AECOM

Final CEAA Screening Document Peninsula Harbour Contaminated Sediment Management Project

Prepared by:

AECOM
1710 Hollis Street, SH400 (PO Box 576 CRO),
Halifax, NS, Canada B3J 3M8

Project Number:

60119893

Date:

January 13, 2012

AECOM
1701 Hollis Street 902 428 2021 tel
SH400 (PO Box 576 CRO) 902 428 2031 fax
Halifax, NS, Canada B3J 3M8
www.aecom.com

January 16, 2012

Mr. Ron Hewitt
Marathon Remediation Project Manager
Public Works and Government Services Canada Ontario
4900 Yonge Street
12th Floor
Toronto, ON M2N 6A6

Dear Mr. Hewitt:

Project No: 60119893
Regarding: Final CEAA Screening for Peninsula Harbour Contaminated Sediment Management Project

AECOM Canada Ltd. is pleased to provide one original and five copies of the Final CEAA Screening Report for the Peninsula Harbour Contaminated Sediment Management Project. One electronic version of the report is also provided. We look forward to your comments and questions regarding this report.

Sincerely,
AECOM Canada Ltd.

Shawn Duncan
Environmental Assessment Task Manager
JR:kv

Executive Summary

Environment Canada (EC) and Ontario Ministry of Environment (MOE) propose to cover contaminated sediments in Jellicoe Cove, Peninsula Harbour in Lake Superior, Ontario with 15 to 20 cm of clean sand. This proposed Project is subject to a federal screening level environmental assessment pursuant to the *Canadian Environmental Assessment Act* (*CEAA*). AECOM was retained by Public Works and Government Services Canada (PWGSC), the contracting authority for EC, to complete the environmental assessment for this Project. This document has been prepared to meet the requirements of a federal Screening Level environmental assessment pursuant to *CEAA*.

The objectives of the Peninsula Harbour Contaminated Sediment Management Project (Project) are:

- To reduce risk to biota from contaminated sediment in Jellicoe Cove;
- To reduce the spread of contaminated sediment from Jellicoe Cove to the rest of Peninsula Harbour;
- To expedite the natural recovery of Jellicoe Cove; and
- To facilitate ecosystem recovery in Peninsula Harbour which will contribute to its "delisting" as an Area of Concern (AOC) identified in the *Great Lakes Water Quality Agreement between Canada and the United States*.

The Project includes the covering of historically contaminated sediment with a thin layer cap (TLC) composed of approximately 15 - 20 cm of sand over a total area of 25.6 ha (256,000 m^2). Capping will focus on the most contaminated area within the Jellicoe Cove. The cap area includes approximately 204,000 m^2 of area where sediment mercury concentrations exceed three (3) mg/kg, and 52,000 m^2 of area with elevated PCB concentrations equalling or exceeding 0.34 mg/kg. Based on the analysis conducted by Northern Bioscience (2011) on all available data collected to date, the cap area is composed of approximately 75.5% silt, 23.7% sand, 0.7% gravel and < 0.1% cobble.

The TLC is proposed to begin in the spring of 2012 and completed by end of August 2012 (mobilization – spring), pending Project regulatory approvals and funding. The anticipated duration of Project activities is approximately two and one half months, given a construction schedule of 24 hours/day and up to seven (7) days/week. Decommissioning of the cap is not contemplated. Monitoring for cap effectiveness will take place periodically over the next 20 years.

A scoping exercise was undertaken to identify an appropriate list of Valued Ecological Components (VECs) and Valued Socio-Economic Components (VSCs) upon which to focus the assessment. The issues scoping process for this assessment included:

- Review of regulatory issues and guidelines;
- Consultations with regulatory agencies, stakeholders, the public, and First Nations;
- Review of available information on the existing environment within which the Project occurs; and
- Professional judgement of the study team.

As a result of this process, the following three (3) VECs and one (1) VSC were retained for detailed analysis:

- Benthic Habitat and Sediment Quality
- Fish and Fish Habitat
- Wildlife

- Land and Resource Use

Each of the VECs / VSCs was evaluated for potential interactions between the VEC / VSC and Project activities during all Project phases as well as malfunctions or accidents that may occur. These interactions were evaluated for potential significance after application of technically and economically feasible mitigative measures. The cumulative effects of the proposed management Project in conjunction with past, present and likely future projects were also evaluated. Environmental monitoring and follow-up measures are proposed and will be undertaken to ensure compliance with applicable regulations, standards and guidelines, to verify environmental effect predictions and refine mitigative measures.

A long term monitoring program has been developed for the Project to monitor the effectiveness of the cap (physical, chemical and biological) similar to that performed during the baseline surveys. The goal of the monitoring program is to assess temporal trends in habitat recovery in the cap and outside the cap areas. In addition to post construction monitoring, future development activities in Jellicoe Cove will be managed via the implementation of existing administrative controls.

The proposed mitigation measures will reduce or eliminate potentially adverse environmental effects. Adverse residual environmental effects were predicted to be not significant for all VECs / VSCs for all Project activities including potential malfunctions and accidental events. There are not likely to be any significant adverse cumulative effects of the Project with other past, present or future likely projects and activities assuming the proposed mitigative measures, including emergency response and contingency planning, are implemented as outlined in this document.

On the basis of this screening, under *CEAA,* Environment Canada and Fisheries and Oceans Canada have reached the following decision;

_____X_____ The Project (taking into account appropriate mitigation measures) is not likely to cause significant adverse environmental effects – Project can be supported. The Project has been screened in accordance with *CEAA* requirements.

Acronym List

Air Quality Indexes - AQIs
Areas of Concern - AOC
Best Management Practices - BMPs
Canadian Environmental Assessment Act - CEAA
Canadian Wildlife Service - CWS
Carbon Monoxide - CO
Committee on the Status of Endangered Wildlife in Canada - COSEWIC
Community Liaison Committee - CLC
Environment Canada - EC
Environmental Assessment - EA
Environmental Compliance Monitoring - ECM
Environmental Protection Plan - EPP
Environmental Risk Assessment - ERA
Federal Authorities Coordination Regulations - FCR
Fine Particulate Matter – $PM_{2.5}$
Fisheries and Oceans Canada - DFO
Five-Day Biological Oxygen Demand – BOD_5
Geographic Information Systems - GIS
Ground-Level Ozone – O_3
Harmful Alteration, Disruption or Destruction - HADD
Hectare - ha
Lowest Effects Levels - LEL
Marathon Pulp Inc. - MPI
Migratory Birds Convention Act - MBCA
Navigable Waters Protection Act - NWPA
Nephelometric Turbidity Units - NTUs
Nitrogen Dioxide – NO_2
Nonaqueous Phase Liquids - NAPL
Non-Government Organizations - NGOs
Ontario Ministry of the Environment – MOE / OMOE
Ontario Ministry of Natural Resources – MNR / OMNR
Ontario Provincial Police - OPP
Parks Canada - PC
Petroleum, Oils and Lubricants - POLs
Polychlorinated-Biphenyls - PCBs
Public Works and Government Services Canada - PWGSC
Remedial Action Plan - RAP
Responsible Authority - RA
Sediment Management Options - SMOs
Severe Effects Levels - SEL
Species at Risk Act - SARA
Species at Risk in Ontario - SARO
Sulphur Dioxide – SO_2
Thin Layer Cap / Capping – TLC

Total Dissolved Solids - TDS
Total Organic Content -TOC
Total Reduced Sulphur – TRS
Total Suspended Solids - TSS
Transport Canada - TC
Valued Ecological Components – VECs
Valued Socio-Economic Components - VSCs
Water Pollution Control Plant – WPCP
Young of the Year - YOY

Table of Contents

Statement of Qualifications and Limitations
Letter of Transmittal
Executive Summary
Acronym List

page

List of Figures

List of Tables

Appendices

1. Introduction

Environment Canada (EC), and Ontario Ministry of Environment (MOE) propose to remediate the contaminated sediments in Jellicoe Cove, Peninsula Harbour in Lake Superior, Ontario (Figure 1). Peninsula Harbour is one of 43 Areas of Concern (AOC) identified in the *Great Lakes Water Quality Agreement between Canada and the United States*. The remediation of this area supports the goals of the Canada - Ontario Agreement Respecting the Great Lakes Basin Ecosystem. The objectives of the proposed remediation activities in Peninsula Harbour are:

- To reduce risk to biota from contaminated sediment in Jellicoe Cove;
- To reduce the spread of contaminated sediment from Jellicoe Cove to the rest of Peninsula Harbour;
- To expedite the natural recovery of Jellicoe Cove; and
- To facilitate ecosystem recovery in Peninsula Harbour which will contribute to its "delisting" as an AOC identified in the *Great Lakes Water Quality Agreement between Canada and the United States*.

This proposed Project, as defined in Section 2.0, is subject to a federal environmental assessment pursuant to the *Canadian Environmental Assessment Act* (*CEAA*) as the Project involves federal funding and triggers the section 35(2) of the *Fisheries Act*. EC and Fisheries and Oceans Canada (DFO) are the Responsible Authorities (RA) for the Project with EC being the lead RA. This document has been prepared to meet the requirements of a federal Screening Level environmental assessment pursuant to *CEAA*.

MOE determined that a provincial environmental assessment (EA) was not required for the Project.

1.1 Project Overview and Purpose

Jellicoe Cove in Peninsula Harbour is located on the north-eastern shore of Lake Superior near the town of Marathon, Ontario (Figure 1). Historical activities in the area resulted in bacterial contamination, aesthetics impairments, and accumulation of mercury and polychlorinated biphenyls (PCBs) in sediment. This led to degraded fish and invertebrate communities, loss of fish habitat and high levels of mercury and PCBs in fish and bottom sediment. Issues of bacterial contamination and aesthetic impairments were largely resolved with improvements to process and effluent quality at a local pulp mill and introduction of a water pollution control plant. However, mercury and PCB contaminated sediment in the Harbour continues to serve as a source of contaminants. Management of the contaminated sediment in Jellicoe Cove will reduce risk to biota and enhance natural recovery which will contribute to delisting of Peninsula Harbour as an AOC under the *Great Lakes Water Quality Agreement between Canada and the United States,* the Canada - Ontario Agreement Respecting the Great Lakes Basin Ecosystem.

A Remedial Action Plan (RAP) was initiated in 1991 and developed by EC, MOE, Ontario Ministry of Natural Resources (MNR / OMNR), DFO and a public advisory committee. In addition to the RAP, an environmental risk assessment (ERA) was conducted in 2008 to evaluate and quantify risk associated with the Peninsula Harbour AOC to support decision making regarding the potential need for sediment management to protect human health and the environment. The following environmental concerns were identified:

- Mercury, methyl mercury and PCB contamination in sediments;
- An accumulation of contaminants in benthos;
- Bioavailability of contaminants;
- Toxicity to fish and other wildlife;
- Fishing and dredging restrictions; and

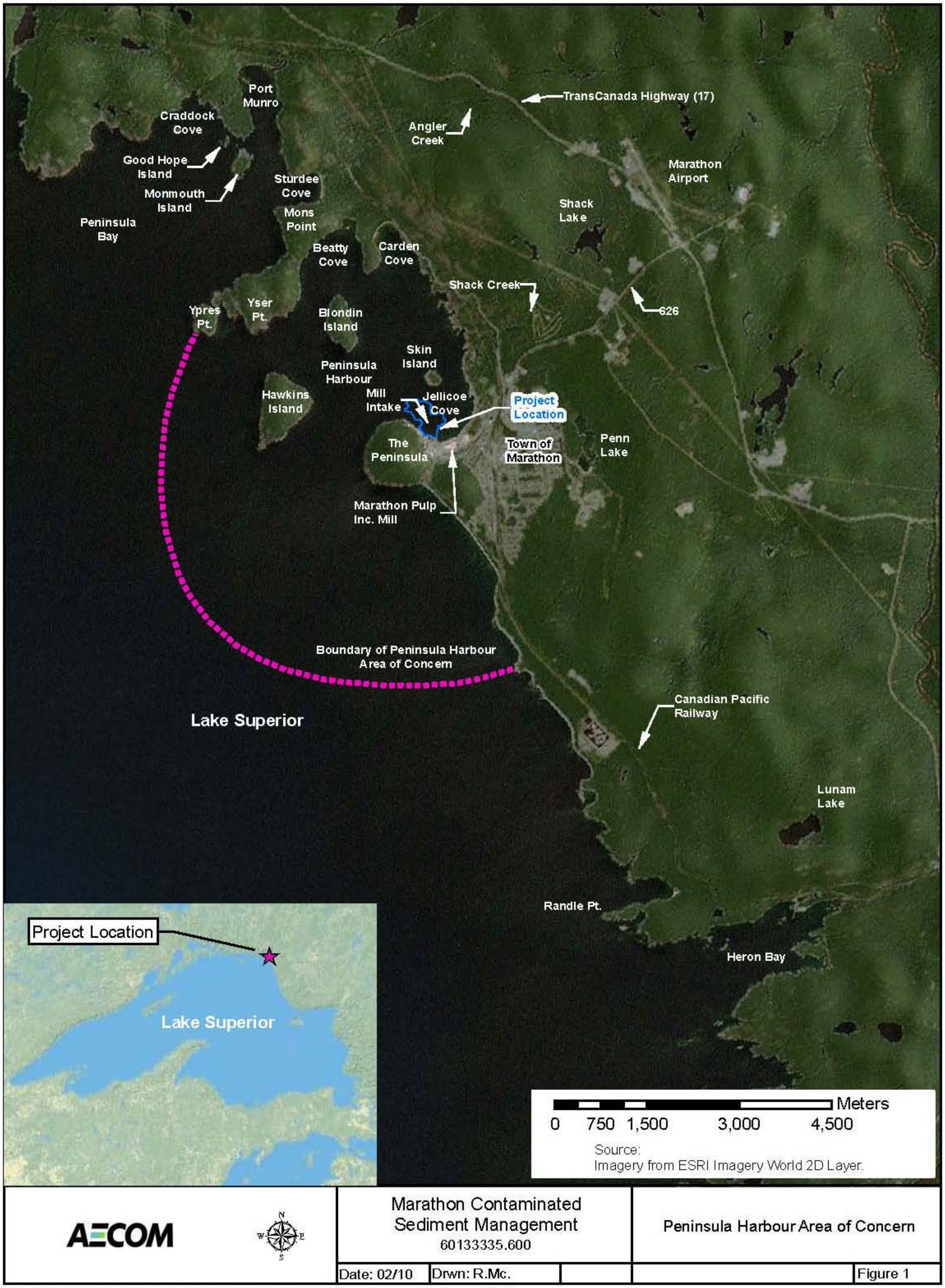
- Further habitat degradation from historical activities (fish breeding habitat destruction from woody materials, presence of trace contaminants, bacterial contamination, aesthetic impairment).

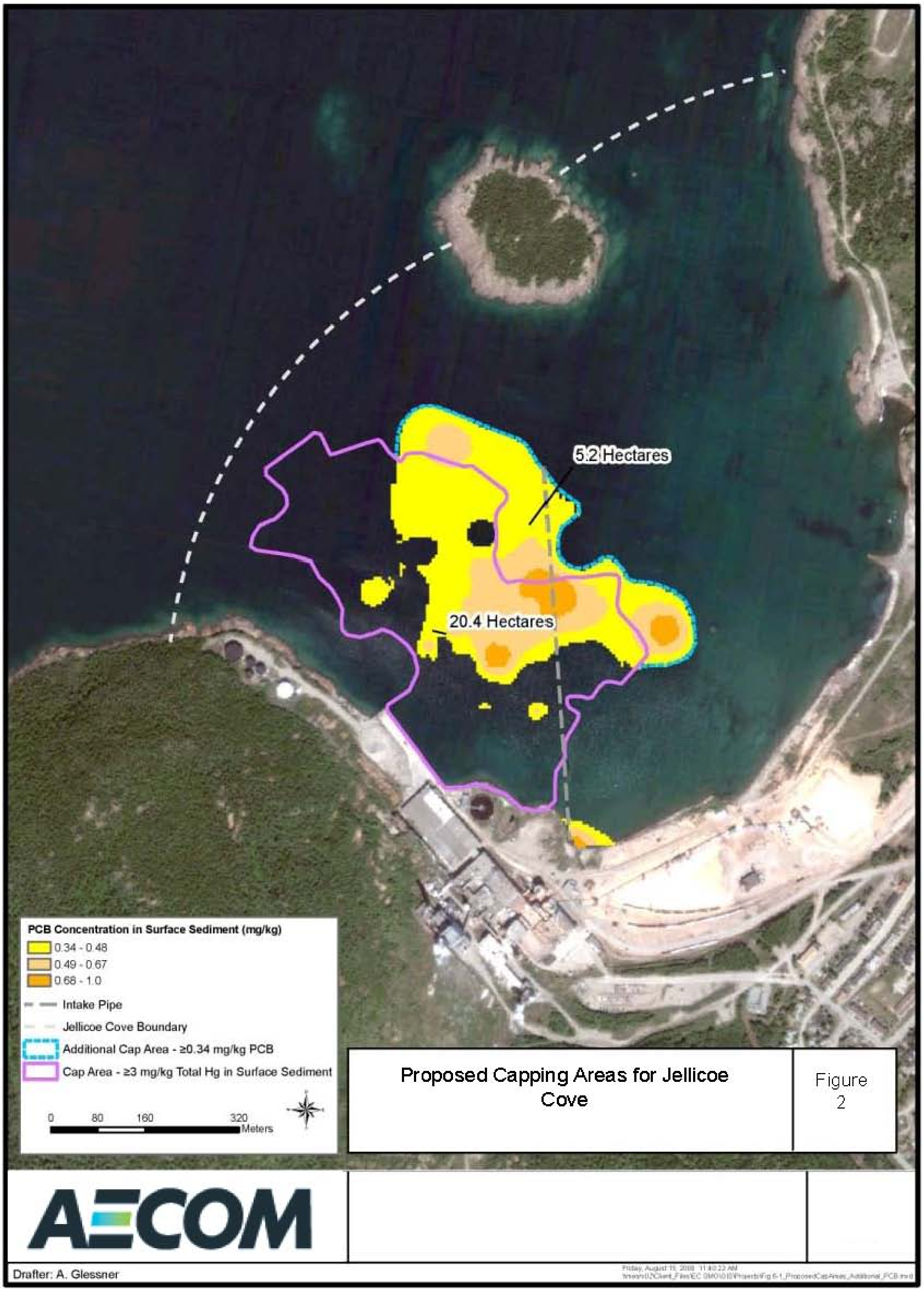
Further to the ERA, a Sediment Management Options (SMOs) analysis for Peninsula Harbour was also conducted. This study identified and evaluated various sediment management options and recommended a preferred management option. Based on the results of the SMO study, public input and in consultation with MOE and the Peninsula Harbour Sediment Management Technical Team, a thin layer capping was chosen as the preferred sediment management option to manage the contaminated sediments in Jellicoe Cove,

Capping will focus on the Jellicoe Cove “hotspot” (Figure 2); the area where sediments were found to be the most contaminated. Capping sediments in the area of highest contamination will reduce further migration of mercury and PCBs to the rest of Peninsula Harbour. Once constructed, the cap will be monitored for a number of years to assess the recovery of the area.

A thin layer cap (TLC), composed of approximately 15 - 20 cm of sand will cover 25.6 hectares (256,000 m^2) of contaminated sediments.

The net sediment deposition in Jellicoe Cove is approximately 2 mm/year and the addition of 15 cm of sand by the capping project (TLC) is equivalent to approximately 75 years of natural net sediment deposition (Environ 2008 b).


Port Munro
Craddock Cove
Good Hope Island
Monmouth Island
Peninsula Bay
Sturdee Cove
Mons Point
Angler Creek
TransCanada Highway (17)
Marathon Airport
Shack Lake
Beatty Cove
Carden Cove
Shack Creek
626
Ypres Pt.
Yser Pt.
Blondin Island
Skin Island
Peninsula Harbour
Hawkins Island
Mill Intake
Jellicoe Cove
Project Location
The Peninsula
Town of Marathon
Penn Lake
Marathon Pulp Inc. Mill
Boundary of Peninsula Harbour Area of Concern
Lake Superior
Canadian Pacific Railway
Lunam Lake
Randle Pt.
Heron Bay
Project Location
Lake Superior
Meters
0 750 1,500 3,000 4,500
Source:
Imagery from ESRI Imagery World 2D Layer.
AECOM
Marathon Contaminated Sediment Management
60133335.600
Peninsula Harbour Area of Concern
Date: 02/10
Drwn: R.Mc.
Figure 1
J:\Sediment\Projects\Marathon Canada Sediment Remediation\GIS\Projects\Figure 1 Peninsula Harbor and Jellicoe Cove_022310.mxd


5.2 Hectares
20.4 Hectares
PCB Concentration in Surface Sediment (mg/kg)
0.34 - 0.48
0.49 - 0.67
0.68 - 1.0
Intake Pipe
Jellicoe Cove Boundary
Additional Cap Area - ≥0.34 mg/kg PCB
Cap Area - ≥3 mg/kg Total Hg in Surface Sediment
0 80 160 320
Meters
Proposed Capping Areas for Jellicoe Cove
Figure 2
AECOM
Drafter: A. Glessner

1.2 Proponent Information

Environment Canada (EC) is the lead Project proponent and is the lead Responsible Authority (RA). Public Works and Government Services Canada (PWGSC) is the contracting authority on behalf of EC. The mandate of EC is inclusive of preservation and enhancement of the quality of the natural environment and the conservation of Canada's renewable resources and water resources. The primary contact within EC for the proposed Project is:

Kay Kim
Sediment Remediation Specialist
Great Lakes Areas of Concern Section
Strategic Integration Division
Environment Canada
4905 Dufferin Street
Downsview, ON M3H 5T4

Phone: 416-739-4787
Fax: 416-739-4404
Email: kay.kim@ec.gc.ca

1.3 Regulatory Context

1.3.1 The *Canadian Environmental Assessment Act* (*CEAA*)

EC and Fisheries and Oceans (DFO) are the RAs for the Project with EC being the lead RA.

The federal government is required to undertake environmental assessments under Section 5(1) of the Act. *CEAA* states responsibilities and procedures for the environmental assessment of projects involving the Federal government. The Act also establishes a process for determining the environmental effects of projects. *CEAA* is triggered whenever a federal authority (FA) performs one or more of the following duties or functions in respect of the project:

- FA is the proponent of a project (Section 5.(1)(a));
- FA grants money or any other form of financial assistance to the project (Section 5.(1)(b));
- FA leases, sells or disposes of land to enable a project to be carried out (Section 5.(1)(c)); or
- FA exercises a regulatory duty in relation to a project, such as issuing a permit or license that is included in the Law List prescribed by the regulations to the Act (Section 5.1(d)).

As the proponent of the proposed thin layer capping (TLC) Project in Jellicoe Cove, Peninsula Harbour, EC is exercising one of the powers, duties, and functions, prescribed under Section 5(1) of *CEAA*, and is therefore an RA for the proposed Project.

Early in the Project planning phase, Project information was distributed to various agencies to formally trigger the Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements (Federal Coordination Regulations or FCR). A copy of the responses from the various agencies is provided in Appendix A.

Through the FCR process and subsequent consultations, DFO has determined that they are an RA for the proposed Project as the Project requires an authorization under Subsection 35(2) of the *Fisheries Act*, which is a Law List Regulations trigger pursuant to *CEAA* (Section 5(1)(d)).

According to *CEAA* and its regulations, a Screening level of EA is appropriate for this Project. As required by the legislation, EC, in consultation with DFO as a RA, has determined the scope of the Project and scope of assessment for the proposed Project and has prepared a scoping document to define the content and extent of the EA (see Appendix A).

1.3.2 Federal Authorities

Based on an application made pursuant to the *Navigable Waters Protection Act* (*NWPA*), Transport Canada (TC) has determined that although an approval under the *NWPA* was required for the Project, it would not be a *CEAA* trigger for TC. This Project has been approved under Subsection 5(1) and (3) of the *NWPA*. A copy of the approval issued by Transport Canada for the Project is provided in Appendix B.

Health Canada (HC) has indicated that it is not a Responsible Authority under *CEAA*; however HC has provided expert advice in relation to the Project. More specifically, HC provided expertise related to air quality health effects; drinking and recreational water quality; and noise impacts.

Aboriginal Affairs and Northern Development Canada has indicated that it is not a Responsible Authority under *CEAA*; however Aboriginal Affairs and Northern Development Canada has knowledge of other projects in the area. According to Aboriginal Affairs and Northern Development Canada, a number of housing projects are taking place on First Nation lands which were screened under *CEAA*.

Parks Canada (PC) has an interest in the Project due to the proximity of Pukaskwa National Park to Peninsula Harbour, and has been included in circulation of Project material.

1.3.3 Provincial, Municipal, and Other Agencies

A Project of this nature would typically require provincial EA as well as federal EA as the Project involves work on Crown land. However, the Ministry of Environment (MOE) has indicated that a provincial EA is not required for this Project (see Appendix A) as the work involves remediation of contaminated sediments by a federal organization. Regardless of provincial EA requirements, the Ministry of Natural Resources (MNR) and MOE are participating in the federal EA process for this Project in consideration of their legislative mandates and expert knowledge of aquatic and terrestrial environments.

1.3.4 Legislation and Permit Requirements

In addition to the federal legislation indicated above (*i.e., CEAA*, *Fisheries Act,* and *NWPA*), the following federal and provincial legislation is relevant to the Project and has been considered in this EA report:

The *Migratory Birds Convention Act* (*MBCA*) protects migratory bird species and states that “no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird” without a permit. Section 35 of the Migratory Birds Regulations prohibits the deposit of oil, oil wastes or other substances harmful to migratory birds in any waters or any area frequented by migratory birds.

The *Species at Risk Act* (*SARA*) protects wildlife species from becoming extinct through prohibitions against killing, harming, harassing, capturing or taking species at risk, and against destroying their critical habitats. Management of species at risk and of special concern (as identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) is accomplished by providing for the recovery of species at risk due to human activity and by using sound management to ensure that species of concern do not become endangered or threatened.

The Ontario *Endangered Species Act* (*ESA*) protects species listed as extirpated, endangered or threatened and their habitats from damage or destruction. Administered by MNR, the *Act* also ensures the development of longer-term protection and recovery strategies for all listed species.

In addition to the above *CEAA* triggers and requirements, consultation with the various regulatory agencies identified the following list of permit requirements for the Project:

Table 1 Anticipated Permit Requirements

Permit	Legislation and Administration	Description	Application Fee	Submission Date
Federal Permits				
HADD Authorization	*Fisheries Act* administered by DFO	Placement of cap material will harmfully alter, disrupt or destruct existing fish habitat.	None. Compensation for loss of fish habitat is not required.	Upon approval of the EA.
NWPA Approval	*Navigable Waters Protection Act* (*NWPA*) administered by TC	An approval is required to conduct work that is built or placed in, on, over, under, through or across navigable water in Canada.	None	Application submitted on January 19, 2010. Project approved under Section 5(1) and 5(3) in September 2010, and in November 2011.
Provincial Permits				
Endangered Species Act Permit	*Endangered Species Act* administered by MNR	A permit is required to undertake an activity in an area known to shelter extirpated, endangered, or threatened species – in this case: lake sturgeon and potentially shortjaw cisco.	N/A	MNR has indicated that this Project will not require permits given that the Project is not likely to impact *ESA* listed species.
Water Taking Permit[1]	*Ontario Water Resources Act* administered by MOE	Permit required for withdrawing more than 50,000 L of water on any day by any means.	$750 (Category II)	Will be submitted if required.

Permit	Legislation and Administration	Description	Application Fee	Submission Date
Work Permit	*Public Lands Act* administered by MNR	Permit required to undertake work on publically owned / administered lands in Ontario which includes the lakebed.	N/A	MNR has indicated that this Project will not require a Work Permit as the Project is to be undertaken by a federal organization.
[1] Requirement depends on the method of material placement (*i.e.,* preparation of slurry using water on site).				

1.4 Organization of the Report

This EA Report is organized to reflect the process by which the assessment has been conducted. Section 1.0 introduces the proponent and the undertaking and provides background information on the Project.

Section 2.0 describes the proposed undertaking. Project activities are discussed as well as the location, scope and schedule for the Project. Emissions and discharges and potential malfunctions and accidental events that may arise during and post construction are described.

Section 3.0 describes the existing physical, terrestrial, marine and socioeconomic characteristics of the study area.

A description of the environmental assessment methodology employed for this assessment is provided in Section 4.0 along with the scope of the assessment. This section also includes a description of the community and regulatory consultation efforts as well as the Aboriginal engagement.

Section 5.0 provides the results of the environmental effects assessment for Valued Ecological Components (VECs) and Valued Socio-Economic Components (VSCs).

Section 6.0 discusses potential malfunctions and accidental events (along with their potential environmental effects and proposed mitigative measures), which could occur during the Project.

Section 7.0 discusses the effects of the local environment on Project components and activities.

Section 8.0 describes potential cumulative environmental effects of the Project considered in conjunction with past, present and likely future projects in the study area.

Section 9.0 describes the Evaluation of Existing Administrative Controls.

A summary of Follow-up Monitoring from the EA are presented in Section 10.0 and a summary of the EA Report and conclusions from the EA are presented in Section 11.0.

Sections 12.0 indicated the assessment decision and course of action.

Section 13.0 details literature and personal communications cited in the report.

A series of technical reports and other supporting information are contained in the appendices to this document.

2. Description of the Project

2.1 Project Location

Peninsula Harbour is located 290 km east of Thunder Bay Ontario, on the Northern shore of Lake Superior and near the Town of Marathon. The Harbour is somewhat sheltered from outer waters of Lake Superior by the Hawkins and Blondin Islands. The Harbour is situated between Ypres Point in the north, an unnamed peninsula in the south (the Peninsula), Hawkins Island in the west, and the main shoreline in the east (Figure 1, page 3). It is in total about 1,070 ha in area, approximately 3 km wide and 4 km long.

Peninsula Harbour is composed of several coves including Jellicoe Cove which is approximately 97 ha in area. The south eastern shore of Jellicoe Cove, adjacent to the cap area is coarse sand. The Marathon Pulp Inc. (MPI) facilities and a shipping wharf exist on the south western shoreline of the Cove. The east and west shorelines are composed of bedrock. A boat launch and seasonal docks occupy the north-eastern corner of Jellicoe Cove.

The sediment and invertebrate tissue concentrations of mercury were found to be the highest in Jellicoe Cove in Peninsula Harbour AOC. Within Jellicoe Cove, areas to be managed were delineated by total mercury and PCBs concentration in sediment to identify the area of greatest risk / concern. Results from the ERA (ENVIRON 2008) indicated that:

- Area (204,000 m^2) where mercury concentrations exceeds 3 mg/kg includes most of the area with elevated PCB concentrations (*i.e.,* in excess of 0.34 mg/kg).
- Additional elevated PCB contaminated area outside the 3 mg/kg mercury footprint is 52,000 m^2. (See Figure 2).
- Management of 204,000 m^2 as identified in (1) above will reduce risks posed to fish, mink, and other fish eating mammals and fish eating raptors to acceptable levels.

According to the ERA, capping 204,000 m^2 is sufficient to reduce risks to biota; however, the Project partners decided to cap the additional 52,000 m^2 PCB contaminated area to further reduce risks to biota.

2.2 Project Background and Alternatives

2.2.1 Background

The pulp mill at Jellicoe Cove discharged effluent directly into the Harbour from the beginning of its operations in 1946, until the installation of a diffuser and a secondary treatment basin (*i.e.,* aerated stabilization) in the 1980s and 1990s respectively. The mill re-routed discharge out of the Cove before ceasing its operations in 2009.

Historically, a chlor-alkali plant adjacent to the mill used elemental mercury in its process and discharged to Jellicoe Cove from 1952 to 1972. The plant ceased operation for water treatment between 1977 and 1984, and eventually closed, sealing and disposing of mercury contaminated equipment. Despite the closing and sealing, PCB and mercury contamination in the sediment at Peninsula Harbour remain ongoing concerns.

In 1987, Peninsula Harbour was designated as an AOC by the International Joint Commission (IJC) in consultation with the Parties under the auspices of the 1978 *Great Lakes Water Quality Agreement between Canada and the United States* (revised 1987). The designation was due to bacterial contamination, higher than average levels of contamination in fish and sediment, aesthetic impairments, degraded fish and invertebrate communities, and loss of fish habitat.

Various studies have been conducted to characterize and quantify the area of contamination in Peninsula Harbour. An early risk assessment study concluded that elevated concentrations of sediment contaminants occurred in the benthic invertebrates, but there were no significant toxic effects on this group from mercury or PCB contamination (Beak 2003). Other studies reported no changes in benthic community structure in relation to mercury contamination (Milani *et al*. 2002); however, contaminants within benthic organisms interacting with the sediment were found to be bio-available and to bio-accumulate within Peninsula Harbour and Jellicoe Cove (Grapentine *et al.* 2005). Furthermore, the results of the more recent Environmental Risk Assessment (ERA) (ENVIRON 2008) concluded that, based on multiple lines of evidence, sediment management action is required. The ERA found the following:

- Invertebrates are not likely to be harmed by mercury or PCBs in sediment;
- Reproduction in sport fish and bottom-dwelling fish may be reduced by mercury and PCBs;
- Some mink young may be harmed by PCBs if they eat fish from the harbour; and
- Fishermen and their families may be at risk from PCBs if they eat fish from Peninsula Harbour.

Mercury concentrations were found to have the potential to negatively impact reproductive activities of nearly all fish in the AOC (ENVIRON 2008). With respect to the longnose sucker, reproduction was also considered be impaired due to PCB concentrations, although PCB concentrations were unlikely to adversely affect most other fish species. Impaired reproduction in the longnose sucker could potentially propagate to population level impacts (*i.e.,* changes in long-term abundance or harvest levels), such that the potential for adverse effects is greatest in the longnose sucker.

Although the risk posed to waterfowl by mercury and PCBs was not considered to be significant, concentrations of mercury in fish (not PCB concentrations) could impede the reproductive success of individual bald eagles and other piscivorous (fish eating) raptors if they primarily forage in Jellicoe Cove. Effects to both fish and raptors were not anticipated to extend to the population level or cause acute toxicity based on the risk estimates. Piscivorous mammals are not anticipated to be adversely affected by mercury concentrations in fish; however, PCB concentrations in fish were found to pose a significant risk to piscivorous mammals foraging in both Jellicoe Cove and the rest of Peninsula Harbour (including mink), although acute toxicity or population level effects were unlikely.

The ERA found that humans eating fish from Jellicoe Cove were unlikely to be at health risk due to methylmercury levels; however, PCBs in fish pose unacceptable health risk to humans and mammals. These effects are unlikely to occur at the population level, as is acute toxicity (ENVIRON 2008). Despite the findings of the ERA, the elevated concentrations of both mercury and PCBs have resulted in consumption restrictions for a number of fish species in the AOC as indicated in the Guide to Eating Ontario Sportfish (MOE 2009). Similar advisories also exist for fish caught in all other Ontario lakes.

A survey was conducted of First Nation members in the Marathon and Pic River reserves to determine residents' fishing and eating practices. No evidence of subsistence fishing was found within the Harbour as a result of the survey, with most fishing found to be taking place in other regions of Lake Superior (outside Peninsula Harbour).

There is also a concern with the movement of contaminated sediments from the Cove to the rest of Peninsula Harbour.

Based on these environmental and human health risks, the mercury and PCB management areas were identified for the Project. Capping of the Project area is expected to accelerate natural sediment deposition in Jellicoe Cove.

2.2.2 Review of Project Alternatives

Over the past several years, and throughout the development of the remedial action plan (RAP), a number of sediment management options (SMOs) were identified and presented in the 2008 SMO Report (ENVIRON 2008b). A preliminary screening exercise, undertaken as a component of the SMO Report, examined options based on effectiveness, ease of implementation, and relative cost. The SMOs evaluated under the preliminary screening included:

- The use of institutional controls such as legal restrictions;
- Natural recovery and /or no response;
- Sediment capping:
  - Isolation capping with armouring layer
  - Engineered capping with reactive materials
  - Thin layer capping
- Sediment removal including:
  - Removal via mechanical, hydraulic, or dry mechanical dredging;
  - Dredged material dewatering, stabilization via passive dewatering, mechanical dewatering, or dewatering with geosynthetic tubes;
  - Disposal at offsite waste disposal facilities, consolidation and capping in local CDF, beneficial re-use following ex situ treatment, in situ treatment, and / or ex situ treatment.

Through the preliminary screening, natural recovery was eliminated because low sedimentation rates would result in a significant timeframe required to meet the goal of delisting. The sedimentation rate at Jellicoe Cove is approximately 2 mm per year (ENVIRON 2008b).

The preliminary screening process developed three (3) key alternatives; thin layer capping; hydraulic dredging and offsite disposal of dredged material combined with thin layer capping; and hydraulic dredging and onsite disposal of dredged material at a confined disposal facility combined with thin layer capping (ENVIRON 2008b). The three (3) alternatives were then evaluated against the following criteria:

- Restoration goals to prevent and minimize the potential for exposure of PCBs and mercury, and the potential for migration of these substances from areas of most elevated concentration;
- Human health and ecological risk;
- Technical feasibility of each potential solution, location and area, with respect to construction and operation requirements, timeframe, and reliability;
- Need for measures to control residual contamination;
- Short term and long term monitoring requirements;
- Community acceptance;
- Regulatory compliance; and
- Cost.

Based on the detailed evaluation of the three (3) alternatives, Thin Layer Capping (TLC) was identified in the SMO Report as the preferred option. The following is a brief summary of the options analysis.

Remedial Alternatives 1 and 2 – Dredging and Thin Layer Capping (1- Offsite Disposal of Dredged Sediment and 2- Consolidation of Dredged Sediment in an Onsite Land-Based Confined Disposal Facility

Generally, the advantage of dredging is the removal of mercury and PCBs from the aquatic environment. Removal is a technically feasible option, given that little long term monitoring and maintenance are required; however, there are drawbacks to this method as well: there may be difficulty in dredging thin layers of sediment which overlie hardpan or bedrock, dredging in shallower waters may be incomplete due to the increased difficulty of operating dredging equipment, and residual contaminants in the remaining sediment could remain in concentrations equal to those prior to dredging. An MOE sediment sampling study (1991) calculated that complete removal of mercury in areas less than 18.2 m depth would reduce the local area of bioavailable mercury by approximately 9.8 - 12.9%, while in order to eliminate fish advisories, 17% (lake trout), 36% (longnose suckers) and 62% (white suckers) reductions would be required.

Dredging may also pose health risks to the community and construction workers via exposure to the contaminated dredged sediment during dredging, dewatering, and transport of contaminated sediment. Since the construction period for dredging and capping would be longer (relative to capping alone), there is also a greater potential for short term adverse impacts. This could also create public concern regarding potential nuisances due to prolonged construction periods (*e.g.,* noise, traffic, odours, lighting), inland management of contaminated materials, as well as concerns regarding Harbour access and the potential associated economic impact.

The process of dredging and removing sediment can result in short term and long term human and ecological risks. Sediment re-suspension would occur during dredging and while this can be mitigated (by operational controls, the presence of relatively coarse grained sediment). Significant re-suspension during dredging could impact water quality and potentially transfer mercury and PCBs from particulate to dissolved phases (*i.e.,* sediment and water).

Sediment dewatering significantly increases the technical challenges of dredging. Dewatering also requires leachate testing to verify that decant water passes the Provincial Water Quality Objectives and total suspended sediment loading prior to discharge back into Jellicoe Cove. Substantially greater onsite support such as staging, heavy machinery, and transport are also required relative to thin layer capping in isolation.

Onsite disposal will require significant site-preparation work (*i.e.,* lining, berming) and a placement of a landfill cap to assist in the long-term stability of the stored material.

Based on the SMO report, the estimated cost of dredging to 14 ppm mercury is $6.9 M, and dredging to 17 ppm mercury is $5.5 M. (ENVIRON 2008b).

Remedial Alternative 3 –Thin Layer Capping

Of the capping options identified (*i.e.,* isolation capping with armouring layer, engineered capping with reactive materials, TLC), TLC was shortlisted due to the limitations associated with other capping methodologies. Isolation capping with an armouring layer is applicable but was evaluated to be more suitable for areas with high mechanical disturbance. Engineered capping with reactive materials (*e.g.,* binding or sequestering agents) serves to chemically manage contaminants, or geosynthetic membranes which stabilize, prevent mixing of, and serve as a bioturbation barrier. For remediation at Peninsula Harbour, there is currently no field-ready reactive material known to sequester methylmercury occurring in the sediment.

The benefits of TLC capping include burial of mercury and PCB contaminated sediment and dilution of the contaminated sediment layer through mixing with clean material. TLC effectively enhances natural recovery and reduces the risks to mink by PCBs by 12% to 33%, and mercury to fish by 22% to 47%.

The largest technical challenge with TLC in general, is to establish a relatively uniform sediment cap thickness during placement without disturbing the in-situ sediment and entrained contaminants. Gradual application techniques such as particle broadcasting, spraying, or other methods have been designed to overcome this obstacle during placement and are potential options for remediation at Peninsula Harbour.

Environmental impacts associated with thin layer capping include the covering of existing sediment which is habitat to benthic invertebrates. As a result, surficial sediment would be void of benthic invertebrates until re-colonization occurs. TLC placement is not likely to cause the release of significant concentrations of mercury or PCBs and sediment re-suspension is likely to be limited (Lyons *et al.* 2006 in ENVIRON 2008b). A study conducted by the US EPA found that, in general, contaminant re-suspension was relatively low during placement of all cap layers where contaminant concentrations remained in the low ng/L range for most samples (US EPA 2008). Because the sand TLC is intentionally not armoured, some localized re-suspension and re-deposition of the TLC and underlying sediments may occur during extreme storms, and by propeller wash. Nevertheless, it is judged that such localized re-suspension and re-deposition will not impact the overall, global effectiveness of the cap. The grain size for the cap material was chosen based on the local hydrodynamic conditions in the Cove.

According to the SMO report, the estimated cost of TLC is $3.8 M (ENVIRON 2008b). This is significantly less expensive than other shortlisted options.

TLC is relatively effective when compared to other options. Construction times are generally brief, and sediment is left in place thereby minimizing community nuisances associated with dredging and dredge spoil management activities. TLC at Jellicoe Cove is also expected to enhance natural recovery throughout Peninsula Harbour. Between all shortlisted management options, TLC was selected by the Project partners as the preferred sediment remediation strategy based on these factors and community input. The Project partners consulted with the local community via public meetings regarding the evaluation of sediment management options in 2008. At that time, the community generally agreed that TLC is the preferred option.

2.3 Project Components

As previously indicated, the Peninsula Harbour Contaminated Sediment Management Project consists of TLC of contaminated sediment within Jellicoe Cove. The proposed cap will be composed of clean material (*e.g.,* medium and coarse sand) measuring approximately 15 – 20 cm in depth and covering an area of 25.6 ha.

