lie off the southern limit of the Canadian Shield in low land and rolling countryside from which the rainfall runoff is slow and losses are high. The Northern Reservoirs, or as they are sometimes called, the Haliburtons, are drained southward into the Kawarthas by Jack Creek, Eels Creek, Mississauga River, Nogies Creek, Burnt River, and Gull

River. These lie within the Canadian Shield, which is topographically an area of rocky outcrops and shallow over-burden giving fast response to rainfall and high run-off (Dept. of Indian & Northern Affairs, 1973).

Physiographic Regions

The TSW crosses several major physiographic regions, which have few common characteristics. In the north, the Severn River and part of the Kawartha Lakes lie on the Canadian Shield, which is characterized by numerous low, granitic rock ridges and knobs. South of the Shield is a zone of limestone plains ranging from about five to twenty miles in width. These marginal plains have shallow soils and frequent low, north-facing escarpments of Black River age. They are best developed outside of the immediate Trent-Severn corridor, in the Carden Township area northeast of Lake Simcoe, but examples do occur in the Kawartha Lakes area and on Thorah and Georgina Islands in Lake Simcoe. South of this northwest-southeast trending marginal belt of limestone plains, surficial deposits become progressively deeper until in the south Lake Simcoe and Lake Scugog areas they may exceed 400 feet in thickness. To the east, the surficial deposits are not as thick and river erosion in the Trent and Otonabee Valleys has frequently exposed the bedrock (Cuddy, D. G., 1977).

The most common surficial deposits are glacial tills, which frequently occur as drumlinized ground moraine. The Waterway passes through the Peterborough drumlin field, following a prolonged course of east and south trending reaches, and eventually finds its way around the east end of the Oak Ridges Moraine into the Bay of Quinte. This protracted route of the Waterway is necessitated by the blockage of drainage to the south by the Oak Ridges Moraine, which extends from the Niagara Escarpment in the west to Trenton (Cuddy, D. G., 1977).

Prince Edward County is a separate physiographic region, which in some ways resembles the limestone pavements to the north. Here, however, the limestone pavement and escarpments are of Trenton aged sediment. Prince Edward County was completely flooded by glacial Lake Iroquois; consequently, all surficial deposits have been affected by erosion or water sorting in varying degrees (Cuddy, D. G., 1977).

Hydrology

During fall and winter, the Haliburton and Kawartha Lakes are lowered by increasing their outflows. This drawdown prepares the lakes for the spring snowmelt and reduces the threat of high water and ice damage. Snow course sites throughout the Trent and Severn drainage areas are surveyed regularly beginning in January. Information about the depth and water content of the snowpack obtained from these surveys aids in forecasting the total volume and peak runoff for the upcoming spring freshet.

March, April and May are critical months for Waterway hydrologists as melting snow and rain fill Waterway lakes. Attention focuses on the weather. Both heavy rainfall and prolonged warm temperatures will cause rivers and lakes to peak. The historical record shows this often happens more than once during spring freshet. Efforts to control this flooding are hampered by narrow channels, insufficient storage capacities in some lakes and the differing abilities of soils throughout the drainage basins to absorb water. While flood abatement is a primary springtime concern of waterway staff, care is also taken to ensure that water flows and levels are adequate to protect fish spawning beds.

During the summer, attention shifts to managing water levels and flows. Navigable depths on the Waterway must be maintained while minimizing the requirement for water from the reservoir lakes. Although minimum flows are maintained to sustain water quality, the main source of water loss is evaporation from the surface of lakes. The weather, particularly temperature, humidity and rainfall, determines the rate at which water from the reservoir lakes is lost to evaporation - this would in turn influence the amount of water needed (regulated) from the canals.

While summer water management generally means conserving water supplies, unusually heavy rainfall at any time during the season can increase the risk of flooding. At these times, flows and levels are raised to move water through the system. This may sometimes result in closures to navigation until flows and levels return to seasonal norms.

Geology

The TSW flows through a range of bedrock lithologies and age ranges. It is underlain by the Middle Ordovician Simcoe Group beginning at Trenton and the Trent River through the Otonabee River to Stony Lake (OGS, 1991). These are dominantly limestones with interbedded shales (Hewitt, 1972). Moving west from Stony Lake to Pigeon Lake, the northern shorelines mark the southern extent of the plutonic and metasedimentary rocks of the Grenville Province. These lithologies range in age from 0.57 to 1.6 Ga. The central and southern portions of these lakes remain underlain by the Middle Ordovician Simcoe Group. Continuing west, the TSW is again encompassed by the underlying Simcoe Group through to the northern portion of Lake Couchiching. At this point, the Waterway enters the Canadian Shield in the rocks of the Grenville Province. The Severn River is underlain by a series of lithologies including felsic igneous, gneissic, migmatitic and metasedimentary rocks. Ages range from 0.9 to 1.6 Ga.

Bedrock has the prevailing influence upon topography and physiography in the northern part of the Trent-Severn corridor and again in the south (Prince Edward County). There are two major rock types: the Precambrian granite gneisses and the Palaeozoic limestones. The boundary between these lies essentially along the north side of the Kawartha Lakes, extending westward to Georgian Bay. A number of Precambrian inliers are found to the south of the contact line, as far south as Prince Edward County. Palaeozoic outliers are similarly frequent north of the contact line (Cuddy, D. G., 1977).

The bedrock of the area resembles a plain dipping gently toward the southwest where it is progressively more and more deeply buried by surficial deposits. The limestone deposits rest unconformably upon the Precambrian rocks. When Ordovician deposition began in the area some 500 million years ago, the Precambrian rock had been eroded down to a peneplain that resembled the knob and valley topography, which is characteristic of the southern shield today. Some higher hills or “monadnocks” existed; these form the inliers of today, such as can be seen near Rohallion or Ameliasburg. Deposition on this irregular surface in shallow marine waters was uneven with thicker deposits occurring in the valleys. Subsequent pressure from the weight of overlying sediments caused compression of the sedimentary rock layers resulting in deformation around the basement highs or the hills on the Precambrian land surface. Thus, today we see steeply sloping limestones around and on the flanks of the inliers despite the very gently regional slope of the sediments (Cuddy, D. G., 1977).

The geology of the TSW corridor is made up of Precambrian rocks, which contain a mixture of gneisses, granite gneisses, granites and schists with occasional inclusions of crystalline limestone, dolomite, amphibolite and pegmatite (Cuddy, D. G., 1977).

The Palaeozoic rocks are a sequence of limestone beds of varying thickness and purity, frequently with interbeds of shale or calcareous sandstone. In the north, the lower or Black River group of limestones tend on the whole to be more massive and finer-grained than rock units of the overlying Trenton group. They generally have shallower and often poorly drained soils. Hence they often remain forested whereas the more deeply soiled areas underlain by Trenton limestone have been cleared for agriculture (Cuddy, D. G., 1977).

Some of the best exposures of Palaeozoic bedrock occur along the Trent, Otonabee and Indian Rivers where overlying glacial deposits have been scoured away. The Waterway contains the best natural stratigraphic section of Middle Ordovician in Ontario. Quarries, particularly those along the Waterway, also offer good concise acceptable places for fossil collecting as fresh surfaces can be exposed with little further environmental damage (Cuddy, D. G., 1977).

Water Quality

Water quality in the Trent-Severn system is characterized by the following:

- Relatively high conductivity (>200 µmhos/cm)
- High alkalinity (>90 mg/L as $CaCO^3$)
- Moderate phosphorus levels (ranging from about 0.01 mg/L to 0.02 mg/l in the Severn to above 0.02 mg/L in the Trent)
- Basic in pH (8.1 to 8.3).

Water quality from Ministry of the Environment (MOE) monitoring stations on the Severn River at the Couchiching outlet and the Trent River at Campbellford generally describe conditions in the Waterway. Water quality conditions can generally be described as mesotrophic across the system with the trend being oligotrophic to eutrophic conditions in the Severn system and towards eutrophic conditions in the Trent system.

Mean concentrations of most parameters generally meet Provincial Water Quality Objectives (PWQO). There are exceptions, especially fecal coliforms, which may be associated with urban runoff and sewage. There has been a trend towards decreasing total phosphorus in the Trent-Severn system, which may be attributable to the implementation of phosphorus control measures at sewage treatment plants. Higher phosphorus concentrations have been observed on the Trent River, and may be attributable to local municipal or agricultural sources. These are indicative of a eutrophic condition. There is a significant effort to control these through the Bay of Quinte Remedial Action Program (QRAP). The stage 1 QRAP document concluded that phosphorus loading is the major water quality problem in the Trent River. Bacterial problems are the second priority, but are generally localized to source areas. Persistent toxic chemicals do not seem to be a significant problem in this river (QRAP Workshop, 16-17 March, 1993).

The Severn Sound Remedial Action Plan (Part 1 – Environmental Conditions and Problem Definitions) identified the Severn River as the largest contributor of total phosphorous to Severn Sound (MOE, *et al.*, 1988). Input to the system is highest during the spring; however, significant inputs through both Glouchester Pool and Little Lake, prior to entering the Sound, allowing for an equalization of phosphorous concentrations within Severn Sound, are reflective of increased effluent control from water pollution control plants located in major population centres. However, overall levels of phosphorous within the Sound have not dropped significantly. Phosphorous levels within the Severn Sound exceed 20 µg/L resulting in eutrophication and growth of algal blooms (MOE, 1989).

Soils

Medium textured soils (loams with some clay loams and sandy loams) predominate along much of the Waterway. They are most common in the Peterborough drumlinized till plain and in the Simcoe lowlands. Stony loams are found all along the Dummer moraine. The Oak Ridges moraine and the many outwash, spillway valley and sand plain deposits have light sandy loam soils that tend to be excessively drained. The north shore of the Bay of Quinte, part of Prince Edward County, and the Schomberg pond clay deposit north of Lake Scugog, all have heavy textured clay and clay loam soils. The Carden and Prince Edward limestone pavements have very shallow loams.

Terrestrial Vegetation

The majority of the TSW (Campbellford west through Lake Couchiching) is situated in the Huron-Ontario Section of the Great Lakes-St. Lawrence Forest Region of Canada (Rowe, 1972). Native trees common to this region include sugar maple (*Acer saccharum*,), beech (*Fagus grandifolia)*, basswood (*Tilia Americana*), white ash (*Fraxinus americana*), red ash (*Fraxinus pennsylvanica Marsh*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*)and red oak (*Quercus rubra*), white oak (*Quercus alba*) and bur oak (*Quercus macrocarpa*). Scattered occurrences of largetooth aspen, bitternut hickory, hop hornbeam and black cherry are also common to this region. Blue beech, silver maple, slippery elm and rock elm, and black ash are found along river bottom and swampy sites. Shrubs that commonly occur in the mixed deciduous or Great Lakes-St.Lawrence Forest Region include the bush and fly honeysuckle, mountain holly, elderberries including common, red-berried, narrow and broad-leaved, the American yew and the hobble bush (McKay and Catling, 1979). In poorly drained sites, willows, alders, and dogwoods may be found, while on drier sites viburnums, hazels, raspberries, cherries, sumac and mountain maple dominate (Canada Department of Agriculture, 1971).