More specifically, the Project includes the following components:

- TLC placement in areas where concentrations of total mercury in the surface sediment exceeds 3 mg/kg, which is approximately 204,000 m^2 in extent;
- TLC placement in areas with elevated concentrations of PCBs (equalling or exceeding 0.34 mg/kg) outside the above area, which is approximately 52,000 m^2; and

- Temporary ancillary elements (*i.e.,* use of laydown and storage areas; equipment set-up; transport of borrow material).

During the Detailed Engineering Design phase, the grain size for the cap material was chosen based on local hydrodynamic conditions and in consideration of local supply of sand. The cap material has been designed so as to resist displacement associated with the maximum wave height in historical record (6.4 m) (Environmental Hydraulics Group 1993). AECOM reviewed calculations that simulated wave action from a peak storm event, as well as some scour potential calculations in a study on future use of MPI pier, and used them to bolster the cap design in areas closer to the pier, within the navigation channel. Based on a preliminary evaluation of hydrodynamic conditions, two (2) size grades of sand, both medium and coarse-grained sands have been selected for cap material, due to ease of placement, stability, and ability to maintain aerobic conditions. In consideration of the proximity to the location of the historical shipping channel adjacent to the MPI Pier, a slightly coarser grade of sand was selected to improve resistance to displacement should the pier be reopened to shipping in the future. It is noted that the coarser grade material is not designed to withstand all potential vessel traffic but rather nominal usage as projected in a shear stress analysis (ENVIRON 2009). The grain-size selected will withstand a wave height of 6.4 m.

The TLC will be designed and constructed in compliance with regulatory agency requirements and necessary permits. Strategies employed during cap design and placement will provide adequate protection against excessive disturbance and damage to adjacent aquatic habitats and organisms. Construction work will be scheduled so as to minimize impacts to fish species in Jellicoe Cove by adhering to fisheries timing restrictions whenever possible, and by employing best management practices that minimize ecological impacts. Throughout this report, fisheries timing restrictions refer to the preferred in-water working window (the fisheries timing window) as defined by MNR. In consideration of the restrictions for coldwater and warmwater fish, the fisheries timing window for Jellicoe Cove is from approximately June 16 to August 31, but MNR has given approval to start the in-water works starting May 1 for this Project.

2.4 Project Activities

The development of the proposed Project will include the following key phases: site preparation, construction, and long-term monitoring. Given the nature of the project, decommissioning and abandonment are not required.

2.4.1 Site Preparation

2.4.1.1 Preparation of the Laydown Area

The Contractor will be responsible for the identification of the laydown and storage area to be used for equipment and material storage. It is anticipated that the laydown area will occur on a previously disturbed / prepared area, void of vegetation and a minimum of 30 m from aquatic habitat (*i.e.,* watercourses and wetlands). Otherwise, the Contractor is responsible for ensuring that the selected site is suitable for development; that is, undertake any necessary environmental evaluations at the site in consideration of rare and sensitive wildlife species and habitat to ensure compliance with all relevant federal and provincial legislation and provide documentation of the evaluation to the satisfaction of proponent.

The boundary of the area required for the construction laydown and material storage area will be clearly marked at the commencement of the Project. The area will be large enough to accommodate construction equipment and material storage. Access roads will be upgraded or constructed as and if required to accommodate the transport of vehicles and equipment that will be required for the Project and in accordance with the evaluation procedures indicated above and all relevant legislation.

Site preparation will also include equipment set-up, such as the material conveyance equipment needed to transfer the cap material from the pier / dock to the transfer barge.

Site preparation activities will be done prior to commencement of capping and are not limited by fisheries timing restrictions. These activities are expected to take approximately three (3) to four (4) weeks.

2.4.1.2 Staging and Erosion Control

Based on site conditions, an appropriate erosion and sediment control plan will be submitted by the Contractor for review. Erosion control will be the first line of defence and the amount and duration of any exposed soils will be kept to a minimum. Appropriate erosion and sediment control measures will be implemented prior to any shoreline construction and where there is the potential for erosion due to rain, flowing water, steep slopes and highly erodible soils, and will be left in place for the duration of construction in that area. These control measures will follow the Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites (MNR *et al.* 1987) and will be implemented according to the Ontario Provincial Standard Specification (OPSS – Construction Specification for Temporary Erosion and Sediment Control Measures (OPSS 2006). The Contractor has the ultimate responsibility to install, monitor and maintain erosion and sediment controls until the erosion risk has ended. Requirements for barge access and manoeuvrability will be finalized during the Detailed Engineering Design and contractor procurement phases; however, neither issue is expected to present substantial Project challenges in Jellicoe Cove.

2.4.2 Construction

Approximately 59,000 m^3 of sand will be required to construct the 15 – 20 cm cap over the proposed cap area. The Contractor will identify the source of the cap material and will ensure that the material meets the required Project specifications, as specified in Technical Specification 35 20 44, and that material is sourced from a permitted pit. It is understood that there are a number of permitted borrow sites in the Marathon area, some of which are known to have suitable borrow material. For the purpose of this assessment, it is assumed that any sand washing required to ensure minimal fines in the cap material will occur at the permitted pit or source. The Specification 35 20 44 identifies the particle size acceptable for this Project. The fines are limited to 6%. The reason for selecting this limit is twofold. First, AECOM team members have experience with other subaqueous capping projects in which a borrow source with similar fines was used, and the placement conditions were also similar. Consequently, AECOM has reasonable assurance that the material evaluated for this Project can be placed without posing substantial work delays related to excessive turbidity. Second, the material sources sub-sampled and analyzed for fines can meet this requirement without extensive washing, saving Project cost and schedule delays.

2.4.2.1 Transport of Cap Material

For the purpose of this assessment, it is assumed that cap materials will be trucked overland from the borrow areas to Jellicoe Cove on local and provincial roads. Materials will be stored in a designated area in the construction laydown area and will be covered with tarps, if necessary, to reduce the potential for wind or water erosion. Assuming the use of a local borrow pit and overland transportation to the laydown area, it is estimated that a total of approximately 5,217 truck loads or approximately 85 - 90 truck loads per day will be required to haul enough material to maintain a cap placement production rate of 1,500 m^3 per day. This is based on a per load volume of

16.5 – 17.5 m^3 (*i.e*., tandem truck with pup). It is assumed that material hauling will take place on a 12 hour per day – six (6) day per week basis, with each truck making multiple trips each day. An increase to seven (7) days per week may be required to make up for slower than anticipated production and / or construction delays. Given that the pit and laydown areas will be selected by the successful Contractor, the available area for stockpiling and hence, the number of loads per day cannot be confirmed. In recognition of the potential environmental effect that truck traffic may have on local communities and residents, Contractors will be asked to include as part of their bid, details regarding material hauling and what measures will be taken to minimize impacts to surrounding populations (*e.g.,* haul route, haul method, volume to be stockpiled, scheduling for material transport). The Project proponents and administrator will consider this in the evaluation of bids.

It should be noted that the successful Contractor may opt to obtain the borrow material from a non-local source and transport it to the Project area via barge. In such an instance, the Contractor will ensure that the material meets the required Project specifications for grain size and other criteria; is obtained from an approved source (*i.e.,* source pit has all necessary regulatory approvals in place); and that transportation to the Project area is undertaken in such a manner as to minimize vehicular traffic and prevent loss of the material to the environment. If this option is selected, the need for overland trucking will be eliminated.

2.4.2.2 Cap Placement Activities

Placement of the TLC may require both onshore and offshore construction. In shallow areas of Jellicoe Cove, barge access required for the Project will be limited by water depth, such that shoreline access may be required for nearshore cap placement activities. Shoreline improvements to accommodate heavy equipment are not anticipated. The nearshore cap placement from onshore will use existing hardened shoreline, so damage to shoreline is not anticipated. Should damage occur, the contractor is responsible for returning the area back to its original condition at the completion of the project.

Offshore construction will be implemented from a barge or similar vessel and will require a pier facility for loading material. Like the laydown area, the Contractor will identify the pier / dock facility to be used for the Project. It is anticipated that the pier selected will be an existing pier that is sufficiently adequate for the intended use and with all necessary regulatory approvals for operation in place. Otherwise, the Contractor will be responsible for obtaining the necessary approvals for the construction of a new pier / dock facility which may include but not necessarily limited to authorizations pursuant to the *Fisheries Act*, the *Navigable Waters Protection Act*, and the Ontario *Public Lands Act* as well as any associated environmental assessments that such permits may be subject to.

The specific method of sand placement will be determined by selection of a successful bidder. There are several placement techniques that can adequately place the sand cap material within the proposed boundary while minimize effects on water quality. Further, there are several marine contractors in the area with the equipment and experience to undertake the work. Consequently, bidders on the Project will be required to submit a Technical Execution Plan specifying how the material will be placed and what measures will be employed to optimize placement and minimize impacts. Construction will include an initial pilot phase to evaluate and optimize the specific technique and procedures at the start of the Project to address changed conditions such as the grain size of the capping material and / or the deployment water depth.

Cap Placement Scenario

For cost estimating and assessment purposes, AECOM had established a conceptual placement scenario involving the use of a derrick barge equipped with a clam-shell bucket. This placement scenario is considered reasonable given it has been used for other similar projects and is a feasible option given potentially available marine contractors and vessels in the area. Under this scenario, capping material will be loaded onto a flat bed transfer barge via a conveyance system then hauled to the placement barge. It is assumed that two (2) two capping barges consisting of barge-mounted derrick cranes and / or backhoes, and approximately three (3) deck barges (material barges) will be operating at all times (*i.e.,* 24 hours/day and up to seven (7) days/week) throughout construction. In addition, two (2) tug boats and two (2) support vessels will likely be used. The capping barge is positioned over the capping area by tugs and secured using multi-point anchor systems. The capping barge bucket will swing over and grab capping material from the deck barge, and place the capping material over the target location. After release the capping material will descend through the water column to the targeted placement location on the lake bottom (particle broadcasting). The capping barge will advance in a capping lane using the anchor system, and will be repositioned within the cap area when necessary by tug assist.

Alternate placement methods may include the preparation of a slurry with the cap material using water extracted from the lake. Like the clam-shell placement method, the Contractor will place the material to allow for particle broadcasting and in thin multiple lifts to minimize re-suspension. It should be noted that this method may require a permit for the extraction of surface water pursuant to the Ontario *Water Resources Act*, depending on the volume of water to be extracted (*i.e.,* greater than 50,000 L per day). Additionally, a dry broadcast technique using a telescoping spreader may also be suitable.

Cap Placement Technique

To minimize re-suspension of sediment, the cap will be placed in multiple thin lifts and the relatively low application rate (estimated bucket size of 3 m^3 - 8 m^3 and maximum production rate of 2,000 m^3/day) is expected to have minimal impact on ambient sediment during placement. With increasing thickness of capping material placed over ambient sediment, the increased loading can cause consolidation of the underlying material with the accompanying release of sediment pore water up through the cap.

Regardless of the method of placement, the Contractor will employ the appropriate positioning equipment to ensure that the cap material is placed in the intended locations.

Cap Placement Schedule

Based on a cap placement rate of approximately 1,500 m^3 per day and a six (6) day work week, construction of the TLC is expected to occur over an approximate nine (9) week period including potential delays for weather, equipment malfunctions and slower than expected production rates. Construction may increase to seven (7) days a week to make up for slower than anticipated production and / or construction delays. In consideration of fisheries timing restrictions, cap placement will be limited to May 1 to August 31, unless otherwise authorized by MNR.

Sunken Logs and Debris

It is assumed that any sunken logs and other debris will be left in place. Woody debris was identified during the side scan sonar survey but it was not as predominant in the area of the TLC as other locations within the Cove. Due to re-suspension concerns and additional cost, the design did not include log / debris removal. The presence of the debris will deflect sand placement locally but the overall efficacy of the TLC is not expected to be compromised by leaving the material in place.

Fate of Cap Material

As the capping material is released at the water surface over the target location, it will undergo an initial convective descent (because of the density difference with the surrounding water), accelerating and drawing water into its mass. In shallow water (less than 3 m in depth), the released material will generally reach the bottom with minimal water entrainment. In deeper water, the varying fall rates of different sized particles within the bucket load will cause some vertical spreading of the material as it transits to the bottom. As the capping material reaches the bottom, it will generally spread radially outward from the center of impact, potentially causing re-suspension of in-situ sediment at the immediate sediment-water interface.

Interaction with Contaminated Native Sediment

The contaminated sediment contains mercury and PCBs but no separate phase nonaqueous phase liquids (NAPL) has been observed or measured and, hence, the potential release of surface sheens is not expected. Some consolidation of underlying sediment is expected following placement of the cap, but given the thickness of the intended cap and the nature of the underlying sediment, settlement is expected to be less than a few centimetres, resulting minimal release of porewater. Test borings made by AECOM in 2009 revealed that the recent surficial sediments were generally very loose silt with organic material. Geotechnical laboratory testing was performed to evaluate the geotechnical properties of representative sediment samples, and these data were subsequently used to analyze rate of cap settlement, bearing capacity, slope stability, and sediment-cap intermixing. These analyses confirm that the sediments have adequate bearing capacity to support the cap and that the cap will be stable. Large debris (*e.g.,* logs) will be left in place and cap sand will be placed over them.

There is also potential for some lateral displacement of sediment at the cap perimeter during implementation. The extent of lateral displacement may be on the order of 1/3 to 1/2 times the thickness of the cap, such that underlying sediment could be displaced 5 – 10 cm in any direction. A study conducted by the US EPA found that, in general, contaminant re-suspension was relatively low during placement of all cap layers. Contaminant concentrations remained in the low ng/L range for most samples (US EPA 2008). The intent of the TLC is not complete isolation of the underlying contaminated sediment, but rather enhancement of natural sediment deposition. The physical mixing of cap material with the underlying contaminant sediment will occur during cap placement and may result in a mixed layer of 2 - 3 cm at the base of the clean overlying cap layer.

Site Clean-Up

Garbage and debris generated during construction will be removed and disposed of at an approved location. Disposal of waste will be conducted in accordance with provincial and municipal waste management regulations and guidelines. All construction equipment and vehicles will be removed from the Project area upon completion of construction and the laydown area will be cleaned-up and left in a condition similar to pre-construction, ensuring surface runoff from the site does not enter the Harbour.

2.4.2.3 Performance Monitoring

In accordance with the technical specifications (Technical Specification 35 20 44) established for the Project, monitoring of cap thickness will be undertaken by divers using push or pistons cores, or by other methods. Sand cap placement shall be measured for acceptance in 10,000 m^2 cells. As capping is initiated, a Test Phase will be established based on placement of the first 10,000 m^2 of material at which time 16 core samples will be collected: four (4) samples from each of the four (4) quadrants of the test cell. Measurement for acceptance of subsequent cells shall be performed by collecting five (5) sediment cores in each cell: one (1) in the center and one (1) in the center of each 2,500 m^2 quadrant of the cell. Acceptance of each cell shall be based on achievement of capping performance requirements. Upon completion of the cap placement, a multibeam bathymetric survey will be completed to establish the post-construction conditions.

2.4.2.4 Mitigation and Monitoring for Turbidity

Sediments or solid matter in suspension originating from physical, chemical, or biological processes occurs naturally in aquatic systems. All aquatic organisms are subjected to natural variations in suspended sediment arising from episodic precipitation or weather related events or seasonally from snowmelt. Aquatic organisms and their lifecycles are uniquely adapted to survive these natural occurrences. When sediment concentrations and rates of deposition exceed natural background levels, aquatic biota can be negatively affected resulting in reduced abundance and diversity, and shifts in community composition.

Sedimentation affects growth, reproduction and mortality rates at all trophic levels and can impact the key components of the food chain, including primary production, zooplankton, benthic invertebrates, and ultimately fish communities. Effects on fish and aquatic biota are determined by both the concentration of suspended sediments and the duration of exposure to them (Newcombe and Jensen, 1996), and can range from no effect to behavioural and sublethal and lethal effects, in addition to habitat impacts (Kemp et al., 2011).

Guidelines for suspended sediments and turbidity have been created by the Canadian Council of Ministers of the Environment (CCME 1999) to protect aquatic resources from elevated levels of sediment.

The technical specifications for this Project require the percentage of fines to be less than or equal to 6% of the material. With limited ambient currents, minimal loss to the water column is expected (Ruggaber 2000). The Cove area is characterized by a relatively low current regime and limited wave action which will significantly limit dispersion during performance of the capping program.

The shoreline near the Project area is mainly industrial and heavily impacted. Two small nearshore areas to the southeast and southwest side of the cap have been identified as potential fish habitat, however it is unknown (can not be verified 100%) whether or not it is a sensitive fish habitat. Should sensitive fish habitat be found in these areas, precautions will be taken to protect these areas (e.g. turbidity curtains may be used and the turbidity level within the curtain area must meet the turbidity criteria specified in Table 2)..

Further consideration to the use of turbidity curtains will be given in the event of consistent exceedances of turbidity readings at the 100 m compliance boundary (see Figure 3 in Appendix C). Two turbidity criteria, primary and secondary will be used to monitor suspended sediment levels as outlined in Table 2.
The turbidity criteria established for the Project are presented in Table 2 and the background turbidity level will be established by the Departmental Representative based on data from background stations.

Table 2 Summary of TSS and Turbidity Criteria (all criteria are above background levels)

Criteria	Shallow Curtain Protected Area (If Required)		Non Curtained Area	
	TSS (mg/L)	Turbidity (NTU)	TSS (mg/L)	Turbidity (NTU)
Primary Criteria - exceedance requires immediate notification of contractor and cessation of operation to evaluate cause	45	15	150	50
Measured at:	10m to the land side of the silt curtain		100 m from the capping operation or at the cap boundary, whichever is greater	
Secondary Criteria - exceedance requires immediate notification of contractor to evaluate cause and continued monitoring; second exceedance within a one(1) hour period requires cessation of operation to evaluate cause	25	8	90	30
Measured at:	any location within 10 m to the land side of the silt curtain		100 m from the capping operation or at the cap boundary, whichever is greater	

Notes:

- TSS is the controlling criteria; turbidity may be adjusted following review of site-specific TSS-turbidity relationship
- The background level will be determined by averaging TSS/Turbidity at all depths from the reference site
- criterion compared to water column average with depth of measurements noted below
- depth of real time and water sample collection:
  - ≤ 2 m - one measurement point at mid depth
  - > 2m and < 4m - two measurement points; 0.5 m below the surface and 0.5 m above the bottom
  - ≥ 4 m - three measurement points; 0.5 m below the surface, mid depth, and 0.5 m above the bottom

Turbidity curtains may be used if consistent exceedances of turbidity readings at the 100 m compliance boundary (see Figure 3 in Appendix C) occurs. The details of the turbidity monitoring program are presented in Appendix C.

The MPI's water intake pipe is in the capping area and precautions will be taken by the contractor not to damage it. Since MPI will not be operating during the capping operation, there is no need to cover the intake pipe to prevent fines from entering the pipeline.

2.5 Project Schedule

The construction of the cap is proposed to begin in the spring of 2012, pending Project regulatory approvals and funding. The anticipated duration of Project activities is approximately two and one half months, given a construction schedule of 24 hours/day and up to seven (7) days/week. Activities will not begin until the *CEAA* Screening report has been approved by the RAs, and all other required regulatory approvals have been obtained. Construction will include an initial pilot phase to evaluate and optimize the specific technique and procedures at the start of the

Project to address changed conditions such as the grain size of the capping material and / or the deployment water depth.

The Project schedule was developed in consideration of the preferred in-water working or fisheries timing window defined by MNR. The fisheries timing window for Jellicoe Cove is from approximately June 16 to August 31, but MNR has given approval to start the in-water works starting May 1 for this Project. To the extent possible, the Contractor will place the cap material in the nearshore areas first to ensure that work in these areas is completed first. Based on the above work schedule and anticipated production rate of 1,500 m^3 per day, construction of the TLC is expected to occur over a nine (9) week period. This construction period includes approximately three (3) weeks for contingency in the event of construction delays or slower than anticipated production.

Monitoring for cap effectiveness will take place periodically over the next 20 years as indicated in the Long Term Monitoring Plan (Appendix D).

2.6 Wastes, Emissions and Discharges

Wastes, emissions and discharges during all Project phases have the potential to adversely affect some aspects of the environment. While some of these emissions will be unavoidable, the Project will take place in a commercialized / industrialized part of Jellicoe Cove. The equipment required for this Project represents only a minor increase in total potential emissions.

Temporary air emissions associated with Project activities will generally be related to the generation of dust along the material haul route(s) and the staging area (during site preparation, construction and abandonment and clean-up of the staging area) as well as routine combustion emissions (greenhouse gas emissions – CO_2, SO_2 and NO_X) from the operation of Project vehicles and equipment during all phases of the Project. Fugitive dust emissions at the staging area will be temporary and localized and will be controlled with the application of water. Trucks hauling material to the staging area from the borrow pit will be covered to minimize dust and loss of material. It is estimated that a total of approximately 5,217 truck loads or approximately 85 – 90 truck loads per day will be required to haul enough material to maintain a cap placement production rate of 1,500 m^3 per day. Given the short duration of site preparation and construction activities, the majority of combustion emissions associated with the Project, which will occur during the period of greatest activity (*i.e.,* site preparation and construction), will be localized and temporary, lasting the duration of Project activities. Emissions associated with the monitoring, operations and maintenance phase of the Project will be infrequent and highly limited. Combustion emissions will be reduced through proper equipment selection, maintenance and inspection. Consideration will be given to opportunities to reduce idling, as feasible.

Noise generated during site preparation and construction will be related to vessel, vehicle and equipment operation, material loading and unloading, and cap installation. The provincial guidelines for residential areas set in MOEs 1995 publication "NPC-115 Construction Equipment" are presented below (Table 3).

Table 3 Maximum Sound Emission Standards (MOE 1995)

Equipment Type	Date of Manufacture	Maximum Sound Level (dBA) Publication NPC - 103 - Procedures	
Excavation Equipment (Dozers, Loaders, Backhoes, etc.)	January 1, 1979 to December 31, 1980	85 (Power Rating <75 kW)	88 (Power Rating >75 kW)

Equipment Type	Date of Manufacture	Maximum Sound Level (dBA) Publication NPC - 103 - Procedures	
	January 1, 1981 and after	83 (Power Rating <75 kW)	85 (Power Rating >75 kW)
Pneumatic Pavement Breakers (Quiet Zone)	January 1, 1981 and after	85	
Pneumatic Pavement Breakers (Residential Area)	January 1, 1979 to December 31, 1980	90	
	January 1, 1981 and after	85	
Portable Air Compressors (Quiet Zone)	January 1, 1979 to December 31, 1980	76	
	January 1, 1981 and after	70	
Portable Air Compressors (Residential Area)	January 1, 1981 and after	76	
Tracked Drills	January 1, 1981 and after	100	

The equipment anticipated to be used includes trucks, loaders, dozers, excavators and marine vessels including barges and tugs. Table 4 outlines sound levels at maximum engine power. These sound levels assume that the engine exhausts are fitted with manufacturer-installed or approved mufflers. Typically, construction activities do not always operate equipment at full rated speed or power. Reduced speeds and / or power will produce less sound than the levels outlined for maximum engine power.

Table 4 Anticipated Equipment Noise Levels

Equipment Type	Range of Sound Levels at 15 metres (dBA)	Approximate Range of Engine Power Rating (kW)
Backhoe	82 – 84	98 – 156
Bulldozer	85 – 90	187 – 522
Excavator	86 – 90	251 – 567
Front End Loaders	86 – 90	224 – 560
Graders	86 – 89	262 – 448
Trucks	84 – 97	150 – 300
Cranes (Moveable)	83 – 85	120 – 179
Cranes (Derrick)	82 – 86	90 – 209
Portable Air Compressors	87 – 89	299 – 448
Portable Generators	81 – 87	75 – 300

In the Project area and adjacent residential areas, noise levels are usually dominated during the day by traffic and nearby commercial / industrial activity. Although baseline measurements were not collected, the anticipated average noise is assumed to be approximately 60 dBA based on professional experience and judgement. Noise associated with the Project's activities will be a new contributor to these background levels. Using a sound pressure range of 81 – 97 dBA and a distance of 300 m from the Project boundary, the anticipated sound level is predicted to be in the range of 35 – 51 dBA. This change is expected to be perceivable, but not obtrusive as the construction activities are predicted create sound levels that are below the existing environment. Also, the predicted sound levels are below all levels outlined in the *N.P.C. 115 Construction Equipment* publication.

Given the nature of the planned activities, noise emissions will be intermittent, temporary and localized. Noise mitigation to meet provincial guidelines will be achieved through appropriate site layout, design and operational procedures. Vehicle, barge and equipment noise emissions will be reduced through proper selection, maintenance and inspection.

Due to the limited fisheries timing window of approximately two and one half months, it may be necessary to undertake TLC construction activities (in-water construction) at any time of the day or night; however, two (2), seven (7) to nine (9) hour shifts are anticipated. Artificial lighting will be required for these activities to take place at night safely, and as required for compliance with occupational health and safety standards. All vessels will carry operational, navigation and warning lights. Lighting will only be used when required for safe operations and will comply with relevant offshore standards / regulations. Emissions will be minimized by shielding lights to shine down only where it is needed, without compromising safety.

Solid waste generated from the Project will be minimal (domestic refuse) and efforts will be made to recycle and to reduce waste, where applicable. All solid waste will be properly collected and stored until such time that it can be transported to a provincially approved recycling or waste disposal facility.

Lubricants and other petroleum products will be stored according to provincial regulations, and waste oils and filters will be disposed of according to provincial requirements. Qualified personnel will be tasked with conducting regular maintenance of equipment and vehicles. Any hazardous materials will be transported according to the *Transportation of Dangerous Goods Act* and Regulations.

There is potential for erosion and sedimentation to Jellicoe Cove from activities and material storage in the laydown area. Generic plans for erosion and sediment control will be developed as part of the Project design and specific plans will be developed by the Contractor for the specific laydown area selected (see Section 2.4.1.2). The Contractor's plans are subject to the approval of the Project Engineer, as well as representatives from the responsible parties. Plans will be developed and implemented to minimize impacts to water quality from construction activities. The following requirements shall be adhered to by the Contractor on this Project:

- The storage of construction materials and equipment at least 30 m away from the shoreline to the extent possible;
- Installation of siltation control devices such as silt fencing along the perimeter of terrestrial areas where up-gradient work may result in erosion and sediment laden runoff entering the Cove to ensure that sediment does not leave the site;
- Diversion of clean water from undisturbed areas around the site using berms or lined diversion channels or carry the water across the site in lined channels or pipes;

- The Contractor shall maintain on site, sufficient quantities of silt fence, straw or hay mulch, clear stone, geotextile fabric, and erosion control blankets to address erosion and sediment control; and
- Should a storm event be predicted, the Contractor shall implement additional controls within the active work area as necessary.

The following erosion control devices will be included in the erosion and sediment control plan, and will be installed as appropriate and as required:

- *Mulch*: to reduce the impact of rain and the velocity of overland flow;
- *Erosion Control Blankets*: to temporarily stabilize and protect exposed soils until vegetation has been established;
- *Clear Stone:* to prevent erosion on fill or cut slopes;
- *Silt Fencing:* to surround a disturbed work site;
- *Temporary Diversion Ditches:* to intercept clean water from flowing onto active work areas and convey it around the site;
- *Flow Checks or Check Dams:* to control sediment-laden runoff and erosion of ditches by slowing runoff velocities and trapping slit; and
- *Sediment Ponds*: to manage silt laden runoff in problematic areas and can be used with or without flocculation.

2.7 Malfunctions and Accidental Events

Construction of the TLC presents minimal increased risks to the community associated with construction activities, transportation accidents, or spills, including spills of site-related materials (*i.e.,* sand). The construction period is generally brief and the location is separated from residences (*i.e.,* approximately 300 m); therefore there are minimal community nuisances, such as construction noise, lighting, and odours due to diesel engines. Since contaminated sediments are to be left in place, an accidental exposure to mercury and PCBs is not contemplated. Brief construction periods and proper site management also minimize potential for inadvertent spills and thus exposures due to such spills.

The potential effects on the environment due to malfunctions and accidents during the proposed Project are primarily related to hazardous materials spills released into the aquatic environment and, to a lesser extent, the terrestrial environment. Barge traffic has the potential to interact with existing vessel / barge traffic which could potentially result in aquatic vessel accidents / collisions. An assessment of accidental events is provided in this EA Document. Refer to Section 6.0 for additional detail and discussion.

In the aquatic environment, barges will be used to undertake Project activities and accidental leaks of petroleum products during equipment fuelling and maintenance may occur. These risks will be mitigated through development and implementation of the Contractor's Spill Prevention and Emergency Response and Contingency Plan; conducting regular inspections and maintenance of equipment and procedures; and by the deployment of a clean-up crew with personnel and equipment necessary to manage spills and leaks. An Environmental Protection Specification as been developed for the Project that includes protection measures for fuel storage and dispensing including spill response and clean-up. All spills will be reported to required government agencies according to MOE Spill Action Centre's Spills Reporting – A Guide to Reporting Spills and Discharges as Required by the (Ontario) *Environmental Protection Act* (s.92 and s.15) and Ontario Regulation 675/98 Classification and Exemption of Spills Reporting of Discharges (MOE 2007).

A Notice to Mariners or similar public notice will be issued prior to the construction phase in order to prevent vessel collisions and the Project-specific EPP will contain detailed response procedures to follow in the event of a vessel collision. To minimize the potential for inadvertent damage to cap integrity, which could result in exposure and re-suspension of contaminated sediment, the cap will be designed to withstand anticipated activity in the Harbour (*i.e.,* vessel traffic). The Spill Prevention and Emergency Response and Contingency Plan supplied by the Contractor prior to mobilization will identify a contingency plan for when suspended soils exceed limits. Approval of this plan will be subject to departmental review. Regular monitoring will also serve to identify any integrity issues that may arise. Furthermore, an Administrative Control Guidance Document has been developed to manage future activities and development in the Project area to ensure the integrity of the cap is maintained (refer to Section 9.0 and Appendix E for more details on the program).

2.8 Environmental Management

An Environmental Protection Plan (EPP) Technical Specification will be prepared for the Project to describe the procedures required to meet regulatory obligations, as well as the mitigative measures and commitments made in this EA Document. The purpose of the EPP will be to:

- Ensure that all commitments to minimize environmental effects in general, as well as specific regulatory and EA commitments and mitigative measures will be met;
- Provide concise instruction for construction personnel regarding procedures for protecting the environment and minimizing potential environmental effects; and
- Function as a training document / guide for environmental education and orientation.

Environmental management and protection is considered an integral element in the way daily activities will be undertaken. The Project will uphold this position while complying with all applicable regulations, laws and industry standards. The EPP will be developed in order to communicate this commitment as well as detailed Project requirements for environmental management and protection to staff, contractors, regulatory agencies and the public alike. Those individuals involved in the Project will incorporate the environmental management and protection practices into their daily work routine. The EPP will be used during site preparation and construction, monitoring and maintenance activities and will detail the various monitoring programs to be undertaken.

3. Existing Environment

As an Area of Concern, Peninsula Harbour has been the focus of numerous studies leading up to and since its designation in 1987. The resulting body of knowledge encompasses a historical progression of information providing a comprehensive knowledge base for assessment and management decision making. Studies included, but are not necessarily limited to a Remedial Action Plan which included preliminary and detailed site assessment and investigation of Peninsula Harbour; studies related to mercury contamination and bioaccumulation, bioavailability, and biomagnification; PCB and mercury in fish and sediments; benthic assessment of sediments; physical and chemical analyses of sediments in Jellicoe Cove; bathymetric studies; sediment stability study; an environmental risk assessment; and an evaluation of sediment management options.

A geotechnical investigation, a detailed bathymetric survey, and a side scan sonar survey were conducted in the late summer and fall of 2009 in support of the design of the Project. EC commissioned a sediment chemistry and benthic community studies in the fall of 2009 to establish the pre-construction baseline conditions. In 2009 and 2011, MOE conducted a YOY fish study to establish baseline PCB and mercury levels in YOY fish tissue, but was not successful in capturing sufficient numbers of YOY in Jellicoe Cove. Since YOY is difficult to capture, a fish survey targeting Longnose Suckers will be conducted as part of the long term monitoring plan. Further, in 2010, an underwater video survey of the proposed cap area was commissioned to gather information regarding pre-construction substrate / fish habitat types in the Project area. All information collected to date on the substrate was assessed by Northern Bioscience in 2011 to understand the existing fish habitat / substrate for the area. In May and June of 2011, benthic invertebrate tissue study was undertaken by EC to provide baseline data. Information gathered during these surveys was incorporated into the EA report as appropriate. This data is intended to be used for future comparison with post-construction monitoring data to establish trends and to measure the recovery of the site.

These studies, along with additional research for any more recent data as well as consultation with various provincial and federal regulatory agencies with knowledge of the Project area, were relied upon for the following description of the existing environment. It is the opinion of the study team that in general, the available existing information related to Peninsula Harbour along with additional desktop research and consultation is sufficient for the purpose of understanding the existing conditions in the Project area so as to effectively assess the potential environmental effects of the Project on the environment.

3.1 Biophysical Environment

3.1.1 Atmospheric Environment and Climate

Jellicoe Cove and Peninsula Harbour in general, are within the Superior Climatic Region. This region covers a narrow area of land along the northern shore of Lake Superior between Nipigon and the eastern boundary of the Town of Marathon. The climate in this region is typically moderate, with cooler summers, milder winters, with a relatively large amount of precipitation and wind. In the summer months, warm humid air masses from the south, alternate with drier and colder air masses from the north. This alternation results in periods of dry, clear weather followed by periods of humid, warm weather. The Project area occurs within the Moist Mid-Boreal Ecoclimatic Region of the Boreal Ecoclimatic Province, which typically has warm and rainy summers coupled with cold and snowy winters (Beak 2000).

Weather data were acquired from the Sault Ste Marie A, Ontario meteorological station, which meets the World Meteorological Organization's standard to calculate 30-year norms of temperature and precipitation. Additional wind and climatology information is available from meteorological stations located in Thunder Bay, Ontario; however, data from these stations does not meet the World Meteorological Organization's standard.

The proposed thin layer cap will be in place throughout the year; therefore a variety of conditions will occur. Using data from 1971 to 2000 (Sault Ste Marie A, Ontario meteorological station), it was found that the average annual temperature in the region is 4.3 ^{0}C, with an average daily maximum of 9.6 ^{0}C and an average daily minimum of -1 ^{0}C. July and August are the warmest months and the coldest month, January, is marked with the highest snowfall (81.7 cm), however, only 41 cm of snow remains at the month's end.

In Marathon, February and March tend to be the driest months (averaging 41.1 and 60.1 mm of precipitation respectively between 1971 and 2000), while the months from August through November are considered the rainy season (marked by the highest monthly precipitation). Total precipitation in the area averages approximately 888.7 mm.

In contrast, weather data acquired from the Wawa A, Ontario meteorological station reports cooler average temperatures with an average annual temperature of 1.7 ^{0}C, average daily maximum of 7.4 ^{0}C and average daily minimum of -4 ^{0}C. January is the coldest month, with the highest snowfall occurring in December (82.9 cm, 39 cm remaining at month's end). January and February are the driest months (59.3 cm and 48 5 cm of precipitation) and the months with the greatest precipitation are July through October. Total precipitation was found to average 1002.2 mm.

The Sault Ste Marie A meteorological station in Ontario has wind speed and direction data available. The average annual wind speed at the station is approximately 13.1 km/h (between 1971 and 2000). Through the months of June to September, average winds speeds are slightly lower (10.7 to 12.5 km/h), and through October to April average wind speeds are slightly higher (up to 15.6 km/h). The prevailing wind direction is from the west. The Wawa A meteorological station reports less winds with an average annual wind speed of 9.2 km/h, lower wind speeds in June through August (6.9 to 7.9 km/h) and the highest winds in November (10.6 km/h). Prevailing winds at the Wawa station are from the north (Environment Canada 2009).

To date, air quality monitoring has not been conducted to determine air-quality within the Project area. Air Quality Indexes (AQIs) have been developed based on a number of parameters that are measured. No AQI monitoring stations are located in or near the Town of Marathon. The AQI monitoring station located in Sault Ste Marie is presented as a conservative generalization of air quality in the Project area as Sault Ste Marie is located east of the Project area and generally jet streams in the area move from west to east. AQI monitoring station data from Thunder Bay, west of the Project is also presented here to further provide a general picture of air quality in the region.

The AQI indicated air quality based on hourly pollutant measurements of some or all of six (6) common pollutants which include sulphur dioxide (SO_2), ground-level ozone (O_3), nitrogen dioxide (NO_2), total reduced sulphur (TRS), carbon monoxide (CO), and fine particulate matter ($PM_{2.5}$). Values for the AQI are divided into five categories presented in Table 5.

Table 5 Air Quality Index (AQI) Categories (Ontario Ministry of Environment 2009)

Air Quality Index Value	Category and Interpretation
1-15	Very Good
16-31	Good
32-49	Moderate: there may be adverse effects of very sensitive people
50-99	Poor: there may be short-term adverse effects on human or animal populations, or may be significant damage to vegetation and property
100+	Very Poor: there may be adverse effects on a large proportion of those exposed

During 2009, the Sault Ste Marie station reported "very good", "good" or "moderate" air quality categories. However, it appears that air quality degrades in the area beginning in the spring, when reports were in the "moderate" category (March through September) and were associated with ground level ozone concentrations. The greatest frequency of "moderate" air quality categories were reported during the months of April and May. Isolated "moderate" category records were also reported in the months of February and November, although these instances were associated with fine-particulate matter.

In 2009, the Thunder Bay station also reported "very good", "good" or "moderate" air quality categories. Similarly, air quality appears to degrade in the area beginning in the spring, with "moderate" air quality categories reported in March through June. All "moderate" air quality categories reported in at the Thunder Bay station were associated with ground level ozone (MOE 2010).

In the Town of Marathon, the Ontario Ministry of Environment has collected continuous air quality monitoring data for TRS associated with the operation of the kraft pulp mill. In 1997, there were no exceedances of the one hour air quality criterion of 27 parts per billion (ppb).

The majority of the lands surrounding Peninsula Harbour are predominantly undeveloped, with the exception of the Town of Marathon, such that overall air quality is expected to be "good" (Beak 2000). Based on the meteorological conditions presented above, and the historical air quality monitoring data for TRS, it is expected that the air quality would be in the "good" category in the Project area and its vicinity.

Environmental noise levels may vary depending on the kind / number of noise sources, the proximity of receptors to these sources, the intensity of the sound, topography, presence / absence of barriers or absorbers, and meteorological conditions. The variety of land and water uses in Peninsula Harbour contributes to the existing noise level in the area. Major noise sources include road traffic, construction activities, railroad operations, recreational and commercial boating, as well as noise associated with the mill when in operation (Beak 2000). The nearest residential area to the Project site is located approximately 300 m from the shoreline. Specific noise monitoring for the Project area has not been conducted to date.

3.1.2 Physical Environment, Bathymetry and Flow Patterns

Peninsula Harbour is located within the Lake Superior watershed of the St. Lawrence River Drainage System. This system is typically characterized by irregular drainage patterns and the occurrence of relatively small watercourses (Beak 2000). The Harbour is approximately 3 km wide and 4 km long and is bound by Ypres Point to the north, an unnamed peninsula to the south (The Peninsula), Hawkins Island to the west and the main shoreline to the east. The mouth of the Harbour is largely sheltered from the remainder of Lake Superior by two (2) islands (Hawkins and Blondin Islands) and two (2) peninsulas located to the north and to the south (Figure 1, page 3).

Jellicoe Cove is a small (97 ha), protected inlet within Peninsula Harbour, surrounded by rugged hilly terrain with complex steep shores and cliffs extending into the water. No significant wetlands exist within the shoreline area of the Cove. Two (2) creeks flow into the Harbour; Shack Creek and an unnamed creek north of Shack Creek; Shack Creek flows through a closed wood storage site before flowing into the Harbour, while the unnamed creek also flows through a second closed wood waste site prior to entering the Harbour. Sections of the shoreline, adjacent to the mill have been armoured with large boulder / rubble material, with bedrock occurring along the west and east heads of the Cove (ENVIRON 2008).

The proposed Project area is underlain by a unique suite of Proterozoic rocks from the middle Precambrian era, which belongs to the Port Coldwell alkalic complex. The mineralogical composition of this complex includes: carbonatite, nepheline, syenite, alkalic syenite, ijolite and fenite, with intrusions of older Precambrian felsic and mafic metavolcanic rocks. The syenites also contain deposits of copper and iron (Sommerfreund *et al.* 2005). Covering an area of approximately 325 km^2, this is the largest occurrence of this type of complex in northern Ontario.

Peninsula Harbor and Jellicoe Cove (the Project area) occur within the Abitibi Upland Physiographic Subregion of the James Physiographic Region. This subregion is characterized by broad rolling surfaces, and is contained within the Canadian Shield where glaciation has modified the landscape to a significant extent. Upland areas in this subregion have a thin mantle of drift material over bedrock, and lowland areas have a layer of thin till material and deposits of limestone (Beak 2000).

Past bathymetric studies show that the Harbour is sloping downward in a north-westerly direction with a median depth of 12.5 m (Environmental Hydraulics Group 1993) and maximum observed depth of 28 m (Beak 2001a). The total length of the Jellicoe Cove shoreline, is approximately 3.3 km (ENVIRON 2008). A detailed bathymetry survey was conducted in support of this Project (see Appendix F for detailed bathymetric data). The depth of water in the proposed cap area ranges from 2 – 26 m.

Waves in Peninsula Harbour predominantly roll from the west and less frequently from the southwest. The heights of these waves average 1 - 1.7 m throughout the year, except during February when the lake is typically frozen. Freeze-up in Peninsula Harbour generally occurs early in December, with ice break-up typically occurring in mid- to late-April (MNR 1984), while Jellicoe Cove is reportedly ice-free during the winter. Within Jellicoe Cove, the wave direction is entirely from the west with heights ranging from 0.4 to 0.7 m year round (except February) (Beak 2000).

The currents in the proposed Project area at 6 m below the water surface average 4 cm/s (Environmental Hydraulics Group 1993) primarily in a west-northwest to east-southeast direction, however, the strongest currents are from the west-northwest (Skafel 2006, 2007). The bottom currents in the Project area, at 0.5 m above the bottom, average 1.4 cm/s with a maximum recorded velocity of 19 cm/s (Skafel 2006). Lake bottom flow movement in Jellicoe Cove is predominantly from the wave effects of the open lake water area into Peninsula Harbour. The surrounding islands and land of the Harbour provided a barrier and serve to reduce wave energy in the area (Beak 2000).

A report by Krishnappan and Biberhofer (2004) found that the average velocities required to suspend sediments in Jellicoe Cove ranges between 32 cm/s and 43 cm/s, which is much higher than average bottom velocities measured (1.4 cm/s). Bottom velocity calculations indicate that flow velocities could occur under average and extreme wave conditions (associated with storm events) in Jellicoe Cove which could re-suspend fine to very fine sands, of the type that presently occur in the broader area of the Project (Environmental Hydraulics Group 1993) (see Section 3.1.3 Benthic Habitat and Sediment Quality).