The boundary between the Ordovician limestones and the Precambrian Shield rocks to the north also marks the division between two major forest sections of the Great Lakes-St. Lawrence Forest Region (Rowe, 1972). The area to the south is classed as the Huron-Ontario forest section outlined above, while to the north, including the Severn River portion of the TSW, the forests are classified mainly within the Georgian Bay Forest Section. This section is dominated by maple-beech climax forest, but with a greater variety of northern hardwoods and conifers. Eastern hemlock increases in abundance from the inland towards Georgian Bay, and scrubby stands of jack pine, trembling aspen, red oak, white birch, white spruce and black spruce can be found in the thin soils along the rocky shores (Rowe, 1972). Extensive hardwood-cedar swamp areas and peat bogs also occur in this section.

Natural non-forest plant communities along the Waterway have not been studied as thoroughly as the forest associations but appear to show similar trends in that the dominant species often remain the same but other species shift in relative importance. Some of the most interesting plant communities occur on the sand dunes of Prince Edward County. Typical Great Lakes shore species occur along the shore and on the foredunes. Sand cherry, sea rocket (*Cakile edentula*) and dune or marram grass (*Ammophila breviligulata*) are examples. On back dunes, wild grape and poison ivy occur frequently. The dunes at Sandbanks, however, have been largely stabilized in recent years by reforestation.

Aquatic Vegetation

Marshlands and aquatic vegetation have a strong alien or introduced floristic component. Typical introduced species include the Eurasian milfoil and flowering rush (*Botomus umbellatus*). The narrow-leaved cattail (*Typha angustifolia*) has spread (mostly naturally) from the east coast, up the St. Lawrence and along Lake Ontario. It is abundant in the Bay of Quinte where it hybridizes with the wider leaved cattail (*T. latifolia*).

Other aquatic species found along the Waterway include a variety of plant groupings consisting of narrow and broad-leaved emergents, robust emergents, free-floating, rooted floating, and submerged plants. Appendix C contains a listing of aquatic vegetation species found along the TSW.

Fish and Wildlife

The wildlife along the Waterway has changed immensely over the past few hundred years. The total number of species has not changed greatly as new species have been introduced while certain native species have been extirpated. The major factor affecting the abundance and distribution of species has been the changes in habitat. Species of open fields and shrubby second growth (e.g. Savannah Sparrow and cottontail rabbit) have increased in number whereas species of closed, mature forests have declined or been extirpated within the southern part of their range (e.g. wolverine or fisher).

The clearing of the land and the creation of humanized landscapes with buildings, bridges, croplands, etc. has enabled many new species of wildlife to invade southern Ontario. Birds are the most common invaders due primarily to their mobility. Not all of the spread of bird species into southern Ontario can be directly related to modification of habitats. The Ring-necked Duck, for example, has gradually spread its breeding range eastward with no apparent connection to man-altered habitats. Other species that have spread from the west to become part of the avifauna of the TSW include the Mallard, Western Meadowlark, Evening Grosbeak and the Clay-coloured Sparrow. An even greater number of bird species has spread into southern Ontario from the south. Some of those that have reached the Waterway corridor include the Cardinal, Bewick's Wren, Carolina Wren, Mockingbird, Willow Flycatcher, Golden (Blue)-winged Warbler and Cerulean Warbler.

Other species of birds native to the area are Red-winged Blackbirds (*Angelaius Phoeniceus*), Common Grackles (*Quiscalus quiscula),* Swamp Sparrows (*Melospiza georgiana*), Blue-winged Teals (*Anas discors*), American Coots (*Fulica americana*), Virginia Rails (*Rallus limicola*), Soras (*Porzana carolina*), American Bitterns (*Botaurus lentiginosus*), Black Terns (*Chlidonias niger*), Marsh Wrens (*Cistothorus palustris*), Osprey (*Pandion haliaetus*), Turkey Vultures (*Cathartes aura*), Common Terns (*Sterna hirundo*) , and gulls (*Creagrus furcatus*).

Several European introductions have occurred over the years including the Common Starling, Hungarian Partridge, House Sparrow, Ring-necked Pheasant and the Mute Swan. The Starling and House Sparrow are now ubiquitous throughout southern Ontario, but the other species have very limited ranges. Aside from the Norway Rat, the House Mouse and humans, the European Hare appears to be the most significant mammalian introduction. It has spread throughout Ontario south of the Canadian Shield.

The TSW mainly supports a warm water fish community that includes northern pike, walleye, largemouth and smallmouth bass, muskellunge, yellow perch, various centrarchids, catfish, carp

and a number of forage and other species. Two lakes on the system, Lake Simcoe and Gloucester Pool, support a cold-water fish community. The Kawartha Lakes region is renowned for walleye, muskellunge, smallmouth and largemouth bass. In addition, the Kawarthas support large populations of panfish such as rock bass, yellow perch, sunfish and bullheads. The Lake Simcoe region, during the spring, has lake trout, northern pike, yellow perch and whitefish readily available. In the summer and fall, smallmouth and largemouth bass, lake trout, whitefish, northern pike, yellow perch and occasionally muskellunge are found. Trophy muskellunge, northern pike and yellow pickerel are caught in Georgian Bay every year. A complete list of known fish species on the TSW is found in Appendix C.

Several mammals are found along the Waterway, which include beaver (*Castor canadensis*), eastern cottontails (*Sylvilagus floridanus*), groundhogs (*Marmota monax*), muskrat (*Ondatra zibethicus*), American mink (*Mustela vison*), fox (*Vulpes vulpes*), raccoons (*Procyon lotor*), fishers (*Martes pennanti*), otters (*Lontra canadensis*), deer (*Odocoileus virginianus*), coyotes (*Canis latrans*), timber wolves (*Canis lupus*), black bears (*Ursus americanus*), porcupines (*Erethizon dorsatum*), weasels (*Mustela nivalis*), skunks (*Mephitis mephitis; Mephitis macroura*), eastern grey squirrels (*Sciurus carolinensis*) and red squirrels (*Tamiasciurus hudsonicus*).

Green frogs (*Rana clamitans)*, Leopard frogs (*Rana pipiens*), Bullfrogs (*Rana catesbeiana*), wood frog (*Rana sylvatica*), grey treefrog (*Hyla Versicolor*), spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), Painted Turtles (*Chrysemis picta*), snapping turtles (*Chelydra serpentina*), Five-Lined Skinks (*Eumeces fasciatus*), northern water snake (*Nerodia sipedon*), eastern garter snake (*Thamnophis sirtalis*), northern redbelly snake (*Storeria occipitomaculata occipitomaculata*), Eastern Massasauga Rattlesnake (*Sistrurus catenatus*), blue-spotted salamander (*Ambystoma laterale*), and redback salamander (*Plethodon cinereus*) are among the herpetiles found along the Waterway as well.

Significant Features

The TSW has extensive marshes, swamps and aquatic vegetation. It is, at least, of provincial, and may well be of national significance as a migration corridor for breeding birds (particularly waterfowl and marsh birds), small mammals and several species of fish. To date, there has not been a sufficient amount of research done on endangered species or species at risk within the TSW corridor. However, a preliminary assessment of species at risk has tracked more than 70 species at risk from the Waterway area and immediate vicinity as shown in the following table.

List of Species at Risk along the Trent-Severn Waterway and Immediate Vicinity

Scientific Name	Common Name	COSEWIC Status	Provincial
Mammals			
Glaucomys volans	Southern Flying Squirrel	SC	
Myotis septentrionalis	Northern Long-eared Bat		G4, S3?
Urocyon cinereoargenteus	Grey Fox	THR	SZB
Birds			
Ammodramus henslowii	Henslow's Sparrow	END	G4, S1B, ZN
Asio flammeus	Short-eared Owl	SC	G5,S3S4B,SZN
Buteo lineatus	Red-Shouldered Hawk	SC	G5, S4B,SZN
Chlidonias niger	Black Tern		G4, S3B, SZN
Coturnicops noveboracensis	Yellow Rail	SC	G4, S4B,SZN
Dendroica cerulea	Cerulean Warbler	SC	G4, S3B,SZN
Empidonax virescens	Acadian Flycatcher	END	G5, S2B,SZN
Haliaeetus leucocephalus	Bald Eagle		G4, S4B, SZN
Icteria virens	Yellow-breasted Chat	SC	G5,S2S3B,SZN
Ixobrychus exilis	Least Bittern	THR	G5, S3B,SZN
Lanius Iudovicianus migrans	Loggerhead Shrike	END	G4, S2B SZN
Melanerpes erythrocephalus	Red-headed Woodpecker	SC	G5, S3B SZN
Rallus elegans	King Rail	END	G4G5, 2B,SZN
Herpetofauna			
Clemmys guttata	Spotted Turtle	END	G5, S3
Elaphe gloydi	Eastern Foxsnake	THR	G3, S3
Eumeces fasciatus	Common Five-lined Skink	SC	G5, S3
Graptemys geographica	Map Turtle	SC	G5, S3
Emydoidea blandingii	Blanding's Turtle	THR	G4, S3
Heterodon platirhinos	Eastern Hog-Nosed Snake	THR	G5, S3
Lampropeltis triangulum	Milksnake	SC	G5, S3
Sistrurus catenatus	Massasauga	THR	G3, G4, S3
Sternotherus odoratus	Stinkpot	THR	G5, S3
Thamnophis sauritus	Eastern Ribbonsnake	SC	G5, S3
Butterflies			
Callophrys gryneus	Juniper Hair		G5, S2
Danaus plexippus	Monarch Butterfly	SC	G4, S4
Lycaeides Melissa samuelis	Karner Blue	EXT	
Fish			
Coreonus clupeaformis	Lake Whitefish (Simcoe pop)	THR	
Percina copelandi	Channel Darter	THR	
Lepisosteus oculatus	Spotted Gar	THR	
Moxostoma carinatum	River Redhorse	SC	
Moxostoma valenciennesi	Greater Redhorse		G4, S3
Acipenser fulvescens	Lake Sturgeon	SC	
Vascular Plants			
Arnoglossum plantagineum	Tuberous Indian Plantain	SC	G4, G5
Celtis tenuifolia	Dwarf Hackberry	THR	G5, S2
Isoetes engelmannii	Engelmann's Quillwort	END	G4, S1
Panax quinquefolius	American Ginseng	END	G4, S3
Phegopteris hexagonoptera	Broad Beech Fern	SC	G5, S3