Sediment coring has identified sand horizons which may suggest sediment transport, which may be associated with storm events. The downslope contouring of mercury concentrations on surface level sediment, despite the removal of point source deposition of contaminants may also be further indication that at least some sediment transport is occurring in this area. However, it should be noted that average current velocities are two (2) orders of magnitude lower than that required for sediment re-suspension (*i.e.,* benthic shear). Additionally, the net accumulation rate in Jellicoe Cove is extremely low, with little new material accumulating to cover the in-place sediments. Under tranquil conditions, the sediments in Jellicoe Cove are stable such that there is little potential for sediment re-suspension (Biberhofer and Dunnett 2005). In summary, strong bottom currents are required to mobilize sediment that is deeper than 5 cm, while surface sediment (< 5 cm) requires much weaker currents. These weaker currents (strong enough to move surface sediment) are common; however, currents strong enough to move subsurface sediment are rare (Santiago 2008). Sediment deposition at Jellicoe Cove averages 1 - 2 mm annually as indicated by isotope dating (ENVIRON 2008b).

Based on existing and potential hydrodynamic conditions in the Project area, two (2) size grades of sand, both medium and coarse-grained sands have been selected for cap material. The cap material has been established so as to resist displacement associated with the maximum wave height in historical record (6.4 m) (Environmental Hydraulics Group 1993) and in consideration of the proximity to the location of the historical shipping channel adjacent to the MPI Pier, a slightly coarser grade of sand was selected to improve resistance to displacement should the pier be reopened to shipping in the future. It is noted that the coarser grade material is not designed to withstand all potential vessel traffic but rather nominal usage as projected in a shear stress analysis (ENVIRON 2009). The grain-size selected will withstand a wave height of 6.4 m.

Peninsula Harbour is located within the North American continental plate, which is known to have little potential for seismic activity. Zones which are prone to earthquakes are typically located along continental plate margins and in areas of orogeny. Any potentially minor seismic activities which could occur in the Project area would likely be related to an ancient fault system formed during periods of Precambrian continental rifting (Beak 2000).

3.1.3 Benthic Habitat and Sediment Quality

The total length of the shoreline along Jellicoe Cove is approximately 3.3 km. A large portion of the southeast shore of the Cove is beach, with coarse sand and gravel substrate (ENVIRON 2008b) and a patch of cobble occurs off the south shore. Portions of shore adjacent to the mill have been armoured with large boulder / rubble material and a shipping wharf occupies some of the western shore. Bedrock shoreline occurs along the west and east heads of the Cove. Log piles and rock cribs occur throughout the area due to antecedent log booming activities associated with the mill. A boat launch and docks are situated at the northeast corner of the bay (Beak 2001a).

3.1.3.1 Sediment Quality

A study found that sediment from 13 of 21 sites within Jellicoe Cove had mercury levels above provincial SEL. In addition, one site in Jellicoe Cove had concentration above the SEL guidelines for total organic carbon (Milani and Grapentine 2005). Another study found that sediment in most sites in Jellicoe Cove were found to have significantly higher total mercury than references sites. In addition, midges and amphipods from Jellicoe Cove were found to have significantly higher total mercury concentrations (Grapentine *et al.* 2005). The sediments and benthic invertebrates in Jellicoe Cove are thought to have higher concentrations of mercury due to the amount of contamination.

Mercury and PCBs have long been identified as the major contaminants in sediments by a large number of studies over the last 30 years or more. Within Jellicoe Cove, both contaminants have been found to have elevated concentrations, extending from the mouth of the Harbour, southwest into the deeper waters of Lake Superior. Higher concentrations in sediments were generally present within the deeper depositional areas where finer sediments (slit, clay) were present, typical of the common binding process of mercury with sediment (Beak 2000). This contamination has contributed to the 1987 Great Lakes Water Quality Agreement between Canada and the United States AOC designation.

In 2005, in a review of eight (8) studies regarding mercury and PCBs in fish and sediment in Jellicoe Cove, Peninsula Harbour was undertaken in support of this Project (Sommerfreund *et al.* 2005). Studies reviewed for the 2005 report suggested that although a study undertaken in 1991 confirmed previous reports that mercury concentrations in Jellicoe Cove sediments have been decreasing overtime (Smith 1992), significant mercury and PCB contamination remains in the sediments (and fish) of Jellicoe Cove. The report concluded that total mercury concentrations within Jellicoe Cove sediment exceeded the Severe Effects Levels (SEL) by up to three (3) orders of magnitude and is highest in the deeper sediments adjacent to the mill (10 – 19 cm), while total PCB concentrations exceeded the Lowest Effects Level (LEL) by an order of magnitude (Sommerfreund *et al.* 2005).

Mercury concentrations increasing with depth indicate that mercury accumulation has been higher in the past, and that net deposition has occurred in this area (Golder Associates 2005). Total mercury and PCBs in sediment have been buried by sediment with lower mercury and PCB concentrations with significant mixing of contaminated material with clean material, such that mercury and PCBs, which are associated with fine-grained sediment, have been moving downwards due to a sediment sorting process. Furthermore, contaminated sediments have moved laterally with fine-grained sediment moving northwest as a result of sediment focusing towards the deeper part of the Cove (Sommerfreund *et al.* 2005). The proposed Project will reduce the risk associated with this contamination by minimizing the potential for exposure to PCBs and mercury in sediment and to reduce the potential for migration of mercury and PCBs from areas of greatest concentration to the remainder of Peninsula Harbour.

3.1.3.2 Benthic Invertebrate Species

Benthos refers to those organisms which are associated with bottom substrates. They may be semi or permanently attached to hard (rocky) substrates, buried in soft sediments, or move around on the surface of the lake floor. The distribution of benthos is determined primarily by the nature of available substrates; however, other factors such as exposure to the atmosphere and exposure to predation also play a role in determining their distribution. Lake Superior is oligotrophic and the community structure and densities of phytoplankton and zooplankton are characteristic of this nature. Benthic invertebrates and planktonic organisms are at the base of the trophic pyramid within Peninsula Harbour (Beak 2000).

In 1976, MOE recorded 15 taxa of benthic macroinvertebrates within Peninsula Harbour. Sludgeworms were the predominant taxon, followed by midge larvae and the amphipod *Monoporeia hoyi.* The isopod *Caecidotea racovitzai* and fingernail clams were also present in significant numbers, with the remaining taxa occurring sporadically. The description of the community structure was similar to that discerned by a previous survey in 1969, namely, a positive correlation between *Monoporeia hoyi* densities and increased water depth; increased sludgeworm densities proximate to the mill outfalls; and increased numbers of *Caecidotea racovitzai* in areas of bark and wood chip accumulations. The numbers of organisms collected in 1976 were dramatically reduced from those taken in 1969. Furthermore, a survey by Beak in 2000 in nearby Carden Cove, found similar community compositions to previous surveys. The total number of organisms in samples ranged from 600 to 900/m^2 (average of 729/m^2), with the most abundant taxon being the amphipod *Monoporeia affinis* (86 - 329 animals/m^2). The remainder of the taxa in samples were nearly exclusively represented by the chironomid (*Stictochironomus, Heterotrissocladius,* and *Monodiamesa)* and oligochaete groups (*Uncinais uncinata, S. heringianus* and *tubificid* immatures without hair chaeta) with the exception of the mollusc *Pisidium* (43 – 157/m^2). As also determined by previous studies, the 2000 survey found that sensitive taxa, such as mayfly (*Ephemeroptera*) and caddisfly (*Trichoptera*) larvae were absent. The low macroinvertebrate densities likely reflect the low productivity of Carden Cove and lack of benthic habitat diversity, with fine sand being the dominant substrate (Beak 2000).

More recently, Milani *et al.* (2002) conducted an investigation of the benthic invertebrate composition within Jellicoe Cove and other locations within Peninsula Harbour and found that midge larve (*Chironomidae*), oligochaete worms (*Tubificidae* and *Naididae*), fingernail clams (*Sphaeriidae*), isopods (*Asellidae*), and snails (*Valvatidae*) were prevalent, and other taxa such as amphipods and oligochaetes, comprised less than ten (10) % of the benthic community. Invertebrate densities also relate to proximity to outfalls (Peninsula Harbour Area of Concern, Proposed Delisting Criteria 2008). Benthic invertebrate communities in Lake Superior have been described as extremely taxa poor (USEPA 2009).

Milani and Grapentine (2005) found that dominant benthic invertebrates in the Peninsula Harbour include midge larvae, oligochaete worms, fingernail clams, isopods, and snails. Benthic invertebrates in Jellicoe Cover were generally found to be more diverse than reference sites; however, this is hypothesized to be due to the high organic content in Jellicoe Cove. Dominant benthic invertebrates families in Jellicoe Cove were found to be *Chironomidae, Tubificidae* and *Sphaeriidae*. Other benthic invertebrates found included *Naididae, Valvatidae, Asellidae, Lumbriculidae, Enchytraeidae,* and *Haustoriidae* (Milani and Grapentine 2005).

3.1.3.3 Benthic Habitat

Sediment variation throughout all of Peninsula Harbour includes regions of greater sand composition located to the east and west of Jellicoe Cove, as well as regions where sediment is made up of 5 - 20% gravel, located immediately adjacent to and 100 m north and west of the Peninsula (ENVIRON 2008). Lake sediment in the general Jellicoe Cove area is predominantly comprised of fine to very fine silty sands and some clay with mixed organic matter (with boulders and stones evident in the nearshore), while sediment in the cap area is comprised of silty sands with relatively less clay sized material (Beak 2001a, Biberhofer and Dunnett 2005, AECOM 2009a). Gradation tests confirm that the sediments are generally fine-grained, with varying quantities of sand. A patch of cobble occurs off the south shore of the Cove (Beak 2000). The results of the geotechnical investigation conducted by AECOM in support of the Project design are consistent with the above (AECOM 2009a).

Sediment sampling in the area has shown that very hard sand substrates and high percentages of clay represent unusual physical characteristics. No definitive information regarding the thickness of the sediment was obtained through sampling, however, based on limited penetration of the sampling device it is likely that the soft surficial layer of sediment is relatively thin (several tens of centimetres, possibly exceeding 1 m in some areas) and underlain by firm substrate (ENVIRON 2008b).

Organic material concentration ranges from 1 - 11%. Sawdust and wood particles have been identified in grab samples taken during a previous sediment sampling study; generally underneath a thin layer of sediment. Sediment core studies from 2007 have also identified distinct strata in lake sediment composed of fibrous materials reported to emit a strong hydrocarbon odour (ENVIRON 2008b). Moisture content in sediment ranges from 18 - 71%, with the lower moisture content generally is occurring in the underlying uncontaminated glacial clay or till and recent sediment, where the higher moisture content generally associated with sediment containing organic matter (Beak 2000).

Substrates in the area of the proposed capping were described as having coarse sand over gravel (Burt and Fitchko 2001), and photographs indicate material consists predominantly of a soil matrix (*i.e.,* clay, silt, sand, gravel spectrum) with occasional layers of darker organic matter resembling peat. Eakins and Fitchko (2000) have also reported that substrate in Jellicoe Cove is generally a silty sand in the shallows becoming mud offshore in deeper waters with areas of exposed glacial clay also present. The area that contains the highest mercury concentrations overlies two types of hard uncontaminated substrate comprised of either glacial till (*i.e.,* light gray compacted fine sand with clay) or light gray glaciolacustrine clay (Burt and Fitchko 2001, Beak 2000), and occupying approximately 3 and 2 ha, respectively (Dainty 2003).

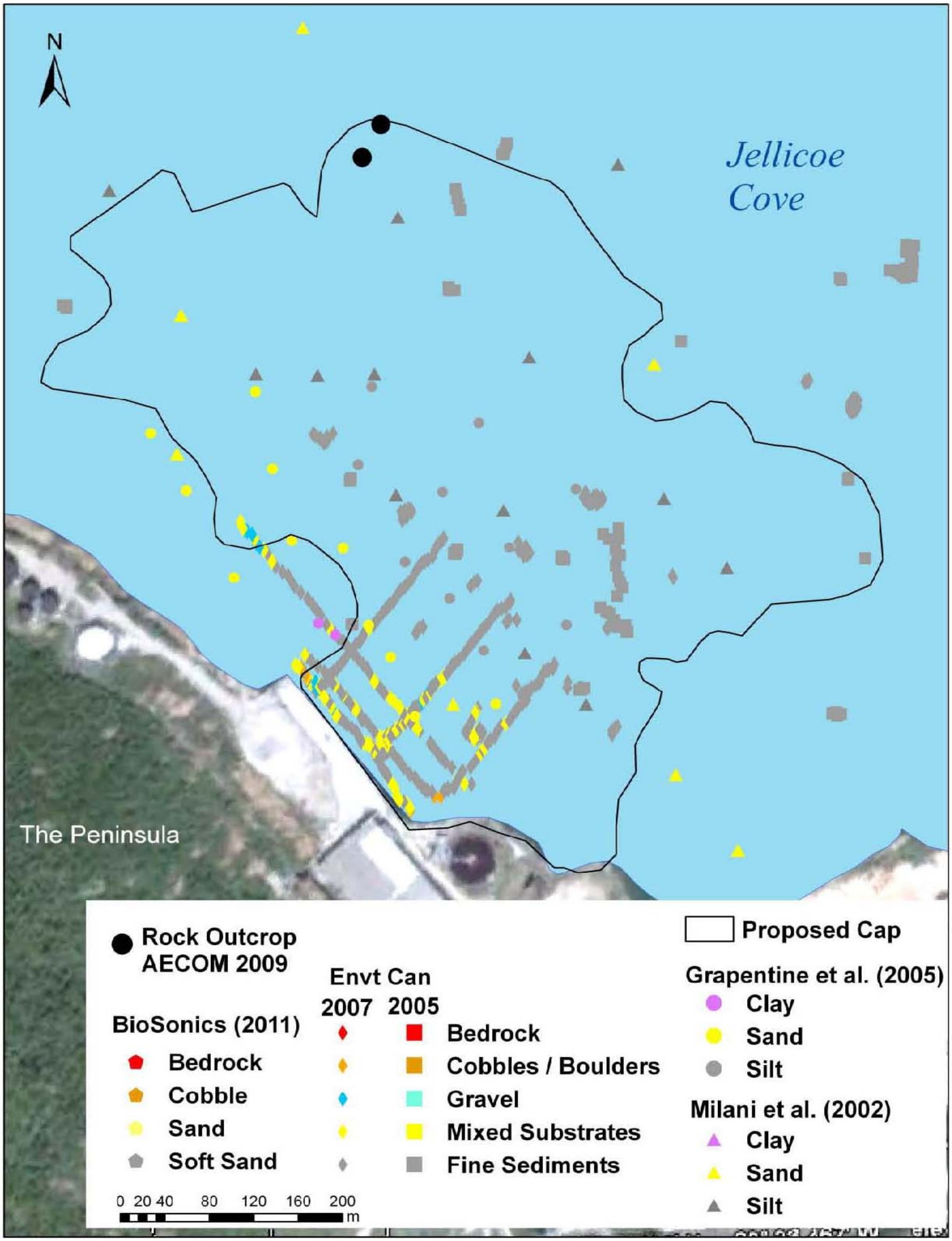
Beak (2001) conducted a habitat and fisheries resource assessment (August 22 to 27, 2000) in Jellicoe and Carden Coves, as well as the two (2) tributaries discharging to Peninsula Harbour (Shack Creek and a small unnamed creek). A description of the existing conditions in these areas, including photographs and maps of habitat inventory and physical / biological conditions were completed over the length of the field program. The evaluation of the aquatic habitat of Shack Creek found that immediately upstream of the creek outlet to Peninsula Harbour, the substrate included bedrock, boulder, cobble, gravel, sand and very occasionally clay.

Updated Habitat Data

Existing information on the substrate in the proposed capped area in Jellicoe Cove was assessed by Northern Bioscience 2011 using existing data and by using the results of a new study conducted in fall 2010. The information which was used to assess the substrate in Jellicoe Cove includes (Northern Bioscience 2011):

- Beak (2001): Visual Assessment;
- Existing Reports by Environment Canada (Milani *et al.* 2001 and Grapentine *et al.* 2005);
- Environment Canada 2007: Underwater Video (unpublished data);
- Environment Canada 2005: Underwater Video (unpublished data);
- Ministry of the Environment: Underwater Video and Acoustic; and
- BioSonics 2010: Side Scan Sonar (Hydroacoustic) Survey with Confirmation Grab Samples / Video (to verify discrepancies between above studies)

The habitat information for benthic invertebrates is similar to the habitat description for Fish and Fish Habitat. Please refer to Section 3.1.4.5 for updated habitat data. Updated substrate map (Figure 3) and distribution of submerged aquatic vegetation (Figure 4) for the proposed capping area are provided in Appendix G Northern Bioscience (2011). Photos of the substrate are provided in the Northern Bioscience (2011) report attached in Appendix G.



AECOM

Figure 3 Updated Substrate Map

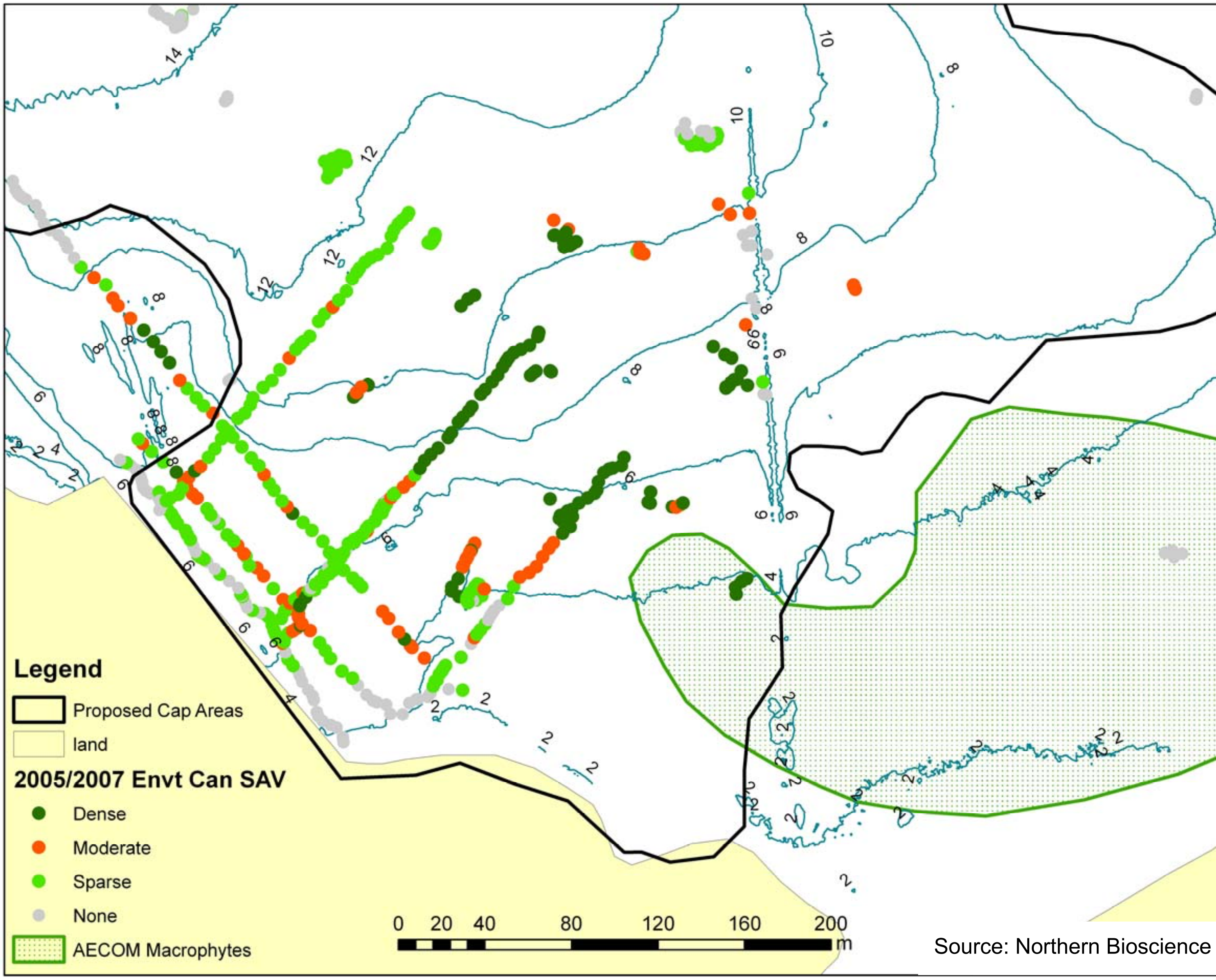


Figure 4. Submerged Aquatic Vegetation Map

3.1.3.4 Sediment Toxicity to Benthic Invertebrates

In one study, sediment samples from Jellicoe Cove were taken and amphipods were exposed to the sediments in the lab. Results indicated that sediments from one site in Jellicoe Cove were toxic to benthic invertebrates (*H. azteca* and *C. riparius*). Since this particular site was found to have low contaminant levels, the substrate type found at the site, hard compact clay, was hypothesized to potentially be a confounding factor in the sediment toxicity (Milani and Grapentine 2005).

3.1.4 Fish and Fish Habitat

3.1.4.1 Regional Context

The proposed capped area (approximately 25 ha) is located within Jellicoe Cove in the Peninsula Harbour of Lake Superior. Peninsula Harbour and Jellicoe Cove are approximately 1,000 ha and 97 ha in size, respectively. Peninsula Harbour includes the following coves and creeks besides Jellicoe Cove: Carden Cove, Beatty Cove, Shack Creek and an Unknown Creek. Shack Creek and the Unknown Creek are located approximately 250 m and 500 m, respectively from the proposed capped area and flow into Peninsula Harbour. Carden Cove and Beatty Cove are located approximately 1 km north of Jellicoe Cove.

3.1.4.2 Water Quality

Water quality is an important component of fish habitat. Historically, outfalls associated with the operation of the kraft pulp mill have been the major sources of pollutants to Jellicoe Cove (*e.g.,* increases in concentrations of total dissolved solids (TDS), total suspended solids (TSS), nutrients (phosphorus, nitrogen), five-day biological oxygen demand (BOD_5), metals (mercury), phenolics and bacteriological parameters). Log storage and booming activities in Peninsula Harbour also resulted in this historical impairment of water quality. Operational changes at the mill, the end of long booming operations in the harbour and the closure of the chlor-alkali plant in 1977 (the active mercury source), have improved water quality in the area.

Water quality sampling in Peninsula Harbour have found significant improvements, although elevated concentrations of some metals and organic compounds remained in the mid 1980's. Sampling in 1999, however, did not find elevated concentrations of these, or other parameters typically associated with industrial activities (Richman 2004). Currently, water quality in Peninsula Harbour is relatively good, with infrequent water quality impairment due to sediment re-suspension associated with storm events and large vessel propeller action (Beak 2000).

Peninsula Harbour is described as an oligotrpohic (low nutrient content, low productivity) region of Lake Superior (Larsson *et al*. 1992). Dissolved oxygen ranges 10.3 - 14.35 mg/L, pH ranges 7.2 - 8.35 and conductivity ranges 93 -134 µS/cm within the water column. Significant mixing within Harbour is indicated by similar water chemistry across the site (Sommerfreund *et al*. 2005). Beak (2001) habitat and fisheries resources assessment also collected supporting water quality measurements in both Carden Cove and Jellicoe Cove during the fish surveys. Water depth was three (3)-times greater in Jellicoe Cove (18 m) than in Carden Cove (6 m), with water temperatures in Carden Cove being slightly greater than those in Jellicoe Cove, at all depths (*i.e.,* Carden Cove bottom water (15.5°C) on average 1°C higher, while surface (16.0°C) and mid-depth waters (15.7°C) about 0.5°C higher). This difference in temperature was considered to be related to the discrepancy in depth and natural circulation patterns in the two (2) coves. No spatial differences in dissolved oxygen levels were evident in either area, with oxygen saturation ranging between 102 and 105%. Water conductivity and pH were also not significantly different between the two (2) areas; conductivity around 83 µmhos/cm and pH about 8.35. Secchi depth was at the bottom in Carden Cove and greater than 6 m in Jellicoe Cove. Water colour in both areas is transparent blue / green (Beak 2001).

Mercury contaminated soils (terrestrial) in the vicinity of the pulp mill (approximately 15 cm depth), were found not to be contributing to significant quantities of mercury entering the harbour. Surface drainage surveys conducted MOE in 1978 detected low levels of mercury in soils and only very small quantities of mercury entering the harbour via runoff (Beak 2000).

3.1.4.3 Fish Species

Lake Superior supports approximately 82 species of fish (NOOA and GLERL 2009). Ten (10) such species are introduced species (*i.e.,* deliberate planting, accidental escapes, immigration through navigational locks, canals and lake outlet), including: sea lamprey (*Petromyzon marinus)*, alewife (*Alosa pseudoharengus*), carp (*Cyprinus carpio)*, rainbow smelt (*Osmerus mordax*), pink salmon (*Oncorhynchus gorbuscha*), coho salmon (*Oncorhynchus kisutch*), rainbow trout (*Oncorhynchus mykiss*), chinook salmon (*Oncorhynchus tshawytscha*), Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta)* (Beak 2000). When compared to other Great Lakes, Lake Superior supports a lower diversity of fish species and a lower productivity due to its highly oligotrophic nature and northerly location (Ryder 1972); however, these results may be due to the limited sampling effort and the limited amount of data available (Northern Bioscience 2011).

In Peninsula Harbour, fish communities include at least 31 species (dominated by coldwater species), with lake trout (*Salvelinus namaycush*) being the dominant piscivorous (*i.e.,* fish-eating) species in the harbour and round whitefish (*Prosopium cylindraceum*) being the dominant planktivore (*i.e.,* plant eating).

<u>Jellicoe Cove</u>

In Jellicoe Cove, 19 species of fish have been documented (Beak 2001 and Hamilton 1986) (Table 6). Four (4) additional species may also be present within Jellicoe Cove (Table 6) (Suns pers. comm. in Hamilton 1986). Native species were found to dominate the community structure of the area (Beak 2001). The area supports several sportfish and bottom dwelling species. Representative sportfish species at the focus of toxicological studies include lake trout, lake whitefish (*Coregonus clupeaformis*) and the longnose sucker (*Catostomus catostomus*). Consumption restrictions exist for many of these species caught in Peninsula Harbour, in particular, whitefish, round whitefish, longnose sucker, and white sucker (*Catostomus commersoni*) (MOE 2009). The most abundant species in Jellicoe Cove based on sampling are the round whitefish and the longnose sucker.

Table 6 Fish Species Present in Jellicoe Cove (Northern Bioscience 2011, Beak 2001, Hamilton 1986)

Common Name	Scientific Name	Life Stages
Species Confirmed in Jellicoe Cove		
Alewife	*Alosa pseudoharengus*	Adult
Burbot	*Lota lota*	Juvenile
Cisco (Lake Herring)	*Coregonus artedi*	Juvenile
Coho Salmon	*Oncorhynchus kisutch*	Adult, Juvenile
Lake Chub	*Couesius plumbeus*	Juvenile
Lake Trout	*Salvelinus namaycush*	Adult, Juvenile
Lake Whitefish	*Coregonus clupeaformis*	Juvenile

Common Name	Scientific Name	Life Stages
Longnose Dace	*Rhinichthys cataractae*	Adult, Juvenile
Longnose Sucker	*Catostomus catostomus*	Adult, Juvenile
Mottled Sculpin	*Cottus bairdi*	Adult, Juvenile
Northern Pike	*Esox lucius*	Adult
Pink Salmon	*Oncorhynchus gorbuscha*	Juvenile
Rainbow Trout	*Oncorhynchus mykiss*	Juvenile
Rainbow Smelt	*Osmerus mordax*	Juvenile
Round Whitefish	*Prosopium cylindraceum*	Adult, Juvenile
Slimy Sculpin	*Cottus cognatus*	Adult, Juvenile
Threespine Stickleback	*Gasterosteus aculeatus*	Adult
White Sucker	*Catostomus commersoni*	Juvenile
Yellow Perch	*Perca flavescens*	Juvenile
Species with High Potential to Occur in Jellicoe Cove		
Emerald Shiner	*Notropis atherinoides*	-
Johnny Darter	*Etheostoma nigrum*	-
Spottail Shiner	*Notropis hudsonius*	-
Stickleback	*Unknown species*	-
Walleye	*Zander vitreus*	-

Shack Creek

The following fish species were observed in Shack Creek: lake chub (*Couesius plumbeus*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), white sucker, brook trout (*Salvelinus fontinalis fontinalis*), Chinook salmon, coho salmon, pink salmon, rainbow trout, mottled sculpin (*Cottus bairdi*), and slimy sculpin (*Cottus cognatus*) (Beak 2001, Northern Bioscience 2011).

Fish sampling was not conducted in the unknown tributary.

Carden Cove

The following fish species were observed in Carden Cove: round whitefish, lake herring (cisco) (*Coregonus artedi*), alewife, longnose sucker (*Catostomus catostomus*), rainbow trout, lake whitefish (*Coregonus clupeaformis*) and white sucker. Longnose sucker juveniles were the most abundant species (Beak 2001).

3.1.4.4 Known Status of Fish Habitat

Substrate

Existing information on the substrate in the proposed capped area in Jellicoe Cove was assessed by Northern Bioscience (2011) using existing data and by using the results of a new study conducted in fall 2010. The information which was used to assess the substrate in Jellicoe Cove was described previously in Section 3.1.3.3.

The major findings of the EC (2005 and 2007) underwater video surveys was that the substrate in the proposed capped area is composed primarily of fine sediments (78%) with a lesser amount of mixed substrate (18%), gravel

(3%), and cobble (1%) (Northern Bioscience 2011). This data was confirmed by a review of EC's underwater video data; however, some of the gravel identified by EC was determined to be dense accumulations of bark (Northern Bioscience 2011).

Results from Beak (2001) revealed that the capped area consisted primarily of soft sediments. Discrepancies that this study had compared to other studies were the presence of sand in the northern and eastern section of the cap and the presence of cobble in two (2) sections in the capped area. BioSonics (2010) verified that the sand was in fact silt and that the cobble section in the center of the polygon was vegetated silty deposits with some cribbing. The other section of cobble was not verified in the BioSonics report; however, grab samples and video taken approximately 50 m to the east indicated that cobble was present. The cobble in this location is most likely associated with the effluent pipe and cribbing. BioSonics also found that sand rather than cobble was present along the shore of Jellicoe Cove (Northern Bioscience 2011).

A summary of the substrate by depth for the capping area is presented in Table 7. Existing habitat maps and updated substrate maps are provided in Appendix G Northern Bioscience (2011).

Table 7 Substrate by Depth for the Capping Area

Depth (m)	Substrate	Vegetation	Area (m2)	Percent (%)
0-1	cobble	vegetated	41	3
0-1	gravel	vegetated	29	2
0-1	sand	vegetated	1,112	94
1-2	gravel	vegetated	37	2
1-2	sand	vegetated	2,424	98
2-5	gravel	vegetated	338	1
2-5	sand	vegetated	17,942	68
2-5	silt	bare	2,987	11
2-5	silt	vegetated	4,989	19
5-10	gravel	vegetated	1,454	2
5-10	sand	bare	7	<1
5-10	sand	vegetated	12,282	19
5-10	silt	bare	14,703	22
5-10	silt	vegetated	37,358	57
10+	sand	bare	24,687	15
10+	sand	vegetated	2,324	1
10+	silt	bare	114,826	72
10+	silt	vegetated	18,646	12
TOTAL			**256,188**	

All studies concluded that the proposed capped area was primarily composed of fine sediments (sand or silt). However, the identification of the secondary substrate types was unclear due to discrepancies between the different data sources. For instance, it is understood that EC scientists with knowledge of the Project area questioned the presence of cobble / gravel habitat in the cap boundary that has been previously identified in earlier studies (Beak 2001) (see Figures 13 and 14 in Appendix G Northern Bioscience 2011). The additional information provided by EC in 2005 and 2007 indicated sand and some macrophytes in the location previously mapped as cobble / gravel. To verify the questionable areas, BioSonics conducted a hydroacoustic (side scan sonar) survey in 2010. They also confirmed the substrate in some areas by using video and / or ponar grabs. Although hydroacoustic data collected by BioSonics revealed that the majority of the secondary substrate was cobble (see Figure 30 (right) in Appendix G Northern Bioscience 2011), Northern Bioscience (2011), hypothesized that the hydroacoustic may have misinterpreted some of the "cobble" with substrate / material that has similar acoustic properties. One possibility is that the hydroacoustic misinterpreted logs or bark as cobble since an abundant amount of logs and bark were observed during video analysis east of Skin Island (Northern Bioscience 2011).

Although there are still some data gaps regarding the substrate in the proposed capped area, AECOM has estimated the percentages of different substrate types in the proposed capped area based on the substrate by depth information provided by EC (Northern Bioscience, 2011) which was based on the data collected by BioSonics 2010 and the analysis conducted by Northern Bioscience (2011). AECOM estimates that 75.5% of the capped area is silt, 23.7% is sand, 0.7% is gravel, and < 0.001% is cobble (Table 8). Photos of substrate are provided in Appendix 2 of the Northern Bioscience (2011) report attached in Appendix G.

Table 8 AECOM Substrate Estimate within the Proposed Cap Area*.

Substrate	Composition (%)
Silt	75.5
Sand	23.7
Gravel	0.7
Cobble	<0.1

**Based on the substrate by depth for the capping area information provided by Northern Bioscience (2011).*

Vegetation

Aquatic vegetation was mainly assessed within the southern section of the proposed capped area (see Figure 37 in Appendix G Northern Bioscience 2011); therefore, data gaps still remain for aquatic vegetation. All observed vegetation within the proposed capped area was submergent. Emergent vegetation was not present. Observed aquatic vegetation within the proposed capped area included aquatic macrophytes and filamentous macroalgae. Beak (2001) assessed approximately 0.5 ha of the southeast section of the proposed capped and found that aquatic macrophytes were fairly common. Common varieties included pondweed, waterweed (*Elodea* sp.) and stonewort (*Chara* sp.), which is a filamentous algae. Less common varieties included Canada smartweed (*Elodea canadensis*), *Potamogeton* spp. and several other known species (Northern Bioscience 2011). In 2005 and 2007, EC conducted video transects along the south and southeast sections of the proposed capped area. Results of the video transects indicated that aquatic macrophytes were well distributed within approximately 10 ha of the southern section of the proposed capped area (see Figure 37 in Appendix G Northern Bioscience 2011). Macrophytes were observed in shallow water to depths of about 13 m. The highest concentrations were observed in 4 m to 10 m of water. Macrophtes reached up to 50 cm in height. Abundant aquatic macrophytes were present within the southeast / central section of the proposed capped area and growth was limited to water depth. Trace to moderate macrophytes were present along the southern section near the shore and wave action along the shore may limit growth along the shore. No aquatic vegetation was observed in depths greater than 13 m; however, little sampling and video coverage was conducted in waters deeper than 13 m.

Although there are still some data gaps regarding the vegetation in the proposed capped area, AECOM has estimated the percentage of vegetation in the proposed capped area based on the vegetation information provided by EC (Northern Bioscience, 2011) which was based on the data collected by BioSonics 2010 and the analysis conducted by Northern Bioscience (2011). AECOM estimates that 38.6% of the cap area is vegetated and 61.4% is bare or not vegetated. Area by depth is provided in Table 7.

Less data on aquatic vegetation exists for other areas of Peninsula Harbour due to limited sampling effort. Beak (2001) found trace amounts of aquatic macrophytes in Carden Cove; however, a few patches of pondweed (*Potamogeton* spp.) were found in the middle of the cove.

Woody Debris

The same information sources used to analyze substrate was used to analyze woody debris in Jellicoe Cove. Results of video interpretation revealed that abundant woody debris (logs and bark) is present in Jellicoe Cove and in the proposed capped area (Northern Bioscience 2011). The highest concentration of woody debris and bark is located east of Skin Island. The majority of logs were observed near the shore at depths around 15 m. Some logs were also found in deeper water. The distribution of the logs within the proposed cap is provided in Figure 40 in Appendix G Northern Bioscience (2011).

Abundant logs and bark are not considered to be natural habitat for fish in the Peninsula harbour since no large tributaries exist which would supply a source for logs. The logs have accumulated since the Peninsula Harbour was once used to hold logs for building log rafts and for log storage (Boultbee 1967, Peninsula Harbour RAP Team 1991).

Organic material derived from woody debris is also present in Jellicoe Cove. Organic material concentration in Jellicoe Cove ranges from 1 - 11%. Abundant organic material decomposition can impair fish habitat by releasing organic leachates and decreasing oxygen due to microbial decomposition (Northern Bioscience 2011). Dissolved oxygen in Jellicoe Cove does not appear to be impaired since oxygen was found to be within 102 - 105% (Beak 2001).

Overwintering

Fall movements from shallow to deep water occur for fish species such as rainbow trout, cisco, lake trout, Chinook salmon, and YOY coho salmon (Lane *et al*. 1996b). These species were observed moving into waters 5 m or deeper during the fall. Water depth in the proposed capped area ranges from approximately 2 m to 28 m (Beak 2001); therefore, the proposed capped area could provide potential overwintering habitat for fish species present in the area.

3.1.4.5 Fish and Fish Habitat Evaluation

In 1986, the shored area along the southern section of the proposed capped area was considered to have productive fish habitat (Hamilton 1986). The type of fish habitat was not indicated; however, no rearing habitat was observed at that time. In 1986, this area provided habitat for lake whitefish, rainbow smelt, longnose sucker, white sucker, and mottled sculpin.

In 2000, Beak (2001) indicated that Jellicoe Cove provided nursery habitat for longnose sucker and yellow perch in the small embayment at the boat launch area approximately 400 m northeast of the proposed capped area. They also found that the armoured shoreline within the proposed capped area provides rearing habitat for coho salmon and rainbow trout. Habitat also exists in Jellicoe Cove for adult round whitefish, longnose sucker, lake trout and northern pike.

Nearshore areas used by certain fish species for spawning have been historically identified in Jellicoe Cove, Carden Cove and Peninsula Harbour; however, these areas have been identified in studies that are between 10 - 30 years old. Therefore, the current use of fish habitat in these areas is not certain. In general, these areas are associated with different substrate types depending on the species. These areas include the following:

- Cisco / Lake herring – Major spawning grounds along the western shore of the Peninsula and Pebble Beach (inshore October to December), with peak spawning occurring in late November to early December (Goodier 1981) (see Figure 5 in Appendix G Northern Bioscience 2011);
- Round whitefish – Nursery habitat in Carden Cove, spawning in shallow beach areas mainly between late November and early December, extending into January (see Figure 9 in Appendix G Northern Bioscience 2011);
- Lake trout – Historic major spawning grounds along the south shore of Ypres Point and along the western shoreline of Beatty Cove, as well as average spawning habitat in Jellicoe Cove, with spawning occurring from late September to early November (Goodier 1981) (see Figure 5 in Appendix G Northern Bioscience 2011);
- Rainbow trout – Spawning, nursery and rearing habitat within lower reaches of Shack Creek with major runs in the spring peaking near the end of May and other runs occurring in the fall. Nursery habitat for this species also occurs along the armoured shoreline in Jellicoe Cove, adjacent to the mill (Beak 2011) (see Figure 8 in Appendix G Northern Bioscience 2011). One of the identified rearing areas is within the proposed cap area; however, the current use of the habitat by rainbow trout young of the year is unknown;
- Pink, Chinook and Coho Salmon – Spawning habitat in Shack Creek, congregating offshore prior to entering the tributary and spawning from September to November for chinook and coho salmon, or over a two (2) week period beginning in mid September for pink salmon. Nursery habitat for coho salmon also occurs along the armoured shoreline in Jellicoe Cove, adjacent to the mill (Beak 2001). One of the identified rearing areas is within the proposed cap area; however, the current use of the habitat by coho salmon young of the year is unknown;
- Yellow perch – Nursery habitat within the small embayment at the boat launch within Jellicoe Cove, with adults moving into tributaries or lake shallows to spawn from April to June (Beak 2001) (see Figure 8 in Appendix G Northern Bioscience 2011); and
- Longnose sucker – Spawning habitat in Shack Creek and nursery habitat within the small embayment at the boat launch within Jellicoe Cove (Beak 2001). Adults move into tributaries or lake shallows to spawn mid April to May, with peak spawning occurring from late May to early June.

MOE conducted young of the year fish survey in 2009 and was unable to catch sufficient quantities of fish. Northern Bioscience (2011) evaluated the following data to evaluate fish habitat within the proposed capped area: existing data from Beak (2001); existing reports by EC (Milani *et al*. 2001 and Grapentine *et al*. 2005); EC underwater video (unpublished data 2007); EC underwater video (unpublished data 2005); MOE underwater video and acoustic; and BioSonics hydroacoustic survey with confirmation grab samples / video (2010).

Based on historical research, the following section evaluates the fish species which likely use fish habitat in the proposed capped area (Northern Bioscience 2011, Beak 2001, Hamilton 1986) (see Table 9).

Table 9 Evaluation of Fish and Fish Habitat for Species Known to be Present in the Proposed Capped Area

Common Name	Spawning Habitat	Rearing Habitat	Overwintering Habitat	Overall Habitat	Potential for Fish Presence
Alewife	Poor-Moderate	Moderate-Good	Moderate-Good	Moderate-Good	High
Burbot	Poor	Poor-Moderate	Moderate-Good	Moderate	Moderate
Cisco	Moderate to Good	Poor	Poor-Moderate	Moderate	Moderate
Coho Salmon	Poor to nil	Poor-Moderate	Moderate	Moderate	Low-Moderate
Lake Chub	Poor	Poor-Moderate	Moderate	Poor-Moderate	Moderate
Lake Trout	Poor	Poor-Moderate	Moderate	Poor-Moderate	Moderate
Lake Whitefish	Moderate	Poor-Moderate	Moderate	Moderate	Moderate
Longnose Dace	Poor	Moderate-Good	Poor-Moderate	Moderate	Moderate
Longnose Sucker	Poor to nil	Moderate	Good	Moderate	High
Mottled Sculpin	Poor	Poor-Moderate	Moderate	Poor-Moderate	Moderate
Northern Pike	Poor	Moderate	Moderate	Moderate	Moderate
Pink Salmon	Poor to nil	Poor	Moderate	Poor	Low-Moderate
Rainbow Smelt	Poor to nil	Moderate-Good	Moderate-Good	Moderate	Moderate
Rainbow Trout	Poor to nil	Good	Moderate-Good	Moderate-Good	High
Round Whitefish	Poor	Poor-Moderate	Good	Moderate	Moderate-High
Slimy Sculpin	Poor	Poor-Moderate	Poor-Moderate	Poor-Moderate	Low-Moderate
Threespine Stickleback	Poor	Poor	Moderate	Poor	Low
White Sucker	Poor	Moderate	Moderate	Moderate	Moderate
Yellow Perch	Moderate-Good	Moderate-Good	Good	Moderate-Good	High

<u>Lake Trout</u>

Generally lake trout prefer oligotrophic lakes and waters with mean depths > 6 m. Habitat use includes rocky shorelines, streams and deep water. Lake trout prefer temperatures ranging from 4°C to 18°C (Newbury and Gadbury). Lake trout move into deeper waters > 5 m in the fall (Lane *et al*. 1996b).

Lake Trout spawn in the fall and spawn at depths between 0 - 5 m and > 5 m in depth and in crevices and cracks. Lake trout spawning is strongly associated with clean cobble and rubble and cobble and rubble over boulder and bedrock and poorly associated with gravel and sand. Lake trout also require shoals with enough wave action to remove fine sediments (Lane *et al*. 1996a). Historically, the majority of the proposed capped area was documented as moderate spawning habitat for lake trout (Goodier 1981). Results from core sampling suggest that Jellicoe Cove did not historically contain cobbles; therefore, lake trout may have historically spawned over sand or gravel in areas that do not receive a lot of sediment settling. The quality of lake trout spawning habitat has lessened since 1981 due to the shoreline and near shore modifications in this area such as the construction of the Warf (Northern Bioscience 2011). Presently, Jellicoe Cove primarily contains abundant fines (*i.e.,* clay, sand, soft sand and silt) with trace amounts of cobble and gravel. Northern Bioscience (2011) estimated that approximately 1000-2000 m^2 of the proposed capped area is suitable spawning habitat for lake trout. Preferred rearing habitat is typically located in cool near shore water with rocky shorelines (Northern Bioscience 2011). In the spring, young of the year can be found in waters > 1 m in depth. Throughout the year, young of the year can be found in waters > 2m in depth (Lane *et al*. 1996a). Young of the year are strongly associated with boulder / cobble, rubble and gravel, moderately associated with boulder and sand and poorly associated with silt.

Overall fish habitat is considered poor to moderate for lake trout with a moderate potential for fish presence. Spawning habitat for lake trout is considered to be poor due to few areas of preferred substrate and due to the presence of sand which is poorly associated with lake trout spawning. Rearing habitat is considered to be poor to moderate owing to the presence of sand and shallow water along the southern section of the proposed capped area; however, the highly vegetated areas would be unsuitable. Overwintering habitat is considered moderate owing to foraging opportunities and sufficient water depth.

Yellow Perch

In general, yellow perch prefer rivers and open water of clear lakes, moderate amounts of vegetation and clay, sand and gravel substrate. They prefer clear water ranging in temperature from 18 - 21°C and can tolerate pH from 3.9 - 9.5 (Newbury and Gadbury 1993). They are also known to be pelagic for four (4) to five (5) weeks. Yellow perch are known to overwinter in the great lakes (Lane *et al*. 1996b).

Spawning for yellow perch occurs in the spring and in water between 0 - 5 m and > 5 m in depth. One study indicated that yellow perch historically spawn at a location 10 m in depth in Lake Michigan (Dettmers *et al*. 2001).

Yellow perch are spawning habitat generalists which means that they can spawn in a variety of habitat types. Yellow perch spawning is strongly associated with gravel and sand and moderately associated with clay, silt, rubble, submergent vegetation and emergent vegetation. The eggs of yellow perch are enclosed in gelatinous tubes which attach to vegetation or substrate (Lane *et al*. 1996a). Young of the year are strongly associated with gravel, sand and silt and moderately associated with submergent and emergent vegetation (Lane *et al*. 1996b). In the spring, young of the year yellow perch are found in water ranging from 0 - 5 m in depth; however, in the fall they move into waters > 5m in depth.

Overall fish habitat is considered moderate-good for yellow perch with a high potential for fish presence. Spawning habitat is considered moderate to good owing to the presence of preferred substrates (*i.e.,* sand, clay and silt) and adequate depth. Rearing habitat is considered moderate to good owing to the presence of submergent vegetation and to the presence of preferred substrate. Overwintering habitat is considered to be good due since the area provides preferred habitat and also since yellow perch will migrate into deeper waters in the fall.

Longnose Sucker

In general, longnose sucker prefer clear and cold deep water in lakes and streams. They can be found in water up to 55 m in depth. Spawning for longnose sucker occurs in the spring and in water between 0 - 5 m in depth.

Longnose sucker spawning is strongly associated with gravel and sand (Lane *et al*. 1996a). Young of the year are strongly associated with sand and submergent vegetation. Throughout the year, young of the year are found in water ranging from 0 - 2 m in depth (Lane *et al*. 1996b).

Overall fish habitat is considered moderate for longnose sucker with a high potential for fish presence. Spawning habitat is considered poor to nil since most spawning will likely occur in Shack Creek (Northern Bioscience 2011). Rearing habitat is considered moderate owing to the presence of submergent vegetation and to the presence of some suitable substrate. Overwintering habitat is considered to be good owing to adequate depth and good foraging opportunities.

Northern Pike

Adult pike prefer depths in lakes < 8m or above the thermocline. They prefer to inhabit the boundary between vegetation and open water. Adults occur in shallow water during the spring and fall months and move into deep water during the summer (Newbury and Gadbury 1993).

Spawning for northern pike occurs in the spring in water between 0 - 2 m in depth. Northern pike spawn over emergent aquatic vegetation or flooded terrestrial vegetation and spawning locations can alter each year depending in water levels. Northern pike spawning is strongly associated with sand, silt and emergent vegetation and poorly associated with rubble and gravel. Once laid, the eggs will stick to vegetation (Lane *et al*. 1996a). Young of the year are strongly associated with silt. During the spring northern pike are found in waters ranging from 0 m to 2 m in depth. During the fall, young are found in waters between 2 - 5 m in depth (Lane *et al*. 1996b). Northern pike larvae prefer marshes and shorelines with abundant submergent and emergent vegetation (Newbury and Gadbury 1993).

Overall habitat is considered moderate for northern pike with a moderate potential for fish presence. Spawning habitat is considered poor due to the lack of flooded terrestrial vegetation, lack of emergent vegetation and few areas of water between 0 - 2 m in depth. Rearing habitat is considered moderate owing to the presence of preferred substrate, preferred depth and the presence of submergent vegetation. Overwintering habitat is considered moderate since young of the year prefer shallow water.

Lake Whitefish

Lake whitefish spawn in the fall in water between 0 - 5 m and > 5 m in depth. Spawning is strongly associated with boulder, cobble, rubble and gravel, moderately associated with sand and poorly associated with clay (Lane *et al*. 1996a). Young of the year strongly associated with gravel and sand, moderately associated with rubble and poorly associated with emergent vegetation. Young are found in warm water between 0 - 2 m in depth during the spring and can be found in water > 2 m throughout the year (Lane *et al*. 1996b).

Overall habitat is considered moderate for lake whitefish with a moderate potential for fish presence. Spawning habitat is considered moderate owing to the presence of suitable substrate and adequate depth. Rearing habitat is considered poor to moderate owing to the presence of suitable substrate. Overwintering habitat is considered moderate owing to adequate depth.

White Sucker

White sucker spawn in the spring and in water between 0 - 2 m in depth. Spawning is strongly associated with gravel, moderately associated with rubble and sand and poorly associated with submergant and emergent vegetation (Lane *et al*. 1996a). Young of the year are strongly associated with sand, moderately associated with silt and poorly associated with boulder/cobble and rubble. Young are also strongly associated with submergent vegetation. Young are found throughout the year in water between 0 - 5 m (Lane *et al*. 1996b).

Overall habitat is considered moderate for white sucker with a moderate potential for fish presence. Spawning habitat is considered poor due to few areas of water depth between 0 - 2 m. Rearing habitat is considered moderate owing to suitable substrate. Overwintering habitat is considered to be moderate owing to sufficient depth.

Coho Salmon

Spawning takes place over clean gravel and cover in streams (Northern Bioscience 2011). Young of the year are strongly associated with boulders and moderately associated with sand. Young are found in water between 0 - 2 m during the spring and > 5m during the fall (Lane *et al*. 1996b).

Overall habitat is considered poor to moderate with a low to moderate potential for fish presence. Spawning habitat is considered to be poor to nil since no streams occur within the proposed capped area. Rearing habitat is considered poor to moderate owing to the presence of some suitable substrates. Overwintering habitat is considered moderate owing to sufficient depth and since young move into deeper water in the fall.

Pink Salmon

Spawning takes place over clean gravel and cobble in streams. Young of year are highly associated with boulder, and moderately associated with boulder / cobble and rubble. Young are found in water > 2m deep throughout the year (Lane *et al*. 1996b).

Overall habitat is considered poor with a low to moderate potential for fish presence. Spawning is considered poor to nil due to the lack of streams within the proposed capped area. Rearing is considered poor due to the lack of suitable substrate. Overwintering is considered moderate owing to sufficient water depth.

Rainbow Trout

Rainbow trout spawn in the spring in water between 0 - 5 m and > 5 m in depth. Spawning is strongly associated with gravel and poorly associated with rubble (Lane *et al*. 1996a). Rainbow trout young of the year are strongly associated with gravel, sand and silt. Young are poorly associated with submergent vegetation and can be found between 0 - 2 m during the spring and > 5 m during the fall. The young also use log jams for cover (Lane *et al*. 1996b).

Overall habitat is considered moderate to good with a high potential for fish presence. Spawning habitat is considered poor to nil due to the lack of suitable substrate and lack of streams. Rearing habitat is considered good owing to the presence of preferred substrate and the abundance of logs. Overwintering is considered moderate to good owing to adequate depth.

Round Whitefish

Round whitefish spawn in the fall in water between 0 - 5 m and > 5 m in depth. Spawning is strongly associated with rubble and gravel (Lane *et al*. 1996a). Young of the year are strongly associated with gravel and sand. Young are found in water between 1 - 5 m deep in the spring and > 5 m throughout the year (Lane *et al*. 1996b).

Overall habitat is considered moderate with a moderate to high potential for fish presence. Spawning habitat is considered poor due to the absence of suitable substrate. Rearing habitat as considered poor to moderate owing to areas of suitable substrate. Overwintering habitat is considered good owing to adequate depth and good foraging oppertunities.

Burbot

Burbot spawn in the winter and in water between 0 - 5 m in depth. They may also spawn in deep water. Spawning is strongly associated with boulder, cobble, rubble and gravel and moderately associated with sand and silt (Lane *et al*. 1996a). Young of the year are strongly associated with rubble, gravel and sand. Young are found in water between 0 - 5 m deep in the spring and > 5m deep during the fall (Lane *et al*. 1996b).

Overall habitat is considered moderate with a moderate potential for fish presence. Spawning habitat is considered poor due to limited areas of preferred depth. Rearing habitat is considered poor to moderate owing to the presence of some suitable substrate. Overwintering habitat is considered moderate to good owing to adequate depth.

Cisco

Cisco spawn in the fall in water between 0 - 5 m and > 5 m in depth. One study found that ciscoes were spawning at depths > 20 m (Hénault and Fortin 1991). Spawning is strongly associated with cobble, rubble, gravel, and sand and moderately associated with boulder, silt, clay and hard-pan clay (Lane *et al*. 1996a). Young of the year are strongly associated with boulder / cobble, rubble, moderately associated with boulders and gravel and poorly associated with sand. Young are also poorly associated with submergent vegetation. Young can be found in waters between 0 - 2 m deep during the spring and > 2 m deep during the fall (Lane *et al*. 1996b).

Overall habitat is considered moderate with a moderate potential for fish presence. Spawning habitat is considered moderate to good owing to the presence of suitable substrate and adequate depth. Rearing habitat is considered poor to the low amounts of suitable substrates. Overwintering habitat is considered poor to moderate owing to sufficient depth.

Lake Chub

Lake chub spawn in the spring and in water between 0 - 2 m in depth. They also are known to spawn under boulders. Spawning is strongly associated with rubble, gravel, and sand, moderately associated with boulders and poorly associated with silt (Lane *et al*. 1996a). Young of the year are strongly associated with gravel and sand. Young are found in water between 0 - 2 m throughout the year (Lane *et al*. 1996b).

Overall habitat is considered poor to moderate with a moderate potential for fish. Spawning is considered poor due to few areas of preferred depth. Rearing habitat is considered poor to moderate owing to the presence of some suitable substrate. Overwintering habitat is considered moderate owing to sufficient water depth.

Rainbow Smelt

Rainbow smelt spawn in the spring in streams. They spawn in water between 0 - 5 m and > 5 m in depth. Spawning is strongly associated with rubble, gravel and sand, moderately associated with boulder and cobble and poorly associated with silt and emergent and submergent vegetation (Lane *et al*. 1996a). Young of the year are strongly associated with gravel and sand. Young are found between 1 - 5 m during the spring and > 5 m during the fall (Lane *et al*. 1996b).

Overall habitat is considered moderate with a moderate potential for fish. Spawning habitat is considered poor to nil since this fish migrates into streams to spawn. Rearing habitat is considered moderate to good owing to the presence of preferred substrate. Overwintering habitat is considered moderate to good owing to sufficient water depth.

Mottled Sculpin

Mottled sculpin spawn in the spring and in water between 0 - 1 m in depth. They also can spawn in crevices, under rocks and in burrows. Spawning is strongly associated with boulder, cobble, rubble, gravel, and sand (Lane *et al*. 1996a). Young of the year are strongly associated with boulder, boulder / cobble and rubble and moderately associated with gravel and sand. Young are poorly associated with submergent and emergent vegetation and can be found in water between 0 - 2 m and > 5m throughout the year (Lane *et al*. 1996b).

Overall habitat is considered poor to moderate with a moderate potential for fish presence. Spawning is considered poor due to few areas of preferred depth. Rearing habitat is considered poor to moderate owing to presence of some suitable substrate. Overwintering habitat is considered moderate owing to sufficient depth.

Slimy Sculpin

Slimy sculpin spawn in the spring and in water between 0 - 5 m in depth and > 5 m in depth. They can also spawn under rocks and logs. Spawning is strongly associated with boulder, cobble, rubble and gravel and poorly associated with sand and silt (Lane *et al*. 1996a). Young of the year are strongly associated with boulder and boulder / cobble and moderately associated with rubble, gravel and sand. Young can be found in water between 0 - 2 m and > 5 m throughout the year (Lane *et al*. 1996b)

Overall habitat is considered poor to moderate with a low to moderate potential of fish presence. Spawning habitat is considered poor to the low abundance of preferred substrate. Rearing is considered poor to moderate owing to the presence of some suitable substrate. Overwintering habitat is considered poor to moderate owing to sufficient depth.

Longnose Dace

Longnose dace spawn in the spring and in water between 0 - 2 m in depth. Spawning is strongly associated with rubble and gravel and moderately associated with cobble and sand (Lane *et al*. 1996a). Young of the year are strongly associated with sand and silt and moderately associated with rubble and gravel. Young are poorly associated with emergent and submergent vegetation and can be found in water between 0 - 2 m deep throughout the year (Lane *et al*. 1996b).

Overall habitat is considered moderate with a moderate potential for fish presence. Spawning habitat is considered poor due to few areas of adequate depth. Rearing is considered moderate to good owing to the presence of preferred substrate. Overwintering is considered to be poor to moderate owing to adequate depth.

Alewife

Alewife spawn in the spring between 0 - 5 m in depth. They prefer stones and debris for cover. Spawning is strongly associated with boulder, cobble, rubble, gravel, sand, silt and clay and poorly associated with submergent and emergent vegetation (Lane *et al*. 1996a). Young of the year are highly associated with rubble, gravel, sand, silt and clay. Young are poorly associated with submergent vegetation and are found in water between 0 - 2 m during the spring and > 2m during the fall.

Overall habitat is considered moderate to good with a high potential for fish presence. Spawning is considered poor to moderate owing to the presence of preferred substrate abut limited by water depth. Rearing habitat is considered moderate to good owing to the presence of preferred substrate. Overwintering habitat is considered moderate to good owing to sufficient depth.

Threespine Stickleback

Threespine stickleback spawn in the spring and in water between 0 - 1 m in depth. Stickleback prefer to spawn in open areas but are not restricted to those areas. Spawning is strongly associated with sand and silt, moderately associated with gravel and poorly associated with submergent and emergent vegetation (Lane *et al*. 1996a), although they do use vegetation to make a nest (Northern Bioscience 2011). Young of the year are highly associated with gravel. Young are poorly associated with submergent vegetation and are found in water between 0 - 2 m during the spring and > 2m during the fall.

Overall the habitat is considered to be poor for threespine stickleback with a low potential for fish presence. Spawning habitat is considered poor due to few areas of preferred depth. Rearing habitat is considered poor due to the lack of preferred substrate and the abundance of aquatic vegetation. Overwintering habitat is considered to be moderate since stickleback migrate into deep water in the fall.

3.1.4.6 Fish and Fish Habitat Summary

The relative strength of fish populations is difficult to assess as little information exists on fish populations. However, no rare species were captured or are considered to use Peninsula Harbour. Less than 2% of the cap is in shallow (<2 m) water preferred by many YOY fish including salmonids and suckers, and relatively similar littoral habitat is expected to be abundant elsewhere in Peninsula harbour along more natural shorelines. With the majority of cap area (approx. 96%) consisting of fine sediments, this habitat is not limiting and is available nearby (Appendix H: DFO, Risk Assessment Worksheet, 2011).

The cap area contains approximately 100,000 m^2 of aquatic vegetation that will be covered by 15 to 20 cm of sand. There is limited knowledge of the abundance of aquatic vegetation elsewhere in Peninsula Harbour and as such, the significance of the potential disruption of this habitat is difficult to determine (Appendix H, DFO, Risk Assessment Worksheet, 2011). Aquatic vegetation height less than 15 to 20 cm will be covered by sand, but it is anticipated that they will recover over time. The response of vegetation to disturbances such as the proposed capping is poorly understood for oligotrophic systems like Peninsula Harbour, but various lines of evidence suggest that the plant species present in Jellico Cove will be able to recover in the short to medium term (less than 5 years) (Northern Bioscience, 2011). Monitoring will be conducted to assess:

- The distribution and potential movement of the sand cap; and
- The recovery of SAV in the proposed cap and adjacent areas.

Two nearshore areas close to the cap area have been identified: one on the south-west and the other on the south-east side of the cap area. These areas have the potential to contain sensitive fish habitat. Should sensitive fish habitat be found in these areas, precautions will be taken to protect the areas (e.g. turbidity curtains may be used and the turbidity within the curtain area must meet the turbidity criteria specified in Table 2).

The proposed capped area appears to be a moderate quality habitat for the majority of fish species known to be present in Jellicoe Cove. The area appears to be a moderate to good overall habitat for yellow perch, alewife, and rainbow trout. Spawning habitat is moderate to good for yellow perch and cisco. The proposed capped area also has moderate to good or good rearing habitat for alewife, longnose dace, rainbow trout and yellow perch, rainbow smelt and moderate habitat for longnose sucker, northern pike, and white sucker. Overwintering habitat appears to moderate to good or good for longnose sucker, round whitefish, burbot, alewife, yellow perch, rainbow trout, and rainbow smelt. Due the limited and outdated fish habitat use data, especially for potential spawning and rearing habitats in Jellicoe Cove and in other areas of the Peninsula, it is difficult to speculate on the actual habitat use of the species identified in the proposed capped area. In addition, the sediments are contaminated with PCBs and mercury and does not represent a good foraging habitat since these chemicals will bioaccumulate and impair fish health and reproduction.

3.1.4.7 Shack Creek and the Unnamed Tributary

Shack Creek was found to provide spawning, nursery and rearing habitat within its lower reaches for lake-run Lake Superior rainbow trout and coho salmon. Pink salmon, chinook salmon, longnose and white suckers (*Catostomus commersonii*) also were found to use this stream for spawning. Pink salmon typically congregate offshore prior to entering tributaries in mid-September with runs lasting approximately two (2) weeks, while coho and chinook salmon undertake spawning runs in September to November. Longnose sucker, like rainbow trout, spawn in the spring. Peak spawning generally occurs in late May to early June in streams (where available) or in shallow lake areas, just before the run of white suckers. The middle reaches of Shack Creek support a fishery of brook trout, characterized by a high density of trout across all age classes (fry, juvenile, adult). The assessment also noted as absence of migratory salmonids upstream of the CP Rail System crossing, resulting from a barrier to migration downstream (*i.e.,* falls downstream of municipal golf course).

The unnamed tributary to the north of Shack Creek was intermittent in nature and was considered to have no fish habitat value (Eakins and Fitchko 2000 *In* Beak 2000). However, Northern Bioscience (2011) indicated that the unnamed creek could provide fish habitat during peak flows.

3.1.4.8 Carden Cove

Carden Cove was found to have nursery habitat for longnose sucker and round whitefish. The maximum water depth observed by Beak (2001) was 7 m; however, lake bathymetry data results from subsequent studies indicate that the maximum water depth is 10 m. Abundant sand over clay were found with trace amounts of bedrock. Trace aquatic macrophytes and some sections of pondweed were found. The west and east shores are exposed boulders and / or bedrock while the north shore is sand (Beak 2001).

3.1.4.9 Beatty Cove

Limited data is available on fish and fish habitat in Beatty Cove. Goodier (1981) indicated that the northwestern side of Beatty Cove was a major spawning grounds for lake trout. However, some of these grounds may have been destroyed due to the accumulation of organic matter due to log and / or mill operations. Limited video and ponar grabs indicated that abundant silt is present in deep water in the center with some logs. Pondweeds were also observed near the mouth of the cove. Maximum water depth in Beatty Cove is approximately 20 m (Northern Bioscience 2011).

Potential fish species within the proposed cap area are addressed in Section 3.1.4.3.

3.1.5 Wildlife

3.1.5.1 Terrestrial Vegetation

Peninsula Harbour is located in the Superior Section of the Boreal Forest Region. This region is characterized by extensive conifer forests including white spruce (*Picea glauca*) and black spruce (*Picea mariana)*, with tamarack (*Larix laricina)*, balsam fir (*Abies balsamea)* and jack pine (*Pinus banksiana)* occurring less frequently. Forests within this region are primarily coniferous; however there are also broadleaved tree species such as white birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*). These broadleaved species occur particularly on south-facing slopes, as well as both conifer and broadleaved species typical of the Great Lakes-St. Lawrence Forest Region, including eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*), black ash (*Fraxinus nigra*) and eastern white cedar (*Thuja occidentalis*). The cold waters of Lake Superior provide a suitable habitat for a number of sub-arctic or alpine plants, such as crowberry (*Empetrum sp.*), billberry (*Myrtillus fructus*) and encrusted saxifrage (*Saxifraga paniculata*), which have been recorded near the lake shore in Neys Provincial Park and Pukaskwa National Park.

The shoreline of Jellicoe Cove has limited vegetative cover due to human development in the area, and areas to be used for Project temporary ancillary elements and shorelines modifications (if required) are non-vegetated and no clearing / grubbing is likely required, such there will be no direct interactions between terrestrial vegetation and Project activities. It is anticipated that the laydown area will also occur a minimum of 30 m from aquatic habitat (*i.e.,* watercourses and wetlands). Otherwise, the Contractor is responsible for ensuring that the selected site is suitable for development; that is, undertake any necessary environmental evaluations at the site in consideration of rare and sensitive wildlife species and habitat to ensure compliance with all relevant federal and provincial legislation and provide documentation of the evaluation to the satisfaction of proponent.

Overall, likely terrestrial portions of the proposed Project area do not provide a wide variety of habitat types necessary to support diverse wildlife communities and are unrepresentative of natural habitat (Beak 2000).

3.1.5.2 Avifauna

A few species of birds exist in the Peninsula Harbour area all year-round including grosbeaks, chickadees, ravens, jays and grouses. Ruffed grouse (*Bonasa umbellus*) is the most common species of upland game bird (OMNR 1983), while spruce grouse (*Dendragapus canadensis*) are also present, but less common. Snipe and woodcock, although not abundant, also occur. During the growing season, diurnal hawks, eagles and osprey, as well as nocturnal owls, can also be found.

Wetland areas and large open water bodies / areas typically provide suitable feeding and / or roosting habitat for migratory birds and may accommodate relatively large accumulations of waterfowl as they as prepare to begin or resume flight. Such habitats are considered of the most concern for migratory birds. Peninsula Harbour is located within the overlapping area between the Mississippi and Atlantic flyways and all waterfowl (ducks, geese and shorebirds) present in the area of the proposed Project are migratory species (Beak 2000). There is an absence of significant coastal wetlands within the shoreline area that would otherwise support either an extensive growth of aquatic vegetation or provide suitable habitat for migratory birds. Furthermore, the widespread development around the shore of Jellicoe Cove has left sparse vegetation on land, with the adjacent land area being forested by mainly coniferous species.

There are a number of significant duck species which breed in the area of Peninsula Harbour. Such species include mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*), ring-necked duck (*Aythya collaris*), American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), common goldeneye (*Bucephala clangula*), hooded merganser (*Lophodytes cucullatus*), common merganser (*Mergus merganser*), northern pintail (*Anas acuta*), lesser scaup (*Aythya affinis*) and scoter (*Melanitta nigra*) (Cadman *et al.* 1987). Also present in the Project are during migration are Canada geese (*Branta Canadensis*) and snow geese (*Chen caerulescens*) (Beak 2000).

Within the general area of Peninsula Harbour are a number of nesting sites for colonial waterbirds, the most predominant being the herring gull (*Larus argentatus*). A number of great blue heron (*Ardea herodias)* nesting sites may also be present in the area; the closest recorded approximately 6 km northwest of Marathon on Good Hope Island in 1978. In 1989, a single double-crested cormorant (*Phalacrocorax auritus*) colony was observed on an island at the west tip of Ogilvy Point, approximately 12.5 km south of Marathon; however, there have been no observations of ring-billed gull (*Larus delawarensis*) nesting sites in the area. The only nesting sites within Peninsula Harbour are herring gull colonies were recorded on Skin Island with 15 nests in 1978 and 48 nests in 1989. In addition, on the southeast tips of Hawkins Island and Blondin Island, 62 and 27 nests were recorded respectively in 1989 (Blokpoel *et al.* 1980; Blokpoel and Tessier 1993).

As presented in the Environmental Risk Assessment (ERA) (ENVIRON 2008), the piscivorous bird populations of Peninsula Harbour are represented by two (2) susceptible species inhabiting the area, common loons (*Gavia immer*) and bald eagles(*Haliaeetus leucocephalus*) (a species of Special Concern according to MNR, see Section 3.1.5.4 Species at Risk). Due to variation in the preferred prey and foraging strategies of these two (2) species, their potential for exposure is also expected to differ.

The common loon characteristically winters along coastal marine waters and breeds along inland freshwater lakes. Lakes favoured for breeding are generally clear and oligotrophic, surrounded by forested rocky shorelines, deeply sunken bays, numerous islands, and floating bogs (ENVIRON 2008). This species feeds opportunistically on available fish species which can include lake whitefish, lake trout and longnose sucker (McIntyre and Barr 1997), as well as other aquatic vertebrates, some invertebrates and vegetation (Barr 1996). This feeding primarily occurs along shorelines with good underwater visability and low density vegetation and is typically concentrated in the upper five (5) m of the water column (although may dive to 60 m in clear water) (Roberts 1932). The ERA reports that Jellicoe Cove may support a single pair of common loons, while a number more would likely be supported elsewhere in the Harbour (ENVIRON 2008).

Bald eagles are a species of Special Concern in Ontario, as listed by MNR, however, are not a federally listed species. Species at risk are discussed further in Section 3.1.5.4 of this document. Bald eagles are found in a broad range of habitats (coast, beach, shore, river, stream, and riparian), with the most frequent habitat being areas which provide an sufficient supply of fish in shallow waters and availability to elevated nesting and perching sites (ENVIRON 2008). Nesting typically begins in February and March, egg incubation generally lasts five (5) weeks, and young fledge in another ten (10) to 11 weeks (Beak 2000). Bald eagles have been found to have a diet based on fish (between 70% and 90%), limited to surface-schooling fish and those species that inhabit shallow waters. The ERA reports that depending on prey and nesting availability, Jellicoe Cove and Peninsula Harbour could theoretically support several breeding pairs of bald eagles (ENVIRON 2008). Bald eagles are typically abundant in the Marathon area, particularly during the autumn near watercourses which support spawning habitat for chinook and other autumn-spawning salmon species, as they are feeding on these salmon species (Beak 2000).

3.1.5.3 Terrestrial Fauna

A number of mammal species are thought to occur in the general area of Peninsula Harbour. For example, moose (*Alces americanus*) are common throughout the OMNR Terrance Bay District (which includes the Town of Marathon), local woodland caribou (*Rangifer tarandus*) herds occur on Pic Island, in Neys Provincial Park and in Pukaskwa National Park, and black bear (*Ursus americanus*) are also considered to be moderately common in north-western Ontario. A number of other mammal species are thought to be relatively abundant in the area of Peninsula Harbour including lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), grey wolf (*Canis lupus*), weasel (*Mustela erminea*), beaver (*Castor canadensis)*, muskrat (*Ondatra zibethicus*), otter (*Lontra canadensis)*, skunk (*Mephitis mephitis*), snowshoe hare (*Lepus americanus*) and red squirrel (*Tamiasciursus hudsonicus*). Furthermore, certain species are known to forage along the shoreline of the Harbour which include raccoons (*Procyon lotor)*, fishers (*Martes pennant*), martins (*Martes americana*), and mink (*Neovison vison*). During field surveys undertaken in August and September 2000 (Beak 2000), three (3) mammal species were observed around the nearby Carden Cove area, a brown bear, lynx and grey wolf. The Project area does not fall within the recognized rage of the brown bear (*Ursus arctos*); however, no scientific name was provided in Beak 2000 for the bear identified. It is acknowledged that “brown bear” may refer to either a grizzly bear or a black bear. It is not clear which was identified in the field.

Similar to piscivorous bird populations, the ERA presented piscivorous mammal populations of Peninsula Harbour represented by a single species, the mink. Mink are expected to be the most highly exposed and the most sensitive mammal inhabiting the region, and can serve as a conservative surrogate (ENVIRON 2008). Minks are found near all types of aquatic habitats, preferring irregular shorelines and often using brushy or wooded cover adjacent to the water (Linscombe *et al.* 1982, Allen 1986). In general, the diet of mink in the Peninsula Harbour area is thought to be evenly divided between aquatic and terrestrial prey species. The population density of mink in the area is suggested to be lower than some earlier estimates, likely a result of constraints on habitat suitability within the shoreline area (*i.e.,* limited vegetative cover) (ENVIRON 2008).

Thirteen (13) species of amphibians and four (4) species of reptiles have been reported in the OMNR Terrance Bay District. Amphibians include the blue-spotted salamander (*Ambystoma laterale*), yellow-spotted salamander (*Ambystoma maculatum*), eastern redback salamander (*Plethodon cinereus*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*), striped chorus frog (*Pseudacris triseriata*), wood frog (*Rana sylvatica*) and northern leopard frog (*Rana pipiens*). The reptile species in the region include the common snapping turtle (*Chelydra serpentina serpentina*), painted turtle (*Chrysemys picta*), common garter snake (*Thamnophis sirtalis*) and redbelly snake

(*Storeria occipitomaculata*). All of these species of amphibians and reptiles except the redbelly snake are associated with moist habitats and waterbodies and are most likely to be encountered near wetlands and watercourses (Beak 2000).

3.1.5.4 Species at Risk

Undisturbed areas of native vegetation in the Peninsula Harbour area are thought to have the potential to support plant species which are of special concern (*i.e.,* species which are designated with special status under federal or provincial legislation). Federally, species of special concern are recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Species at Risk Act* and provincially, they are recognized by the OMNR under the Ontario *Endangered Species Act* (2007).

Although there are several plant species of special concern in Ontario, they are unlikely to occur in proximity to Peninsula Harbour (Argus *et al.* 1982-1987). There are no documented records of vegetative species of special concern in the area of the proposed Project (J. Bonnema OMNR Terrace Bay Area office 2000 pers. comm. from Beak 2000). Furthermore, the shoreline of Jellicoe Cove has limited vegetative cover due to human development in the area, and areas that are likely to be used for Project temporary ancillary elements and shorelines modifications (if required) are non-vegetated and no clearing / grubbing is likely required such there will be no direct interactions between terrestrial vegetation and Project activities. Overall, terrestrial portions of the proposed Project area do not provide a wide variety of habitat types necessary to support diverse wildlife communities and are unrepresentative of natural habitat (Beak 2000).

A review of the OMNR Species at Risk in Ontario (SARO) list reveals a number of naturally-occurring species, in danger of extinction or of disappearing from the province, and whose habitat ranges coincide with the proposed Project area (OMNR 2009). Species listed as extirpated, endangered or threatened are legally protected from harm under the *Endangered Species Act*. These species at risk are within the Boreal Forest and Great Lakes – St. Lawrence Forest Regions and include one (1) mammal species, one (1) insect species, one (1) reptile species, five (5) fish species, and nine (9) avian species.

The eastern cougar (*Felis concolor couguar*) is listed as an endangered species in Ontario. Historically this species preferred large forested areas, relatively undisturbed by humans and human activity. This species is threatened by human disturbance and habitat loss through land clearing for settlement and agricultural purposes, such that it is unlikely that this species would present in the immediate area of Jellicoe Cove due to the lack of large expanses of available natural habitat and forest.

The monarch butterfly (*Danaus plexippus*) is listed as a species of special concern both provincially and federally by COSEWIC. As a species of special concern, there is no formal protection for this species in Ontario; however, three (3) key management strategies or recovery initiatives have been identified to aid in its protection. The species occurs widely distributed, especially in southern Ontario, often associated with the distribution of its main host plant, milkweed (*Asclepias sp.*). Monarchs are also often found on abandoned farmland and roadsides, as well as in city gardens and parks. This species only occurs in Ontario during certain times of the year, as the North American population migrates to Mexico each fall to overwinter. The shoreline of Jellicoe Cove is largely devoid of vegetation, including milkweed. Monarch butterflies are therefore unlikely to be present within the immediate area of the Project in large numbers, due to a lack of suitable or key habitats.

Snapping turtle (*Chelydra serpentine),* is a species of special concern, both federally and provincially as listed by COSEWIC and OMNR. It is distributed in Ontario through southern and central regions (COSEWIC 2008b), occurring commonly in the local region of the Project (Beak 2000). This species inhabits shallow waters, concealed under soft mud and leaf litter (OMNR 2009), generally preferring water with dense vegetation (COSEWIC 2008b). Snapping turtles nest in gravely or sandy areas along streams, sometimes associated with anthropogenic disturbances, such as the shoulders of roads (OMNR 2009), in May and June. This species has been reported in the OMNR Terrance Bay District; however, due to the generally oligotrophic nature and clear waters of the Project area, preferred habitat for the snapping turtle (waters with dense vegetation) does not occur and large numbers of this species are unlikely.

Five (5) species of fish are listed as species at risk in Ontario have ranges extending into the general region of the Project, including the Great Lakes – St. Lawrence population of lake sturgeon (*Acipenser fulvescens*),shortjaw cisco (*Coregonus zenithicus*), upper great lakes kiyi (*Coregonus kiyi kiyi*), deepwater sculpin (*Myoxocephalus thompsonii*) and the northern brook lamprey (*Ichthyomyzon fossor*). Both the lake sturgeon and shortjaw cisco are listed as threatened species both federally (COSEWIC) and provincially and as such are protected under the *Endangered Species Act*, while the upper great lakes kiyi and northern brook lamprey are species of special concern both under Schedule 1 of *SARA* and by COSEWIC (OMNR 2009).

Lake sturgeon is provincially listed as *Threatened* in Ontario (SARO 2010) and are not listed federally (SARA 2011). However, Lake sturgeon are currently under consideration for federal listing which would not occur until at least 2013 (D. Ming Fisheries and Oceans Canada Science and Technology Coordinator pers. comm. 2011). The lake sturgeon can be found at depths ranging from 5 - 10 m and sometimes greater (SARA 2011). They are found throughout Ontario, particularly in the Great Lakes and their tributary rivers, as well as the large rivers in northern Ontario, however, this species is no longer found in many of the waters within their range historically (Kerr 2009). Lake sturgeon is a bottom feeding species (demersal), consuming mainly small fish, insect larvae, crayfish and molluscs. This species inhabits the bottoms of shallow areas of large freshwater lakes and rivers, migrating each year during early May to late June in to swift-flowing water in order to spawn *(e.g.,* rapids, chutes, waterfalls) (OMNR 2009, Kerr 2009). Adult lake sturgeon use rapids in Lake Superior tributaries for spawning in late May and June with lakes, rivers and estuaries being used for feeding and overwintering (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009). Lake sturgeon are a slow-growing species and females often spawn for the first time at 15 to 25 years of age (males spawning at a slightly younger age) and will only spawn once every five (5) to nine (9) years (Kerr 2009). The YOY use estuaries, embayments and rivers associated with Lake Superior for feeding. This species is known to occur in Pic River, while the White River population is believed to be extirpated (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009). Threats to lake sturgeon include human over-exploitation, dam construction (disrupt habitat and interrupt spawning movements and timing), habitat degradation resulting from human activities (including habitat contamination), and introduction of non-native species including predatory and competing fishes, as well as plants which may modify fish habitat. Although this species has the potential to occur in Jellicoe Cove, it was not recorded during the habitat and fisheries resource assessment undertaken in 2000 for both Jellicoe Cove and Carden Cove, and also including Shack Creek and the small unnamed creek north of Shack Creek. Lake sturgeons spawn in the spring in water between 0 m and 5 m in depth and they prefer rocks and logs for cover. Spawning is strongly associated with boulder, cobble, rubble, gravel, sand and silt (Lane *et al*. 1996a). Young of the year are strongly associated with sand and silt, moderately associated with rubble and gravel and poorly associated with submergent and emergent vegetation (Lane *et al*. 1996b). Young of the year are found in water > 2m in depth. However, the proposed Project area is considered to be too deep for YOY lake sturgeon to use, and while adults are known to inhabit lakes, it is considered unlikely that lake sturgeon would "depend" on the Project area to carry on its life processes (L. Nyman Nipigon District MNR Species at Risk

Biologist pers. comm. 2009). Further, early May to late June spawning times for the lake sturgeon are outside of the cap construction window (early July to early September), such that in water Project activities will not coincide with sensitive periods for this species. The Project is not likely to impact lake sturgeon in Jellicoe Cove, such that MNR does not require a permit under the *Endangered Species Act* for the Project (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009).

The shortjaw cisco is federally listed as *Threatened* Schedule 1 (SARA 2011). In Ontario this species occurs in Lake Superior, Lake Nipigon and some smaller inland lakes, while it is considered extirpated from Lake Michigan, Lake Erie and Lake Huron. The decline of the population was a result of over-fishing, however, the introduction of predatory and competitive species (*i.e.,* rainbow smelt, alewife, sea lamprey) are also thought to have contributed to the decline. Shortjaw cisco's are usually found in waters > 40 m (Murray and Reist 2003). This species lives in the deep waters of lakes (55 - 144 m), feeding primarily on insect larvae, crustacean and shrimps (OMNR 2009). In Lake Superior ciscos are typically found at water depths between 110 - 114 m in the spring, 55 - 71 m in the summer, and 73 - 90 m in the fall (SARA 2011). Spawning of this species in Lake Superior has been observed in either the spring or fall (COSEWIC 2003, SARA 2011) and in water > 5 m in depth. Spawning is strongly associated with sand and clay and moderately associated with bedrock, boulder, cobble, rubble, gravel, silt and hard-pan clay (Lane *et al.* 1996a). Young of the year are strongly associated with clay (Lane *et al*. 1996b). Shortjaw cisco was not found in the area of the Project during the 2000 habitat and fisheries resource assessment, likely due to the shallow nature of the cove. In addition, key spawning periods for the shortjaw cisco are outside of the in water construction window for the Project. In conclusion, the proposed capped area is too shallow to support shortjaw cisco. The Project is not likely to impact shortjaw cisco in Jellicoe Cove, such that MNR does not require a permit under the Endangered Species Act for the Project (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009).

The deepwater sculpin is federally listed as *Special Concern* Schedule 1 (SARA 2011). The deepwater sculpin is fairly common in Lake Superior. The deepwater sculpin can be found at the bottom of deep cold lakes. Adults are typically found in water between 60 - 150 m in depth (SARA 2011). Deepwater sculpin spawn in the winter in a nest. Spawning is strongly associated with bedrock, boulder, cobble, clay and hard-pan clay and poorly associated with rubble (Lane *et al*. 1996a) and occurs in water > 5 m in depth. Deepwater sculpin move into shallower water to spawn (Becker 1983 *In* Lane *et al*. 1996b). Young of the year are strongly associated with boulders and boulder / cobble. Young are found in water > 5m in depth throughout the year (Lane *et al*. 1996b). No other information on habitat preferences is known (SARA 2011). Based on what information is available on this species, the proposed capped area appears to be unsuitable habitat for adults, rearing and likely overwintering. The proposed capped area does, provide preferred substrate and shallower water for spawning. However, since so little is known about the spawning locations and preferences of this species no conclusions can be made regarding potential spawning habitat for this species in the cap area.

The upper great lakes kiyi is federally listed as *Special Concern* Schedule 1. In Ontario this species historically occurred in Lake Superior, Lake Heron and Lake Michigan, however, it has been declared to be extirpated from Lake Huron as well as Lake Michigan. The Lake Superior population now supports a small, regulated fishery. The population decline of this species was likely a result of intense commercial fishing, as well as competition from rainbow smelt and alewife, and from eutrophication of their habitat. The upper great lakes kiyi population typically dwell in deep waters of the Great Lakes, usually found at depths > 100 m (ONMR 2009). However, the kiyi can be found in water ranging in depth from 35 - 200 m and less likely to be found and depths < 108 m. The kiyi spawns from September to January fall at depths > 100 m (SARA 2011), typically 106 - 165m (COSEWIC 2005). Spawning is strongly associated with silt and clay (Lane *et al*. 1996a). Young of the year are strongly associated with silt and clay (Lane *et al*. 1996b). In conclusion, the proposed capped area is too shallow to support the upper great lakes kiyi.

The northern brook lamprey is federally listed as Special Concern Schedule 1. Northern brook lamprey inhabits small rivers, spawning in gravelly riffles before dying. Spawning adults gather in the shallows of creeks and small rivers during May and June to lay eggs. Larvae / ammocoetes burrow in to soft mud where they spend six (6) years growing, metamorphose into immature adults over the winter (approximately eight (8) months), and then quickly develop to sexual maturity emerging from the mud and moving to spawning grounds. Adults never feed, living only one (1) year before dying. Northern brook lamprey in Ontario inhabits rivers draining into Lake Superior, Lake Huron and Lake Erie. This species prefers warm water which may indicate that this species may never have been common in Ontario. Threats to the population have included the application of non-selective chemicals in streams to control the introduced sea lamprey, although the northern brook lamprey persists in streams which were not treated, above barriers and in backwater areas away from treatment areas. Other threats include siltation and water drawdown (OMNR 2009). The lamprey lives in freshwater streams and tributaries of Lake Superior (SARA 2011). The proposed capped area does not provide habitat for the northern brook lamprey since there are no streams occur within the proposed capped area. The closest potential habitat for the lamprey is Shack Creek and the Unknown Creek which are located approximately 250 - 500 m north of Jellicoe Cove. Therefore, suitable habitat for this species may be present within Shack Creek, although no Project activities will take place directly in this area.