Scientific Name	Common Name	COSEWIC Status	Provincial
Platanthera leucophaea	Eastern Prairie White Fringed Orchid	END	G2, S2
Juglans cinerea	Butternut	END	
Saururus cernuus	Lizard's Tail		G5, S3
Carex conoidea	Field Sedge		G5, S3
Carex Formosa	Handsome Sedge		G4, S3S4
Carex haydenii	Cloud Sedge		G5, S2
Juncus acuminatus	Sharp-fruit Rush		G5, S3
Polygonum careyi	Carey's Smartweed		G4, S3S4
Carex folliculata	Long Sedge		G4G5, S3
Sagittaria graminea var. cristata	Crested Arrowhead		G4? S3
Peltandra virginica	Arrow-arum		G5, S2
Triadenum virginicum	Marsh St. John's-wort		G5, S3
Xyris difforrnis	Carolina Yellow-eyed-grass		G5, S3?
Polygonum arifolium	Halberd-leaved Tear-thumb		G5, S3
Utricularia geminiscapa	Hidden-fruited Bladderwort		G4G5, S3
Rhexia virginica	Virginia Meadow-beauty		G5, S3S4
Panicum spretum	Panic Grass		G5, S2
Potamogeton bicupulatus	Snail-seed Pondweed		G4? S3S4
Carex novae-angliae	New England Sedge		G5, S3
Juncus militaris	Bayonet Rush		G4, S3S4
Juncus secundus	Secund Rush		G5? S2
Panicum rigidulum	Redtop Panic Grass		G5, S2S3
Sporobolus heterolepis	Northern Dropseed		G5, S3
Bartonia virginica	Yellow Screwstem		G5, S2
Collinsia parviflora	Small-flowered Blue-eyed Mary		G5, S2S3
Neobeckia aquatica	Lake-cress		G4? S3?
Schoenoplectus heterochaetus	Pale Great Club-rush		G5, S2
Platanthera flava var, herbiola	Pale Green Orchid		G4T4Q S3
Potamogeton confervoides	Algae-like Pondweed		G4, S2
Bulbostylis capillaris	Bulbostylis		G5, S3
Cyperus houghtonii	Houghton's Umbrella-sedge		G4? S3?
Non-Vascular Plants			
Tortula cainii	A Moss		G1, S1

Many fish species are declining in number with the deterioration of their freshwater habitat. Fish species listed as Threatened under COSEWIC (Committee on the Status of Endangered Wildlife in Canada) for the TSW include the Channel Darter (*Percina copelandi*) and Lake Whitefish (*Coregonus clupeaformis*) of the Simcoe population.

The Eastern Fox Snake (*Elaphe vulpina gloydi*), Eastern Hognose Snake (*Heterodon platirhinos*), Eastern Massassauga Rattlesnake (*Sistrusus catenatus catenatus*), and Musk Turtle (*Sternotherus odoratus*) are reptiles found along the Waterway which are listed as Threatened under COSEWIC. Species listed as Special Concern under COSEWIC and located along the Waterway include: Eastern Milk Snake (*Lampropeltis triangulum*), Northern Ribbon Snake (Great Lakes population) (*Thamnophis sauritus septentrionalis*), Five Lined Skink (*Eumeces fasciatus*), Northern Map Turtle (*Graptemys geographica*), Spotted Turtle (*Clemmys guttata*), and the Wood Turtle (*Clemmys insculpta*). The Eastern Fox Snake and the Massassauga Rattlesnake have similar ranges in Ontario – along the shores of Lake Erie and Lake Huron, and up the eastern

shore of Georgian Bay to about Parry Sound. Both are expected to be in the Severn section of the Waterway corridor. The Eastern Hognose Snake, most commonly found on sandy habitats, is becoming increasingly rare in Ontario. The Spotted Turtle has been declining due to a combination of habitat destruction and indiscriminate collecting.

There are several bird species along the Waterway listed as Endangered under COSEWIC. These include the King Rail (*Rallus elegans*), Piping Plover (*Charadrius melodus circumcinctus*), Northern Bobwhite (*Colinus virginianus*), Acadian Flycatcher (*Empidonax virescens*), Henslow's Sparrow (*Ammodramus henslowii*), and the Eastern Loggerhead Shrike (*Lanius ludovicianus migrans*). The Least Bittern (*Ixobrychus exilis*), found in many areas along the Waterway, is listed as Threatened under COSEWIC. Seven bird species in this area are listed as Special Concern and include the Yellow Rail (*Coturnicops noveboracensis*), Red-Shouldered Hawk (*Buteo lineatus*), Short-Eared Owl (*Asio flammeus*), Red-Headed Woodpecker (*Melanerpes erythrocephalus*), Yellow-Breasted Chat (Eastern population) (*Icteria virens virens*), Louisiana Waterthrush (*Seiurus motacilla*), and the Cerulean Warbler (*Dendroica cerulea*).

Mammal species listed under COSEWIC and occurring along the Waterway include: the Grey Fox (*Urocyon cinereoargenteus*) (threatened), and the Southern Flying Squirrel (*Glaucomys volans*) (special concern).

The Waterway traverses an interesting mixture of habitats containing a variety of northern and southern plant species. Plant species listed as Engangered under COSEWIC and present along the Waterway include White Prairie Gentian (*Gentiana alba*), American Ginseng (*Panax quinquefolius*), Engelmann's Quillwort (*Isoetes engelmanii*),

Socio-economic Environment

National Historic Sites, by their very nature, are irreplaceable. The TSW comprises over 734 physical assets, including locks, dams, weirs, wharves, bridges, buildings, utilities, grounds and miscellaneous structures. Today's replacement cost of Waterway structures is estimated to be close to $500 million, making it the most valuable Historic Site in Parks Canada and accounting for approximately 45 percent of Ontario Region's asset base and almost 10 percent of Parks Canada's entire asset base.

The TSW is a major revenue-generating facility in Ontario (Parks Canada, 2000). A recent study entitled *Economic Impact Study of the Trent-Severn Waterway National Historic Site* summarizes its economic importance. This study prepared by the Canadian Tourism Research Institute shows that $24.5 million of Ontario's Gross Domestic Product (GDP) is associated with direct expenditures made by Waterway visitors and Parks Canada in its operation of the historic canal (Parks Canada, 2000).

The most important non-economic benefits of the Waterway are those related to lifestyle, science, ecology, education, and culture. For example, recreational participation may take the form of active and direct use of the watersheds, natural areas and Waterway facilities or of passive enjoyment from simply living in the area. Scientifically, the protection of the Waterway's natural areas provides natural laboratories from which information on ecosystem function and response to change can be derived. Ecological processes maintained through the protection of habitats around the Waterways provide key environmental benefits such as the production of oxygen, the absorption and breakdown of pollutants, and the maintenance of local water quality. Educational benefits include an increase in understanding and appreciation, through interpretive programs, of

the heritage value of the Waterway. As for cultural benefits, the presence of the Waterway provides a sense of community and identity to those living next to it.

Cultural Resources

The TSW is a genuine magnet for boaters and car travellers. Man's relationship with the TSW stretches back thousands of years — from the Native groups who used these waters as an ancient canoe highway to today's recreational boaters.

Successive groups of Native people have travelled the natural waterway formed by the Kawartha Lakes since at least 9000 B.C. Archaeological sites found throughout the area point to the importance of this transportation and migration route. One of the largest single concentrations of Native rock carvings in Canada may be seen at Petroglyphs Provincial Park near Stony Lake. As well, prehistoric burial mounds such as those at Serpent Mounds Provincial Park on Rice Lake and fish weirs at Atherley Narrows testify to the area's early significance.

Around the 17th century, the waters of what is now the TSW were a significant transportation route for fur traders. For a time, Prince Edward County and the upper Trent were important Huron centres in the trade with the French. In 1615, Samuel de Champlain led his Huron allies from Georgian Bay down the Trent-Severn to attack the Iroquois on the south shore of Lake Ontario. Part of what is now Highway 48, near Bolsover lock station, was portaged by the explorer on his way from Lake Simcoe to Lake Ontario.

The dream of building an inland navigation route from Lake Ontario to Georgian Bay took 87 years to become a reality. It began in the heart of the Kawarthas at Bobcaygeon. Settlers, anxious for a waterway which would provide access to lucrative southern markets, pressured for the building of a small wooden lock there in 1833. Construction of the future TSW continued sporadically until 1878, when Sir John A. Macdonald's newly elected government promised to complete the canal. Between 1883-87, locks were built at Burleigh Falls, Lovesick, Buckhorn, and Fenelon Falls. The Kawartha Lakes finally became navigable from Lakefield through to Balsam Lake. Construction elsewhere on the waterway continued into the 20th century — through navigation was not possible until 1920.

Recreational use of the Trent-Severn began early. By the 1830s, Rice Lake, Lake Simcoe and the Kawarthas were the focus of activity for regattas, fish and game clubs, and the first conservationist associations. It was the late l9th century, however, that is most fondly remembered as the “golden age” of steamboating and resorts on the Kawarthas. The northward push of the railway provided the impetus for widespread tourist access to the lakes. Steamboats fanned out from railway terminals such as Lakefield or Lindsay, carrying vacationers to the summer resorts, which were opening throughout the Kawarthas.

An inventory of archaeological sites within the TSW is available. Canal staff must ensure they refer to this listing prior to using the RCSR.

Appendix B: Rideau Canal Species Lists

B1- Aquatic Vegetation found along The Rideau Canal

Species	Common Name
Azolla caroliniana Willd	Eastern mosquito-fern
Alisma gramineum	Northern water plantain
Butomus umbellatus	Flowering rush
Ceratophyllum demersum	Coontail
Drepanocladus exannulatus	Curved branch moss
Elodea canadensis	Common waterweed
Equisetum fluviatile	Water horsetail
Fontinalis hypnoides	Water moss
Hydrocharis morsus-ranae	European frogbit
Lemna minor	Lesser duckweed
Lemna trisulca	Star duckweed
Megalodonta beckii	Water marigold
Myriophyllum verticillatum	Bracted water milfoil
Myriophyllum sibiricum	Northern water milfoil
Myriophyllum spicatum	Eurasian water milfoil
Najas flexilis	Slender water nymph
Nuphar microphylla	Small yellow pond lily
Nuphar variegata	yellow pond lily
Nymphaea odorata	Fragrant white water lily
Polygonum amphibium	Water smartweed
Pontederia cordata	Pickerelweed
Potamogeton amplifolius	Large-leaved pondweed
Potamogeton crispus	Curly pondweed
Potamogeton epihydrus	Ribbon-leaved pondweed
Potamogeton foliosus	Leafy pondweed
Potamogeton friesii	Fries' pondweed
Potamogeton natans	Foating-leaved pondweed
Potamogeton nodosus	Knotted pondweed
Potamogeton pectinatus	Sago pondweed
Potamogeton pusillus	Slender pondweed
Potamogeton richardsonii	Richardson's pondweed
Potamogeton robbinsii	Robbins' pondweed
Potamogeton zosteriformis	Flat-stemmed pondweed
Ranunculus aquatilis	White water-crowfoot
Sagittaria cuneata	Floating arrowhead
Sagittaria latifolia	Broad-leaved arrowhead
Sagittaria rigida	Stiff arrowhead
Scirpus fluviatilis	River bulrush
Scirpus pungens	Threesquare bulrush
Scirpus tabenaemontani	Soft-stem bulrush
Sparganium chlorocarpum	Green-fruited bur-reed
Sparganium eurycarpum	large-fruited bur-reed

Species	Common Name
Spirodela polyrhiza	greater duckweed
Utricularia vulgaris	Common Bladderwort
Vallisneria americana	Tape grass
Wolffia columbiana	Columbia watermeal
Wolffia borealis	Dotted watermeal
Zannichellia palustris	Horned pondweed
Zosterella dubia	Water Star-grass
Zizania palustris	Wild rice