None of the five (5) fish species were recorded during the habitat and fisheries resource assessment undertaken in 2000 in Jellicoe Cove, Carden Cove, Shack Creek and the small unnamed creek north of Shack Creek, potentially due to the relatively short duration of the study and / or, for certain species, the shallow nature of the Cove (*i.e.,* shortjaw cisco and upper great lakes kiyi). There remains the potential however for these species to occur in Jellicoe Cove (and in Shack Creek for the northern lamprey). Key spawning periods for these species will occur outside of the fisheries timing window (June 16 to August 31), such that in water Project activities (with the potential to temporarily degrade water quality in the area) will not coincide with sensitive periods for these species. For the species protected under the *Endangered Species Act* (*i.e.,* Great Lakes – St. Lawrence population of lake sturgeon and shortjaw cisco), it is considered unlikely that populations would “depend on the Project area to carry out lifecycle processes (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009). The Project is not likely to impact these two (2) species in Jellicoe Cove, such that MNR does not require permits under the *Endangered Species Act* for the Project (L. Nyman Nipigon District MNR Species at Risk Biologist pers. comm. 2009).

Nine (9) avian species are listed as species at risk in Ontario which have habitat ranges coinciding with the area of the Peninsula Harbour Sediment Remediation Project. These species include peregrine falcon (*Falco peregrinus anatum / tundrius*), chimney swift (*Chaetura pelagic*), whip-poor-will (*Caprimlugus vociferous*), bald eagle (*Haliaeetus leucocephalus*), yellow rail (*Coturnicops noveboracensis*), black tern (*Chlidonias niger*), olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*) and the short eared owl (*Asio flammeus*).

Of the avian species at risk that potentially occur within the region, four (4) species are highly unlikely to occur at or immediately near the Project area, due to lack of appropriate habitat resulting from absence of wetlands, limited vegetation and a highly disturbed terrestrial environment. This lack of suitable habitat applies to the whip-poor-will (roost and nest in closed canopy forests and forage in open areas such as savannahs, open woodlands or openings in more mature, deciduous, coniferous and mixed forests (OMNR 2009)), the yellow rail (preferring larger marsh areas with dense stands of grasses and sedges with shallow water (Ross 1985), nesting in areas with little standing water (COSEWIC 2001)), the olive-sided flycatcher (mixed and coniferous forest edges, burned or harvested forest, or widely open mature forest stands such as old growth, most often in natural forests, foraging from perches in snags and tall trees (OMNR 2009; COSEWIC 2007b)), and the short eared owl (breeding, hunting and migration in dense grass and sedge dominated ecosystems such as marshes and undisturbed grassy fields (Ross 1985; COSEWIC 2008), as well as tundra with areas of small willows (SARA 2009b)). Large numbers of these bird species are not likely to be encountered during Project activities due to the lack of suitable habitat, although suitable habitat for these species may be available in close proximity to the proposed Project (*e.g.,* the Peninsula). While these species may be present in the region, they are unlikely to be present at or immediately adjacent to the work area and are thus unlikely to be directly or indirectly affected by the Project.

Peregrine falcons are protected under the Ontario *Endangered Species Act*, listed as a threatened species. Further, this species is listed as a Specially Protected Raptor under Ontario's *Fish and Wildlife Conservation Act*, providing protection to nests and eggs and prohibiting hunting and trapping. Several subspecies have been assessed by COSEWIC and under *SARA*. The subspecies *anatum* and *tundrius* are grouped as one for evaluation by COSEWIC and ranked as a species of special concern. Under *SARA* the subspecies *anatum* as is listed as threatened and *tundrius* is listed as a species of special concern. Subspecies *pealei* is listed as a species of special concern by both COSEWIC and under *SARA*. This is a widely distributed species across all continents, with the majority of the breeding population in Ontario located around Lake Superior. By the mid 1960s, the peregrine falcon had disappeared from Ontario as a result of the use of the pesticide DDT, leading to major recovery efforts across North America and the banning or restricted use of DDT in Canada. MNR is also working on a provincial recovery strategy for this falcon in addition to the national Peregrine Falcon Recovery Plan.

The peregrine falcon typically nests on tall, steep cliff ledges near large water bodies, although some peregrines have adapted well to urban environments, raising young on ledges of tall buildings (OMNR 2009). Breeding occurs in southern Ontario in early March, with incubation lasting 35 days, nestlings leaving the nest after 40 days and remaining in the nesting area for another three (3) to six (6) weeks (late May to mid-July) after fledging prior to dispersing up to 100 km away (SARA 2009). These falcons have also been known to use the abandoned nests of common ravens. Young peregrines have a high rate of mortality with only 30% surviving the first year. Peregrine falcons undergo a fall migration south although urban residents may remain all year if food is plentiful. The species is known to mainly feed on birds (*i.e.,* black guillemots and other water birds) often caught in mid-flight, they have also been known to feed on bats, rodents and other mammals. Feeding areas include productive wetlands or other open hunting areas both terrestrial and aquatic, as well as riparian habitats (Ontario Peregrine Falcon Recovery Team 2009). The absence of high, steep cliffs or structures in the immediate area of the Project limits the number of individuals expected in the area of capping activities, although the Harbour may be used as feeding habitat by this species.

Chimney swift is listed as a threatened species both federally and provincially by COSEWIC, under the *SARA*, and the *Endangered Species Act*. This status is largely due to habitat loss, particularly with respect to availability of suitable habitat for nesting and roosting. It has also been suggested that the decline of insect prey species due to pesticide use has impacted the chimney swift (COSEWIC 2007). The migratory species winters in South America, while its summer population in Ontario is mainly concentrated in the southern half of the province (Helleiner 1987), also occurring elsewhere throughout the province. Chimney swift habitat is concentrated near water bodies where the flying insects they feed on congregate. Suitable nesting (May through July) and roosting sites are an important characteristic of chimney swift habitat. These have historically included caves and tree hollows in old growth forests, and more recently older chimneys (OMNR 2009). The likelihood of suitable nesting or roosting habitat within the Project area is quite low, given the absence of vegetation, although the Harbour may be used as feeding habitat for this species. Additionally, Project activities are not anticipated to include disturbance to any existing structures within the area where the birds could potentially nest.

Bald eagles are considered a species of special concern under the *Endangered Species Act* indicating that the species is sensitive to human activities or natural events which may cause it to become endangered or threatened, however is not legally protected under the *Endangered Species Act*. Further, this species is protected from being hunted and trapped under the *Fish and Wildlife Conservation Act*. Bald eagles nest on large stick platforms, typically placed high in a tree and near water (see Section 3.1.5.2 Avifauna) (OMNR 2009), beginning in February and March (Beak 2000). Similar to the peregrine falcon, the population decline beginning in the 1950s was a result of the widespread application of organochlorine pesticides. Due to the restricted use of these pesticides, bald eagle populations no longer experience related reproductive failure. At present, threats to this species are a result of illegal hunting, poisoning and electrocution (OMNR 2009). Bald eagles are typically abundant in the Marathon area (*i.e.*, near watercourses with spawning habitat for chinook and other autumn-spawning salmon species) (Beak 2000). The ERA reports that Jellicoe Cove and Peninsula Harbour could theoretically support several breeding pairs of bald eagles (ENVIRON 2008).

The black tern is listed as a species of special concern under the *Endangered Species Act* and is protected federally under the *MBCA*. This species are found throughout Ontario, typically breeding in the marshes along the edges of the Great Lakes. Black terns build floating nests in loose colonies in the shallow waters of marshes, particularly in cattails. Overwintering in warmer climates, black terns usually return each spring to the same wetland area to breed (early May to early August). They prey mainly on insects by hovering just above the surface of the water and pick prey off the surface. Once common in Ontario, declines began in the 1980 resulting from wetland drainage and alteration, water pollution and human disturbance of nesting sites, such as boat traffic (OMNR 2009). The absence of suitable marsh habitat in the area of the Project may indicate that large numbers of these species are unlikely to be encountered during Project activities, although the Harbour may be used as feeding habitat by this species.

The common nighthawk is listed as a threatened species by COSEWIC, as well as under Schedule 1 of the *SARA*, and as a species of special concern under the *Endangered Species Act*. This species, its nests and eggs are also protected under the *MBCA*. Common nighthawks are found throughout the province of Ontario, with the exception of the coastal regions of James Bay and Hudson Bay, overwintering in South America beginning in mid August to mid September. Nighthawks prey on avian insect species, typically at dawn and dusk in low-light conditions (OMNR 2009), also feeding over water during breeding and migration periods (Savignac 2007). This species has historically preferred open area habitats with little to no ground vegetation (*e.g.,* forest clearing, beaches, lakeshores, rock barrens, peat bogs, mine tailings); however, this species also nests in cultivated fields, orchards, urban parks, along gravel roads and railways, tending to occupy natural sites, but also occupying urban areas where it uses flat gravel roofs for nesting (OMNR 2009). Eggs are often laid directly on the ground beginning in late May to mid August (Savignac 2007). Common nighthawk nestlings may begin to fly 18 days post hatching, capturing their first insects near the ground within 25 to 30 days (OMNR 2009). Nestlings remain in the nest from mid June to late August. Threats to this species include habitat loss and alteration (*e.g.,* reforestation of abandoned agricultural fields and harvested forests), agriculture and the reduction of buildings with flat gravel covered roofs. Other threats include the decline of insect prey populations from widespread insecticide use, motor vehicle collisions and fluctuations in the climate at breeding sites and during migrations (Savignac 2007). This species may occur feeding and nesting within the Project area during periods of migration and breeding, as open areas with little to no ground vegetation and aquatic habitats preferred by this species both are present. However, according to M. Butler, a local bird watcher, common nighthawks have not been observed in the Project area (communication with M. Butler, June 2011).

3.2 Socio-Economic Environment

3.2.1 Population and Demographics

The proposed Project is located within Peninsula Harbour and the Town of Marathon, in the Thunder Bay District, on the north-eastern shore of Lake Superior midway between Sault Ste. Marie and Thunder Bay, Ontario. The town of Marathon was initially established as the Town of Peninsula to serve as a main supply centre during the construction of the CP Rail railroad in the early 1880s from Heron Bay to Port Author (Boultbee 1967). Port Arthur along with Fort William now makes up Thunder Bay. Following completion of the railroad in 1885, the population of Peninsula dwindled until the early 1930s when logging operations began on the Pic River and along the Lake Superior shoreline.

The Marathon Paper Mills of Canada Ltd. kraft pulp mill was constructed between 1944 and 1946, further increasing the population of the town. Peninsula's name was then changed to the Town of Everest, in honour of the president of the mill, and then again to the Town of Marathon, in honour of the mill itself, within the same year.

Additionally, in the early 1980s, a number of major gold deposits were discovered near Hemlo about 48 km east of Marathon. Three (3) gold mines began operation in 1985 increasing the population of Marathon as most employees of two (2) of the mining companies took up residence in the town.

Population statistics for the Town of Marathon and the Thunder Bay District are summarized below.

Table 10 Population Statistics for the Town of Marathon and the Thunder Bay Health District

Population and Dwelling Counts	Town of Marathon	Thunder Bay Health District
Population in 2006	3,863	154,067
Population in 2001	4,416	155,531
2001 to 2006 population change (%)	-12.5	-0.9
Total private dwellings	1,678	73,163
Population density per square kilometre	22.7	0.7
Land area (square km)	170.48	235,531.34

Source: Statistics Canada 2007

The Town of Marathon had a population decrease of approximately 13% from 2001 - 2006. The 2006 population of Marathon was distributed fairly evenly across various age groups; however, the age ranges 10 - 19 and 40 - 54 are related anomalies (representing parental and subsequent child cohorts), and are significantly higher than other age ranges. The median age of the population was 39.8, which is very close to the provincial median of 39. Approximately 6.7% of the population was over the age of 65, which is significantly lower than the province's 13.6%. Approximately 7.6% of the population identified as Aboriginal, while 3.8% identified as foreign-born (Statistics Canada 2007). MPI closed in 2009 and population further decreased.

From 2001 - 2006, the Thunder Bay District experienced a very slight population decline. Similar to the Town of Marathon, the Thunder Bay District's population distribution is fairly even across various age groups, with similar anomalies for the age ranges 10 - 19 and 40 - 54, although the variance for age range 10 - 19 is not as pronounced as in the Thunder Bay District. The median age of individuals residing in the Thunder Bay District was 41.1.

Approximately 13.3% of the population identified as Aboriginal, and 9.2% identified as foreign-born (Statistics Canada 2007).

3.2.2 Health, Industry and Employment

Traditionally, resource-based activities have been, and to a large extent, continue to play a significant role in the area. Marathon's economy is fuelled by the Hemlo Gold Mines (Williams and David Bell Gold Mines), and the MPI kraft pulp mill, up until March, 2009 when MPI announced an indefinite shutdown. The shutdown eliminated hundreds of jobs from the region, and has negatively impacted both to Marathon's tax base and its local economy. In addition to natural resource-based industries, Marathon's economy is also supported by small and medium-sized retail businesses, large-sized business, industry supply services, the education sector, and a growing health sector.

In Marathon, approximately 15% of the labour force is concentrated in manufacturing and construction industries, while roughly 24% is concentrated in resource-based industries. In the Thunder Bay Health District, 15% of the labour force is concentrated in manufacturing and construction industries, similar to the Town of Marathon, however; in contrast, only 6 % is concentrated in resource-based industries (Statistics Canada 2007).

Table 11 Local Industry for the Town of Marathon and the Thunder Bay Health District

Industry	Marathon			Thunder Bay Health District		
	Total	Male	Female	Total	Male	Female
Total – Experienced labour force	2,335	1,280	1,060	77,820	40,475	37,35037,350
Resource-based industries	560560	490	65	4,935	4,105	830
Manufacturing and construction	350	295	45	11,365	9,930	1,450
Wholesale and retail trade	320	120	195	11,420	5,470	5,940
Finance and real estate	60	20	40	2,890	1,285	1,605
Health and education	465	75	390	17,765	3,910	13,865
Business services	215	130	90	12,150	7,8607,860	4,290
Other services	365	140	225	17,290	7,9207,920	9,3759,375

Source: Statistics Canada 2007

In Marathon, approximately 20% of the labour force is located in the health and education sector. The education system incorporates facilities within two publicly-funded primary and secondary school systems: Superior-Greenstone District School Board and Superior North Catholic District School Board. In addition, Confederation College operates a satellite campus in Marathon providing post-secondary education.

Marathon is under the jurisdiction of the Thunder Bay Health District (Statistics Canada 2007). The Wilson Memorial General Hospital is an acute and chronic care hospital located on Peninsula Road. The hospital employs approximately 150 people, has approximately 25 beds and services Marathon and the surrounding area. Services offered include family medicine, maternity and paediatrics, emergency, tele-medicine and consultation, laboratory, radiology, ultrasound, physiotherapy, occupational therapy, clinical nutrition, and chemotherapy. In addition the Marathon Family Health Team is a full service family medical clinic with nine (9) physicians, two (2) RNs, two (2) RPNs, a social worker, and an epidemiologist on staff. A wide and diverse range of medical and health services are performed at the clinic (http://www.marathon.ca/article/welcome-to-marathon-ontario-1.asp).

Fire protection is serviced by the municipal fire department, while police protection for the town is provided by the Marathon detachment of the Ontario Provincial Police (OPP).

In 2005, 2,615 individuals in the Town of Marathon earned an income (from either full time or part time jobs). The average earning for all persons working was $33,428, which is slightly above the average earnings for Ontario $29,335. For those in Marathon who had full-time work all year-round, the average earnings were approximately $61,601, well above the provincial average of $44,748 (Statistics Canada 2007).

The unemployment rates for Marathon and the Thunder Bay District are 6.4% and 8.2% respectively, similar to the provincial unemployment rate of 6.4% (Statistics Canada 2007). Overall, Marathon labour force indicators have improved slightly since 2001, when the unemployment rate stood at 5.8% (Statistics Canada 2002).

3.2.3 Land and Resource Use

3.2.3.1 Adjacent Land Use

Land use in the area Peninsula Harbour and the Town of Marathon is limited by the dense forest and rugged, rocky landscape. Most of the waterfront property around Jellicoe Cove is zoned heavy industrial and is primarily occupied by the former Marathon Pulp Inc. (MPI) mill and its operations (Marathon 1989). The MPI facilities are located along the southwest shoreline of Jellicoe Cove. Portions of the shore adjacent to the mill have been armoured with large boulder / rubble material and a shipping wharf occupies some of the western shore. Bedrock shoreline occurs along the west and east heads of the Cove. A boat launch and docks are located at the northeast corner of the Cove. The CP Rail railway passes through the Town of Marathon along the Harbour shore. A hydro corridor also extends through this area (Beak 2000).

Southwest of the proposed cap area, on the Peninsula, is Peninsula Hill, a generally unoccupied forested area with an elevation of up to 1100 m above sea level. Further south still, around the Peninsula, are Pebble Beach and Lagoon Trail where local residents and tourists enjoy hiking and spectacular views (see Section 3.2.4 below).

Based on available mapping of the Town, the nearest residential and commercial areas are approximately 300 m south and east of the immediate Project area.

3.2.3.2 Water Use

Historically, water from Peninsula Harbour has been used for pulp processing by Marathon Pulp Inc. According to Kleinfeldt (1990), the intake for the mill is located 472.4 m from shore and has a diameter of 122 cm. The water depth at the end of the pipe is 13.1 m. In addition, at the time of the Beak Phase I Preliminary Site Assessment

(2000), two (2) discharges were entering Jellicoe Cove: a mill cooling water outlet at the southeast corner and a storm sewer outfall mid-way along the south shore beach. The primary discharge from the mill was later rerouted out of Jellicoe Cove and into Lake Superior.

The municipal Water Pollution Control Plant (WPCP) was also reported to be discharging into Lake Superior, southwest of Marathon (Beak 2000). In 1982, the primary treatment facility was upgraded to include secondary treatment, the installation of a submerged diffuser, and connection to the pulp mill's sanitary sewer (Peninsula Harbour RAP Team 1991). In 1986, the plant was expanded to a capacity of 4,400 m^3/day in anticipation of the population increase resulting from the Hemlo gold mine development. The 1989 annual average discharge rate was 1,930 m^3/day. Additional storm sewer construction began in 1984 and will continue as new developments are built. The storm sewer outfalls are located near the WPCP outfall. All storm sewers discharge directly into Lake Superior.

There were two (2) potable water intakes in the general area of the proposed Project at the time of the Phase I Preliminary Site Assessment. The Ojibways of the Pic River First Nation Water Treatment Plant intake is located in the Pic River, whereas the Pukaskwa National Park drinking water intake is located in Hattie Cove (Beak 2000).

3.2.3.3 Shipping and Navigation

Jellicoe Cove is relatively shallow with a maximum depth of 28 m whereas the maximum depth in Peninsula Harbour is 37 m. Water depth alongside the existing MPI dock is approximately 4 m.

Prior to the mill shutdown in February 2009, approximately 10 - 12 commercial vessels docked at the MPI facility between mid April and mid December carrying imports such as caustic soda, limestone and Bunker C oil, as well as exporting pulp from the mill. In addition, the docking facilities were used twice a year by the Canadian Coast Guard to service the unnamed lighthouses located on Hawkins Island and Skin Island.

3.2.3.4 Commercial and Recreational Fisheries

Prior to the 1960s, the commercial fisheries of Lake Superior (mainly lake trout) were negatively affected by unregulated exploitation and the introduction of exotic species, particularly the sea lamprey (Smith 1972). An assessment of the lake trout fishery in Lake Superior between 1929 - 1950 concluded that the fishery became overexploited at about the same time that the sea lamprey was first observed in the lake (Jensen 1978). Collapse of the lake trout stocks apparently was caused by sea lamprey predation on a population that was stressed by intensive exploitation. The principal commercial fishing port along the north shore of Lake Superior is Port Coldwell located approximately 11 km west of Peninsula Harbour. Port Coldwell was established as a commercial fishing port in 1880 during the construction of the CP Rail railway. The expansion of the Port Coldwell fishing industry resulted in the development of Peninsula Harbour as a commercial fish port in 1887, and remained such until the early 1960s (Beak 2000).

The waters of Lake Superior are divided into 34 management zones, with Peninsula Harbour located in Zone 19. Prior to the sea lamprey invasion in the early 1950s, the average commercial catch from Zone 19 totalled 49,400 kg between 1951 and 1953, of which 45,200 kg were lake trout (Peninsula Harbour RAP Team 1991). Subsequently, the commercial catch of lake trout in Zone 19 was greatly reduced to a range of 0 - 3,626 kg/yr between 1980 - 1987. Although lake trout populations continued to steadily increase following the control of sea lamprey in the mid-1960s, the populations have yet to attain the numbers that existed in the 1950s. Following the sea lamprey invasion, lake trout were replaced by chubs and lake whitefish as the major commercial species in the Peninsula Harbour area. Lake trout, lake whitefish, suckers and lake herring are the principal commercial species, although total harvest has decreased since commercial fishing first began in the area. At the time of the Beak Feasibility Study (2000), there were two (2) commercial licences that could harvest fish from Zone 19. No commercial harvest has been reported since 1994 in this management zone, including 1999 (OMNR Lake Superior Management Unit 2000). No commercial fishing is currently undertaken within the Peninsula Harbour area, although two (2) commercial baitfish areas, Ter 50 and Ter 51, are present within 5 km of the Town of Marathon (Beak 2000). It is important to note that MOE publishes an annual Guide to Eating Ontario Sport Fish which includes recommended limits and restrictions on the consumption of fish caught in many lakes and rivers in Ontario, including Peninsula Harbour (MOE 2009).

There are no recreational marinas within Peninsula Harbour although MPI also permits public access to the Harbour, other than in the immediate vicinity of the industrial site. The only recreational boat launching facility located in Peninsula Harbour is on property owned by MPI (Beak 2000). The facility is not formally available for public use; however, it is used on occasion by public boaters (Schaefer 1992). The Port Coldwell Harbour is used as an anchorage site for large recreational craft.

It is understood that the Town of Marathon is pursuing a Sustainable Waterfront Development Plan to look at options to utilize the Lake Superior waterfront for economic / tourism development purposes (D. Skworchinski Town of Marathon Economic Development Manager pers. comm. 2009). It is anticipated this work will be completed in the near future and, as such, the details and any potential developments that may arise from the plan are not available for the purpose of this cumulative effects assessment.

3.2.4 Recreation and Tourism

The Town of Marathon is located on Trans Canada Highway #17, the primary land corridor linking Canada from east to west. This location places the town in an ideal position for tourism. The United States border crossings at Sault Ste. Marie (east) and Pigeon River (west) are within 4 hours of Marathon. The Town of Marathon is also located along the famous Lake Superior Circle Tour Route. The municipal airport is located approximately 5 km from downtown Marathon. There is currently no regular air service, but landing and fuel services are available.

The Marathon Visitor Information Centre, located on Highway #17 south, serves approximately 10,000 visitors each year. It is fully staffed and operational from the beginning of May until the end of September. Accommodations in the town of Marathon range from inns and lodges, to the Dunc Lake Resort, to a number of campgrounds.

The natural beauty and wilderness surrounding the Town of Marathon are attractions for tourists and residents alike. Numerous parks, trails and beaches are located in the area, including Neys Provincial Park (approximately 15 km west of Marathon), Pukaskwa National Park, Penn Lake Park and Trail, Carden Cove Trail, Lagoon Trail, Craig’s Pit Nature Reserve and Provincial Park, Red Sucker Point Nature Reserve and Provincial Park and Pebble Beach.

Pukaskwa National Park, more than 15 km south of Marathon, is Ontario’s largest national park covering an area of approximately 1,187,800 ha (1,878 km^2). The park is a dense boreal forest extending along 130 km of the Lake Superior coastline, the shores of which are very remote and accessible only by water (or limited helicopter access). Two (2) wilderness river routes are available for canoeing and kayaking and a coastal hiking trail extends from Hattie Cove at the Park’s north entrance, 60 km south to the North Swallow River. The park is open year round; however, many services and facilities are open only during the summer season. The only road access to the park is at the north end near Hattie Cove, where there is a Visitor Centre, interpretive programs and a full-service campground open from May to September.

Neys Provincial Park, approximately 15 km west of Marathon, is situated on a remote and rugged peninsula characterized by rocky islands, icy blue water, sub-Arctic plants and a rare herd of caribou. Activities at the park include camping, hiking, boating, fishing, swimming, canoeing, wildlife viewing, and hunting.

Pebble Beach is located south of the Town of Marathon on Lake Superior. The beach is often used for picnics, bonfires, walking, hiking and photography; however, the cold Lake Superior water temperatures and heavy wave action discourage contact water sports such as swimming, surfing and sailboarding.

In addition to outdoor attractions, Marathon is home to the Marathon Museum, the Marathon Provincial Library and the largest indoor shopping mall between Thunder Bay and Sault Ste. Marie.

The Marathon area also boasts a wide array of recreational opportunities including the public nine (9) hole Peninsula Golf Course and the Superior Slopes Ski Hill. The Town’s location on the shore of Lake Superior offers an ideal environment for swimming, boating, wildlife and bird watching. Other outdoor recreational opportunities include over 200 km of groomed snowmobile trails and over 14 km of cross country ski trails, used as a training site for the Canadian Team in preparation for the 1995 Nordic World Ski Championships. There are also a number of indoor recreational activities such as the Port Hole Pool, Marathon Arena, Marathon Bowling Lanes and the Marathon Curling Club.

There are numerous opportunities in the area for sport fishing and hunting. The Peninsula Harbour and its tributaries lie within the OMNR Division 23 and 33 fishery areas, respectively, with specific fishing seasons and catch limits. A sport fishery targeted on lake trout has developed in the last few years in the northern and eastern portions of the Harbour. Sporadic lake trout angling also occurs around Skin Island during the summer. Other species fished in the Harbour include three (3) species of salmon (Beak 2000). Hunting is a seasonally restricted activity, occurring mainly from September to December. The big game species hunted in this area of Ontario are moose, black bear and white-tailed deer. The principal small game species are ruffed grouse, spruce grouse, snowshoe hare and American woodcock (OMNR 1983).

3.2.5 Archaeological, Heritage and Cultural Resources

In the general area of the Town of Marathon, evidence of human habitation exists as far back as 1,500 B.C. This is based on the presence of approximately 200 ancient stone structures, known as the “Pukaskwa Pits”, located along the north shore of Lake Superior from the Marathon area eastward to Ganley Harbour (Boultbee1967). The Pukaskwa Pits are located on various levels of raised stoney beaches between six (6) to 40 m above the present level of Lake Superior. These pits have also been found on Detention and Monmouth Islands, which suggests that these people likely travelled by boat (Beak 2000).

There is also evidence of occupation during the Middle Woodland period (~500 B.C.) and later at three (3) distinct beach levels at the mouth of the Pic River, approximately 14 km southeast of the Project area (Boultbee 1967). At the highest and oldest level, about 90 -150 m from the present water line of Lake Superior, a rich supply of ceramic, copper and flint artifacts, as well as fish remains, have been uncovered. Layers of carbon from campfires separated by a clean sand layer indicate two separate periods of occupation at the two (2) lower, more recent beach levels. Broken pieces of pipe and other ceramics, flint arrowheads and flint scrapers, as well as moose and beaver bones were found at both beach sites. The presence of mixed bits of English pottery and small beads of European origin indicates that these sites were also occupied after the point of aboriginal / European contact (Beak 2000).

As long ago as 500 B.C., Ojibway Natives inhabited areas along the Pic River and there are still their descendants living in the area today (Beak 2000). The Ojibways of the Pic River First Nation Reserve #50 is located approximately 18 km southeast of the Town of Marathon and 3 km east of Lake Superior on Highway No. 627 off Highway No. 17. The reserve was settled by Ojibways in the early 1800s following the establishment of the trading post (OMNDM 1987). The area was granted reserve status in 1914 under the Robinson Superior Treaty.

The earliest European settlement in the area was likely established by Gabriel Coté, who built an independent fur trading post at the mouth of the Pic River, approximately 14 km southeast of the Town of Marathon, around 1790 to 1792 (Boultbee 1967). The fur trade opened up the north shore area changing the lifestyle of the native inhabitants, such that traditional pursuits of hunting and gathering were abandoned in favour of the commerce of the fur trade. Soon after this establishment, the Pic trading post came under the control of the North West Company. In 1821, the Hudson’s Bay Company assumed control of the fur trade and absorbed the North West Company properties. When the Hudson’s Bay Company sold most of its territory of Rupert’s Land to the Government of Canada in 1870, the Pic trading post continued to operate but as its importance declined, the company moved from the Pic to Mobert in 1888 (Beak 2000).

The Neys Provincial Park, Craig’s Pit Nature Reserve and Provincial Park, and Red Sucker Point Nature Reserve and Provincial Park located within 3.5 - 15 km of the Town of Marathon represent known heritage, archaeological and cultural sites located in the vicinity of the proposed Project.

Neys Provincial Park covers an area of approximately 4,476 ha and is located on the rugged Coldwell Peninsula, about 15 km west of the Town of Marathon. The park features nature trails starting at Prisoner Cove which lead to lookout points with magnificent views of Lake Superior. Four campgrounds provide a total of 144 campsites (61 with electricity) and there is a beach is present at the west end of the park and a boat ramp is available on the Little Pic River. During World War II, German prisoners were brought back to Canada for internment and a prisoner-of-war camp was built on the park site in 1941. The Visitor Centre has a scale model of the camp and some artifacts.

Craig’s Pit Nature Reserve and Provincial Park covers an area of 480 ha and is located approximately 3.5 km southeast of the Town of Marathon. There are no campsites or other developed facilities within the park. Sport fishing is permitted in the park; however, hunting is not permitted. The park protects three (3) representative earth science landform / process themes consisting of glacial features, which were formed during the Timiskaming Interstadial time period and are important environmental indicators of the Minong and later lake stages in the Superior Basin. The bluff area of the park represents an important migratory hawk-watching area.

Red Sucker Point Nature Reserve and Provincial Park covers an area of approximately 360 ha and is located about 9 km northwest of the Town of Marathon. The park has several sensitive archaeological sites as well as raised beaches. There are no campsites or other developed facilities located within the park (Beak 2000).

A side scan sonar survey of the Jellicoe Cove area identified 18 numbered targets within the limits of the TLC placement area (AECOM 2009b), none of which were identified as shipwrecks or other archaeological, heritage or cultural resources. These targets predominantly were small isolated piles of logs (likely the remnants of historical log booming and storage operations, ending in the 1980s), measuring no more than 0.5 m in height above the surrounding sediment bed. Other than small log piles, other targets included an apparent log crib extending 0.7 m from the sediment bed, the MPI water intake pipeline alignment, and a couple of isolated rock outcrops. It is assumed that any sunken pulp logs and other debris will be left in place during Project construction. No shipwrecks or other archaeological, heritage and cultural resources were observed in benthic video surveys conducted by AECOM on behalf of Environment Canada.

4. Environmental Assessment Methodology

4.1 Overview and Approach

The environmental assessment methodology for the Peninsula Harbour Contaminated Sediment Management Project has been developed to satisfy regulatory requirements for a screening level assessment pursuant to *CEAA*. The approach and methodology for the Project will address the scope of the proposed Project, as defined in Section 15(1) of *CEAA*, as well as the factors to be considered for a screening level report as they are identified in Section 16 of *CEAA*. The approach and methodology used are based largely on the work of Beanlands and Duinker (1983), the Canadian Environmental Assessment Agency (1994, 1997, 1999a, b) and Barnes et al (2000), as well as the study team's expertise in conducting environmental assessments. The approach and methods have proven very effective for environmental assessments in various jurisdictions throughout the world.

It is generally acknowledged that an environmental assessment should focus the assessment on Valued Ecological Components (VECs) and Valued Socio-Economic Components (VSCs). VECs and VSCs are the biophysical and socio-economic components which are of greatest concern to stakeholders, regulators and the general public; are indicators of environmental change; and are selected in consideration of their value to these parties and their potential interactions with the proposed Project. The selection and scoping of VECs and VSCs calls for an educated understanding of the proposed Project, the existing environmental and socio-economic conditions, as well as the ways in which interactions between the environment and activities associated with the Project (during all phases) can occur.

Boundaries provide a meaningful and manageable focus for an environmental assessment. Boundaries are described generally below, and in further detail as part of the effects analysis sections for each of the VECs.

Temporal and spatial boundaries encompass those periods and areas within which the VECs are likely to interact with, or be influenced by, the Project. Spatial boundaries for the assessment vary according to the VEC, but are generally limited to the immediate Project area unless otherwise noted. For the purpose of this assessment the study area for the Project includes the limits of the TLC area (Figure 2), as well as the maximum zones of influence predicted for the proposed Project activities and related emissions and discharges, including likely accidental events.

The temporal boundary of this EA is highly limited in consideration of the short-term nature of the proposed Project activities (construction duration is approximately two and one half months, given a schedule of 24 hours/day and up to seven (7) days/week), and the anticipated short duration of environmental effects.

4.2 Scope of the Project

EC and MOE are proposing to conduct a sediment remediation project in a contaminated area of Jellicoe Cove, Peninsula Harbour in Lake Superior, Ontario (the Project). The scope of the proposed Project includes all of the components and activities as described in Section 2.0 of this document, including any potential malfunctions and accidental events which may occur in relation to the Project (Section 6.0). The potential cumulative environmental effects of this Project in relation to other projects in the region are also considered within this EA (Section 8.0), as are the potential effects of the environment on the Project (Section 7.0).

4.2.1 Issues Scoping and Selection of Valued Environmental Components

To ensure that the assessment is holistic, the CEA Agency guidance documents (1994) require a description of the environmental context for each potential VEC / VSC. The consideration of the current state of a potential VEC / VSC and any Project-related effects requires an evaluation of the relationship of each potential VEC / VSC with other components of the ecosystem or human systems (*i.e.,* trophic relationships). A detailed description of each potential VEC / VSC is provided in Section 3.0.

A scoping exercise was undertaken early in the Project EA process. This exercise was conducted by the study team to identify an appropriate list of VECs / VSCs upon which the assessment can be focused for a meaningful and effective evaluation, as it has been stated previously that assessing all of the potential issues associated with a proposed undertaking is impractical, in not impossible (Beanlands and Duinker 1983). The issues scoping process for this assessment included:

- Review of regulatory issues and guidelines;
- Consultations with regulatory agencies, stakeholders, the public, and communication with First Nations;
- Review of available information on the existing environment within which the Project occurs; and
- Professional judgement of the study team.

Section 4.4 of this document provides a detailed description of the consultation program undertaken specifically for the proposed Project. Information gathered through this process assisted in the identification and scoping of an appropriate list of VECs / VSCs from the full list of potential VECs / VSCs for the EA to focus on.

The EA Scoping Document prepared by EC for the Project (EC 2009) includes an inclusive list of potential VECs / VSCs to be considered in the environmental assessment for the Project. The issues scoping process included an evaluation of each potential VEC / VSC. Table 12 summarizes potential interactions between Project phases / components and the potential VECs / VSCs.

Table 12 Project Component / Environment Interactions

Project Phases / Components		Ecological and Socio-Economic Components														
		Air Quality	Bedrock	Soil Quality	Groundwater Quality	Vegetation	Wetlands	Wildlife (Water Birds)	Species at Risk	Benthic Habitat and Sediment Quality	Fish and Fish Habitat	Navigable Water	Fisheries Resources	Adjacent Lands	Human Health and Safety	Archaeology / Traditional Resources
Site Preparation	Preparation of Laydown Area			√				√	√		√			√		√
	Staging and Erosion Control	√						√	√			√		√		
Construction	Transport of Cap Material	√		√				√	√					√		
	Cap Placement Activities							√	√	√	√	√				√
	Performance Monitoring															
	Mitigation and Monitoring for Turbidity															
Post-Construction Monitoring								√	√	√	√	√		√		

Table 13 summarizes the evaluation undertaken and provides the rationale for inclusion / exclusion as a VEC / VSC for the EA. In cases where there is no interaction between the Project activity and the VEC, where an interaction between the Project and the potential VEC / VSC occurs; however, the interaction would not result in a significant environmental effect, even without the implementation of mitigation measures, or where the interaction would not result in a significant environmental effect due to the implementation of measures known to successfully mitigate the predicted environmental effects, the potential VEC / VSC will be excluded. Such interactions are well understood and are subject to prescribed mitigation. Such interactions can be mitigated with a high degree of certainty with proven technology and practices.

Those VECs / VSCs selected for inclusion represent cases where an interaction between the Project and the VEC / VSC occurs and would result in an environmental effect, even with the implementation of mitigation measures, or if there is less certainty regarding the effectiveness of mitigation and / or substantial public or government concern. In these cases the potential environmental effects are of concern and are considered further in this EA.

Table 13 Selection of Valued Ecological and Socio-Economic Components

Environmental Component	Scoping Considerations	Selected VEC / VSC
Air Quality – Local and Downwind	The majority of the lands surrounding Peninsula Harbour are predominantly undeveloped, with the exception of the Town of Marathon, such that overall air quality is expected to be "good" (Beak 2000). Based on the meteorological conditions and the historical air quality monitoring data for TRS, it is expected that the air quality would be in the "good" category in the Project area and its vicinity. The variety of land and water uses in Peninsula Harbour contributes to the existing noise level in the area. Major noise sources include road traffic, construction activities, railroad operations, recreational and commercial boating, as well as noise associated with the mill when in operation (Beak 2000). The nearest residential area to the Project site is located approximately 300 m from the shoreline. Noise generated will not exceed provincial guidelines for residential areas set in MOEs 1995 publication "NPC-115 Construction Equipment". The Project will contribute to existing noise levels and given the nature and of the planned activities, noise emissions will be intermittent, temporary and localized. Noise mitigation to meet provincial guidelines will be achieved through appropriate site layout, design and operational procedures. Vehicle, barge and equipment noise emissions will be reduced through proper selection, maintenance and inspection. Given the limited duration of Project activities and the fact that contaminated sediments will not be brought to the surface, there is only minor interaction between the Project activities and air quality: vehicle emissions and dust. Vehicle emissions and dust will be managed using standard practices as provided in Section 2.6 of the EA report. No further assessment of air quality is warranted.	
Soil Quality	Like groundwater, there is limited interaction between Project activities and soil quality. Accidental spills of POLs have the potential to effect soil quality. A Spill Prevention and Emergency Response and Contingency Plan will be developed for the Project. No further assessment of soil quality is warranted.	
Groundwater Quality and Movement	With the exception of potential spills of Petroleum, Oils and Lubricants (POLs) during transport of capping material as a result of activity at the Project staging area, interaction between Project activities and groundwater are not anticipated. A Spill Response and Emergency Response and Contingency Plan will be developed for the Project. No further assessment of groundwater is warranted.	
Vegetation	The shoreline of Jellicoe Cove has limited vegetative cover due to human development in the area, and areas to be used for Project temporary ancillary elements and shorelines modifications (if required) are non-vegetated and no clearing / grubbing is likely required, such there will be no direct interactions between terrestrial vegetation and Project activities. It is anticipated that the laydown area will also occur a minimum of 30 m from aquatic habitat (*i.e.,* watercourses and wetlands). Otherwise, the Contractor is responsible for ensuring that the selected site is suitable for development; that is, undertake any necessary environmental evaluations at the site in consideration of rare and sensitive wildlife species and habitat to ensure compliance with all relevant federal and provincial legislation and provide documentation of the evaluation to the satisfaction of proponent. Overall, likely terrestrial portions of the proposed Project area do not provide a wide variety of habitat types necessary to support diverse wildlife communities and are unrepresentative of natural habitat (Beak 2000). Given that on-land activities are anticipated to occur on disturbed sites free of vegetation, consideration of vegetation in the EA is not warranted.	
Surface Water Quality, Currents and Circulation	Cap placement will temporarily degrade surface water quality (*i.e.,* during placement of the cap and during integrity monitoring). An assessment of surface water quality will be included in the EA report.	
Water Birds and Other Migratory Birds	Peninsula Harbour is located within the overlapping area between the Mississippi and Atlantic flyways and all waterfowl (ducks, geese and shorebirds) present in the area of the proposed Project are migratory species (Beak 2000). There is an absence of significant coastal wetlands within the shoreline area that would otherwise support either an extensive growth of aquatic vegetation or provide suitable habitat for migratory birds. Furthermore, the widespread development around the shore of Jellicoe Cove has left sparse vegetation on land, with the adjacent land area being forested by mainly coniferous species. Within the general area of Peninsula Harbour are a number of nesting sites for colonial waterbirds, the most predominant being the herring gull (*Larus argentatus*). A number of great blue heron (*Ardea herodias)* nesting sites may also be present in the area; the closest recorded approximately six (6) km northwest of Marathon on Good Hope Island in 1978 (Blokpoel *et al.* 1980; Blokpoel and Tessier 1993). Given the nature and limited duration of Project activities, there is limited potential for interaction between the Project and water and other migratory birds. It is however acknowledged that the Project area is located in the migration path of many waterfowl such as ducks and geese. There is also breeding habitat and known nesting sites in the Peninsula Harbour area for herring gull and great blue heron.	
Species at Risk	Although there are several plant species of special concern in Ontario, they are unlikely to occur in proximity to Peninsula Harbour (Argus *et al.* 1982-1987). There are no documented records of vegetative species of special concern in the area of the proposed Project (J. Bonnema OMNR Terrace Bay Area office 2000 pers. comm. from Beak 2000). Furthermore,	

Environmental Component	Scoping Considerations	Selected VEC / VSC
	the shoreline of Jellicoe Cove has limited vegetative cover due to human development in the area, and areas that are likely to be used for Project temporary ancillary elements and shorelines modifications (if required) are non-vegetated and no clearing / grubbing is likely required such there will be no direct interactions between terrestrial vegetation and Project activities (Beak 2000). A review of the OMNR Species at Risk in Ontario (SARO) list reveals a number of naturally-occurring species, in danger of extinction or of disappearing from the province, and whose habitat ranges coincide with the proposed Project area (OMNR 2009). Species listed as extirpated, endangered or threatened are legally protected from harm under the *Endangered Species Act*. These species at risk are within the Boreal Forest and Great Lakes – St. Lawrence Forest Regions and include one (1) mammal species, one (1) insect species, one (1) reptile species, five (5) fish species, and nine (9) avian species. A number of provincially, and one (1) federally, listed species are known to be present in the general Project area and / or have a range that includes the Project area including species of special concern and threatened species. Although the nature and duration of Project activities are relatively limited, there is some potential for interaction with between the Project and species at risk.	
Benthos	Lake sediments and the benthic communities inhabiting the Project area have elevated levels of mercury and PCBs. Placement of the cap will result in the loss of benthic communities present in the area; however it is expected that, in the long-term, benthic communities will re-establish themselves to a similar or improved state. An assessment of benthos and habitat is included in the EA report.	Benthic Habitat and Sediment Quality
Fish and Fish Habitat	Peninsula Harbour is a designated AOC and Jellicoe Cove is the known area of most concentrated contamination. Fish tissue samples indicate absorption and accumulation of mercury. Fishing restrictions are imposed and fish habitat is significantly degraded. The proposed Project will, in the short-term, degrade water quality and further disrupt fish and fish habitat but is expected to result in improved conditions in the long-term. An assessment of fish habitat (including water quality) is included in EA report.	Fish and Fish Habitat
Sediment Quality	Mercury and PCBs have long been identified as the major contaminants in sediments by a large number of studies over the last 30 years or more. Within Jellicoe Cove, both contaminants have been found to have elevated concentrations, extending from the mouth of the Harbour, southwest into the deeper waters of Lake Superior. Higher concentrations in sediments were generally present within the deeper depositional areas where finer sediments (slit, clay) were present, typical of the common binding process of mercury with sediment (Beak 2000). Benthic invertebrate communities in Lake Superior have been described as extremely taxa poor (USEPA 2009). Lake sediments within the AOC are a source of mercury and PCBs to benthic organisms. These organisms are known to have accumulated mercury and methylmercury tissue concentrations (Grapentine *et al.* 2005). Habitat for benthic invertebrates is contaminated with mercury and PCB and acts as a source of contaminants to organisms. Some benthic invertebrates are known to inhabit the Project area despite contamination. The Project will result in an improvement in overall sediment quality by covering of contaminated sediments with clean cap material. If the interaction between benthos and contaminated sediment can be reduced through remediation, body burdens of benthos can be reduced thereby minimizing potential for adverse impacts at higher trophic levels in the food web, inclusive of fish as primary consumers (ENVIRON 2008). Benthic organisms displaced or lost as a result of cap placement are anticipated to re-establish to a similar or improved state. Sediment quality, as it related to benthic and fish habitat, will be addressed in the EA report.	Benthic Habitat and Sediment Quality
Socio-Economic and Cultural Components		
Navigable Water	Prior to the mill shutdown in February 2009, approximately ten (10) to 12 commercial vessels docked at the MPI facility between mid April and mid December carrying imports such as caustic soda, limestone and Bunker C oil, as well as exporting pulp from the mill. In addition, the docking facilities were used twice a year by the Canadian Coast Guard to service the unnamed lighthouses located on Hawkins Island and Skin Island. It is anticipated that navigation in the Harbour for all vessel types may be limited in the immediate vicinity of cap placement (*i.e.,* 100 m radius) during construction. Upon placement of the cap, there will be a limited number of physical works and activities that would have the potential to compromise to overall integrity of the cap. It is understood that shipping in the Project area is currently non-existent since the close of the MPI facility in 2009. Future shipping opportunities are not precluded by the Project; however, shipping in and out of the Jellicoe Cove must consider potential impacts on the integrity of the cap. It is anticipated that recreational uses of the Harbour may be limited in the immediate vicinity of the cap placement activity (*i.e.,* 100 m radius). Once construction is complete, recreational vessel operation in the Harbour will not be limited (due to the size of recreational vessels and the design of the cap). It should be noted that completion of the cap will not immediately alleviate fish consumption restrictions currently in place.	
Fisheries Resources	No commercial fishing is currently undertaken within the Peninsula Harbour area, although two (2) commercial baitfish areas, Ter 50 and Ter 51, are present within five (5) km of the Town of Marathon (Beak 2000).	