B2 - Fish Species along The Rideau Canal

Scientific Name	Common Name
Ambloplites rupestris	Rock bass
Ameiurus nebulosus	Brownbullhead
Aplodinotus grunniens	Freshwater drum
Astronotus ocellatus	Oscar
Catostomus commersoni	White sucker
Cottus bairdi	Mottled sculpin
Cyprinus carpio	Common Carp
Esox lucius	Northern pike
Esox masquinongy	Muskellunge
Etheostoma olmstedi	Tessellated darter
Fundulus diaphanus	Banded killifish
Hybognathus hankinsoni	Brassy minnow
Labidesthes sicculus	Brook silverside
Lepomis gibbosus	Pumpkinseed
Lepomis macrochirus	Bluegill
Luxilus cornutus	Common shiner
Micropterus dolomieu	Smalmouth bass
Micropterus salmoides	Largemouth bass
Moxostoma anisurum	Silver redhorse
Moxostoma valenciennesi	Greater redhorse
Notemigonus crysoleucas	Golden Shiner
Notropis atherinoides	Emerald shiner
Notropis heterodon	Blackchin shiner
Notropis heterolepis	Blacknose shiner
Notropis hudsonius	Spottail shiner
Notropis volucellus	Mimic shiner
Noturus gyrinus	Tadpole madtom
Perca flavescens	Yellow perch
Percina caprodes	Logperch
Pimephales notatus	Bluntnose minnow
Pomoxis nigromaculatus	Black crappie
Semotilus corporalis	Fallfish
Stizostedion vitreum	Walleye
Umbra limi	Central Mudminnow

B3 – Amphibians found along The Rideau Canal

Scientific Name	Common Name
Ambystoma laterale	Blue-spotted salamander
Ambystoma maculatum	Yellow-spotted salamander
Eurycea bislineata	Two-lined salamander
Notophthalmus viridescens	Eastern Newt
Necturus maculosus	Mudpuppy
Bufo americanus	American Toad
Hyla versicolor	Gray Treefrog
Pseudacris triseriata	Striped chorus frog
Rana catesbeiana	Bullfrog
Rana clamitans	Green frog
Rana palustris	Pickerel frog
Rana pipiens	Northen leopard frog
Rana septentrionalis	Mink frog
Rana sylvatica	Wood Frog

B4 – Reptiles found along The Rideau Canal

Scientific Name	Common Name
Chelydra serpentina	Common snapping turtle
Chrysemys picta	Painted turtle
Emydoidea blandingi	Blanding's turtle
Graptemys geographica	Map turtle
Trachemys scripta elegans	Red-eared slider
Sternotherus odoratus	Musk Turtle
Diadophis punctatus	Ringneck snake
Elaphe obsoleta	Rat snake
Nerodia sipedon	Northern water snake
Opheodrys vernalis	Smooth green snake
Storeria occipitomaculata	Redbelly snake
Thamnophis sirtalis	Common garter snake

B5 – List of Waterfowls found along The Rideau Canal

Scientific Name	Common Name
Gavia immer	Common Loon
Phalacrocorax auritus	Double-crested Cormorant
Ardea herodias	Great Blue Heron
Cygnus olor	Mute Swam
Branta canadensis	Canada Goose
Chen caerulescens	Snow Goose
Anas platyrhynchos	Mallard
Anas rubripes	American Black Duck
Anas acuta	Northern Pintail
Anas crecca carolinensis	American Green-winged Teal
Anas crecca crecca	Eurasian Green-winged Teal
Anas americana	American Wigeon
Anas clypeata	Northern Shoveler
Aix sponsa	Wood Duck
Aythya americana	Redhead
Aythya collaris	Ring-necked Duck
Aythya affinis	Lesser Scaup
Aythya marila	Greater Scaup
Bucephala clangula	Common Goldeneye
Bucephala albeola	Bufflehead
Lophodytes cucullatus	Hooded Merganser
Mergus merganser	Common Merganser

Appendix C: Trent Severn Waterway Species Lists

C1 - Aquatic Vegetation found along the Trent-Severn Waterway

Species	Common Name
Acorus calamus	Sweet flag
Brasenia schreberi	Water shield
Calla palustris	Wild calla
Callitriche hermaphroditica	Submerged water starwort
Carex spp.	Sedges
Ceratophyllum demersum	Coontail
Chara spp.	Muskgrass
Elodea canadensis	Canadian waterweed
Heteranthera dubia	Water star-grass
Hydrocharis morsus-ranae	European frogbit
Isoëstes echinospora	Spiny-spored quillwort
Isoëtes engelmannii	Engelmann's quillwort
Isoëtes xeatonii	Eaton's quillwort
Juncus spp.	Rushes
Lemna spp.	Duckweed
Lemna trisulca	Star duckweed
Megalodonta beckii	Water marigold
Myriophyllum heterophyllum	Two-leaf milfoil
Myriophyllum sibiricum	Northern water milfoil
Myriophyllum spicatum	Eurasian water milfoil
Myriophyllum verticillatum	Whorled water milfoil
Najas flexilis	Water nymph
Nitella spp.	Muskgrass
Numphaea odorata	White water lily
Nuphar variegatum	Yellow water lily
Polygonum spp.	Smartweed
Pontederia cordata	Pickerelweed
Potamogeton ampligolius	Large-leaf pondweed
Potamogeton crispus	Curly pondweed
Potamogeton epihydrus	Ribbon-leaf pondweed
Potamogeton foliosus	Leafy pondweed
Potamogeton friesii	Fries pondweed
Potamogeton gramineurs	Variable pondweed
Potamogeton natans	Floating pondweed
Potamogeton pectinatus	Sago pondweed
Potamogeton perfoliatus	Perfoliate pondweed
Potamogeton praelongus	White stem pondweed
Potamogeton pusillus	Small pondweed
Potamogeton richardsonii	Richardon's pondweed
Potamogeton robbinsii	Robbin's pondweed
Potamogeton strictifolius	Slender pondweed
Potamogeton vaseyi	Vasey pondweed
Potamogeton zosteriformis	Flat-stem pondweed
Ranunculus aquatilis	White water buttercup

Species	**Common Name**
Ranunculus fascicularis	Early buttercup
Ranunculus longirostris	Curly white water crowfoot
Sagittaria latifolia	Broad-leaved arrowhead
Sagittaria rigida	Sessile-fruit arrowhead
Sagittaria spp.	Water plantain
Scirpus spp.	Bulrushes
Sium suave	Water parsnip
Sparganium eurycarpum	Large-fruited burreed
Sparganium fluctuans	Floating-leaved burreed
Spirodela polyrhiza	Big duckweed
Tolypella intricata	Tassel stonewort
Typha angustifolia	Narrow-leaved cattail
Typha latifolia	Common cattail
Utricularia intermedia	Flat-leaf bladderwort
Utricularia minor	Northern bladderwort
Utricularia spp.	Bladderwort
Utricularia vulgaris	Common bladderwort
Vallisneria americana	Wild celery
Wolffia columbiana	Columbia watermeals
Wolffia spp.	Watermeals
Zannichellia palustris	Horned pondweed

C2 - Fish Species of the Trent-Severn Waterway

Scientific Name	**Common Name**
Acipenser fulvescens	Lake Sturgeon
Ambloplites rupestris	Rock Bass
Anguilla rostrata	American Eel
Aplodinotus grunniens	Freshwater Drum
Carpiodes cyprinus	Quillback
Catostomus catostomus	Longnose Sucker
Catostomus commersoni	White Sucker
Chrosomus eos	Northern Redbelly Dace
Chrosomus neogaeus	Finescale Dace
Coregonus artedii	Cisco
Coregonus clupeaformis	Lake Whitefish
Cottus bairdi	Mottled Sculpin
Cottus cognatus	Slimy Sculpin
Couesius plumbeus	Lake Chub
Culaea inconstans	Brook Stickleback
Cyprinus carpio	Common Carp
Esox lucius	Northern Pike
Esox masquinongy	Muskellunge
Etheostoma caeruleum	Rainbow Darter
Etheostoma exile	Iowa Darter
Etheostoma flabellare	Fantail Darter
Etheostoma nigrum	Johnny Darter
Fundulus diaphanus	Banded Killifish
Hybognathus hankinsoni	Brassy Minnow
Hybognathus nuchalis	Silvery Minnow
Ictalurus melas	Black Bullhead
Ictalurus natalis	Yellow Bullhead
Ictalurus nebulosus	Brown Bullhead
Ictalurus punctatus	Channel Catfish
Labidesthes sicculus	Brook Silverside
Lepisosteus osseus	Longnose Gar
Lepomis gibbosus	Pumpkinseed sunfish
Lepomis macrochirus	Bluegill
Lepomis megalotis	Longear Sunfish
Lota lota	Burbot
Micropterus dolomieui	Smallmouth Bass
Micropterus salmoides	Largemouth Bass
Moxostoma anisurum	Silver Redhorse
Moxostoma carinatum	River Redhorse
Moxostoma macrolepidotum	Shorthead Redhorse
Moxostoma valenciennesi	Greater Redhorse
Neogobius melanostromus	Round Goby
Nocomis micropogon	River Chub
Notemigonus crysoleucas	Golden Shiner
Notropis atherinoides	Emerald Shiner
Notropis cornutus	Common Shiner

Scientific Name	**Common Name**
Notropis heterodon	Blackchin Shiner
Notropis heterolepis	Blacknose Shiner
Notropis hudsonius	Spottail Shiner
Notropis volucellus	Mimic Shiner
Perca flavescens	Yellow Perch
Percina caprodes	Logperch
Percina copelandi	Channel Darter
Percina maculata	Blackside Darter
Percopsis omiscomaycus	Trout Perch
Petromyzon marinus	Sea Lamprey
Pimephales notatus	Bluntnose Minnow
Pimephales promelas	Fathead Minnow
Pomoxis nigromaculatus	Black Crappie
Rhinichthys atratulus	Blacknose Dace
Rhinichthys cataractae	Longnose Dace
Roccus americanus	White Perch
Roccus chrysops	White Bass
Salmo gairdneri	Rainbow Trout
Salmo trutta	Brown Trout
Salvelinus fontinalis	Brook Trout
Salvelinus namaycush	Lake Trout
Semotilus atromaculatus	Creek Chub
Semotilus corporalis	Fallfish
Semotilus margarita	Pearl Dace
Stizostedion canadense	Sauger
Stizostedion vitreum vitreum	Walleye
Umbra limi	Central Mudminnow

Appendix D : Sources for Best Management Practices/Standard Mitigation

Fisheries and Oceans Canada. 1999. Working Around Water Fact Sheet - What You Should Know About Fish Habitat.

Fisheries and Oceans Canada. 1999. Working Around Water Fact Sheet No. 3 - What You Should Know About Fish Habitat and Dredging.

Fisheries and Oceans Canada. 1999. Working Around Water Fact Sheet No. 4 - What You Should Know About Fish Habitat and Controlling Aquatic Plants.

Fisheries and Oceans Canada. 1999. Working Around Water Fact Sheet No. 6 - What You Should Know About Fish Habitat and Building a Beach.