Environmental Component	Scoping Considerations	Selected VEC / VSC
	There are no recreational marinas within Peninsula Harbour although MPI also permits public access to the Harbour, other than in the immediate vicinity of the industrial site. The only recreational boat launching facility located in Peninsula Harbour is on property owned by MPI (Beak 2000). The facility is not formally available for public use; however, it is used on occasion by public boaters (Schaefer 1992). The Port Coldwell Harbour is used as an anchorage site for large recreational craft. It is understood that recreational and sport fishing occurs on occasion in the general Project area.	
Adjacent Lands	Most of the waterfront property around Jellicoe Cove is zoned heavy industrial and is primarily occupied by the former Marathon Pulp Inc. (MPI) mill and its operations (Marathon 1989). The MPI facilities are located along the southwest shoreline of Jellicoe Cove. A boat launch and docks are located at the northeast corner of the Cove. The CP Rail railway passes through the Town of Marathon along the Harbour shore. A hydro corridor also extends through this area (Beak 2000). The transport of capping material and the use of nearby lands for equipment and material storage and staging may interact with adjacent land and resource use. A Project of this nature is anticipated to result in a short term economic stimulus in the town of Marathon via the use of local resources and / or an increase in the hospitality services sector during construction. Upon placement of the cap, heavy industrial use of the pier may be limited. This in-turn may affect the potential future re-development of the MPI site which may affect the future economy of the area.	Land and Resource Use
Local Neighbourhood and Residents	Based on available mapping of the Town, the nearest residential and commercial areas are approximately 300 m south and east of the immediate Project area. The cap area is not immediately adjacent to residential areas (*i.e.,* several hundred metres to nearest residence). Potential staging areas however may interact with local neighbourhoods and residents. Furthermore, hauling of material through residential areas which may occur depending on the location of the borrow pit may result in public concern.	Land and Resource Use
Site Workers	Peninsula Harbour is located within the North American continental plate, which is known to have little potential for seismic activity. As indicated above, given the fact that contaminated sediments will be left in place such that workers are not exposed to contaminants, there is limited risk to worker health and safety. Furthermore, the Contractor will be required to provide and implement a health and safety plan for the Project which complies with all appropriate federal, provincial, and municipal legislation. Further consideration of worker health and safety is not warranted.	N/A
General Public	There is limited potential for interaction between the public and the Project. Hauling of borrow material through residential areas, which may occur depending on the location of the borrow pit, may result in public concern.	Land and Resource Use
Archaeological and Heritage Resources and Resources for Traditional Purposes by Aboriginal Persons	No shipwrecks or other archaeological, heritage and cultural resources were observed in benthic video surveys conducted by AECOM on behalf of Environment Canada. Given that on-land activities are anticipated to occur on disturbed sites and that no excavation for site preparation will be required, consideration of archaeological and heritage resources and the use of lands and resources for traditional purposes by aboriginal purposes, in the EA is not warranted. Further, no specific issues of concern have been raised with respect to archaeological and heritage resources and the use of lands and resources for traditional purposes by aboriginal purposes during public and stakeholder consultation. In the event that a Contractor proposed to develop a greenfield site, they will be required to undertake an environmental evaluation of the site to confirm that use of the site for the Project will not result in non-compliance with any federal, provincial, or municipal legislation.	
Noise and Light	Project generated noise and light emissions may interact with local neighbourhoods and residents as well as wildlife.	Land and Resource Use and Wildlife
Aesthetics	Given the limited duration of construction activities, the industrial nature of the surrounding area, the lack of any potential aesthetics issues beyond construction as well as the fact that the public and stakeholders have not raised this as an issue of concern, consideration of aesthetics is not warranted.	N/A
Residential Areas Beyond Local Area Site	There is limited potential for interaction with residential areas beyond the local area site (*i.e.,* Jellicoe Cove). Hauling of borrow material through residential areas, which may occur depending on the location of the borrow pit, may result in public concern. Also, the Contractor may select a site for a laydown and staging area that is in proximity to residential areas.	Land and Resource Use
City Storm Sewer and Combined Sewer Outfalls	It is the understanding of the Project study team that there are no sewer outfalls in the vicinity of the cap area. If MPI is in operation, the MPI water intake will be protected with geotextile fabric fastened to the line during construction to prevent material from entering the line if the mill is in operation during the capping project.	N/A
Wilderness Areas, Parks and Trails	Numerous parks, trails and beaches are located in the area, including Neys Provincial Park (approximately 15 km west of Marathon), Pukaskwa National Park, Penn Lake Park and Trail, Carden Cove Trail, Lagoon Trail, Craig's Pit Nature Reserve and Provincial Park, Red Sucker Point Nature Reserve and Provincial Park and Pebble Beach. It is understood that tourist activity in the Jellicoe Cove area are limited. Tourism in the town of Marathon focuses on wildlife and wilderness areas, parks and trails. The Project is not anticipated to interact with existing tourism activities either during construction or after. It should be noted that the Project may limit the potential for small (*i.e.,* 100 passenger) cruise ships to use the MPI dock.	Land and Resource Use

The selection of VECs / VSCs reflects a strong understanding of potential environmental interactions, the importance of each component to ecological integrity, the sensitivity of components to the planned perturbations, and their value to society. By assessing potential impacts on VECs / VSCs within the study boundaries, a meaningful evaluation of Project effects on the relevant environmental aspects is achieved. Based on the results of Tables 12 and 13, the following three (3) VECs and one (1) VSC have been selected upon which to focus the assessment:

- Benthic Habitat and Sediment Quality
- Fish and Fish Habitat
- Wildlife
- Land and Resource Use

4.3 Assessment Methodology

Information for the proposed Project was gathered though a review of plan and profile drawings, site investigations, air photos, site mapping, and other information sources, such as previous relevant studies (*e.g.,* Feasibility Studies).

An important aspect of the effects assessment process is the determination of the boundaries of the assessment. Temporal and spatial boundaries encompass time periods and geographic areas within which the VEC / VSC is likely to interact with, or be influenced by the proposed Project. Both the temporal and spatial boundaries for the environmental assessment will vary according to the VEC / VSC being analyzed. Temporal boundaries are generally limited to the duration of Project activities, and for a period of time after, while spatial boundaries are generally limited to the immediate Project area, unless otherwise noted. These boundaries may extend well beyond the limits of direct disturbance (*e.g.,* migratory species whose range extends beyond the area of physical disturbance associated with the Project). Other boundaries to be considered as appropriate include administrative and technical boundaries imposed by factors such as finite resources of data, time, cost and labour, as well as technical, political, or administrative considerations or jurisdictions.

Essential to the methodology described by Barnes *et al.* (2000) is the determination of significance. Section 16(1)(b) of *CEAA* specifically requires that the significance of environmental effects of the project be determined. Accepted practice in meeting this requirement involves establishing evaluation criteria for the determination of significance. The *CEAA* requires an assessment of the significance of the environmental effects that are likely to occur as a result of the project, having taken into account the implementation of the proposed mitigation measures. Such effects are called “residual effects”.

It is also necessary to define the threshold beyond which an effect is considered, for the purpose of this assessment, to be significant. For each VEC / VSC, a definition is provided for “significant adverse effect” and “positive effect”. These significance definitions are generally population or community-based, but may be based on regulatory standards or limits, where these exist for a particular VEC / VSC. In most cases the significance of an environmental effect is apparent when compared to the criteria in light of data and information contained in the analysis; however, in certain instances, the lack of previous experience, gaps in the data or information, or the use of predictive tools may cast sufficient uncertainty such that it may be difficult to apply the criteria with a high degree of confidence. This is considered to be a technical limitation or boundary of the assessment. Given this, the establishment of significance criteria that incorporate an appropriate margin of safety, in addition to a precautionary approach to mitigation, will assist in dealing with this potential challenge should it arise.

Potential interactions with VECs / VSCs (*i.e.,* a description of the degree to which the VECs / VSCs are exposed to each Project activity), are described in the assessment. Where appropriate, the assessment includes a summary of major concerns or hypotheses of relevance regarding the effect of each Project activity on the VEC / VSC being considered. Where existing knowledge indicates that an interaction is not likely to result in an effect, certain issues may not warrant further analysis.

The assessment focuses on the evaluation of potential interactions between the VECs / VSCs and the various Project activities outlined in the Project Description (Section 2.0). A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. Evaluating the potential residual environmental effects of the Project will be undertaken in consideration of the evaluation criteria for determining significance (CEA Agency 1994), as well as the specific mitigation measures that will be applied. Interactions between Project-related activities and the VECs will be evaluated and the nature and extent of residual environmental effects determined (*e.g.,* those environmental effects that may persist after all mitigation strategies have been implemented). The majority of projects / activities involve at least some kind of environmental effect, such that it is standard practice and necessary to evaluate the significance of those environmental effects. The significance of environmental effects is determined based on the identification of potential interactions and the evaluation of environmental effects.

The evaluation of environmental effects takes into consideration the following:

- The potential interactions between Project-related activities, for each of the Project phases, and their environmental effects;
- The mitigation strategies applicable to each of the interactions; and
- The Agency's (1994) evaluation criteria for determining significance and any other evaluation criteria established by the study team to further characterise the nature and extent of the environmental effects, where required.

A standardized environmental effects assessment matrix will be used to summarize the analysis (Table 14). A supporting discussion will accompany the matrix and focus on particularly important relationships, data, or analysis, but will not address every one of the items noted in the matrix.

Categorizing potential environmental effects involves the determination of whether effects are adverse (A) or positive (P) and including this categorization in the standardized Residual Environmental Effects Assessment Matrix (Table 14). Based on the Agency's guidelines (1994), the following is a list of some key factors that will be considered in the determination of adverse environmental effects:

- Habitat fragmentation or fragmentation of migration and / or movement routes;
- Avoidance or loss of critical / productive habitats;
- Negative effects on the health of biota;
- Decrease in biological diversity;
- Loss of rare or endangered species;
- Alteration of natural landscapes;
- Negative effects on the health or well-being of humans, including toxicity effects;
- Release of toxic and / or persistent chemicals;
- Loss of future resource use or production; and
- Loss or negative change in the current use of lands and resources for traditional purposes by Aboriginal persons.

Table 14 Typical Residual Environmental Effects Assessment Matrix for [Name of VEC]

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Name of VEC							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Construction Phase							
Operations Phase							
Decommissioning Phase							

Legend Magnitude[1]: 1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation) 2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability) 3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)	Geographic Extent: 1 = < 1 km^2 2 = 1 – 10 km^2 3 = 11 – 100 km^2 4 = 101 – 1,000 km^2 5 = 1,001 – 10,000 km^2 6 = > 10,000 km^2 Duration: 1 = < 1 month 2 = 1 – 12 months 3 = 13 – 36 months 4 = 37 – 72 months 5 = > 72 months	Frequency: 1 = < 11 events/year 2 = 11 – 50 events/year 3 = 51 – 100 events/year 4 = 101 – 200 events/year 5 = > 200 events/year 6 = continuous Reversibility: R = Reversible I = Irreversible	Ecological / Socio-Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not applicable A = Adverse P = Positive

Mitigation measures to be applied for the Project include elements of the Project design, environmental protection strategies, and measures specific to the reduction or control of adverse environmental effects on a specific VEC. *CEAA* requires that mitigation measures proposed must be both technically and economically feasible. Where effects will be positive, opportunities for enhancements are considered (*e.g.,* maximize opportunities for local contracts). The analysis of environmental effects will be undertaken in consideration of mitigation measures as well as the predictions of environmental effects. Current environmental management practices undertaken by the

Proponent will also be factored into the overall mitigation strategy. Mitigation measures to be implemented will be summarized in the Residual Environmental Effects Assessment Matrices.

The CEA Agency (1994) lists criteria that should be taken into account in deciding whether adverse residual environmental effects are significant. These criteria include, among other factors:

- Magnitude;
- Geographic extent;
- Duration;
- Frequency;
- Reversibility; and
- Ecological and / or socio-cultural context.

These criteria have been considered in this assessment with regard to the determination of significance for each VEC / VSC. Each criterion has a numeric descriptor (see Table 14 legend) of the Residual Environmental Effects Assessment Matrix. The key will be modified for each VEC, as appropriate.

Section 16(2)(c) of *CEAA* requires consideration of the need for, and requirements of, any follow-up studies. Follow-up and monitoring programs provide essential feedback, in particular with respect to:

- Predicted project effects;
- Unanticipated effects;
- The necessity and efficacy of project management strategies; and
- Cumulative effects.

Monitoring by the proponent may be undertaken for a number of reasons including regulatory or corporate compliance (environmental compliance monitoring or ECM), evaluation of mitigating measures, strengthening predictive capacity in future environmental assessments, and commitments to third parties.

Monitoring and follow-up requirements are evaluated for each VEC / VSC and are linked to the sensitivity of a VEC / VSC to both Project-related and cumulative environmental effects. The likelihood and importance of such effects, as well as the level of confidence associated with the adverse residual effects rating, are also taken into consideration. An exercise to scope cumulative effects has been conducted to identify past, present and likely future projects that have the potential to interact cumulatively with the Project. The assessment of cumulative environmental effects necessitates the consideration of both temporal and spatial boundaries and interactions among environmental effects of the Project and past, present and future projects and activities. Additional detail regarding cumulative effects is provided in Section 8.0.

A section to summarize the adverse environmental effects on each VEC / VSC is also included. The rating of significance is determined by the collective consideration of Project-related effects against the thresholds and within the assessment boundaries established for the specific VEC. Significant environmental effects are those which are determined to be of adequate magnitude, duration, frequency, geographic extent, and / or reversibility to cause a change in the VEC which will alter its status or integrity beyond a level considered to be acceptable. This section also addresses the likelihood of all predicted significant adverse effects. The likelihood of a significant adverse environmental effect is based on scientific knowledge with reference to statistical significance, quantitative risk assessment, or professional judgement.

4.4 Consultation

Regulatory, public / stakeholder, consultation and Aboriginal communication occurred at various stages throughout the Project planning and design phase (*i.e.,* during the identification and analysis of alternative sediment management options).

Although many issues and concerns were raised and feedback was provided during that process, the following discussion and summary is limited to the comments, issues and concerns raised that are related to the proposed TLC Project and the consultation and engagement initiatives conducted in support of the EA for the Project (Table 16).

It is important to note that consultation and public engagement initiatives conducted in support of the EA were focused on informing the public on project design, schedule and identifying issues and concerns that should be addressed in the EA. Public Participation, in accordance with Section 18(3) of *CEAA* was considered as not required based on the Ministerial Guideline on Assessing the Need for and Level of Public Participation in Screenings under the *Canadian Environmental Assessment Act*. However, opportunities were provided to the public for participation through the open houses and community liaison committee in Marathon.

Table 15 Record of Public Participation Determination

Is there an indication that…	Describe potential indication and issues	Consider public participation?	
There is an existing or likely public interest in the type, location or potential effects of the project?	The public has been involved throughout the planning phase via open houses and meetings.	☐ Yes	☒ No
There are members of the public with a history of being involved in past proposed projects in the area?	Yes, as above	☐ Yes	☒ No
The project has the potential to generate conflict between environmental and social or economic values of concern to the public?	No.	☐ Yes	☒ No
The project may be perceived as having the potential for significant adverse environmental effects?	No.	☐ Yes	☒ No
There is potential to learn from community ecological knowledge or Aboriginal traditional knowledge?	No.	☐ Yes	☒ No
There is uncertainty about potential direct and indirect environmental effects or the significance of identified effects?	No.	☐ Yes	☒ No
The project has been or will be subject to other public participation processes that would meet the objectives of the Ministerial Guideline *http://www.ceaa.gc.ca/013/006/ministerial_guideline_e.htm*	Yes.	☐ Yes	☒ No
There is any other reason why public participation is or is not appropriate?	PP in accordance with Section 18(3) of CEAA is not appropriate primarily due to the involvement of	☐ Yes	☒ No

	the Community Liaison Committee, the Town of Marathon and the Ojibways of the Pic River First Nation throughout the planning and design phase of the Project. There is a low level of controversy in the project, and low public concern.		

4.4.1 Public Engagement

Open house was held in June 2008 to inform officials and residents in the Town of Marathon on the results of the risk assessment and the assessment of contaminated sediment management options that were undertaken. Input was sought from the Town of Marathon to select a preferred contaminated sediment management option.

In 2008, EC and MOE began work to establish a community liaison committee (CLC) for the Peninsula Harbour Area of Concern. EcoSuperior Environmental Programs (a not-for-profit organization that delivers programs that encourage and support environmental stewardship in the Lake Superior basin and beyond) was contacted by MOE and aided the agencies in the establishment of the CLC in early 2009. The CLC – open to all residents who wanted to join – includes residents from the Town of Marathon as well as the mayor and other council members; industry representatives; provincial and federal government representatives; and a representative from the Ojibways of the Pic River First Nation. The first meeting was held in May 2009 and meetings have been held monthly (for the most part) since that time. In general, the purpose of the meetings is to exchange information between the community and government agencies related to the status of the Peninsula Harbour AOC and the remediation of contaminated sediment. In addition to supporting the establishment of the CLC, EcoSuperior also posts relevant information on their website such as reports, presentations, and meeting minutes and provides notification of website updates to those involved in the Project as well as CLC members.

AECOM hosted a public meeting in October 2009 in the Town of Marathon. The purpose of the meeting was to provide a more detailed update of the Project planning and design, to identify issues and concerns from the community and solicit input into the scope of the EA. The public meeting in the Town of Marathon was relatively well attended.

Project information and notifications were communicated to the public in advance of public meetings via local newspapers (*i.e.,* Marathon Mercury, Chronicle-Journal) as well as the Marathon municipal website; however, the time between these communications and the meetings was limited. All meeting notices, agendas, notes and related materials were posted on the website of the Lake Superior Binational Forum and are available to the public: http://www.superiorforum.org/area-of-concern/peninsula-harbor.

In late May 2011, updates on the design and EA process were presented by AECOM to the CLC.

Further consultation with the community took place on November 16, 2011 in the form of an open house to the CLC and the Town of Marathon. It was attended by approximately 20 members of the public. Table 16 below summarizes the issues / concerns that were discussed at the open house. Presentations given at the open house and the details on the questions and concerns raised by these members of the public are presented in Appendix J.

The notification on the construction schedule and other relevant Project activities will be provided to the public via public announcements (*e.g.,* radio, newspaper) as the Project progresses.

4.4.2 Aboriginal Consultation

The Ojibways of the Pic River First Nation was engaged due to their close proximity to the Project site. The Ojibways of the Pic River First Nation is generally involved / interested in any environmental / resource management activity in that area.

The Ojibways of the Pic River First Nation was first introduced to the need for sediment management actions in January 2008 via a preliminary meeting with the Chief and Council with staff from EC and the MOE. In addition to discussing the various sediment management options, the Chief and Council were asked what their preference would be in terms of the best means of consultation and contact throughout the process. The preference is to first discuss new information with the Chief and Council before community meetings are held.

This preliminary meeting was followed by a formal letter dated March 11, 2008 (Appendix J) from EC's Regional Director General. The letter, addressed to the Chief and Council, invited a further discussion on sediment management in Peninsula Harbour, and included an information package providing detail on the Remedial Action Plan for the Area of Concern (Appendix J).

Subsequent meetings were held in April and May 2008 with the Chief and Council of the Ojibways of the Pic River First Nation. The April meeting was held with the Chief to provide an update on the status of the sediment management options being considered. The May meeting was with the Chief and Council to further discuss the potential options, and provide a forum for the Ojibways of the Pic River First Nation to raise questions, concerns and / or provide words of support for the proposed Project.

An open house available to the entire community was held on June 10, 2008 to inform the Ojibways of the Pic River First Nation about the results of the ecological risk assessment and the assessment of contaminated sediment management options that were undertaken. Displays and presentations were provided, and input was sought from participants to select a preferred contaminated sediment management option. Support was voiced for the capping option. A second public open house was hosted in the Town of Marathon on June 11, which provided another opportunity for discussion and consultation for those who could not attend the day before.

Following the meetings with Chief and Council and the two community open houses, EC and the MOE provided a joint letter to the Ojibways of the Pic River First Nation Chief and Band Administration [dated November 27, 2008] informing them of the decision to select the thin layer cap as the preferred option (Appendix J). It also provided information on next steps and invited their participation in both a technical team and a community-based liaison committee.

The Community Liaison Committee is a public advisory group with members of the local community, officials with the Town of Marathon, and a representative of the Ojibways of the Pic River First Nation. A representative of the First Nation attended no fewer than two meetings in 2009 and three meetings in 2010. They receive all meeting notices and summary notes, offering yet another avenue for communication and engagement, in addition to the direct meetings with Chief and Council and community open houses at Pic River.

In early October 2009, during a regular Band Council meeting, time was dedicated to update the Chief and Council on the sediment management project. A supporting presentation was delivered (Appendix J). Discussions included the rationale for choosing a thin-layer cap; the EA process and detailed Project design; current status of work and next steps, and any questions or concerns they may have.

AECOM then hosted another open house on October 21, 2009 that was open to the entire community. It was to provide a more detailed update of the Project planning and design, and to identify any issues or concerns from the community, and to solicit input into the scope of the EA. However, there was only one attendee; who is an employee of the Band Administration and a member of the CLC. There was an open house the evening before (October 20) in the Town of Marathon, where again the intention was to describe the sediment management work underway, and give participants the opportunity to ask questions and provide their views for inclusion in the EA.

Invitations to the open houses were not only sent to the Chief and Council of the Pic River First Nation, but also to the Pic Mobert First Nation, Pays Plat First Nation, Red Rock First Nation, and Fort William First Nation; along with the province-wide organizations Union of Ontario Indians, and the Métis Nation of Ontario (Appendix J). These letters from EC's Regional Director General [dated September 8, 2009] provided information on the sediment management process, the environmental assessment, and invited participation in the October 2009 community events.

On November 5, 2010, the Lake Superior Binational Forum – a public stakeholder group partly funded by EC – held a community meeting in the Town of Marathon that again focused on the management of contaminated sediment in Peninsula Harbour. The Chief and several Council Members of the Pic River First Nation attended.

The Community Liaison Committee communicated with AECOM and the agencies on May 31, 2011 to hear and discuss an update on the EA for the proposed thin-layer cap. A representative of the Pic River First Nation could not attend, but they did receive the meeting notices and summary notes.

On June 10, 2011, EC and the MOE held a meeting and presentation with the Métis Nation of Ontario to discuss sediment management within the Peninsula Harbour Area of Concern; and also to provide status updates on all four (4) Areas of Concerns along the Lake Superior north shore (Appendix J). The Métis Nation of Ontario will be providing a response at a future dates on how they would like to be consulted going forward on matters across the Areas of Concern.

Since the process began in 2008, Project information and notifications have been communicated in advance of public meetings via local newspapers (*i.e.,* Marathon Mercury, Chronicle-Journal) as well as the Ojibways of the Pic River First Nation website and newsletter; however, the time between these communications and the meetings was limited. Further Project communications will continue through similar avenues.

Additional Aboriginal consultation and communication on the Project was undertaken in November 2011. Invitations for open houses held on November 15 and 16, 2011 in Pic River and the Town of Marathon, respectively, were extended to the Pic River First Nation, Fort William First Nation, Pic Mobert First Nation, Pays Plat First Nation, Red Rock First Nation, the Union of Ontario Indians, Red Sky Métis Independent Nation and the Métis Nation of Ontario. EC continues to be the primary contact with the Ojibways of the Pic River First Nation, and continues to engage in communication with the Band Administration. Based on discussions thus far, there is preference to continue with updates and dialogue with the Chief and Council first prior to open public meetings.

A meeting with the new Chief and Council (sworn-in October 2011) took place on November 15, 2011 in Pic River to provide an update on the Project and to seek further comments/questions on the Project if any. The following were presented to the Chief and Council of the Ojibways of the Pic River First Nation:

- project and its impacts on the environment

- legislative triggers and
- the EA process.

Questions and concerns raised were addressed, and the Chief and Council accepted the project and potential environmental impacts. Additional details on the discussion with the Chief and Council are available in Appendix. J. First Nations will continue to be part of consultation throughout the project and its monitoring phase.

4.4.3 Agency Consultation

In preparation of the EA Report, AECOM consulted with the following provincial and municipal agencies to gather expert knowledge these agencies may have with regards to the Project:

- Ontario Ministry of the Environment (MOE)
- Ontario Ministry of Natural Resources
- Ontario Ministry of Transportation
- Town of Marathon (Chief Administrative Officer and Economic Development Manager)

MOE held a meeting with the Town of Marathon Council on October 11, 2011 to discuss potential impacts from the project to the Town. EC, AECOM and PWGSC participated by phone. Town of Marathon was concerned with the ability of the Peninsula Road to support the potential truck traffic from the Project, and wanted to discuss road assessment process and compensation for damages.

A discussion on the usage of the road as a potential haul road took place on November 16, 2011 between EC, PWGSC, MOE, AECOM and the Town of Marathon.

4.4.4 Federal Coordination

In accordance with the Federal Coordination Regulations established under *CEAA*, the following Federal Authorities were contacted to determine if they are a Responsible Authority or have technical / scientific advice or comments regarding foreseeable environmental issues raised by this Project, and to determine *CEAA* responsibilities with regard to the Project (Appendix A):

- Fisheries and Oceans Canada (DFO)
- Transport Canada (TC)
- Aboriginal Affairs and Northern Development Canada
- Health Canada (HC)
- Parks Canada (PC)

All comments, advice, mitigation measures and best management practices received from the federal departments have been considered and where relevant have been incorporated into this environmental assessment screening report.

4.4.5 Summary

The following is a summary / description of issues and concerns raised during the EA review process, the CLC and public meetings and how and / or where they are discussed in this EA report.

Table 16 Summary of Issues and Concerns

Issue / Concern	Disposition
Concern regarding the stability of the cap material given the wave and storm activity in the lake	Addressed in Section 7.0 Effects of the Environment on the Project and during the public meeting. Some movement and shifting of the cap is expected and considered in the design (two (2) size grades of medium and coarse sand to be used), but cap maintenance is not anticipated. The gradation of the cap material is engineered based on the highest wave height measured in 19 year period at Terrace Bay (AECOM, Calculation Sheet – Hydrodynamic (non breaking) wave load, 2011; Environmental Hydraulics Group, 1993). Should significant movement be identified during post construction monitoring, federal and provincial partners will evaluate the risk and identify if additional measures are required.
Concern was raised regarding the location of the borrow material as this has a significant effect on Project cost (Public)	Local pits in the Marathon area have suitable cap material (AECOM). The Contractor will select the source which meet the specified grain size and % fines.
Given the closure of the MPI mill in March 2009, the Town is concerned about the maintaining flexibility in shipping in the Harbour Concern that the capping would have negative impacts on shipping and other vessel operation (reduced depth due to cap placement) particularly in near the MPI dock	Addressed in Section 5.4 Land and Resource Use and 8.0 Cumulative Effects Assessment. The water depth will be reduced by 15 to 20 cm in the capping area. There is no restriction on dredging post cap to allow larger vessels (*i.e.,* the dock area can be dredged with appropriate approvals from various agencies). The same approvals are required from the pre-cap condition. A request will be made to Transport Canada to designate the capping area as no anchor zone (currently, contaminated sediments are disturbed whenever vessels anchor in this area).
Concern regarding mixing of sand and contaminated sediment from propeller wash	Environ 2009 study addresses propeller wash. The design of the cap considers the potential for propeller wash and mixing, to the extent possible. The design of the cap material carefully considers / balances the potential effects of propeller wash and wave action. Mixing of sand and contaminated sediment is expected

Issue / Concern	Disposition
	as this is a thin layer cap and not an isolation cap. The objective of the thin layer cap is to enhance natural recovery.
Concern regarding potential ongoing contamination source (s) from the mill site	MOE is investigating this issue separately. This EA does not address ongoing contamination from the site.
Concern regarding the fish habitat that currently exists in the Cove and near the MPI dock and whether a HADD authorization and / or compensation are required Concern that the cap will negatively impact fish populations	Addressed in Section 5.2 Fish and Fish Habitat. DFO Authorization under section 35(2) of the Fisheries Act is required: -there will be a temporary disruption to fish habitat during construction period -the effects on aquatic vegetation is unknown but expect that vegetation will recover (monitoring will take place to determine the success of the growth of aquatic vegetation) -approximately 2,000 m^2 of gravel and cobble area will be affected .
Concern that cap material is not suitable habitat for bottom dwelling organisms	Addressed in Section 5.1 Benthic Habitat and Sediment Quality. Most of the sediments in the capping area are fine sediments.
Concern regarding the economic impact of the Project	The construction phase of the Project may result in a positive economic effect in the community. Post construction, water depth along MPI dock will be reduced by up to 20 cm due to the capping material. Capping does not prohibit dredging of the area to increase water depth, but will result in additional material to dredge and to be disposed of. Effects on future use of the Cove are addressed in Section 5.4 Land and Resource Use and Section 8.0 Cumulative effects Assessment.
Concern about the protection of the MPI water intake line	The contractors will know the location of the intake pipe and they will take precautions to ensure it is not damaged. If MPI is in operation during capping, the opening of the pipeline will be covered via geotextile to prevent fines from entering the pipe.
Concern about the allocation of funds for the remediation of Peninsula Harbour when so many in the community are out of work as a result of the closing of the MPI mill	This issue was discussed at the public meeting and is outside the scope of the EA.
Concern that any future or continuing responsibilities that stem from this Project will impose costs on the Town	As indicated in the Evaluation of Existing Administrative Controls (Appendix E), the Ontario Ministry of Natural Resources has agreed to serve as the coordinating

Issue / Concern	Disposition
	agency for the review and permitting for future developments and activities that may affect the Project. This issue was discussed at the meeting and is outside the scope of the EA.
Concerns were raised by the town regarding the contemplated hauling and Peninsula Road's ability to handle it during construction. Peninsula Road is the main municipal road in and out of town. Town expressed concern that there may be damages to the road	Road damage assessment process and compensation for damages will be determined with the Town of Marathon. The road was paved in 2008 and it is assumed that it was built to handle loads from MPI. The stress on the road from the project is expected to be minimal and this will be discussed with the Town of Marathon.
Town raised concerns regarding noise generation during construction	All equipment to be used on the project will meet the provincial noise guidelines. Residents of the Town of Marathon will be advised of the project and the noise prior to project start. Town of Marathon Council advised that they prefer 5 AM to 5 PM trucking hours to minimize noise concern from the residents so trucking hours will be revisited.
Concern that capping of MPI dock may cause additional approvals for dredging	The capped area can be dredged and no additional paper work or approvals will be required from the pre-cap condition. The same agencies need to be contacted to obtain dredging approvals/permits. The only difference is that there may be more material to dredge and to dispose of.
Concerns whether the submerged logs will remain	The submerged logs will remain. As removing the logs will disturb and resuspend the contaminated sediments, it was deemed as safer and more cost effective to leave the logs as they are.
Concerns on effects on small pleasure craft boating season and any restrictions on the public boat launch	Buoys and lighting will be in place as per the *NWPA* approval for this work from Transport Canada. The conditions of approval are in Appendix B.
What is the estimated cost of the work?	Pre-tender amount cannot be disclosed.
Request by the Ojibways of the Pic River First Nation was made for provision of accommodation in the form of economic development and training.	Presently, there is no provision to accommodate in the form of economic development and training.

5. Assessment of Environmental Effects, Mitigation Requirements, and Residual Effects

In previous sections of this Screening Report, the Project and its various activities are summarized (Section 2.0), the existing environmental conditions are described (Section 3.0) and the valued ecological components (VECs) that have potential Project interactions (Section 4.0) have been determined. This section utilizes the methodology described in Section 4.0 to assess the significance of these interactions and the potential effects of the Project on the Environment. As described in Section 4.0, the VECs that were selected for further assessment in this Section are:

Benthic Habitat and Sediment Quality
Fish and Fish Habitat
Wildlife
Land and Resource Use

5.1 Benthic Habitat and Sediment Quality

Benthic Habitat and Sediment Quality is retained as a VEC in consideration of the potential environmental effects of Project-related activities on existing benthic communities and sediments in Peninsula Harbour / Jellicoe Cove. Benthos includes all of those organisms which are associated with substrates, either the lakebed or solid structures sitting upon the lakebed (*e.g.,* thin layer cap). Plants in benthic communities stabilize sediments, provide shelter and act as a food source to the aquatic ecosystem. Animals of benthic communities are herbivores making up a significant portion of the aquatic food web, are prey for carnivorous pelagic and demersal fish species, and contribute to aquatic nutrient cycling. The benthic fauna category includes species which are stationary as well as numerous species that are mobile, but stay very close to the surface of the substrate rather than moving in the water column. This group of epibenthic animals includes amphipods, mayflies, and worms, as well as demersal fish, which are discussed separately in Fish and Fish Habitat (Section 5.2).

Since benthos are closely associated with substrates and benthic organisms live and interact directly in or on sediments, changes to the quality of sediments can have a direct impact on the health of benthic communities, either through physical interactions (behavioural effects, habitat loss, changes in prey abundance or distribution) or chemical interactions (uptake of nutrients and toxins). Changes in sediment quality can therefore result in changes to benthic communities, which in turn can affect higher trophic levels in the aquatic food web (*e.g.,* fish, birds). The assessment of Benthic Habitat and Sediment Quality is therefore closely linked to the assessment of Fish and Fish Habitat (Section 5.2), and Wildlife (Section 5.3), which also includes species at risk.

5.1.1 Boundaries

The spatial boundaries for the assessment of Benthic Habitat and Sediment Quality include Jellicoe Cove in recognition of the fact that Project activities are generally limited to within Jellicoe Cove and, to a lesser extent, Peninsula Harbour given that the AOC extends beyond Jellicoe Cove and covers the Harbour. Benthic Habitat and Sediment Quality in Jellicoe Cove and Peninsula Harbour are described in Section 3.1. The spatial boundaries also include the zone of influence from any sediment plumes associated with Project activities (*e.g.,* cap installation).

The temporal boundaries for the assessment of Benthic Habitat and Sediment Quality include the site preparation and construction, as well as the monitoring and maintenance phases of the Project. The temporal scope also includes the period of sediment suspension and / or contaminated sediment re-suspension and the subsequent return to baseline water quality conditions once construction and / or monitoring activities are complete, as well as the recovery time for benthic communities that are affected by Project activities.

Benthic Habitat and Sediment Quality are components of fish habitat. Any Project activities that could affect Benthic Habitat and Sediment Quality is subject to the federal *Fisheries Act* and the *Canadian Environmental Protection Act*. The Federal Policy for the Management of Fish Habitat applies to all projects with potential to alter, destroy or disrupt fish habitat. Furthermore, surface water quality in Ontario is regulated by the provincial government (MOE), through the new *Clean Water Act.* The assessment of Benthic Habitat and Sediment Quality is closely linked to the assessment of Fish and Fish Habitat (Section 5.2), which is also considered separately in this document.

The analysis of Benthic Habitat and Sediment Quality is based on a review of existing knowledge and reports for the study area, such as surveys of the benthic environment, habitat and sediment chemistry sampling programs, and any limitations therein.

5.1.2 Significance Criteria

A **significant** adverse effect on Benthic Habitat and Sediment Quality is defined as a physical, chemical, or biological alteration of benthos or sediments, in quality or extent, to such a degree that there is a decline in abundance and / or change in distribution of benthos, beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return that population, within a few generations, to its former level. Such a change could result in alterations in sediment nutrient cycling, community structural complexity, biotic interactions, habitat pattern, population dynamics and ultimately genetic diversity.

A **positive effect** on Benthic Habitat and Sediment Quality is defined as an enhancement in benthic quality, increase in the species diversity, or increase in the area of the valued benthic habitat.

5.1.3 Potential Issues, Interactions and Concerns

Project-related activities will affect Benthic Habitat and Sediment Quality. Cap placement will have an interaction between the Project and Benthic Habitat and Sediment Quality, leading to potential adverse effects such as mortality, injury, alteration / disruption of benthic habitat, temporary increase in sediment toxicity, increased turbidity, potential for leaks and spills and a potential disruption to benthic environments. Reducing exposure of biota to the contaminated sediment through the implementation of the Project is also considered.

5.1.3.1 Injury or Mortality

Cap construction may result in mortality or injury of slow-moving, immobile, or sensitive benthic invertebrates. For example, one study found that benthic invertebrate abundance and family richness decreased with increased exposure to sediment (Shaw and Richardson 2001).

5.1.3.2 Alteration and Disruption of Habitat

There will be disruption to fish habitat (approx. 9 weeks) during the actual construction of the cap. The length to recolonize existing benthic habitats may range from a single season to several years, based on cap characteristics and the diversity/resiliency of the benthic community.

Capping will also positively alter benthic habitat in the proposed cap boundary as the TLC will cover pre-existing contaminated habitat. As previously discussed, this alteration is one of the objectives of the Project, as the placement of the clean capping material will reduce exposure of biota to contaminants. This alteration is intended to result in an overall positive effect.

5.1.3.3 Temporary Re-suspension of Contaminated Sediment

Project construction and monitoring may cause the temporary degradation of habitat quality through re-suspension of contaminated sediment in the water column resulting from cap placement and disturbance to the lakebed via vessel operation and sampling. Increased contaminated sediments in the water column will temporarily cause an adverse effect on water quality which may increase the exposure of contaminants to benthic organisms.

5.1.3.4 Long-term Improvement in Sediment Quality

Over the long-term, the management of contaminated sediment in Jellicoe Cove is expected to have a positive effect on benthos, improving the quality of the fish habitat in Peninsula Harbour by decreasing the contaminant flux from disturbance of contaminated sediments. Additionally, TLC will reduce exposure of biota to contaminated sediments, reduce the potential for mercury and PCB bioaccumulation, and reduce the spread of these contaminants to the rest of Peninsula Harbour via re-suspension in the water column.

5.1.3.5 Increased Turbidity

Project construction and monitoring may cause the temporary degradation of sediment quality and benthic habitat quality through an increase in turbidity / suspended solids resulting from cap placement and disturbance to the lakebed via vessel operation and sampling. Further, certain terrestrial Project activities, particularly those activities which disturb soils (*e.g.,* preparation of a construction laydown and material storage area and upgrading access roads (if / as required); transport and storage of capping material to loading site; equipment set-up; and nearshore cap placement (from the shoreline); equipment removal; site clean-up), may increase the potential for sediment erosion and deposition in Jellicoe Cove and areas down-gradient to Jellicoe Cove. The potential for increased turbidity increases during periods of heavy rainfall or snow melt.

5.1.3.6 Potential for Leaks and Spills

Accidental spills or unchecked leaks from construction activities and equipment on land and in the water have the potential to negatively impact benthic populations and their habitat. Accidental spills and leaks could contaminate the water which could have lethal or sublethal effects to benthic populations.

5.1.3.7 Potential Disruption of Benthic Lifecycles

The construction of the proposed cap may temporarily disrupt benthic invertebrate lifecycles, but it is anticipated that benthic invertebrate lifecycles will return to normal following the placement of the proposed sediment cap. As previously noted, it is difficult to predict the exact timing of this recovery of the benthic community. In addition, one of the objectives of the Project is to minimize the current negative effects of the current contamination exposure on benthic organisms.

5.1.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Table 17 Benthic Habitat and Sediment Quality Residual Environmental Effects Assessment Matrix

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Benthic Habitat and Sediment Quality							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Construction	Injury or Mortality (A)	• Ensuring the cap material has minimal (*i.e.,* less than 6%) fines via contract specifications and quality assurance / quality control monitoring; • To the extent possible, the Contractor will place the cap material in the nearshore areas first to ensure that work in these areas is complete so as to avoid in water work outside of the fish window in the event of a delay in construction; • Monitoring placement methods and cap thickness (to ensure adequate coverage) during capping as outlined in Section 2.4.2.2; • A floating turbidity curtain may be deployed if required; • Immediate installation of turbidity curtains should monitoring indicate that elevated turbidity levels have occurred for a 24 hour period which could not be managed via adjustment placement methods; • Monitoring of weather forecasts and adjusting or suspending placement activities during severe storms. ; • Strategies employed during cap design and placement (*e.g.,* grain size fraction, placement to allow for particle broadcasting, low application rate) will provide adequate protection against excessive disturbance and damage to adjacent aquatic habitats and organisms; and • Turbidity monitoring during cap placement such that a one time exceedance of 50 NTUs above background results in cessation of work to evaluate cause and automatic action to reduce turbidity (*e.g.,* adjusting the height and rate of material placement).	1	1	1	R	2
	Alteration and Disruption of Habitat (P)	• Preferred grain size for the cap material was determined with the goals of supporting benthic habitat and responding to existing and potential hydrodynamic conditions within the capping footprint. • HADD authorization.	1	1	1	R	2
	Temporary Re-suspension of Contaminated Sediment and Increase in Turbidity (A)	• As above.	1	1	1	R	2
	Long-term Improvement in Sediment Quality (P)	• N/A	2	2	6	R	2
	Potential Disruption of Benthic Lifecycles (A)	• As above.	1	1	1	R	2
Post-Construction Monitoring	Temporary Re-suspension of Contaminated Sediment and Increase in Turbidity (A)	• Use of coarser sand in areas with higher vessel traffic and adjacent to the pier; and • Institutional controls will be used to restrict vessel speeds and / or anchoring locations in the area defined by the cap placement, as necessary; and • Conducting post construction monitoring of the cap area to confirm that the movement of cap material is within the expected design threshold. Post construction monitoring is outlined in Section 10.1.3.	1	1	1	R	2

Legend Magnitude[1]: 1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation) 2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable	Geographic Extent: 1 = < 1 km^2 2 = 1 – 10 km^2 3 = 11 – 100 km^2 4 = 101 – 1,000 km^2 5 = 1,001 – 10,000 km^2	Frequency: 1 = < 11 events/year 2 = 11 – 50 events/year 3 = 51 – 100 events/year 4 = 101 – 200 events/year 5 = > 200 events/year	Ecological / Socio-Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not applicable A = Adverse

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Benthic Habitat and Sediment Quality								
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**		**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
				Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
change, temporarily outside the range of natural availability) 3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)		6 = > 10,000 km^2 Duration: 1 = < 1 month 2 = 1 – 12 months 3 = 13 – 36 months 4 = 37 – 72 months 5 = > 72 months	6 = continuous Reversibility: R = Reversible I = Irreversible	P = Positive				

Benthic Habitat and Sediment Quality is retained as a VEC in consideration of the potential environmental effects of Project components and activities on benthic habitat and sediment quality in Peninsula Harbour / Jellicoe Cove and the water column in which they occupy. This VEC was selected to meet specific regulatory requirements under the *Fisheries Act* and due to the important role that benthic invertebrates have on the aquatic ecosystem and on the sustainability of fisheries resources.

According to the federal *Fisheries Act*, "fish" includes all fish, shellfish, crustaceans, aquatic animals (including juvenile stages), or parts thereof, as well as the eggs, sperm, spawn, larvae or spat. "Fish habitat" includes food supply and migration areas on which fish either directly or indirectly depend, as well as spawning, nursery and rearing grounds. Fish habitat also includes biological, physical and chemical attributes. Examples of biological attributes may include populations of aquatic plants, plankton and benthic invertebrates. Physical attributes including substrate, temperature, flow velocity, flow volumes and water depth are also components of fish habitat. Finally, chemical attributes of fish habitat include pH, nutrients and dissolved oxygen. For the purposes of this Project, water quality will be assessed based on changes to suspended sediment levels in the water column and metal concentrations, rather than (for example) changes to salinity. The assessment of Project environmental effects on Fish and Fish Habitat is discussed separately in Section 5.2. The following analysis also considers the risk assessment performed by DFO to determine the level of risk that residual effects pose to fish and fish habitat (see Appendix H). This risk assessment was conducted in accordance with the DFO Risk Management Framework.

For details regarding construction performance monitoring, refer to Section 2.4.2.3 for and Section 2.5 for the Project schedule.

5.1.4.1 Injury or Mortality

Cap construction will disturb benthic species in the area, potentially resulting in direct mortality or injury of slow-moving, immobile benthic or flora and fauna in the immediate area of capping. Benthic communities have been shown to recover from the disturbance related to various types of aquatic construction activities, such as dredging (Dernie *et al.* 2003). As such, it is expected that once cap placement is complete, benthic species will re-colonize the area. Therefore, the adverse effects are anticipated to be short term. The loss of a limited number of individuals is unlikely to cause long-term changes at the level of populations.

Mitigation measures listed above (Table 17) will be implemented to reduce the risk for injury or mortality on benthic invertebrates.

The potential for injury or mortality of benthic invertebrates is expected to be minimized with the implementation of mitigation measures.

5.1.4.2 Alteration and Disruption of Habitat

Placement of the thin layer cap will alter and temporarily disrupt fish habitat in Jellicoe Cove. The intent of the cap is to reduce interaction between the contaminated sediment with the aquatic ecosystem and to enhance natural recovery of Jellicoe Cove. The capping is estimated to advance natural net sediment deposition by approximately 75 years.

DFO developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all projects and activities, in or near water that could harmfully alter, disrupt, or destroy (HADD) fish habitats by chemical, physical, or biological means. The guiding principal of this policy is to achieve no net loss of the productive capacity of fish habitats. Sections 34 to 37 of the federal *Fisheries Act* specifically administer those aspects dealing with fish habitat. As previously described, one of the objectives of the Project is to reduce exposure of biota to contaminated sediments. Therefore one of the positive benefits of the Project is the creation of high quality benthic habitat by the placement of clean capping material over the contaminated sediments.

During construction of the TLC, there is potential for temporary disruption of benthic habitat within the proposed cap and adjacent areas. This temporary disruption will likely be in the form of increased turbidity. To reduce the impacts of benthic habitat disruption, mitigation measures listed above will be followed (Table 17).

Capping will permanently alter the contaminated benthic habitat in the proposed capping area, as it will cover existing contaminated sediments with clean medium to course sand. Some rockweed species may be buried, dislodged or displaced from the lake bottom and presumably some encrusting animals and surface dwelling fauna (*e.g.,* amphipods and polychaete worms) may also be displaced. It is anticipated that once capping is complete, species will re-colonize disturbed areas; however, how long that would take is not known. Habitat recovery times following capping may range from a single season to several years, depending on physical cap characteristics and the diversity / resilience of the benthic community (ENVIRON 2008b).

Recovery success depends upon the type of disturbance, sediment properties, species tolerance and the ability of species to re-colonize through adult mobility and larval settlement (Jones 1974). It is unlikely that cap placement in Jellicoe Cove will result in a reduction of community / habitat diversity on a Harbour or lake-wide basis. Although construction activity will potentially affect the existing epibenthos in the Project footprint, its magnitude and duration are such that it is not predicted to present a long lasting interaction on the nature, structure and function of the communities within the area as a whole.

Further, placement of the cap will in the long run result in improved habitat available for benthic species in the area (*i.e.,* decreased contaminant flux from contaminated sediments as existing contaminated sediments will be covered with sand) and improved habitat suitability for fish. During the Detailed Engineering Design phase, the preferred grain size for the cap material was determined with the goals of supporting benthic habitat within the capping footprint.

The evaluation of the anticipated impacts on fish and fish habitat resulted in a High Risk assessment, such that a *Fisheries Act* Authorization is required (Risk Assessment Worksheet; Appendix H).). Potential adverse effects of the Project are anticipated to be temporary in nature and include: disruption of fish habitat, increased turbidity and the potential increase in contaminant levels during cap placement (*i.e.,* re-suspension). To a lesser extent, other effects may include noise and vibration, direct injury or fish mortality and accidents or malfunctions such as leaks or spills.

5.1.4.3 Temporary Re-suspension of Contaminated Sediment

Past studies identified that the sediments of the Project site are contaminated (Sections 3.1.2 and 3.1.3). These past studies identify that the sediments contain very high concentrations of mercury and elevated concentrations of PCB's that likely would cause severe environmental effects on exposed benthos in the area near the remediation site.

As the capping material reaches the bottom, it will generally spread radially outward from the center of impact, potentially causing re-suspension of contaminated in-situ sediment at the immediate sediment-water interface. Section 2.4.2.2 provides a detailed description regarding the cap placement technique and interaction with native contaminated sediment.

The potential for a temporary re-suspension of contaminated sediment is expected to be minimal with the implementation of mitigation measures as outlined in Table 17.

5.1.4.4 Long-term Improvement in Sediment Quality

Total mercury concentrations within Jellicoe Cove sediment exceeded the Severe Effects Levels (SEL) by up to three (3) orders of magnitude and is highest in the deeper sediments adjacent to the mill, while total PCB concentrations exceeded the Lowest Effects Level (LEL) by an order of magnitude (Sommerfreund *et al.* 2005).

Lake sediments within the AOC are a source of mercury and PCBs to benthic organisms. These organisms are known to have accumulated mercury and methylmercury tissue concentrations (Grapentine *et al.* 2005). As the interaction between benthos and contaminated sediment will be reduced through implementation of the TLC, body burdens of benthos will also be reduced. This will minimize the potential for adverse impacts at higher trophic levels in the food web, inclusive of fish as primary consumers (ENVIRON 2008). The effects of the proposed sediment cap on overall sediment quality are anticipated to be positive over the long-term.

5.1.4.5 Increased Turbidity

Capping activities will likely result in the suspension of fines from the capping material and to a lesser degree, potentially re-suspend in-situ contaminated sediments. Increased turbidity may reduce the total dissolved oxygen concentrations in the water column in the immediate area. If suspension and / or re-suspension occur, the suspended sediments, and potentially contaminants, may be transported over varying distances to other portions of Peninsula Harbour. The suspended sediments may modify the physical environment and interact with any exposed species (Beak 2000). However, benthic animals may move to less-disturbed areas (*i.e.,* result in a change in habitat use) during cap construction. Refer to Section 2.4.2.2 for details regarding the cap placement technique and interaction with contaminated sediment.

The Cove area is characterized by a relatively low current regime and limited wave action which will significantly limit dispersion during performance of the capping program. The Contractor will identify the source of the cap material and will ensure that the material meets the required Project specifications and that material is sourced from a permitted pit.

In addition to the suspension of sediments associated with cap placement (as above), there will likely be some sediment disturbance associated with vessel propeller wash (barges and support vessels) during the site preparation and construction (contaminated sediment re-suspension) phase of the Project, and to a lesser extent the monitoring and maintenance phase (re-suspension of cap material), particularly in the more shallow areas of cap placement.

Immobile species which cannot rapidly move away from the construction area (or the area of monitoring and / or maintenance activities), such as phytoplankton, may be unable to avoid the stresses associated with elevated suspended solids and contaminants. (Refer to Section 2.4.2.4 regarding mitigation and monitoring for turbidity). According to the Canadian Water Quality Guidelines for the Protection of Aquatic Life, the acceptable increase of turbidity levels over a 24-h exposure period is 8 NTU above background (CCME 1999 updated 2002). However, the 8 NTU above background criteria would not be attainable since the construction of the proposed cap is anticipated to result in turbidity which would continuously require Project shut down. Given the short fisheries timing window, the 50 NTU above background criterion was considered a balance of providing appropriate levels of environmental protection and ensuring the Project is completed within the "least sensitive window for fish species in the area". A complete rational is provided in Appendix I and additional rational is also provided in Section 5.2.4. It is anticipated that most mobile species will be able to avoid these stresses. It is expected that while benthic organisms may face some localized, temporary disturbance to the use of their habitat due to suspended sediments and potentially contaminated sediments, these effects will be short-lived; returning to baseline or improved levels following completion of construction and intermittent monitoring activities, and they are not expected to result in or long-term adverse alterations.

Re-suspension of cap sediments during the post-Project monitoring phase would be infrequent, as monitoring will take place only periodically over the next 20 years. Existing administrative controls may be used to restrict vessel speeds and / or anchoring locations in the area defined by the cap placement, as necessary. Propeller wash would likely be spatially and temporally limited to within a few meters of the propeller and a timeframe of a few hours. Furthermore, the intent and design of the cap has taken into consideration that there is likely to be some disturbance of the cap as a result of recreational / small vessel use (*i.e.,* vessels under 450 horsepower). (Refer to Section 2.3 for details regarding the design of cap materials.)

The cap has been designed to minimize the movement of material outside the cap boundary area, both during and after placement, which in turn limits the potential interaction and environmental effects on benthic habitat and sediment quality. More specifically, this will be accomplished by the mitigation measures listed in Table 17.

5.1.4.6 Potential for Leaks and Spills

Accidental spills or unchecked leaks from construction activities and equipment on land and in the water have the potential to negatively impact benthic habitat and sediment quality. Accidental spills and leaks could contaminate the water which could have lethal or sublethal effects to benthic populations. The mitigation measures provided in Section 6.1 will be implemented to reduce the risk for leaks and spills.

The potential for spills and leaks are expected to be minimal with the implementation of mitigation measures.

5.1.4.7 Potential Disruption of Benthic Lifecycles

The construction of the proposed cap may temporarily disrupt benthic lifecycles. It is anticipated that mobile benthic invertebrates will be discouraged from using the proposed cap area and will likely choose to temporarily relocate. Life cycles of these species may occur adjacent to the cap or other areas within the cap which are not currently being affected. It is anticipated that lifecycles will return to normal shortly after the proposed cap project is complete. During the placement of the proposed cap, lifecycles of some immobile species may not occur or may be negatively impacted; however, it is anticipated that these lifecycles will return to normal over time.

Mitigation measures to reduce the impacts of benthic lifecycles include the mitigation are provided above in Table 17. The potential for temporary disruption of benthic lifecycles is expected to be minimized with the implementation of mitigation measures.

5.1.4.8 Conclusion

The use of the appropriate mitigation measures listed in this Section will effectively minimize the extent of the effects of the Project and **no significant adverse environmental effects** (as defined in Section 5.1.2) are expected.

At present, the Project area includes sediments with high concentrations of contaminants. Such sediments are known to be toxic to different sediment-dwelling species, hence, it is expected that the application of a clean TLC will reduce the risks to biota from the contaminated sediments, and result in a decreased flux of contaminants from the Project site to Peninsula Harbour. As a result, it is predicted that the long-term outcome of capping contaminated sediments will be a **positive effect** on the Benthic Habitat and overall Sediment Quality for Jellicoe Cove and Peninsula Harbour.

5.1.5 Summary of Residual Environmental Effects

The alteration, and temporary disturbance or destruction of 25.6 ha of aquatic habitat in Jellicoe Cove is a necessary part of the overall TLC process. However, it is presumed that the capping of these contaminated sediments with clean material will result in the long-term improvement of aquatic habitat used by biota and potentially increase the productive capacity of invertebrates and other biota. The net adverse, short term residual environmental effect on Benthic Habitat and Sediment Quality within the Project area or vicinity (*i.e.,* Jellicoe Cove and Peninsula Harbour), is considered to be **not significant** given the likely long-term benefits of the Project and given the standard construction practices, available guidelines and mitigation measures that will be in place to minimize potential shorter-term impacts. Furthermore, post cap monitoring will assess the effectiveness of the cap and recolonization of the cap area.

Cumulative effects are assessed in Section 8.0 and accidental events are assessed in Section 6.0.

5.2 Fish and Fish Habitat

Fish Habitat is retained as a VEC in consideration of the potential environmental effects of Project components and activities on fish and fish habitat in Peninsula Harbour / Jellicoe Cove, which includes water quality of the habitat. This VEC was selected to meet specific regulatory requirements under the *Fisheries Act* and due to the important role that fish populations have on the aquatic ecosystem and on the stability of fisheries resources.

Fish and fish habitat are protected under the federal *Fisheries Act*, while species at risk are protected under the federal *SARA*. The *Policy for the Management of Fish Habitat*, developed in 1986 by DFO, applies to all projects (development and industrial), large and small, in or near watercourses that could alter, disrupt or destroy fish habitat. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. The *Fisheries Act* is administered by DFO with the exception of Section 36(3) which is administered both by EC and DFO. Section 36(3) prohibits the release of deleterious substances into waters frequented by fish; administered by EC when the substance is chemical, and administered by DFO when the substance is sediment. Water quality in Ontario is regulated by the provincial government through the Ontario MOE through the *Clean Water Act*.

Within the *Fisheries Act*, Section 35(1) states that no one may carry out any work or undertaking which would result in the harmful alteration, disruption or destruction of fish habitat, unless previously authorized by the Minister of DFO.

According to the federal *Fisheries Act*, “fish” includes all fish, shellfish, crustaceans, aquatic animals (including juvenile stages), or parts thereof, as well as the eggs, sperm, spawn, larvae or spat. “Fish habitat” includes food supply and migration areas on which fish either directly or indirectly depend, as well as spawning, nursery and rearing grounds. Fish habitat also includes biological, physical and chemical attributes. Examples of biological attributes may include populations of aquatic plants, plankton and benthic invertebrates. Physical attributes including substrate, temperature, flow velocity, flow volumes and water depth are also components of fish habitat. Finally, chemical attributes of fish habitat include pH, nutrients and dissolved oxygen. For the purposes of this Project, water quality will be assessed based on changes to suspended sediment levels in the water column and metal concentrations, rather than (for example) changes to salinity.

The assessment of Project environmental effects on Benthic Habitat and Sediment Quality is discussed separately in Section 5.1. Environmental effects of fisheries are assessed separately as a component of Land and Resource Use (Section 5.4). Project effects on fish considered to be species at risk are considered separately in Section 5.3, Wildlife.

5.2.1 Boundaries

Interactions between Fish, and Fish Habitat and the proposed Project are limited to Peninsula Harbour / Jellicoe Cove, the proposed site of the remediation Project. These interactions may occur at any time of the year, though different species and life cycle components vary seasonally while juveniles and adults of those same species are present year round. Information regarding existing Fish Habitat is described in Section 3.1.4.

Fish habitat in Peninsula Harbour / Jellicoe Cove is available year round and interactions with the proposed Project may occur during all phases of the Project (*i.e.,* site preparation and construction, operation, monitoring and maintenance). Particularly sensitive times for fish populations include periods of migration and spawning (*e.g.,* most species spawn during spring and early summer, from April to early June, and some species spawn in the fall and early winter, from mid September to January) and the overwinter starvation period (November to March). Ecological temporal boundaries for aquatic species are linked to movement patterns of highly mobile species that migrate in and out of the harbour and less mobile species that use the harbour all year. The temporal scope also includes the period of sediment suspension due to fines in the cap material, re-suspension of in-situ contaminated sediment and the subsequent return to baseline water quality conditions once Project activities are complete.

Spatial boundaries include freshwater habitat within the immediate area of the cap in Jellicoe Cove as well as the zone of influence within Jellicoe Cove and Peninsula Harbour and the surrounding area. The zone of influence will include aquatic habitat and biota associated with Shack Creek and open waters of Lake Superior; both of which are used by a range of species with varying mobility. The mobile species are unlikely to spend their life history within the zone of influence of the Project and are more likely to enter the Jellicoe Cove site on an irregular, diurnal or seasonal pattern. By contrast, the less mobile species will spend most of their life stages within the zone of influence of the Project. Such differences in distribution, migration patterns and life history identifies the ecological spatial boundaries of each species and will vary across species.

5.2.2 Significance Criteria

A **significant** adverse effect on Fish and Fish Habitat is defined as an adverse effect that by itself, or in conjunction with other effects, creates an, alteration to a population (or portion of it) to cause an unnatural decline or change in the abundance or distribution of the population to a level from which recovery of the population is uncertain, over one generation or more. Original population levels may not be re-established by natural recruitment (reproduction and immigration from unaffected areas). A significant adverse effect on fish habitat is one that cannot be compensated through creation, enhancement or restoration of fish habitat and irrevocably harms fish productive capacity resulting in population level impacts described above.

In making its EA determination, the RA considers the likelihood of occurrence of any significant adverse effect upon the environment, taking into account cumulative adverse effects that by themselves may not be deemed significant.

A **positive** effect on Fish and Fish Habitat is defined as an enhancement in the quality, extent and suitability of habitat for fish, an increase in productive capacity, an increase in species diversity, an enhancement of a population or its biomass.

5.2.3 Potential Issues, Interactions and Concerns

Aquatic Project-related activities have the potential to affect fish in the water column and temporarily change water quality. Cap placement will have an interaction between the Project, and fish and fish habitat which has the potential to result in adverse effects if not implemented in a proper manner.

The objective the Project is to cap the contaminated sediments thereby reducing their spread through re-suspension in the water column to the rest of Peninsula Harbour and bioaccumulation of contaminants in the food chain and fishery. The TLC is important since fish exposure to contaminated sediments have been found to have decreased size (Rowe 2003), reduced hatching times, higher mortality and developmental abnormalities (Strmac *et al*. 2002). In particular, fish exposed to mercury were found to hatch earlier (Dave and Xiu 1991) and fish exposed to methylmercury were found to have eye deformities (Weis and Weis 1977). Therefore, the capping of contaminated sediments at the Project site is anticipated to also have a positive effect on Fish and Fish Habitat by limiting the bioaccumulation of mercury and PCB in the food chain causing fish consumption advisories.

The evaluation of the anticipated impacts on fish and fish habitat resulted in a High Risk assessment, such that a *Fisheries Act* Authorization is required. (Risk Assessment Worksheet; Appendix H). Potential adverse effects of the Project are anticipated to be temporary in nature and include: disruption of fish habitat, increased turbidity and the potential increase in contaminant levels during cap placement (*i.e.,* re-suspension). To a lesser extent, other effects may include noise and vibration, direct injury or fish mortality and accidents or malfunctions such as leaks or spills.

5.2.3.1 Habitat Alteration and Disruption

Short-term habitat disruption is anticipated during the construction of the sediment cap. The construction of the proposed cap may temporarily discourage fish from utilizing the area. Since the sediment cap construction is proposed to occur in late spring / summer, the main life stages of fish that may be temporarily disrupted are young of the year and adult stages. Adults may be temporarily discouraged from foraging in the area, while young of the year may be discouraged from using the area. Adults and young of the year may choose an alternative habitat to use during construction, but it is anticipated that most species will return to the capped area and use the area post construction.

In addition, long-term habitat alteration is anticipated in areas where the sediment cap material is replacing contaminated in-situ substrate. Depth contours of 1 - 2 m of the proposed cap area are dominated by sand (~97%)

with some gravel; cap polygons at depths of 2 - 5 m are dominated by sand (~70%) and silt (~30%); and polygons at depth contours greater than 5 m are dominated by silt (~80%).

Aquatic vegetation dominated by stonewort (Chara sp.), varies from dense (~90%) in the shallow water (1-5m) to sparse (~10%) in deeper water (10+ m). The existing substrate will be covered by 15 to 20 cm of medium to coarse sand consisting of approximately 94% sand (0.2 – 1 mm) with approximately 6% fines. The capping activity will cover some of the existing vegetation in the area disrupting fish habitat, but the vegetation is expected to recover within short to medium term (Northern Bioscience 2011). The aquatic vegetation will be monitored to assess recovery.

At present, severe storms move the existing fine contaminated sediment from the cap area (highest concentration of contaminants) to areas outside the cap boundary which also contain contaminated sediment. Post cap, severe storms may move, medium to coarse sand from the cap area and cover areas outside the cap boundary. However, since the cap material is heavier than existing fine sediment, the amount of sand being moved and the area covered outside the cap area will be reduced.

5.2.3.2 Increased Turbidity and Potential Injury or Direct Mortality of Fish

Project construction and monitoring may also cause temporary and episodic degradation of habitat quality through an increase in turbidity / suspended solids resulting from cap placement and disturbance to the lakebed via vessel operation and sampling. Further, certain terrestrial Project activities, particularly those activities which disturb soils may increase the potential for sediment erosion and deposition in Jellicoe Cove (*e.g.,* preparation of a construction laydown and material storage area and upgrading access roads (if / as required); transport and storage of capping material to loading site; equipment set-up; silt curtain installation if required and nearshore cap placement (from the shoreline); equipment removal; site clean-up). The potential for increased turbidity increases during periods of heavy rainfall or snow melt.

An excess of sediments can directly affect fish by interfering with egg survival (Cunjak *et al.* 2002, MacNeill and Cundy 2002), causing stress, causing physical damage to gills (Lake and Hinch 1999), decreasing habitat quality (Park 2007) particularly where sediments are contaminated, reduced growth, impaired vision leading to reduced prey capture success (Shaw and Richardson 2001) and fish mortality in large concentrations (Lake and Hinch 1999). For example, generally a lower amount of dissolved oxygen is associated with high suspended sediments values in the water column (Ntengwe 2006). Suspended sediments also have the potential to impede gill function and thus compromise a fish’s ability to exchange gas within the water column and can affect vision and predator / prey interactions. Also, sediments falling out of suspension may fill interstitial spaces in substrates. This can smother eggs and emerging alevins, cutting off their access to oxygenated water and reduce the effectiveness of habitat.

Sedimentation affects growth, reproduction and mortality rates at all trophic levels and can impact the key components of the food chain, including primary production, zooplankton, benthic invertebrates, and ultimately fish communities. Effects on fish and aquatic biota are determined by both the concentration of suspended sediments and the duration of exposure to them (Newcombe and Jensen, 1996), and can range from no effect to behavioural and sublethal and lethal effects, in addition to habitat impacts (Kemp et al., 2011).

Guidelines for suspended sediments and turbidity have been created by the Canadian Council of Ministers of the Environment (CCME 1999) to protect aquatic resources from elevated levels of suspended sediment.

5.2.3.3 Potential Re-suspension of Contaminated Sediment

Project construction and monitoring may cause temporary degradation of habitat quality through re-suspension of contaminated sediment in the water column resulting from cap placement and disturbance to the lakebed via vessel operation and sampling. Increased contaminated sediments in the water column will temporarily cause an adverse effect on water quality which may increase the exposure of contaminants to fish and other aquatic organisms. The contaminated sediments landing or settling on eggs is a concern; however, as the cap is proposed to be constructed between June 15 and September 1, the risk of egg exposure will be lowered since most species spawn in the fall or spring.

5.2.3.4 Potential for Temporary Disruption of Fish Lifecycles

The construction of the proposed cap may temporarily discourage fish from utilizing the area. Since the sediment cap construction is proposed to occur in the summer when the eggs of most species have hatched, the main life stages of fish that may be temporarily disrupted are young of the year and adult stages. Adults may be temporarily discouraged from foraging in the area, while young of the year may be discouraged from using the area. Adults and young of the year may choose an alternative habitat to use during construction, but it is anticipated that most species will return to the capped area and use the area post construction.

5.2.3.5 Changes in Prey Distribution and Abundance

The proposed sediment cap may change the distribution and abundance of prey for fish species utilizing the area. The effects are anticipated to be temporary for the proposed Project area since the amount of benthic invertebrates and the quality of their habitat is anticipated to increase post construction (see Section 5.1); thus increasing the quality of prey. The proposed cap will smother some existing submergent vegetation. Some small prey fish species which may have used the area due to the submergent vegetation may avoid the area temporarily; however, it is anticipated that the submergent vegetation will re-grow overtime and that prey fish species will return to the area.

5.2.3.6 Noise and Vibration Effects

The Project will involve the use of barges (site preparation and construction phase) and support vessels (site preparation and construction; operations, maintenance and monitoring activities phases). Vessels used throughout all Project phases could result in increased noise levels which may cause adverse effects on fish such as localized temporary avoidance behaviour in the area of the vessels.

Behavioural responses of fish to high levels of ambient sound may include temporary avoidance of the area, including avoidance of primary feeding or spawning areas for the duration of this disturbance (Smith *et al.* 2004, Popper 2003). A potential concern of noise and vibration for pink salmon is auditory masking. Noises from construction have the potential to mask the sounds of impeding predators either through difficulty in detection or though noise habituation overtime. An additional concern would be the effects of noise on salmonid fitness; however, more research is necessary. Other potential effects of high levels of ambient sound on fish include hearing damage which may increase risk of predation, alter reproduction or feeding behaviours, or initiate fish freezing (staying in place) which may further increase the risk of hearing damage (Popper 2003).

5.2.3.7 Potential for Leaks and Spills

Accidental spills or unchecked leaks from construction activities and equipment on land and in the water have the potential to negatively impact fish populations and their habitat. Accidental spills and leaks could contaminate the water which could have lethal or sublethal effects to fish populations.

5.2.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Table 18 Fish and Fish Habitat Residual Environmental Effects Assessment Matrix

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Fish and Fish Habitat							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Site Preparation	Increased Turbidity and Potential Injury or Direct Mortality of Fish (A)	• The area required for the construction laydown and material storage will be kept as small as possible to accommodate construction equipment and material storage; • Although not yet confirmed, it is expected that the location of the construction laydown and staging area will be situated within areas which have been previously disturbed, are void of vegetation and unrepresentative of natural habitat, such that it is unlikely that clearing, grubbing or topsoil stripping activities will be required; • Best Management Practice (BMP)s for erosion and sediment control measures will be implemented prior to any shoreline construction and will be left in place until the vegetation and re-grown. These control measures may include the installation of silt fences, sand bags and / or straw bales, and the storage of construction materials and equipment at least 30 m away from the shoreline to the extent possible; • Soil piles will be stabilized to eliminate or reduce wind or water erosion; • Soil piles will be placed in a location which will not erode into a water body • Dewatering, if necessary, will not occur on, between or, beside soil piles or into a water body; • Soils handling will not occur during high wind to reduce the risk of wind erosion; • Soils will not be handled in extremely wet weather to reduce soil erosion; • Soil will be monitored to ensure no erosion occurs; • Soils prone to rutting will not be handled during sensitive conditions (*e.g.,* wet, frozen soils); and • At the first sign of soil rutting, activities on soils will be suspended or altered to eliminate further rutting (*e.g.,* wooden matting).	1	1	1	R	2
Construction	Alteration and Disruption of Habitat (P)	• As per Table 17; • Scheduling cap construction between May 1 and August 31; • To the extent possible, the Contractor will place the cap material in the nearshore areas first to ensure that work in these areas is complete so as to avoid in water work outside of the fish window in the event of a delay in construction; • Initiating construction in May in the southeast section of the cap (closest to Shack Creek) and ending the construction in August in the northwest section (furthest from Shack Creek). This mitigation measure should decrease the noise effects on early spawners in Shack Creek; • Using smaller vessels which do not exceed the thresholds for damage to fish hearing; and • Limiting noise as much as possible.	1	1	1	R	2
	Potential Re-suspension of Contaminated Sediment (A)	• As above.	1	1	1	R	2
	Increased Turbidity and Potential Injury or Direct Mortality of Fish (A)	• As above.	1	1	1	R	2
	Potential for Temporary Disruption of Fish Lifecycles (A)	• As above.	1	1	1	R	2
	Changes in Prey Distribution and Abundance (A)	• As above.	1	1	1	R	2
	Long-term Improvement in Sediment Toxicity (P)	• N/A	2	2	6	R	2
Post-Construction Monitoring	Increased Turbidity and Potential Injury or Direct	• As per Table 17; and • As above.	1	1	1	R	2

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Fish and Fish Habitat

Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
	Mortality of Fish (A)						
	Potential Re-suspension of Contaminated Sediment (A)	• As above.	1	1	1	R	2

Legend

Magnitude[1]:
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2
6 = > 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

Past studies identified that mercury and PCB contamination within the harbour have resulted in fish consumption advisories and / or restrictions for certain species for a number of years (Beak 2001) (Section 3.1.4) and that certain species are still under consumption restrictions (ENVIRON 2008, Sommerfreund *et al.* 2005, Peninsula Harbour RAP Team 1991). A report prepared in 2008 (ENVIRON) recommended the avoidance of fish consumption in the AOC.

The expected duration of Project construction in the aquatic environment is approximately nine (9) weeks (starting May 1), including potential delays for weather, equipment malfunctions and slower than expected production rates. ,

Section 2.4.2.2 provides a detailed description regarding the cap placement technique and interaction with native sediment.

As indicated in Section 2.4.2.2, the successful Contractor may opt to prepare a slurry with the cap material using water extracted from the lake. Water withdrawal raises concerns over the entrainment or impingement of adult fish, juveniles, larvae and eggs. Entrainment occurs when a fish is drawn into a water intake and cannot escape, while impingement occurs when an entrapped fish is held against an intake screen and is unable to free itself. To minimize the risk of impingement and entrainment, DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (1995) will be followed, should this alternate placement method be selected. Adherence to the in-water working window defined by MNR will ensure that sensitive time periods when fish eggs and larvae densities are highest are avoided.

Freshwater habitat components and aquatic species of Peninsula Harbour will interact with the Project in several ways. The Cove is the receiving body, due to hydrological and physical linkages for two (2) creeks, Shack Creek and an unnamed creek, although the unnamed tributary to the north of Shack Creek is intermittent in nature with limited fisheries habitat value. These habitat components are inter-connected and provide the opportunity for unimpeded migration by aquatic species among different portions of the harbour, between the harbour and the tributary creek (Shack Creek) and between the harbour and Lake Superior.

5.2.4.1 Habitat Alteration and Disruption

Recent information and analysis of current fish use of habitat within the proposed cap area is lacking. MOE conducted young of the year fish survey in 2009 and 2011, and was unable to catch sufficient quantities of fish.

Historic data has indicated that the proposed cap area has average spawning habitat for lake trout, rearing habitat for rainbow trout and rearing habitat for coho salmon. Beak (2001) identified the rearing habitat for rainbow trout and coho salmon along the shoreline in the proposed capped area and immediately adjacent to the area (see Figure 8 in Appendix G Northern Bioscience 2011). However, no solid evidence has been provided to confirm that coho salmon and rainbow trout use the area within the proposed capped area for rearing habitat. Since these studies are fairly outdated and little has been done to confirm the use of these habitats, AECOM evaluated the fish habitat for all species that have been historically found within Jellicoe Cove and rated the fish habitat for each species (Table 9). In order to evaluate which species could potentially use the proposed cap area for spawning and rearing, the substrate type at different depths was considered (Table 19) (Lane *et al.* 1996a, Lane *et al.* 1996b). Only substrate which is strongly or moderately preferred for spawning or rearing was considered in the evaluation. Please note that identified fish species in Table 19 may not necessarily be using the habitat identified within the proposed cap area.

Placement of the cap will result in a temporary disruption of fish habitat in the proposed capped area. According to the AECOM 2009a, ≥ 94% of the capped material will be sand (0.2mm – 1 mm) and ≤ 6% will be silt (0.002mm – 0.06mm). Therefore, approximately 23.7% to 30% of the proposed capped area is considered to be the same substrate size as the cap material. Since sand will be replaced with sand, it was not considered habitat disruption. Permanent habitat disruption or habitat alteration will occur when the cap material replaces a different substrate and this is discussed below.

Placement of the cap in the aquatic environment will result in the permanent alteration of fish habitat in the Project footprint (*i.e.,* the TLC will cover pre-existing contaminated habitat). The estimated amount of substrate within the proposed cap area includes 75.5% silt, 23.7% sand, 0.7% gravel, and <0.1% cobble. Habitat alteration is expected in areas where the sediment cap material (mostly sand) is replacing a natural habitat substrate size for a new size. For example, habitat alteration will occur in areas with natural cobble and gravel since the cobble and gravel will be replaced with sand. However, these substrates represent a small percentage of the substrate at the contaminated Jellicoe Cove site and are not limiting substrates in Peninsula Harbour. The potential effects of the placement of the clean capping material on substrate types are described below, along with any potential affect this may have on fish species (see Table 19) that may utilize this habitat.

Habitat Alteration Analysis: Cobble and Gravel

In the proposed cap area, approximately 0.7% gravel and <0.1% cobble will be replaced with sand or silt. Therefore, a small amount of cobble and gravel will be covered. Aside from the known mercury and PCB contamination in the cap area, there is little else known regarding the quality of the cobble / gravel habitat (*i.e.,* degree of infilling of interstitial spaces). No current data is available on the fish habitat use of this habitat; therefore, only a habitat evaluation can be conducted. Since the proposed capped area presently contains low amounts of cobble and gravel, the quantity of spawning and rearing habitat for the fish species identified in Table 19 which prefer these substrates would be considered low. Cobble is located in 2 - 16 m in depth along the shoreline near Yser Point where spawning habitat was considered to be good for lake trout (Northern Bioscience 2011, Goodier 1981). Bedrock and cobble are also located along the shorelines in Carden Cove (Northern Bioscience 2011). These studies indicate that alternative locations for cobble do exist within the Peninsula Harbour. Considering this, it is likely that alterative locations for gravel exist in the Harbour as well. Therefore, permanent removal of approximately 1,792 m^2 of gravel (0.7% of cap total area 256,000 m^2) and 41 m^2 of cobble areas (<0.1% of cap total area) will likely have a low impact on these species.

Habitat Alteration Analysis: Silt

In the proposed cap area 75.5% of the substrate consists of contaminated silt which will be replaced with approximately 94% sand and 6% silt. Most species which select silt for spawning and rearing will also select sand; therefore, the proposed cap will have a low impact on those species. For example, species such as burbot, cisco, and alewife which select silt for spawning can also select sand; therefore, the proposed cap should have minimal effect on these species, if these species are using the cap area for spawning. In addition, species such as alewife, rainbow trout and yellow perch which select silt for rearing can also select sand; therefore, the proposed cap should have minimal effect on these species, if these species are using the cap for rearing. The only species which prefers silt and not sand for rearing habitat is northern pike and the proposed cap area was determined to be moderate rearing habitat for pike. However, silt was identified in many locations throughout the Peninsula Harbour and at varying depths (Northern Bioscience) which suggest that it is not a limiting substrate type for species that prefer silt.

Since most species which favour silt will also strongly or moderately favour sand, the proposed cap area is anticipated to have a low impact on these species.

Table 19 Fish species historically found within Jellicoe Cove and spawning and rearing habitat for each species based on depth and substrate which is strongly or moderately preferred

Depth	Substrate	Spawning	Rearing	Area (m2)	% Total
0-1	cobble	Lake Trout	Lake Trout	41	<0.01%
		Lake Whitefish	Cisco		
		Burbot	Mottled Sculpin		
		Cisco	Slimy Sculpin		
		Mottled Sculpin			
		Slimy Sculpin			
		Longnose Dace			
		Alewife			
0-1	gravel	Yellow Perch	Lake Trout	29	<0.01%
		Lake Whitefish	Yellow Perch		
		White Sucker	Lake Whitefish		
		Round Whitefish	Rainbow Trout		
		Burbot	Round whitefish		
		Cisco	Burbot		
		Lake Chub	Cisco		
		Mottled Sculpin	Lake Chub		
		Slimy Sculpin	Rainbow Smelt		
		Longnose Dace	Mottled Sculpin		
		Alewife	Slimy Sculpin		
			Longnose Dace		
			Alewife		
0-1	sand	Yellow Perch	Yellow Perch	1,112	<1%
		Northern Pike	Longnose Sucker		
		Lake Whitefish	Lake Whitefish		
		White Sucker	White Sucker		
		Burbot	Coho Salmon		
		Cisco	Burbot		
		Lake Chub	Rainbow Trout		
		Mottled Sculpin	Round whitefish		
		Longnose Dace	Lake Chub		
		Alewife	Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
			Longnose Dace		
			Alewife		
1-2	gravel	Yellow Perch	Lake Trout	37	<0.01%
		Lake Whitefish	Yellow Perch		

Depth	Substrate	Spawning	Rearing	Area (m2)	% Total
		White Sucker	Lake Whitefish		
		Round Whitefish	Rainbow Trout		
		Burbot	Round Whitefish		
		Cisco	Burbot		
		Lake Chub	Cisco		
		Slimy Sculpin	Lake Chub		
		Longnose Dace	Rainbow Smelt		
		Alewife	Mottled Sculpin		
			Slimy Sculpin		
			Longnose Dace		
			Alewife		
1-2	sand	Yellow Perch	Yellow Perch	2,424	<1%
		Northern Pike	Longnose Sucker		
		Lake Whitefish	Lake Whitefish		
		White Sucker	White Sucker		
		Burbot	Coho Salmon		
		Cisco	Rainbow Trout		
		Lake Chub	Burbot		
		Longnose Dace	Lake Chub		
		Alewife	Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
			Longnose Dace		
			Alewife		
2-5	gravel	Yellow Perch	Lake Trout	338	<1%
		Lake Whitefish	Yellow Perch		
		Round Whitefish	Rainbow Trout		
		Burbot	Round Whitefish		
		Cisco	Burbot		
		Slimy Sculpin	Cisco		
		Alewife	Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
			Alewife		
2-5	sand	Yellow Perch	Yellow Perch	17,942	7%
		Lake Whitefish	Lake Whitefish		
		Burbot	White Sucker		
		Cisco	Coho Salmon		
		Alewife	Rainbow Trout		
			Round Whitefish		
			Burbot		
			Rainbow Smelt		
			Mottled Sculpin		

Depth	Substrate	Spawning	Rearing	Area (m2)	% Total
			Slimy Sculpin		
			Alewife		
2-5	silt	Burbot	Yellow Perch	7,976	3.1%
		Cisco	Northern Pike		
		Alewife	Rainbow Trout		
			Alewife		
5-10	gravel	Yellow Perch	Lake Trout	1,454	<1%
		Lake Whitefish	Lake Whitefish		
		Round Whitefish	Rainbow Trout		
		Cisco	Round Whitefish		
		Slimy Sculpin	Burbot		
			Cisco		
			Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
			Alewife		
			Yellow Perch		
5-10	sand	Yellow Perch	Lake Whitefish	12,289	4.8%
		Lake Whitefish	Coho Salmon		
		Cisco	Rainbow Trout		
			Round Whitefish		
			Burbot		
			Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
			Alewife		
			Yellow Perch		
5-10	silt	Cisco	Rainbow Trout	52,061	20%
			Alewife		
			Yellow Perch		
10+	sand	Yellow Perch	Lake Whitefish	27,011	10.5%
		Lake Whitefish	Coho Salmon		
		Cisco	Round Whitefish		
			Yellow Perch		
			Rainbow Smelt		
			Mottled Sculpin		
			Slimy Sculpin		
10+	silt	Cisco	Yellow Perch	133,472	52%

5.2.4.2 Increased Turbidity, and Potential Injury or Direct Mortality of Fish

Capping activities will result in the suspension of fines from the cap material, and to a lesser extent, a re-suspension of contaminated in-situ sediments including organic materials and increased turbidity. Cap construction will affect the lakebed and will create direct adverse impact with respect to lakebed disturbance. However, such impacts will be temporary and localized to the area immediately around the TLC. When suspension and / or re-suspension occur, the suspended sediments, and potentially contaminants, may be transported over varying distances to other portions of Peninsula Harbour. A temporary increased suspended sediment concentration above background levels has the potential to negatively interact with fish species through habitat (water) quality degradation. High suspended sediment concentrations may damage gills, decrease feeding success, reduce rates of growth or embryo development, decrease resistance to disease and reduce the ability of fish to see and avoid predators, while also reducing the amount of light reaching any submerged vegetation thereby decreasing photosynthesis (Park 2007). Increased turbidity may also reduce the total dissolved oxygen concentrations in the water column in the immediate area. High levels of suspended sediment may be a problem for filter-feeding species; especially those living in relatively clear water, however, these effects will vary depending upon the susceptibility of the species and the nature of the substrate at the site. Other sub lethal effects have been recorded by Appleby and Scaratt (1989), when species were continuously exposed for a period of several days in waters with suspended sediment concentrations of approximately 650 mg/L or greater.