Fisheries and Oceans Canada. 1999. Working Around Water Fact Sheet No. 11 - What You Should Know About Fish Habitat and the Effects of Silt and Sediment.

Fisheries and Oceans Canada. 2002. Operational Statement for Commercial Dredging Proposals in Ontario.

Hardy BBT Limited. 1989. Environmental Protection Guidelines for Operation and Maintenance Within or Near Water Bodies. Prepared for Environment Canada Canadian Parks Service.

Ontario Ministry of Natural Resources. 1988. Environmental Guidelines for Access Roads and Water Crossings.

Parks Canada - Rideau Canal. 1999. Conditions/Best Management Practices for Commercial Dredging.

Parks Canada - Trent-Severn Waterway. 2004. Sample Conditions of Approval and Environmental Assessment Screenings for In-Water Works.

Parks Canada. Draft Rideau Canal and Trent-Severn Waterway National Historic Sites of Canada-Policies for In-Water and Shoreline Works and Related Activities. 2004

Appendix E: Potential Environmental Effects, Mitigation And Residual Effects
(TABLE 4.2-1 to TABLE 4.2-10)

TABLE 4.2-1: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS
Activity: Permanent Placement of Rock/Gravel on Lakebed (by hand or hoe)
Subclass Affected: Launch Ramps

Environmental Component	Description of Effect	Mitigation	Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	Significance of Residual Effect
Aquatic Sediments	Physical alteration of waterbody substrates and/or increased potential for release of sediments downstream, including contaminated sediments	✓ install sediment and erosion controls ✓ confirm whether sediment is contaminated; if remediation is required, a separate EA must be initiated ✓ remove accumulated sediments prior to removing erosion control devices	L	L	L	L	L	N
Aquatic Habitat and Species	Disturbance of fish spawning and migration	✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW; no dredging permitted April 1 - Sept. 10 for TSW; no in-water works permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout. ✓ consider habitat located on adjacent properties prior to allowing project to proceed ✓ ensure placement of rock/sand/gravel does not cover significant fisheries habitat	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)
** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-2: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS
Activity: Clearing of Vegetation (Terrestrial)
Subclasses Affected: Bridge Repair, Dewatering and Minor Lock/Dam Maintenance, Docks, Launch Ramps, Boathouse Repairs, Shoreline Stabilization

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Topography and Landscape	Subsidence due to onset of soil instability from removal of vegetation/root mass	✓ Minimize clearing as much as possible ✓ Avoid activity during wet weather conditions ✓ Regrade and revegetate to original conditions upon completion of work	L	L	L	L	L	N
	Increased soil exposure resulting in erosion, sedimentation, slope instability and risk of slumping	✓ keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ phase work to minimize duration of exposure of disturbed areas ✓ If prolonged period of exposure is expected, stabilize surface using temporary cover (e.g. grass, mulch, gravel, erosion blanket, etc.) ✓ Hand clear on steep slopes that do not require grading ✓ Avoid high risk areas with unstable slopes ✓ Avoid movement of heavy machinery on areas with sensitive slopes ✓ Direct runoff and overland flow away from working areas, areas of exposed soils and erodable slopes; keep runoff velocities low ✓ Stabilize slopes afterwards as appropriate for local site conditions; possible methods include: grading to a stable slope, hard and soft designs or combinations of designs using riprap, armour stone, crib walls, revetments, gabions, erosion control blanket, brush bundles and replanting with native species	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Soils	Disturbance to soil microfauna and microflora	✓ keep site clearing to a minimum to maintain vegetative cover and windbreaks (maintain vegetated buffer at shoreline wherever possible) ✓ phase work to minimize duration of exposure of disturbed areas ✓ maintain a consistent access route ✓ regrade and revegetate to original conditions upon completion of work	L	L	L	L	M	M
	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ refuel machinery on impermeable pads or buried liners designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N
Surface Water Hydrology	Adverse modifications to physical drainage patterns, stream or shoreline morphology	✓ minimize changes to the ground surface that affect its infiltration and runoff characteristics ✓ maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage ✓ fully restore and revegetate streambanks and shorelines to near original soil materials and contours where this activity does not conflict with the purpose of the project ✓ where possible, restrict complete length of work time ✓ ensure work does not promote flood hazards or create undesired obstructions to drainage into natural waterbodies	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to increased erosion, sedimentation and transport of debris following removal of vegetation, spills/leaks from equipment	✓ minimize clearing near water bodies (maintain vegetative buffer at shoreline wherever possible) ✓ where possible, maintain vegetative buffer along shorelines and streambanks. If buffers cannot be maintained, avoid grubbing of vegetation root mass in close proximity to shorelines and streambanks ✓ implement wet weather restrictions to construction activity ✓ install and maintain silt curtains, check dams, drainage swales, or other methods necessary to prevent silt or sediment from entering the watercourse/waterbody, as needed ✓ inspect erosion control measures daily ✓ stabilize slopes as appropriate for local site conditions ✓ refuel equipment (e.g. chainsaws) off slopes and away from waterbodies (15m away on Rideau) ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ maintain equipment in good working condition ✓ Adhere to policies regarding use of herbicides (banned on Rideau Canal; policies pending on TSW)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Aquatic Habitat and Species	Physical changes to aquatic biota and habitat (e.g., damage or loss of riparian habitat due to disturbance/removal of vegetation)	✓ Implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act ✓ Minimize clearing near waterbodies (maintain vegetative buffer) ✓ Restore habitat where necessary ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW; no dredging permitted April 1 - Sept. 10 for TSW; no in-water works permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout	L	L	L	L	M	M
Terrestrial Habitat and Species	Physical damage and loss of vegetation and habitat (including riparian habitat)	✓ keep site clearing to a minimum to maintain sufficient vegetative cover ✓ minimize physical damage to vegetation by avoiding placement of slash onto living vegetation ✓ dispose of slash appropriately ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community ✓ Adhere to policies regarding use of herbicides (banned on Rideau Canal; policies pending on TSW) ✓ Replace riparian trees and shrubs and other deep root vegetation	L	L	L	L	M	M
	Reduction in habitat quality (e.g. diversity, area, function) and/or increased habitat fragmentation	✓ Keep site clearing to a minimum ✓ avoid habitat fragmentation in sensitive areas ✓ avoid removal of vegetation between April and August to avoid destruction of active bird nests ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community	L	L	L	L	L	N
	Disruption to wildlife from loss of cover	✓ minimize site changes regarding vegetative habitat cover ✓ restore site to original or improved condition	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Contaminant bioaccumulation by wildlife species	✓ direct surface runoff away from waste storage areas and into adequately vegetated areas ✓ store all waste materials in secure areas on impermeable pads, provide berms and covers, if necessary ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure refuelling and handling of contaminants are located off-site where possible, or well away from any waterbody/aqautic habitat ✓ maintain an adequate supply of clean up materials on-site	L	L	L	L	L	N
	Loss of individual/specimen trees, valued vegetation features (e.g. hedgerows)	✓ mark significant woodlots/specimen trees to ensure they are identified and avoided ✓ salvage and replant important species in areas designated for protection	L	L	L	L	L	N
	Disruption to wildlife life cycle patterns (migration, breeding, nesting) due to noise, activity	✓ conduct any clearing or other disruptive (i.e. noise) activities outside of the nesting season for migratory birds known to breed in the area or during sensitive migration/staging, hibernation or nursing periods ✓ investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens ✓ minimize operation of machinery in areas where migratory birds are breeding ✓ establish vegetative buffers between construction zones and areas known to have sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to machinery accidents)	✓ ensure workers wear appropriate protective gear ✓ ensure equipment is operating in good working condition ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption of access to property as a direct result of project activities.	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N
	Disruption to residents, businesses, recreational and tourist activities due to changed noise levels, aesthetics, air and water quality and changed community character	✓ Avoid stockpiling brush in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-3: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Activity: Shoreline Excavation

Subclasses Affected: Bridge Repair, Dewatering and Minor Lock/Dam Maintenance, Docks, Launch Ramps, Shoreline Stabilization

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Topography and Landscape	Changes in slopes and landforms	✓ Avoid high risk areas with unstable slopes; keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ Avoid movement of heavy machinery on areas with sensitive slopes ✓ Regrade and revegetate immediately upon completion of project and after site is cleaned up	L	L	L	L	L	N
	Increased soil compaction due to heavy equipment	✓ Maintain consistent access route where possible, preferably a route previously disturbed	L	L	L	L	M	M
	Increased soil exposure resulting in erosion, sedimentation, slope instability and risk of slumping	✓ keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ phase work to minimize duration of exposure of disturbed areas ✓ If prolonged period of exposure is expected, stabilize surface using temporary cover (e.g. grass, mulch, gravel, erosion blanket, etc.) ✓ Avoid high risk areas with unstable slopes ✓ Avoid movement of heavy machinery on areas with sensitive slopes ✓ Direct runoff and overland flow away from working areas and areas of exposed soils and erodable slopes; keep runoff velocities low ✓ Stabilize slopes as appropriate for local site conditions; possible methods include: grading to a stable slope, hard and soft designs or combinations of designs using riprap, armour stone, revetments, gabions, erosion control blanket, brush bundles ✓ Regrade and revegetate immediately upon completion of project and after site is cleaned up	L	L	L	L	M	M

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Soils	Disturbance to soil microfauna and microflora	✓ Protect stockpiled soils from exposure to and sterilization by solar radiation (an uncovered shaded area would also achieve this) ✓ Limit size of stockpiles to avoid anaerobic conditions ✓ Mercury contaminated soils should be immediately placed into a plastic drum or barrel, sealed and labelled (separate EA requried) ✓ Hazardous wastes and contaminated soils are to be hauled off-site and disposed of in an approved disposal facility (separate EA required) ✓ Maintain consistent access route, preferably one that is already disturbed	L	L	L	L	M	M
	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ refuel machinery on impermeable pads or buried liners designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Hydrology	Adverse modifications to physical drainage patterns, stream or shoreline morphology	✓ minimize changes to the ground surface that affect its infiltration and runoff characteristics ✓ maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage ✓ where needed, use clear span or pontoon bridges for temporary crossings; where possible, avoid locating temporary bridges at stream bends ✓ avoid fording watercourses ✓ maintain vegetative buffer at shore wherever possible ✓ fully restore and revegetate streambanks and shorelines to near original soil materials and contours where this activity does not conflict with the purpose of the project ✓ restrict in-water works to approved timing windows (no in-water work permitted between March 31 and July 1; March 15 for Scugog and Rice Lakes, Trent River, TSW; no dredging permitted from April 1 - Sept. 10 on TSW; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ where possible, restrict complete length of work time ✓ ensure work does not promote flood hazards or create undesired obstructions to drainage into natural waterbodies ✓ if using cofferdams, consider installing piping to allow for sufficient water flow downstream and avoid flooding upstream	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-4: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS
Activity: Pumping of Water
Subclasses Affected: Bridge Repair, Dewatering and Minor Dam/Lock Maintenance

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Soils	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from waterbodies/aquatic habitat (15 m away on Rideau) ✓ refuel machinery on impermeable pads/pans designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to increased erosion, sedimentation, transport of debris, point or non-point sources of pollution (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater input, inputs of contaminants from construction activities and from surface runoff)	✓ only clean material free of particulate matter shall be placed in water ✓ rocks/stone used shall not be taken from the bed or shoreline of any waterbody ✓ implement wet weather restrictions to activity ✓ install and maintain silt curtains, sedimentation ponds, check dams or drainage swales ✓ inspect erosion control measures daily and leave them in place until construction site has stabilized ✓ upon completion of work, all debris on bed shall be completely removed and area restored to its original state ✓ stabilize slopes as appropriate for local site conditions ✓ securely contain and remove any contaminated soils or other contaminated materials off-site to a licensed disposal facility ✓ Any equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks; never leave equipment in the water overnight ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from waterbodies/aquatic habitat (15 m away on Rideau) ✓ refuel machinery on impermeable pads or pans designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ pump water into settling pond or land-based bladder	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Groundwater Quantity and Quality	Changes in groundwater flow patterns, recharge and levels in aquifers and yields of wells due to dewatering or interception of aquifers, changes to infiltration, changed flow patterns or damage to wells.	✓ Avoid intercepting aquifers ✓ Avoid unnecessary disruption of active tile drains ✓ Restore municipal drains and tile drainage fields, test and repair as required ✓ Maintain surface drainage, ponding, existing soil and ground cover conditions, etc., in groundwater recharge areas ✓ Minimize vehicle traffic near wells ✓ Provide alternative water supply and repair or replace damaged wells	L	L	L	L	L	N
Aquatic Habitat and Species	Reduced fish biomass and diversity due to mortality from physical activities (e.g. pumping water) and/or releases of deleterious substances	✓ Schedule activities to avoid migratory and spawning periods ✓ Restrict in-water works to approved timing windows (no in-water work permitted between March 31-July 1 (March 15 for Rice Lake, Trent River, Lake Scugog, TSW; March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ Implement water quality protection measures to control releases of sediment and spills and leaks from equipment ✓ If pumping water into settling basin or land-based bladder during in-water work, any fish in area to be dewatered must be captured alive and relocated outside cofferdam or work area prior to commencement of pumping	L	L	L	M	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to fish spawning and migration	✓ Schedule activities to avoid migratory and spawning periods ✓ Restrict in-water works to approved timing windows (no in-water work permitted between March 31-July 1 (March 15 for Rice Lake, Trent River, Lake Scugog, TSW; March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ Given that significant walleye spawning activity occurs in the spring in the Talbot R. where it enters Lake Simcoe, MNR should be consulted regarding and dramatic changes in water levels	L	L	L	L	L	N
	Physical changes to aquatic biota and habitat (e.g. change in water levels and flow volumes, damage or loss of riparian habitat, base flows and water temperature)	✓ Implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act (note that dewatering fish habitat for extended periods of time may result in a HADD of fish habitat) ✓ Restore habitat where necessary ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15-July 1 for Rice Lake, Trent River, Lake Scugog, TSW; March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout	L	L	L	L	L	N
Terrestrial Habitat and Species	Disruption to wildlife and vegetation from changes in surface water and groundwater quantity and quality	✓ minimize site changes regarding water supplies for wildlife and vegetative habitat cover ✓ restore site to original or improved condition	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to wildlife migration/movement patterns and breeding/nesting season, due to noise, activity	✓ conduct any disruptive (i.e. noise) activities outside of the nesting season for migratory birds known to breed in the area or during sensitive migration/staging, hibernation or nursing periods ✓ investigate the area for any nests or dens prior to pumping ✓ minimize operation of machinery in areas where migratory birds are breeding ✓ establish vegetative buffers between construction zones and areas known to have sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, equipment malfunctions, etc.)	✓ ensure workers wear appropriate protective gear and are familiar with handling of contaminated materials ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N
	Disruption to navigation as a direct result of project activities	✓ Consult with Transport Canada and comply with any conditions imposed ✓ Inform public of ongoing work and possible temporary disruptions	L	L	L	L	L	N
	Disruption of access to property as a direct result of project activities	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character	✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residences of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

TABLE 4.2-5: POTENTIAL ENVIRONMENTAL EFFECT, MITIGATION AND RESIDUAL EFFECTS
Activity: Construction of Rock Access Road
Subclasses Affected: Dewatering and Minor Lock/Dam Maintenance

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Topography and Landscape	Changes in slopes, landforms and landscape diversity	✓ Avoid high risk areas with unstable slopes; keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ Avoid movement of heavy machinery on areas with sensitive slopes ✓ Regrade immediately upon completion of project and site is cleaned up ✓ Utilize temporary erosion mats for controlling erosion while vegetation is being established on disturbed soils	L	L	L	L	L	N
	Ground subsidence from soil thaw, poor excavation and backfilling practices; ground surface mounding/structure movement due to frost heave from inappropriate backfill material or shallow foundation depth.	✓ Ensure backfilling is undertaken using suitable materials free of ice and frozen soils and that adequate soil compaction is conducted to avoid ground subsidence ✓ Provide additional backfill where subsidence has occurred ✓ In areas with high groundwater levels, ensure that soils susceptible to frost heave (generally fine sands to silty soils) are not used for backfill ✓ Ensure adequate burial depth of foundations or below ground structures ✓ For shallow foundations, ensure that frost-susceptible soils are replaced with suitable well-drained backfill material placed to an adequate depth	L	L	L	L	L	N
	Increased soil compaction due to heavy equipment	✓ Maintain consistent access route where possible	L	L	L	L	M	M
Soils	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Hydrology	Adverse modifications to physical drainage patterns, stream or shoreline morphology	✓ minimize changes to the ground surface that affect its infiltration and runoff characteristics ✓ avoid fording watercourses ✓ maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage ✓ where needed, use clear span or pontoon bridges for temporary crossings; where possible, avoid locating temporary bridges at stream bends ✓ fully restore and revegetate streambanks and shorelines to near original soil materials and contours where this activity does not conflict with the purpose of the project; fully remove rock access road upon completion of project ✓ restrict in-water works to approved timing windows (no in-water work permitted between March 31 and July 1; March 15 for Scugog and Rice Lakes, Trent R., TSW; no dredging permitted April 1 - Sept. 10; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ where possible, restrict complete length of work time ✓ ensure work does not promote flood hazards or create undesired obstructions to drainage into natural waterbodies ✓ if using cofferdams, consider installing piping to allow for sufficient water flow downstream and avoid flooding upstream	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to increased erosion, sedimentation, transport of debris, point or non-point sources of pollution (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater input, inputs of contaminants from construction activities and from surface runoff)	✓ minimize clearing, grubbing and grading near water bodies (maintain vegetative buffer) ✓ where possible, maintain vegetative buffer along shorelines and streambanks/shorelines. If buffers cannot be maintained, avoid grubbing of vegetation root mass in close proximity to shorelines and streambanks ✓ implement wet weather restrictions to construction activity ✓ install and maintain silt curtains, sedimentation ponds, check dams or drainage swales, silt fences around dredging site and soil storage sites and elsewhere as required; inspect erosion control measures daily and inspect site upon removal of road ✓ backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for revegetation ✓ stabilize slopes as appropriate for local site conditions; utilize temporary erosion mats to control erosion while vegetation is reestablishing ✓ ensure all materials placed below the high water mark are clean and free of silt and clay-sized particles. All materials must meet applicable regulations governing placement of fill in waterbodies ✓ securely contain and remove any contaminated soils or other contaminated materials off-site to a licensed disposal facility ✓ any equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks; never leave equipment in the water overnight ✓ there shall be no discharge of chemicals and cleaning agents in or near aquatic habitats ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from waterbody/aquatic habitat (15 m away on Rideau) ✓ refuel machinery on impermeable pads/pans designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure that entire rock access road is removed	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Aquatic Sediments	Physical alteration of waterbody substrates and/or increased potential for release of sediments downstream, including contaminated sediments	✓ install sediment and erosion controls (e.g. silt curtains, coffer dams) prior to construction and ensure they remain until road is removed ✓ confirm whether sediment is contaminated; if remediation is required, a separate EA must be initiated ✓ remove accumulated sediments prior to removing erosion control devices ✓ consider sediment type located on adjacent properties prior to allowing project to proceed ✓ completely remove all components of rock access road upon completion of project	L	L	L	L	M	M
Aquatic Habitat and Species	Reduced fish biomass and diversity due to mortality from physical activities and/or releases of deleterious substances	✓ Schedule activities to avoid migratory and spawning periods ✓ Restrict in-water works to approved timing windows (no in-water work permitted between March 31 and July 1; March 15 for Scugog and Rice Lakes, Trent R., TSW; no dredging permitted April 1 - Sept. 10; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ Implement water quality protection measures to control releases of sediment and spills and leaks from equipment ✓ completely remove all components of rock access road upon completion of project	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to fish spawning and migration	✓ Schedule activities to avoid migratory and spawning periods (note that prolonged occupation of the bed of a watercourse/waterbody may result in a HADD of fish habitat) ✓ Restrict in-water works to approved timing windows ((no in-water work permitted between March 31 and July 1; March 15 for Scugog and Rice Lakes, Trent R., TSW; no dredging permitted April 1 - Sept. 10; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ consider habitat located on adjacent properties prior to allowing project to proceed ✓ completely remove all components of rock access road upon completion of project	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Physical changes to aquatic biota and habitat (e.g. change in water flow, damage or loss of riparian habitat)	✓ Implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act (note that prolonged occupation of a watercourse/waterbody may result in a HADD of fish habitat) ✓ Do not place access road in areas of emergent or submergent aquatic vegetation ✓ Restore habitat where necessary ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15-July 1 for Rice Lake, Trent River, Lake Scugog, TSW; until Sept. 10 for dredging in all locations; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ Carefully scrape any existing rock rubble to the side before placing base material ✓ Any rocks or stumps removed must be relocated in area with similar water depth ✓ Place clean imported rock only for base; use geogrid webbing to contain any rock ✓ If removing aquatic vegetation, dispose of plants well above high water level to avoid leaching of nutrients back into water ✓ consider habitat located on adjacent properties prior to allowing project to proceed ✓ completely remove all components of rock access road upon completion of project	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Terrestrial Habitat and Species	Physical damage and loss of vegetation and habitat (including riparian habitat)	✓ keep site clearing to a minimum to maintain sufficient vegetative cover ✓ minimize physical damage to vegetation by avoiding placement of slash onto living vegetation ✓ dispose of slash appropriately ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community ✓ Adhere to policies regarding use of aquatic herbicides (banned on Rideau Canal; policies pending on TSW)	L	L	L	L	L	N
	Reduced terrestrial habitat quality (e.g. diversity, area, function) and/or increased fragmentation of habitat	✓ avoid habitat fragmentation in sensitive areas and avoid clearing between April and August to avoid bird nest disruption ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community	L	L	L	L	L	N
	Disruption to wildlife and vegetation from changes in surface water and groundwater quantity and quality, loss of cover	✓ minimize site changes regarding water supplies for wildlife and vegetative habitat cover ✓ restore site to original or improved condition	L	L	L	L	L	N
	Introduction of non-native species, including opportunistic species, predators and parasitic nesters (e.g. by transport on machinery, materials taken from other locations)	✓ check equipment and machinery prior to entering site to ensure they are clean; if not, clean them before entering site ✓ when rehabilitating, use locally sourced seed mixes that contain native species and/or non-invasive species	L	L	L	L	L	N
	Loss of individual/specimen trees, valued vegetation features (e.g. hedgerows)	✓ mark significant woodlots/specimen trees to ensure they are identified and avoided ✓ salvage and replant important species in areas designated for protection	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to wildlife migration/movement patterns and breeding/nesting season due to noise, activity	✓ conduct any clearing or other disruptive (i.e. noise) activities outside of the nesting season for migratory birds known to breed in the area or during sensitive migration/staging, hibernation or nursing periods ✓ investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens ✓ minimize operation of machinery in areas where migratory birds are breeding ✓ establish vegetative buffers between construction zones and areas known to have sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, equipment malfunctions, etc.)	✓ adhere to local speed limits on access roads ✓ ensure workers wear appropriate protective gear ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N
	Disruption to navigation as a direct result of project activities	✓ Consult with Transport Canada and comply with any conditions imposed ✓ Inform public of ongoing work and possible temporary disruptions ✓ Special measures to ensure navigation is not disrupted include - clearly mark silt curtains for boaters (day and night) - installation of any buoys to mark navigation channels must comply with Canadian Aids to Navigation Standards and the Private Buoy Regulation	L	L	L	L	L	N
	Disruption of access to property as a result of project activities	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character due to presence of new structure	✓ Avoid stockpiling materials and equipment in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-6: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Activity: Stockpiling of Material

Subclasses Affected: Bridge Repair, Dewatering and Minor Lock/Dam Maintenance, Docks, Launch Ramps, Shoreline Stabilization, Boathouse Repairs

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Air Quality	Decreased ambient air quality (i.e., dust, other particulate matter)	✓ Minimize vegetation cutting and maintain windbreaks ✓ Avoid stockpiling during dry and windy periods ✓ Instruct workers and equipment operators on dust control methods ✓ Monitor dust conditions visually and take actions to suppress dust as necessary	L	L	L	M	L	N
Topography and Landscape	Increased soil compaction due to heavy equipment	✓ Maintain consistent access route where possible	L	L	L	L	L	N
	Changes in slopes and landforms	✓ Avoid high risk areas with unstable slopes; keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ Avoid movement of heavy machinery on areas with sensitive slopes ✓ For sloped rock revetments, establish a slope no greater than 2:1 (horizontal:vertical) ✓ Regrade immediately upon completion of project and site is cleaned up	L	L	L	L	L	N
Soils	Disturbance to soil microfauna and microflora	✓ Protect stockpiled soils from exposure to and sterilization by solar radiation (an uncovered shaded area would also achieve this) ✓ Limit size of stockpiles to avoid anaerobic conditions ✓ Mercury contaminated soils should be immediately placed into a plastic drum or barrel, sealed and labelled (separate EA required) ✓ Hazardous wastes and contaminated soils will be hauled off-site and disposed of in an approved disposal facility (separate EA required)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Hydrology	Adverse modifications to physical drainage patterns	✓ minimize changes to the ground surface that affect its infiltration and runoff characteristics ✓ maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage ✓ where possible, restrict complete length of work time ✓ ensure work does not promote flood hazards or create undesired obstructions to drainage into natural waterbodies	L	L	L	L	L	N
Surface Water Quality	Reduced water quality and clarity due to erosion of stockpiled material, sedimentation or transport of debris	✓ install and maintain silt fences around soil storage sites and elsewhere as required ✓ inspect erosion control measures daily ✓ stabilize slopes as appropriate for local site conditions and utilize tarpaulins over materials ✓ securely contain and remove any contaminated soils or other contaminated materials off-site to a licensed disposal facility ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from aquatic habitats/waterbodies (15 m away on Rideau) ✓ refuel machinery on impermeable pads or buried liners designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N
Terrestrial Habitat and Species	Loss of individual/specimen trees, valued vegetation features (e.g. hedgerows)	✓ mark significant woodlots/specimen trees to ensure they are identified and avoided ✓ salvage and replant important species in areas designated for protection	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, equipment malfunctions, accidents, etc.)	✓ adhere to local speed limits on access roads ✓ ensure workers wear appropriate protective gear ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N
	Disruption of access to property as a direct result of project activities	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character due to presence of new structure	✓ Avoid stockpiling materials and equipment in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-7: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Activity: Access and Operation of Heavy Equipment

Subclasses Affected: Bridge Repair, Dewatering and Minor Lock/Dam Maintenance, Docks, Launch Ramps, Shoreline Stabilization, Boathouse Repairs

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Air Quality	Decreased ambient air quality (i.e., due to dust, other particulate matter, exhaust from machinery)	✓ Minimize vehicle idling ✓ Minimize vegetation cutting and maintain windbreaks ✓ Restore disturbed areas as soon as possible to minimize duration of soil exposure ✓ Minimize vehicle traffic on exposed soils ✓ Stabilize high traffic areas with clean gravel surface layer or other suitable cover material ✓ Avoid site preparation or construction during dry and windy periods ✓ Instruct workers and equipment operators on dust control methods ✓ Monitor dust conditions visually and take actions to suppress dust as necessary ✓ Install a tarpaulin on stockpiles and haulage trucks as appropriate ✓ Use new or well-maintained equipment within operating specifications ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	L	L	L	L	N
Noise Quality	Increased ambient noise levels	✓ Use new or well- maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust system baffles, engine covers, etc. ✓ Use heavy equipment and machinery within operating specifications ✓ Be knowledgeable of and maintain municipal noise-control bylaws ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	L	L	L	L	N
Topography and Landscape	Ground subsidence from excessive weight of equipment on unstable soils	✓ Avoid wet weather conditions when accessing site ✓ Ensure access route is stable and consistent ✓ Stabilize slopes with native vegetation	L	L	L	L	L	N
	Increased soil compaction due to heavy equipment	✓ Maintain consistent access route where possible	L	L	L	L	M	M

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Increased soil exposure resulting in erosion, sedimentation, slope instability and risk of slumping	✓ keep site clearing to a minimum to maintain vegetative cover and windbreaks ✓ phase work to minimize duration of exposure of disturbed areas ✓ If prolonged period of exposure is expected, stabilize surface using temporary cover (e.g. grass, mulch, gravel, erosion blanket, etc.) ✓ Avoid movement of heavy machinery on areas with sensitive or high risk, unstable slopes ✓ Direct runoff and overland flow away from working areas and areas of exposed soils; keep runoff velocities low ✓ Stabilize slopes as appropriate for local site conditions	L	L	L	L	L	N
Soils	Disturbance to soil microfauna and microflora	✓ Maintain consistent access route to minimize aerial extent of disturbance	L	L	L	L	M	M
	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N
Surface Water Hydrology	Adverse modifications to physical drainage patterns, stream or shoreline morphology	✓ minimize changes to the ground surface that affect its infiltration and runoff characteristics ✓ maintain effective surface drainage upon completion of the project, which may include re-establishment of, or improvement to, the original site drainage ✓ fully restore and revegetate streambanks and shorelines to near original soil materials and contours where this activity does not conflict with the purpose of the project ✓ restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW; no dredging permitted April 1 - Sept. 10 on TSW; no in-water works permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ where possible, restrict complete length of work time ✓ ensure work does not promote flood hazards or create undesired obstructions to drainage into natural waterbodies	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to increased erosion, sedimentation, transport of debris, point or non-point sources of pollution if equipment working in water (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater input, inputs of contaminants from construction activities and from surface runoff)	✓ minimize clearing, grubbing and grading near water bodies ✓ where possible, maintain vegetative buffer along shorelines and streambanks. If buffers cannot be maintained, avoid grubbing of vegetation root mass in close proximity to shorelines and streambanks ✓ implement wet weather restrictions to construction activity ✓ install and maintain silt curtains, temporary erosion mats, sedimentation ponds, check dams or drainage swales, silt fences around dredging site and soil storage sites and elsewhere as required ✓ inspect erosion control measures daily ✓ stabilize slopes as appropriate for local site conditions ✓ securely contain and remove any contaminated soils or other contaminated materials off-site to a licensed disposal facility (separate EA required) ✓ avoid fording watercourses or operating equipment within water bodies below the normal water level (N/A for lock/dam maintenance). Any equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks; never leave equipment in the water overnight (ensure tires are rubber) ✓ use and discharge of chemicals and cleaning agents prohibited near aquatic habitats ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from aquatic habitats/waterbodies (15 m away on Rideau) ✓ refuel machinery on impermeable pads or buried liners designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Aquatic Sediments	Physical alteration of waterbody substrates and/or increased potential for release of sediments downstream, including contaminated sediments, if equipment working in water	✓ implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act ✓ install sediment and erosion controls (e.g. silt curtains, coffer dams) prior to construction ✓ confirm whether sediment is contaminated; if it is, implement stringent measures to prevent release downstream ✓ remove accumulated sediments prior to removing erosion control devices ✓ consider sediment type located on adjacent properties prior to allowing project to proceed	L	L	L	L	M	M
Groundwater Quantity and Quality	Groundwater contamination from point or non-point sources of pollution (e.g. disturbance of contaminated soils, land discharge of contaminated waters, leaks and accidental spills)	✓ ensure refuelling and areas where contaminants are handled are located away from aquatic habitats/waterbodies (15 m away on Rideau) ✓ maintain an adequate supply of cleanup materials at the work site ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N
Aquatic Habitat and Species	Disturbance to fish spawning and migration, if equipment working in water	✓ Schedule activities to avoid migratory and spawning periods ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW; no dredging permitted April 1 - Sept. 10 on TSW; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ consider habitat located on adjacent properties prior to allowing project to proceed	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Physical changes to aquatic biota and habitat if equipment working in water	✓ Implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act ✓ Restore habitat where necessary ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW; no dredging permitted April 1 - Sept. 10 on TSW; no in-water work permitted between March 15-June 30 on Rideau); further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ Ensure repaired/replaced bridge abutments are in same footprint as original ✓ If removing aquatic vegetation, dispose of them well above high water level to avoid leaching of nutrients back into water ✓ consider habitat located on adjacent properties prior to allowing project to proceed	L	L	L	M	M	M
Terrestrial Habitat and Species	Physical damage and loss of vegetation and habitat (including riparian habitat)	✓ keep site clearing to a minimum to maintain sufficient vegetative cover ✓ minimize physical damage to vegetation by avoiding placement of slash onto living vegetation ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community	L	L	L	L	L	N
	Reduced terrestrial habitat quality (e.g. diversity, area, function) and/or increased fragmentation of habitat	✓ avoid habitat fragmentation in sensitive areas ✓ restore area with fast-growing, low maintenance, diverse native species adapted to the project area to enhance the local plant community	L	L	L	L	L	N
	Bioaccumulation of contaminants by wildlife species	✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure refuelling and handling of contaminants are located off-site where possible, or well away from critical wildlife habitat ✓ maintain an adequate supply of clean up materials on-site	L	L	L	L	L	N
	Introduction of non-native species (e.g. by transport on machinery)	✓ check equipment and machinery prior to entering site to ensure they are clean; if not, clean them before entering site ✓ when rehabilitating, use locally sourced seed mixes that contain native species	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Loss of individual/specimen trees, valued vegetation features (e.g. hedgerows)	✓ mark significant woodlots/specimen trees to ensure they are identified and avoided ✓ salvage and replant important species in areas designated for protection	L	L	L	L	L	N
	Disruption to wildlife migration/movement patterns and breeding/nesting season due to noise, activity	✓ conduct any disruptive (i.e. noise) activities outside of the nesting season for migratory birds known to breed in the area or during sensitive migration/staging, hibernation or nursing periods ✓ investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens ✓ minimize operation of machinery in areas where migratory birds are breeding ✓ establish vegetative buffers between construction zones and areas known to have sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, equipment malfunctions, accidents, etc.)	✓ adhere to local speed limits on access roads ✓ ensure workers wear appropriate protective gear ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N
	Disruption of access to property as a direct result of project activities	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character	✓ Avoid stockpiling equipment in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-8: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Activity: Repair/Replace Concrete/Wood

Subclasses Affected: Bridge Repair, Dewatering and Minor Dam/Lock Maintenance, Docks, Launch Ramps, Boathouse Repairs

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Air Quality	Decreased ambient air quality (i.e., due to dust, other particulate matter)	✓ Avoid site preparation or construction during dry and windy periods ✓ Instruct workers and equipment operators on dust control methods ✓ Monitor dust conditions visually and take actions to suppress dust as necessary ✓ Use new or well-maintained equipment within operating specifications ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	L	L	L	L	N
Noise Quality	Increased ambient noise levels	✓ Use new or well- maintained equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust system baffles, engine covers, etc. ✓ Use equipment and machinery within operating specifications ✓ Be knowledgeable of and maintain municipal noise-control bylaws ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	M	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to transport of debris, point or non-point sources of pollution (e.g. leaks and accidental spills, use of unclean material, inputs of contaminants from construction activities and from surface runoff)	✓ install and maintain appropriate erosion control devices as required ✓ inspect erosion control measures daily ✓ securely contain and remove any contaminated soils or other contaminated materials off-site to a licensed disposal facility ✓ use only clean material free of fine particulate matter in the water; rocks/stone used shall not be taken from the bed or shoreline of any waterbody ✓ avoid fording watercourses or operating equipment within water bodies below the normal water level (N/A for lock/dam maintenance). Any equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks; never leave equipment in the water overnight or permanently (ensure tires are rubber) ✓ use and discharge of chemicals and cleaning agents prohibited near aquatic habitats ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from waterbodies/aquatic habitats (15 m away on Rideau) ✓ refuel machinery on impermeable pads/pans designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure all painting and staining are done upland well above high water mark attach drop cloths to scaffolding to prevent sandblasted materials, paints, timbers, concrete, solvents, etc. from entering the water; cofferdam (clean rock with clay and filter fabric, sandbags or sheet piling) may be required for work on abutment or bridge support ✓ silt or debris that has accumulated around a temporary cofferdam must be removed prior to withdrawal of cofferdam ✓ pressure treated lumber should not be used below the high water mark and cutting and treating cuts with preservative should take place away from the water	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Aquatic Habitat and Species	Disturbance to fish spawning and migration	✓ Schedule activities to avoid migratory and spawning periods ✓ Restrict in-water works to approved timing windows (no in-water works permitted between March 31-July 1 (March 15 for Rice Lake, Trent River, Lake Scugog, TSW); no in-water works permitted between March 15-June 30 on Rideau; further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ consider habitat located on adjacent properties prior to allowing project to proceed ✓ during installation of new cribs under a boathouse, at least 50% of the total boathouse length must be clear, unobstructed open spans to allow for water circulation and fish movement	L	L	L	L	L	N
	Physical changes to aquatic biota and habitat (e.g. change in water levels and flow volumes, base flows and water temperature)	✓ Implement mitigation measures in accordance with any requirements and recommendations stipulated by authorities under the Fisheries Act ✓ Amount of flow downstream of dam must not be altered and must remain constant throughout duration of wall repairs ✓ Restore habitat where necessary; all debris on bed (including unused aggregate/concrete rubble) shall be completely removed and area restored to original state upon completion of work ✓ Restrict in-water works to approved timing windows (not between March 31-July 1; March 15 for Rice Lake, Trent River, Lake Scugog, TSW); no in-water works permitted between March 15-June 30 on Rideau; further restrictions may also apply to coldwater lakes to protect fall spawners such as Lake Trout ✓ consider habitat located on adjacent properties prior to allowing project to proceed	L	L	L	M	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Terrestrial Habitat and Species	Disruption to wildlife migration/movement patterns and breeding/nesting season due to noise and activity	✓ conduct any disruptive (i.e. noise) activities outside of the nesting season for migratory birds known to breed in the area or during sensitive migration/staging, hibernation or nursing periods ✓ investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens ✓ minimize operation of machinery in areas where migratory birds are breeding ✓ establish vegetative buffers between construction zones and areas known to have sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, mechanical difficulties, accidents, etc.)	✓ adhere to local speed limits on access roads ✓ ensure workers wear appropriate protective gear ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N
	Disruption of access to property as a direct result of project activities	✓ Minimize area of disruption and maintain adequate access for property owners/public, as needed	L	L	L	L	L	N
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character	✓ Avoid stockpiling in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-9: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Activity: Painting, Staining, Resurfacing

Subclasses Affected: Bridge Repair, Dewatering and Minor Dam/Lock Maintenance, Docks, Boathouse Repairs

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Air Quality	Decreased ambient air quality (i.e., due to dust, other particulate matter, exhaust from machinery, paint fumes)	✓ Avoid activities during dry and windy periods ✓ Instruct workers and equipment operators on dust control methods ✓ Monitor dust conditions visually and take actions to suppress dust as necessary ✓ Use new or well-maintained equipment within operating specifications ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	L	L	M	L	N
Noise Quality	Increased ambient noise levels	✓ Use new or well- maintained equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust system baffles, engine covers, etc. ✓ Use equipment and machinery within operating specifications ✓ Be knowledgeable of and maintain municipal noise-control bylaws ✓ Notify residents of planned events that may cause disturbance and schedule these activities to avoid sensitive time periods	L	L	L	M	L	N
Soils	Contamination of soil through equipment leakage	✓ Maintain equipment to avoid leakage of fuels and liquids ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060)	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Surface Water Quality	Reduced water quality and clarity due to transport of debris, point or non-point sources of pollution (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater input, inputs of contaminants from construction activities and from surface runoff)	✓ use and discharge of chemicals and cleaning agents prohibited near aquatic habitats ✓ store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads, provide berms if necessary ✓ refuel equipment off slopes and away from aquatic habitats/waterbodies (15m on Rideau) ✓ refuel machinery on impermeable pads or buried liners designed to allow full containment of spills ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure all painting and staining are done upland well above high water mark ✓ attach drop cloths to scaffolding to prevent deleterious materials, paints, timbers, concrete, solvents, etc. from entering the water ✓ cofferdam (clean rock with clay and filter fabric, sandbags or sheet piling) may be required for work on abutment or bridge support	L	L	L	L	L	N
Aquatic Sediments	Increased potential for release of sediments downstream, including contaminated sediments	✓ install sediment and erosion controls (e.g. silt curtains, coffer dams) prior to construction; inspect devices daily ✓ confirm whether sediment is contaminated; if remediation is required, a separate EA must be initiated ✓ remove accumulated sediments prior to removing erosion control devices	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Terrestrial Habitat and Species	Bioaccumulation of contaminants by wildlife species	✓ direct surface runoff away from work areas and into adequately vegetated areas ✓ store all waste materials in secure areas on impermeable pads, provide berms and covers, if necessary ✓ ensure measures are in place to minimize impacts of accidental spills; all measures and procedures are to adhere to provincial and federal regulations; report all spills to the Ontario Spill Action Centre (1-800-268-6060) ✓ ensure refuelling and handling of contaminants are located off-site where possible, or well away from critical wildlife habitat ✓ maintain an adequate supply of clean up materials on-site	L	L	L	L	L	N
	Disruption to wildlife migration/movement patterns and breeding/nesting season due to noise, activity	✓ avoid activities during sensitive wildlife migration/staging, nesting/breeding, hibernation or nursing periods ✓ establish vegetative buffers between construction zones and areas containing sensitive vegetation and wildlife	L	L	L	L	L	N
Socio-Economic Environment	Personal injuries to public and workers (i.e. due to exposure to contaminated soils, spilled fluids, etc.)	✓ ensure workers wear appropriate protective gear ✓ minimize number of vehicles on-site ✓ ensure trucks and heavy equipment are equipped with back-up signals/indicators ✓ inform neighbours of on-site activities and ask them to stay clear of site	L	L	L	L	L	N

Environmental Component	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
			Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character	✓ Avoid stockpiling materials and equipment in proximity to residences and/or community features dependent on environmental quality or aesthetics ✓ Repair all damages to property due to project activities ✓ Install noise barriers around work areas when in close proximity to sensitive receptors, such as homes, schools, community facilities ✓ Adhere to local noise by-laws ✓ Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods	L	L	L	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)

TABLE 4.2-10: POTENTIAL ENVIRONMENTAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS
Activity: Operation of Structure/Entity

Environmental Component	Sub-Class Affected	Description of Effect	Mitigation	Criteria for Determining Significance of Residual Effect*					Significance of Residual Effect**
				Magnitude	Geographic Extent	Frequency/ Duration	Ecological Context	Reversibility	
Air Quality	Docks, Launch Ramps	Decreased ambient air quality (i.e., due to ongoing boat/personal watercraft motor exhaust)	✓ circulate information regarding environmental benefits of upgrading motors and minimizing air pollution	M	L	M	L	L	M
Noise Quality	Docks, Launch Ramps	Increased ambient noise levels (i.e., due to boat/personal watercraft)	✓ post signs indicating noise by-law restrictions	M	L	M	L	L	M
Surface Water Quality	Docks, Launch Ramps	Reduced water quality and clarity due to increased use of boats and personal watercraft (fuel spills, operation of motors, etc.)	✓ post signs at marinas indicating safe fueling practices	L	L	L	L	L	N
Terrestrial Habitat and Species	Docks, Launch Ramps	Disruption to wildlife life cycle patterns (migration, breeding, nesting) due to noise of boats, personal watercraft	✓ post signs/circulate literature regarding known significant habitat and sensitive timing considerations	L	L	L	L	L	N
Socio-Economic Environment	Docks, Launch Ramps	Disruption to residents, businesses, recreational and tourist activities due to changed noise, aesthetics, air and water quality and traffic and changed community character due to presence of new structure and affiliated vehicles/boats	✓ post signs indicating noise by-law restrictions and promoting low-wake zones near residential areas	L	L	M	L	L	N

* L = low; M = moderate; H = high (see Table 4.5 for definitions)

** N = negligible residual effect; M = minor adverse residual effect; S = significant adverse residual effect (see Table 4.5 for definitions)