Construction activities will disturb species in the area, potentially resulting in limited direct mortality or injury to fish (including eggs / larvae), especially in lakebed communities. Most adult pelagic and demersal fish species will likely avoid cap placement activities due to the associated noise and vibration from the presence of barges and other Project-related vessels, thereby limiting direct mortality and injury; however, some fish hide rather than flee from threats and will be more likely to suffer injury or mortality as a result. In one study, mortalities were not observed in juvenile coho salmon until artificial sediments reached around 100 g/L (Lake and Hinch 1999); however, stress and gill damage was observed at lower concentrations. Impacts (*i.e.,* direct mortality and injury of fish) from the placement of the cap are likely to be minimal, with recovery to baseline levels occurring over the short-term. Once the cap is in place there will be minimal impacts of this nature thereafter.

In addition to the suspension of sediments associated with cap placement, there may be some sediment disturbance associated with vessel prop wash (barges and support vessels) during the site preparation and construction (contaminated sediment re-suspension), and to a lesser extent, the monitoring phase (re-suspension of cap material). Prop-wash would likely be spatially and temporally limited to within a few meters of the propeller and a timeframe of a few hours.

Re-suspension of cap sediments during the monitoring phase would be infrequent, as monitoring is expected to take place only periodically over the next 20 years. Additional administrative controls may be used to restrict vessel speeds and / or anchoring locations in the area defined by the cap placement, as necessary. Furthermore, the intent and design of the cap has taken into consideration that there is likely to be some disturbance of the cap as a result of recreational / small vessel use (*i.e.,* vessels under 450 horsepower). (Refer to Section 2.3 for details regarding the design of cap materials.)

The grain size of the material to be used for the cap has been designed to minimize the movement of material outside the cap boundary area, both during and after placement. Post cap studies including substrate and aquatic vegetation surveys are presented in Appendix D (Long Term Monitoring).

The mitigation measures presented in Table 18 will be in place to limit the potential interaction and effects of the Project.

It is expected that any plumes of sediment created from Project activities will quickly dissipate from the immediate area and are likely to be limited in magnitude. Although elevated suspended sediment concentrations may cause temporary changes to water quality and the fish habitat quality and use, it is of short term and limited magnitude. A water quality monitoring program, which is provided in Appendix C, has been developed for the Project.

MPI's water intake pipeline is located in the capping area and precautions will be taken by the contractors to ensure that it is not damaged. If MPI is in operation during capping operation, the opening of the pipeline will be covered via geotextile to prevent fines from entering the pipe..

Terrestrial site preparation and construction activities, such as preparation of a construction laydown and material storage area and upgrading access roads (if / as required), transport and storage of capping material to loading site, shorelines modifications and infrastructure improvements (if / as required), and nearshore cap placement may increase the potential for sediment erosion and deposition in surrounding areas. Terrestrial site preparation activities will be done prior to commencement of capping and will not be limited by the in-water fisheries timing window. Mitigation measures to reduce the impacts of sediment erosion are provided in Table 18.

The potential for sediment erosion is expected to be minimal with the implementation of mitigation measures.

It is expected that while fish may face some localized, temporary disturbance to the use of their habitat due to suspended sediments, these effects are predicted to be short-lived and they are not expected to result in long-term adverse alterations. Based on the anticipated turbidity resulting from Project related activity, the effects of turbidity on adult, juvenile, eggs or larvae of fish species are expected to be minimal with the implementation of mitigation measures.

5.2.4.3 Potential for Temporary Disruption of Fish Lifecycles

The construction of the proposed cap may temporarily discourage fish from utilizing the area. Sensitive time periods for fish species in Jellicoe Cove and Peninsula Harbour include the periods of migration, rearing, and spawning (*e.g.,* most species spawn either during spring and early summer, from April to early June, or during the fall and early winter, from mid September to January) and the overwinter starvation period (November to March). The Project schedule has also been developed in consideration of the preferred in-water working windows as defined by MNR. The in-water window defined as deleterious to neither coldwater nor warmwater fish, is from approximately June 15 to September 1. Since the sediment cap construction is proposed to occur during June 15 to September 1, when the eggs of most species have hatched, the main life stages of fish that may be temporarily disrupted are young of the year and adult stages. Adults may be temporality discouraged from foraging in the area, while young of the year may be discouraged from using the area. Adults and young of the year may choose an alternative habitat to use during construction, but it is predicted that most species will return to the capped area and use the area post construction.

Mitigation measures to reduce the impacts of fish lifecycles include the mitigation outlined in Table 18 (Increased Turbidity and Potential Injury or Direct Mortality of Fish). The potential for temporary disruption of fish lifecycles is expected to be minimized with the implementation of mitigation measures.

5.2.4.4 Changes in Prey Distribution and Abundance

The effects on prey distribution and abundance are predicted to be temporary for the proposed Project since the loss of a limited number of individuals is unlikely to cause long-term changes at the population level and they will re-colonize the new habitat at a later date. The proposed cap will smother some existing submergent vegetation; therefore, some small prey fish species which may have used the area due to the submergent vegetation may avoid the area temporarily; however, it is predicted that the submergent vegetation will regrow overtime which would encourage those fish species to return to the area. Furthermore, strategies employed during cap design and placement (*e.g.,* grain size fraction, placement to allow for particle broadcasting) will provide adequate protection against excessive disturbance and damage to adjacent aquatic organisms and habitats.

Mitigation measures to reduce the impacts of prey distribution and abundance include the mitigation outlined in Table 18 (Increased Turbidity and Potential Injury or Direct Mortality of Fish).

The potential short term effects of the proposed Project on changes in prey distribution and abundance are expected to be minimal with the implementation of mitigation measures. The potential long term effects of the proposed Project on changes in prey distribution and abundance are expected to be minimal.

5.2.4.1 Potential Re-suspension of Contaminated Sediment

An evaluation of contaminated sediment re-suspension potential determined that although some contaminant re-suspension often occurs during capping operations, in general, contaminant re-suspension is relatively low for all capping events. As the capping material reaches the bottom, it will generally spread radially outward from the center of impact, potentially causing re-suspension of in-situ sediment at the immediate sediment-water interface. Section 2.4.2.2 provides a detailed description regarding the cap placement technique and interaction with native sediment.
Mitigation measures to reduce the increase in contaminant levels during the cap placement include the mitigation outlined in Table 18 Increased Turbidity and Potential Injury or Direct Mortality of Fish and by placing the cap material in lifts which will minimize the magnitude of the effect.

The potential increase in contaminant levels is expected to be minimized with the implementation of mitigation measures.

5.2.4.2 Noise and Vibration Effects

Project related vessels will be used to some extent during the site preparation / construction and operations / monitoring / maintenance phases of the Project, increasing the level of marine vessel traffic, noise and vibration in the area (*e.g.,* vessel engine noise, vessel ancillary equipment). Fish species utilize sound for communication, as well as for predator and prey detection, taking advantage of the rapid propagation of sound through water to perceive and discriminate sounds in the aquatic environment (Smith *et al.* 2004). Therefore, there is a potential for an interaction to occur between vessels and the impact of fish hearing. Physiological effects of sound on fish have been summarized as follows:

192 dB (1 μPa): transient stunning;
200 dB (1 μPa): internal injuries;
220 dB (1 μPa): egg / larval damage; and
230 – 240 dB (1 μPa): fish mortality (Turnpenny and Nedwell 1994).

Very few studies have been conducted to determine the effects of high levels of ambient sound on fish; however, behavioural responses of fish to high levels of ambient sound may include temporary avoidance of the area, including avoidance of primary feeding or spawning areas for the duration of this disturbance (Smith *et al.* 2004, Popper 2003). Such behavioural responses could permanently affect behavioural patterns, reproductive success and survival rates. A potential concern of noise and vibration for pink salmon is auditory masking. Noises from construction have the potential to mask the sounds of impeding predators either through difficulty in detection or though noise habituation overtime. Another concern would be the effects of noise on salmonid fitness; however, more research is necessary. Other potential effects of high levels of ambient sound on fish include hearing damage which may increase risk of predation, alter reproduction or feeding behaviours, or initiate fish freezing (staying in place) which may further increase the risk of hearing damage (Popper 2003).

In general, the source level of ship noise increases with ship or barge size, speed, propeller blade size, number of blades, and rotations per minute (Ross 1976, Gray and Greeley 1980, Scrimger and Heitmeyer 1991, Richardson *et al.* 1995, Hamson 1997). As such, the noise generated by vessel traffic will vary depending on the activity and the vessels used. Construction activities will require large vessels and barges for cap placement. Aquatic construction activities are expected to be of short duration (approximately nine (9) weeks), given the proposed schedule. Vessel traffic during operations, monitoring and maintenance is also expected to be of short duration and intermittent, and will use smaller vessels. It has been reported by Richardson *et al.* (1995) that typical vessel traffic (*e.g.,* barges, tugs and bulk carriers) generally produce sound levels between 168 and 193 dB (1 μPa) at 1 m distance. Large vessels required during construction will be limited in number and duration of use. Support vessels used during construction and vessel requirements during operation, monitoring and maintenance are also expected to be of short duration and intermittent, and will use smaller vessels. In addition, Jellicoe Cove the location of the MPI pier has previously been used by marine vessels, such that noise levels produced by the Project will not be abnormal when compared to historic background noise levels in the cove.

Most species of fish have the ability to detect low frequency sounds over great distances (Chapman 1973). Underwater noises from construction activities can be heard by Pacific salmon > 600 m from the source, and pink salmon may be similarly affected (Feist *et al.* 1992). This study suggests that certain salmonid species within 600 m of the proposed capped area could be affected by noise during construction of the cap. The main concern would be the mouth of Shack Creek which is approximately 250 m from the proposed capped area. Fish species residing in Beatty Cove and Carden Cove will likely not be affected since these coves are located approximately 1 km from the proposed capped area.

Mitigation measures to reduce the effects of noise of fish during the cap construction are provided in Table 18 Alteration and Disruption of Habitat.

Based on the anticipated noise levels resulting from Project related vessel traffic, the effects of noise on adult, juvenile, eggs or larvae of fish species are expected to be minimized with the implementation of mitigation measures, as noise levels will not exceed the thresholds for damage to fish (*e.g.,* 192 dB).

5.2.4.3 Conclusion

Fish species present are moderately resilient to sensitive to disturbances in the aquatic environment. No critical habitat was identified at the Project site; however, intensive surveys were not conducted in nearshore areas. Two (2) nearshore areas close to the cap area have been identified: one on the south-west and the other on the southeast side of the cap area. These areas may contain potential sensitive fish habitat. Should sensitive fish habitat be found, precautions will be taken to protect these areas (e.g. turbidity curtains may be used and the turbidity within the curtain area must meet the turbidity criteria specified in Table 2).. Post cap monitoring surveys will be undertaken to assess the recovery of aquatic vegetation and benthic community.

Approximately 100,000 m^2 of aquatic vegetation may be disrupted by the capping activity. Vegetation height less than 15 to 20 cm will be smothered by sand. It is anticipated that the vegetation will re-grow overtime and that prey fish species will return to the area; however, the length of time for recovery is unknown. Benthic invertebrates and general forage habitat will also take a number of years to recolonize. Monitoring will be done to assess recovery/recolonization.

Approximately 2,000 m^2 of gravel and some cobble areas will be permanently destroyed by this project; however, this substrate is found elsewhere in Peninsula Harbour and has not been deemed critical habitat. As a result, the impact to the availability of this type of habitat in the local area is expected to be minimal.

The use of the appropriate mitigation measures, as described in this Section and Table 18, will effectively minimize the extent of the effects of the Project and **no significant adverse environmental effects** are expected. While there are significant adverse environmental effects expected from the Project, the Risk Assessment conducted by DFO has determined an authorization will be required for a Harmful Alteration, Disturbance or Destruction (HADD) of existing fish habitat.

At present, the Project area includes sediments with high concentrations of contaminants. Such sediments are known to be toxic to different sediment-dwelling species, which fish rely on for food, hence, it is expected that the application of a TLC will reduce the exposure of receptors to the contaminated sediments, and result in a decreased flux of contaminants from the Jellicoe Cove site to Peninsula Harbour and Lake Superior. The long-term outcome of capping contaminated sediments is anticipated to have a positive effect on Fish and Fish Habitat and overall water quality for Jellicoe Cove and Peninsula Harbour.

5.2.5 Summary of Residual Environmental Effects

By following existing standard construction practices, available guidelines and associated mitigation measures, Project activities and components are not likely to cause significant adverse residual effects on fish within the Project area or vicinity (*i.e.,* Jellicoe Cove, Shack Creek and Peninsula Harbour). In general, this is due to the relatively small scale of the Project, combined with the limited duration of Project construction activities and adherence to the preferred in-water working windows defined by MNR (June 15 to September 1). Also refer to Section 5.1.5.

The net adverse residual environmental effect on Fish Habitat within the Project area or vicinity (*i.e.,* Jellicoe Cove and Peninsula Harbour), is considered to be **not significant** given the standard construction practices and given the likely long-term benefits of the remediation and available guidelines and mitigation measures that will be in place to minimize potential shorter-term impacts.

Cumulative effects are assessed in Section 8.0 and accidental events are assessed in Section 6.0.

5.3 Wildlife

Wildlife is retained as a VEC in consideration of the potential environmental effects of Project activities on the terrestrial environment adjacent to Jellicoe Cove and the species that inhabit the Project area, and due to the important role that these species play within the ecosystem. Wildlife in this context refers to all terrestrial mammals, birds and herpetiles (amphibians and reptiles) that may interact with the Project, as well as habitat, including vegetation which is important to these species. Additionally, this VEC includes all Wildlife and habitats considered to be rare in Ontario that may interact with the Project. Rare species, by definition, are of interest and often warrant special consideration. Fish and Fish Habitat, including fish species at risk, are discussed in Section 5.2.

5.3.1 Boundaries

Interactions between Wildlife and the proposed Project are limited spatially to the immediate Project area, and include: Jellicoe Cove, terrestrial shoreline equipment use and access areas where the loading structure and conveyor are positioned (*i.e.,* the MPI pier), stockpile and staging areas and access routes. It is acknowledged that the Project Contractor may select an alternate dock and material laydown area. Should this be the case, the Contractor is responsible for ensuring that the selected site is suitable for development; that is, undertake any necessary environmental evaluations at the site in consideration of rare and sensitive wildlife species and habitat to ensure compliance with all relevant federal and provincial legislation and provide documentation of the evaluation to the satisfaction of proponent.

The temporal boundary for this assessment is confined to the duration of active Project site preparation and construction activities. Because the resulting cap will be installed underwater, the cap will have no residual adverse impacts on wildlife; on the contrary, once the sediment contaminants are covered, ecosystem health overall is expected to improve. The cap is considered to be a permanent fixture such that removal or decommissioning of the cap itself is not expected. Occasional monitoring of the cap will be undertaken at multi-year intervals, however, this activity not expected to significantly impact wildlife in the area, which is presumably habituated to the noise of occasional vessel traffic.

Temporal boundaries for birds will also vary by species. Many bird species are migratory while some species do not travel far from specific areas (resident). The breeding season (generally April 1st to August 15th) is typically the most critical time for birds, since birds are especially sensitive to habitat destruction and disturbance during the breeding season: eggs and nestlings cannot avoid areas of disturbance and adults may abandon nests in response to noise to visual stimulus.

The following administrative boundaries apply to the management of contaminated sediment in Jellicoe Cove:

- The federal *MBCA* administered by EC's Canadian Wildlife Service (CWS) protects all migratory bird species in Canada, prohibiting the killing, injuring or harassing of migratory birds, or the destruction of their eggs or their young without a permit.
- The federal *SARA* protects wildlife species from becoming extinct through prohibitions against killing, harming, harassing, capturing or taking species at risk, and against destroying their critical habitats.
- Under provincial policies and regulations, the OMNR is responsible for species at risk on Crown and private lands via the *Endangered Species Act*.

5.3.2 Significance Criteria

A **significant** adverse effect on Wildlife is defined as a decline or change in abundance or distribution of the population over one or more generations, such that natural recruitment may not reestablish the population to its original level, or avoidance of the area becomes permanent; a serious injury to or the loss of one or more individuals from within a population of a species having special conservation status; or any substantial change in distribution, migration or behavioural patterns. A significant effect to wildlife habitat is one that alters the quality or extent of valued habitat physically, chemically, and / or biologically, such that there is a decline in the species diversity, species abundance, composition and / or change of habitat components.

An adverse effect that does not meet the above criteria is evaluated as **not significant**.

A **positive** effect on Wildlife is defined as an enhancement in the quality or extent of habitat, an increase in species health, richness, diversity and abundance or an enhancement of a population such that an increase in that population is evident, or such that natural mortality is reduced.

5.3.3 Potential Issues, Interactions and Concerns

Completion of the Project is expected to have a positive long-term effect on Wildlife, improving the quality of available habitat by decreasing the contaminant flux from disturbance of contaminated sediments. Additionally, sediment remediation will separate contaminated sediments from receptors and reduce the spread of these contaminants to the rest of Peninsula Harbour via re-suspension in the water column. In the short-term however, potential exists for an increase in contaminant flux during cap placement which may disrupt the foraging of Wildlife in the area and should sediment re-suspension during capping causes contaminant increases in fish, then mink or other mammal and bird species may ingest these fish and accumulate the contaminants.

In the short-term site preparation construction activities, such as the use of front end loaders and conveyors to transfer the capping material to barges, operation of vehicles, boats and barges, and other work can negatively impact Wildlife through an increase in noise, production of unfamiliar odours, the use of lights and the visual presence of machinery and humans. In addition (for the duration of the site preparation and construction phase), work activities will also occupy an area of previously disturbed shoreline and aquatic habitat, preventing its use by foraging or feeding species.

As previously noted, terrestrial portions of the proposed Project area do not provide a wide variety of habitat types necessary to support diverse wildlife communities. In general, the Project area is unrepresentative of natural habitat (Beak 2000) and areas designated for Project activities will consist of previously disturbed areas. The Contractor reserves the option of using previously undisturbed areas for Project-related activities.

The proposed Project may result in limited direct mortality to small Wildlife species (larger individuals would likely flee in response to human presence and noise), habitat modification, temporary nest desertion by birds (including species at risk) in non-disturbed areas, the temporary avoidance of the Project area by Wildlife, which could result in the potential disruption of species lifecycles. It is expected that once site preparation and construction activities are complete Wildlife would return to these areas.

5.3.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Table 20 Wildlife Residual Environmental Effects Assessment Matrix

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Wildlife							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Site Preparation	Alteration and Disruption of Habitat (A)	• As per Table 18; and • Artificial lighting required to work throughout the night will be kept to only what is required for the safe operation of vessels and equipment and will be angled in the direction of activity.	1	1	1	R	2
	Injury or Mortality (A)	• Surveyors and workers will keep an eye out for the common nighthawks and if observed, EC's CWS will be contacted. • If any nests are observed, all work in the vicinity will stop and the proponent will contact CWS for further advice.	1	1	1	R	2
Construction	Alteration and Disruption of Habitat (A)	• As per Tables 17 and 18; and • As above.	1	1	1	R	2
	Injury or Mortality (A)	• As above.	1	1	1	R	2
	Long-term Improvement in Sediment Toxicity (P)	• N/A	2	2	6	R	2
	Potential Disruption of Species Lifecycles (A)	• As above.	1	1	1	R	2
Post-Construction Monitoring	Temporary Re-suspension of Contaminated Sediment and Increase in Turbidity (A)	• As per Tables 17 and 18; and • As above.	1	1	1	R	2

Legend

Magnitude[1]:
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2
6 = > 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

Project related site preparation and construction have the potential to affect Wildlife in the Project area as well as wildlife habitat (as described above, Section 5.3.3), however, direct wildlife habitat loss and habitat fragmentation is not expected to result from this Project. Given the lack of wetlands within the Project area, it is unlikely that significant populations of amphibians will be encountered at Jellicoe Cove. Of the 16 species at risk that may potentially occur within the region, the majority are highly unlikely to occur at or immediately near the Project area, due to lack of appropriate habitat (Section 3.1.5.4). While these species may be present in the region, they are unlikely to present at or immediately adjacent to the work area and are thus unlikely to be directly or indirectly affected by the Project.

Construction will disturb Wildlife species in the area, potentially resulting in limited direct mortality or injury of small Wildlife species in the immediate area of terrestrial activities due to vehicle collisions. It is unlikely that large and medium sized Wildlife will suffer direct mortality, as they would flee the area in response to human presence and noise. Similarly, mobile turtles and snakes are expected to temporarily avoid work areas during the construction period. This type of avoidance behaviour has the potential to result in changes in normal movements, migrations or other life history processes of the species in certain situations.

The previously disturbed terrestrial Project footprint does not contain critical habitat for mammal, herpetile or bird species. Certain bird species may be attracted to Project lighting. Refer to Table 20 above for mitigation measures. None of the mammal or herpetile species likely to inhabit the Project area would be particularly sensitive to anthropogenic activities and all are considered to be relatively common species. As such, the limited loss of any individuals would not threaten the existence of local populations as their ubiquitous populations throughout the Marathon area will suffice to re-colonize. Once construction is complete and there is an absence of human presence and noise, any species displaced by Project related activities would continue to be found around the Project, having moved back in from adjacent areas.

Breeding birds are expected to be the most sensitive Wildlife type to noise and human or mechanical activity associated with the Project. While designated Project areas do not appear to support nesting habitat for most bird species, noise, vibration and visual effects may result in temporary nest desertion in adjacent (non-disturbed) areas. This in turn may result in temporary exposure of hatchlings and eggs and increased predation. The common nighthawk (COSEWIC threatened species and species of special concern under the *Endangered Species Act)* prefers open area habitats with little to no ground vegetation (forest clearings, beaches, lakeshores, rock barrens, peat bogs); however, this species also nests in fields, orchards, and along gravel roads and railways, occupying both natural and urban sites.

Of the species at risk that may use Jellicoe Cove for feeding (such as the peregrine falcon, bald eagle, chimney swift and black tern), noise and movement associated with boating and construction will temporarily displace these species from the Cove to neighbouring feeding areas. Once construction is complete and noise levels return to normal, these species would be expected to return to Jellicoe Cove. This temporary displacement is not expected to significantly impact populations of these species. Given the size (and duration) of the Project and the industrialized nature of the Project area, the extent of disturbance to breeding birds in adjacent areas is expected to be limited. Direct mortality or injury of adult birds is unlikely as they would be expected to temporarily flee the area, returning when noise levels abate.

The area required for the construction laydown and material storage will be kept as small as possible to accommodate construction equipment and material storage. This previously disturbed site does not appear to serve as critical habitat for any species but this habitat type can be used by the common nighthawk, a designated species at risk. According to M. Butler, a local bird watcher, common nighthawks have not been observed in the Project area (communication with M. Butler, June 2011).

Given that project timing directly overlaps with the breeding season, there is potential for nesting waterbirds (waterfowl and gulls) in the Project area.

In addition, surveyors and workers will keep an eye out for common nighthawks, and if observed, will contact CWS, EC. No follow up monitoring is proposed once construction is underway or after construction has been completed.

Construction on the Project site may adversely affect herpetile populations by adversely modifying habitat (*e.g.,* through siltation), particularly when disturbed soil remains exposed to the elements. Alternatively, construction activities can positively affect herpetile populations through the creation road side ditch pools which can provide amphibian breeding habitat and the creation of habitat edges (favoured by certain species of snake). Generic plans for erosion and sediment control will be developed as part of the Project design and specific plans will be developed by the Contractor for the specific laydown area selected (see Section 2.4.1.2).

Should sediment re-suspension during capping causes contaminant increases in fish, then mink or other mammal and bird species may ingest these fish and accumulate the contaminants. Re-suspension is generally relatively low for all capping events, and can be further minimized through proper selection of cap materials and placement methods (see Sections 2.3 and 2.4.2.2). Any sediment plumes created from Project activities will be temporary in nature and limited in magnitude, dissipating quickly from the immediate area. This potential impact (if it occurs) would be minor and offset by the greater benefit of reduced contaminant movement following capping. No specific additional mitigation measures (other than those described above and in Sections 5.1.4 and 5.2.4) are proposed to limit sediment re-suspension during capping operations.

5.3.5 Summary of Residual Environmental Effects

By following existing standard construction practices, available guidelines and associated mitigation measures, Project activities and components are **not likely to cause significant adverse residual effects** on Wildlife within the Project area or vicinity (*i.e.,* Jellicoe Cove and Peninsula Harbour). In general, this is due to limited duration of Project construction activities and the previously disturbed nature of terrestrial portions of the Project area.

It is presumed that the isolation of these contaminated sediments will result in the long-term improvement of available habitat by decreasing the contaminant flux from disturbance of contaminated sediments. Additionally, sediment remediation will separate contaminated sediments from receptors and reduce the spread of these contaminants to the rest of Peninsula Harbour via re-suspension in the water column. The net adverse residual environmental effect on Wildlife within the Project area or vicinity (*i.e.,* Jellicoe Cove and Peninsula Harbour), is considered to be **not significant**.

Cumulative effects are assessed in Section 8.0 and accidental events are assessed in Section 6.0.

5.4 Land and Resource Use

Land and Resource Use have been selected as a VSC due to its importance to social and economic development and the value they bring to the community and residents. Land and Resource Use includes all existing residential, industrial and commercial land use, as well as settlement areas, lands used for recreation and tourism, transportation and navigation, agriculture and resource use (*e.g.,* forestry, fishing), and other areas of special community or social value. The nature and extent of developed lands, areas used for recreation and tourism, and other areas of special value are important determinants of the socio-economic character of a community.

The potential environmental effects of the Project on Land and Resource Use are a particular concern to the public, stakeholders and individuals in the areas adjacent or in close proximity to the Project site as well as on ancillary sites and activities. In this assessment, the potential change to existing land and resource uses were examined from possible Project-related changes to the physical environment. This assessment considers Project-related noise, lights, and air quality as they might affect the use or enjoyment of the surrounding properties. The Project may also result in reduced access to and use of land and water for recreational activities, as well as changes to shipping and navigation.

5.4.1 Boundaries

Spatial boundaries for the Project include the cap area, the terrestrial material laydown and storage area as well as the zones of influence / disturbance associated with Project activities. The spatial boundaries also include the transport of material to the laydown area and subsequently to the cap area. The boundaries extend to all lands outside of the Project footprint that could potentially be indirectly affected by the Project.

Temporal boundaries of the Project effects on Land and Resource Use include all Project phases. Certain uses may be seasonal in nature (*e.g.,* recreational) and / or may have seasonal sensitivities (*e.g.,* residential, fisheries) with respect to Project activities, which should be considered in Project planning.

The assessment of potential interactions of the Project on Land and Resource Use is based on existing documented information, information gathered during open house sessions and meetings with the community liaison committee, as well as personal communications with key informants via telephone and email.

5.4.2 Significance Criteria

A **significant** adverse effect on Land and Resource Use (*i.e.,* residential, industrial, commercial, fisheries, shipping, navigation, tourism and / or recreational land use) is one where the proposed Project's land or resource use is not compatible with adjacent land and / or resource use and the proposed Project's land or resource use will create a change or disruption that restricts or degrades present land and / or resource uses such that the activities cannot continue at current or recent levels for extended periods of time, and are not compensated.

An adverse effect that does not meet the above criteria is evaluated as **not significant**.

A **positive** effect occurs when the Project results in enhanced land and / or resource use for residential, commercial, industrial, fisheries, transportation, navigation, tourism and / or recreational uses.

5.4.3 Potential Issues, Interactions and Concerns

The potential exists for Project activities, particularly during the site preparation and construction phase, to disrupt adjacent land and resource use, both in the immediate vicinity of the of the active construction site as well as adjacent to the material laydown and storage area and potentially along the material haul route. Disruption could result from dust, noise, and lights associated with movement of vehicles and construction activities as well as increased traffic along local roads.

There is potential for activities and vessels associated with the placement of the cap in Jellicoe Cove to interact with shipping and navigation both during construction and after construction is complete. During placement, commercial / industrial shipping and navigation (if any) as well as tourism and recreational activities in the Cove will be restricted within 100 m of the active placement area.

All future activities in the Project area need to take into consideration the presence of contaminated sediments and the thin-layer cap.

Commercial fishing in Peninsula Harbour is non-existent (P. Addison MNR pers.comm. 2009; OMNR Lake Superior Management Unit 2000). Sport and recreational fishing in the Harbour are known to occur sporadically in the general area and therefore may be temporarily limited by cap placement activities. Once the cap is in place, restrictions on sport and recreational fishing are not anticipated as a result of the Project.

5.4.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Table 21 Land Use Residual Environmental Effects Assessment Matrix

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Land Use							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Site Preparation	Disruption of Adjacent Land and Resource Use (A)	• As per Tables 19 and 20; • To the extent possible, select a laydown area that is located away from businesses and residences; and • Use water to control dust as required.	1	1	1	R	1
Construction	Disruption of Adjacent Land and Resource Use (A)	• As per Tables 17, 18 and 20; • Construction generated noise will be minimized to the extent possible and will be reduced through proper selection, maintenance and inspection of vessels and equipment and will be kept within provincial guidelines; • To the extent possible, trucking activities will be limited during the evening and night time hours of 7pm to 7am to only what is necessary to maintain production; • Schedule cap placement activities so as to minimize the duration that access to the MPI dock is limited by the safety operating zone; and • Adherence to conditions of *NWPA* Approval (see Section 10.2).	1	1	1	R	1
	Restriction of Land and Resource Use (A)	• As above.	1	1	1	R	1
	Long-term Improvement in Sediment Toxicity (P)	• N/A	2	2	6	R	2
Post-Construction Monitoring	Disruption of Adjacent Land and Resource Use (A)	• As per Tables 17, 18, and 20; • Implementation of an Administrative Control program (see discussion in Section 9.0 and Guidance Document in Appendix E).	1	1	1	R	1

Legend

Magnitude[1]:
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2
6 = > 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not applicable
A = Adverse
P = Positive

As indicated in Section 3.2.3, land development in the immediate vicinity of the cap consists of industrial use (*i.e.,* former MPI facility), transportation (*i.e.,* roads and railways) and an undeveloped forested area (*i.e.,* The Peninsula). Beyond these areas bordering the site, approximately 300 m and more away, are commercial and residential lands in the Town of Marathon. Given the industrial nature of the Cove area, nearby businesses and residents are anticipated to be accustomed to an elevated level of noise, lights and dust that are associated with industrial operations which are often not unlike a construction site. Despite this and the separation distance between the site and the businesses and residences, cap placement is scheduled to occur in the summer and on a 24 hr/day basis and, as such, the mitigation measures listed above (Table 21) will be implemented to minimize the potential for the disruption associated with construction.

Once the cap is placed, these disruptions will cease. Periodic monitoring to be conducted after construction will involve much smaller, recreational type vessels and will occur over a matter of a few days. Due to the limited nature of the post-construction activities, no specific mitigation related to minimizing noise, lights, and dust is required.

Noise, lights and dust are also anticipated to result from activities at the laydown and material storage area. Although the location of the laydown area has not been selected, the mitigation measures listed above (Table 21) are provided to ensure that disruption to any adjacent land uses and users is minimized.

Trucks hauling material will be appropriately selected, maintained and inspected to minimize noise. Trucks will haul from an approved borrow pit, will use local and provincial roads (avoiding residential areas and school zones to the extent possible), and will follow designated speed limits. Truck boxes will be covered to prevent the loss of material during transport. Truck or vessel traffic as well as noise, lights, and dust are not anticipated to result in significant adverse environmental effects on adjacent land uses and users either at the Project site or along the material transport route.

During placement of the cap in the Cove, all other non-Project related vessels (*e.g.,* commercial, recreational) will be restricted within approximately 100 m of the active construction area. The purpose of this restriction it twofold:

- To maintain public safety and minimize potential vessel collisions;
- To minimize the potential for disruption of material placement.

This restriction / safety operating zone will be accomplished via public notification (*e.g.,* radio announcements, local newspaper, publication in the Canada Gazette, posted as a Notice to Mariners, etc.) and the installation of signage and buoys around the work area. Although the MPI dock is not currently used on a consistent, regular, or even daily basis, the Contractor will schedule cap placement activities so as to minimize the duration that access to the MPI dock is limited by the safety operating zone. Given the relative small area of the exclusion zone compared to the available area for boating and navigation and the temporary nature of activity, this restriction will not cause a significant adverse environment effect on vessel use and operation in the Cove.

Some movement or shifting of the cap material due to natural events or propeller wash is expected and the design of the cap is able to accommodate this (AECOM 2009c, ENVIRON 2009). (Refer to Section 2.3 for details regarding the design of cap materials.) Because the TLC is intentionally not armoured, some localized re-suspension and re-deposition of the TLC and underlying sediments may occur during storms, by ice, and by propeller wash. Nevertheless, it is judged that such localized re-suspension and re-deposition will not impact the overall, global effectiveness of the cap.

There may be potential future uses and / or projects proposed for the Project area that may result in damage to the cap such that the integrity is compromised. To ensure that proposed future activities and projects do not significantly affect the cap, each Project / activity will be evaluated and, if required, will implement measures to protect the cap to minimize exposure of the contaminated sediments below. The process of evaluating and managing future projects and activities in Jellicoe Cove will be accomplished via existing administrative controls (see discussion in Section 9.0 and Guidance Document in Appendix E). Implementation of the existing administrative controls is not anticipated to result in a significant adverse environmental effect on potential future land uses.

With regards to recreational fishing, these boats, like all other non-project related vessel traffic, will be temporarily restricted from entering the active work area during cap placement. Given the limited recreational fishing that is known and anticipated to occur in the general area and the limited duration and extent of the exclusion area, significant adverse environmental effects on sport and recreational fishing are not anticipated. Over the long-term, a **positive effect** may be realized as ecosystem health improves and restrictions on fish consumption may be adjusted and perhaps eventually lifted.

5.4.5 Summary of Residual Environmental Effects

The disruptions to adjacent land and resource use that may result from site preparation and construction activities are temporary in nature and short or intermittent duration. Limitations or restrictions on current and future land and resource use once the cap is placed are anticipated to be minimal, assuming that the existing administrative controls are implemented and proper consideration is provided to the protection of the cap and the environment. With the implementation of the mitigative measures provided herein, the net adverse residual environmental effect on Land and Resource within and adjacent to Project-related activities is considered to be **not significant.**

Cumulative effects are assessed in Section 8.0 and accidental events are assessed in Section 6.0.

6. Assessment of Accidental Events

A number of accidents and malfunctions can be associated with projects, including failures of safety precautions, fuel / lubricant spills, containment failures and power outages. With regard to the Peninsula Harbour Contaminated Sediment Management Project, accidental events and malfunctions are limited to fuel / lubricant spills released into the aquatic environment and, to a lesser extent, the terrestrial environment, vessel collisions and failures of safety / mitigation measures. It is difficult to predict the exact nature and severity of events should they occur, however, the probability of serious accidental events causing significant adverse environmental effects is low since construction and monitoring procedures will be designed to incorporate contingency and emergency response planning.

All necessary precautions will be taken by the proponent to prevent the occurrence of accidents and malfunctions which may occur during the life of the Project, and to minimize any environmental effects of such events. Construction and monitoring activities will be conducted in accordance with all relevant regulations, guidelines and industry BMPs.

The objective of assessing possible accidents, malfunctions and unplanned events is to ensure that:

- Potential accidents, malfunctions and unplanned events are identified so that response can be planned;
- Abnormal events or conditions which could upset Project operations are considered; and
- The significance of the residual effects from accidental events is determined (after mitigative measures are implemented).

The focus of the assessment is on those events that are considered credible in the context of the Project and its environmental setting. This assessment will not address all conceivable accidents, malfunctions or unplanned events, but only those that are perceived to have a reasonable probability of occurring, and which may have an effect on the socio-economic or natural environment, considering the design of the Project and the site specific conditions.

Accidents, malfunctions and unplanned events may also be instigated by external factors (natural or man-made). This assessment considered the likelihood of such instigating events as well as the resulting effects of such events. In particular, external factors that may lead to malfunctions and accidents include: potential ice damage; potential seismic damage; wave damage; and changing lake levels. These events, which may be caused by extreme weather conditions, are related to the effects of the environment on the Project, which are discussed further in Section 8.0.

All of the identified accidents, malfunctions or unplanned events are likely to be temporary in nature and limited in duration. Considering the Project specific mitigation measures contained throughout this document, accidents, malfunctions and unplanned events are expected to be rare, and the consequences temporary and subject to immediate clean-up and remedial measures, if required.

6.1 Spills

6.1.1 Terrestrial Spills

During all phases of the proposed Project (*i.e.,* site preparation and construction, monitoring and maintenance activities), spills of petroleum, oils or lubricants could occur while refuelling equipment or transferring fuel from fuelling trucks to shore based and marine vessels and equipment. Such spills would be limited to relatively small quantities, and would be highly localized and easily cleaned up by Project crews using standard equipment. In the unlikely event of a large spill, soils, surface and groundwater contamination could occur, with potential to adversely affect fish and fish habitat, wildlife by immersion, ingestion or uptake, and depending on the nature of the spill, archaeological or heritage resources, or residential and other land uses. Prevention of spills is the most important step in averting these potential effects. Based on site conditions, an appropriate Spill Prevention and Emergency Response and Contingency Plan will be submitted by the Contractor for review. The plan will follow MOE's Guideline for Implementing Spill Prevention and Contingency Plans Regulatory Requirements – O.Reg. 224/07 (MOE 2007). The plan will contain industry Best Management Practices (BMPs) to minimize the likelihood of a spill, as well as procedures for training and orientation of employees and contractors. The plan will also address when and how the responsibility for implementation of the plan will be determined and identified, who will pay for cleanup and restoration in the event of a spill or leak, and within what timeframe.

All petroleum, oils or lubricants as well as any other hazardous materials will be stored and handled in accordance with procedures contained in the plan, and the use of non-toxic lubricants (such as vegetable based oils) will be considered whenever possible. Proper equipment selection, regular inspections and maintenance programs will ensure the reliability and integrity of Project equipment.

In the event of a minor spill or leak during refuelling or general equipment operation, actions will immediately be taken to stop and contain the spilled material. All spills will be reported to required government agencies according to MOE Spill Action Centre's Spills Reporting – A Guide to Reporting Spills and Discharges as Required by the (Ontario) Environmental Protection Act (s.92 and s.15) and Ontario Regulation 675/98 Classification and Exemption of Spills Reporting of Discharges (MOE 2007). A Spill Prevention and Emergency Response and Contingency Plan developed for the Project will contain contingencies for spills, including the type and use of cleanup equipment, training of personnel and identification of personnel to direct cleanup efforts, lines of communications and organizations that could assist cleanup operations. In the case of a minor spill, based on the nature and quantity of liquids available and mitigation and contingency planning, the adverse environmental effects expected from unplanned spills are not considered significant.

In the unlikely event of a large spill of petroleum, oils or lubricants, local and provincial emergency response procedures will be invoked to minimize impacts. The environmental effects of an accident, malfunction or unplanned spill on soils, surface and groundwater, fish and fish habitat, and wildlife are considered significant, but very unlikely.

6.1.2 Aquatic Spills

In the aquatic environment, barges will be used to undertake Project activities. Accidental leaks of petroleum products during equipment fuelling and maintenance may occur. Small spills / leaks are most likely to occur at valves and hose connections. If large quantities of hazardous materials were to be spilled into the aquatic environment, there is potential for significant adverse effects on biota, mammals, birds and aquatic habitat. Any spills into the aquatic environment will likely be small in quantity and frequency and will disperse rapidly.

Adherence to BMPs and proper equipment selection, inspection and maintenance will help to prevent potential accidental spills. Storage areas containing petroleum products will have secondary containment to prevent discharges onto decks and into the aquatic environment. A Spill Prevention and Emergency Response and Contingency Plan for accident scenarios will be in place by the vessel contractors to ensure containment of any potential spills. Spill response planning will reduce the likelihood of contamination of the aquatic environment. The emergency response plan will provide details regarding procedures for responding to larger or more serious spills, including contracts for first responders and cleanup crews. The appropriate regulatory authorities (*e.g.,* Coast Guard, EC, and MOE) will be notified of all spills in accordance with the relevant regulations.

All shipping activities will be conducted in compliance with the *Canada Shipping Act* requirements for vessel inspection and certification, and training and appropriate certificates of competency for operators. Vessels and operators will be required to have procedures in place to safeguard against aquatic pollution including, but not limited to awareness training of all employees, means of retention of waste oil on board and discharge to shore based reception facilities, and capacity of responding to and clean-up of accidental spills caused by vessels involved in the Project. All construction vessels will be required to adhere to all applicable federal and local pollution prevention requirements.

The vessel contractor(s) selected for the Project will be required to provide a Project-specific Spill Prevention and Emergency Response and Contingency Plan. Components of the response plan may include, but will not necessarily be limited to:

- Measures to prevent birds from coming into contact with spilled oil such as hazing or release of scare devices;
- Measures to prevent birds and fish from contacting oil by getting oil off the surface of the water as soon as possible through dispersion of spilled material, using chemical or mechanical dispersants or natural dispersal by environmental conditions;
- Implementation of a humane response (*i.e.,* rehabilitation or euthanization) to oiled birds as required by EC's National Policy on Oiled Birds and Oiled Species at Risk, through bird collection (ship-based effort) of live and dead birds both within the spill area and adjacent to it;
- Determination of the potential impact of the spill by monitoring wildlife by ship, structured aerial surveys, and placement of EC's CWS staff on vessels and aircraft; and
- Beached bird surveys to determine the potential impact of the spill and identify any live wildlife in distress in order to implement a humane response (*i.e.,* euthanization or rehabilitation).

Effects of localized, minor spills on the aquatic environment would be minimal, as any such spills would be rapidly cleaned up in accordance with the Spill Response and Emergency Response and Contingency Plans. A major spill is unlikely given the limited volumes of liquids that would be available at any given time; however should the unlikely occur emergency response would be rapid due to emergency response planning. If such an event occurs, procedures will be triggered to respond to and investigate the occurrence and institute any corrective actions deemed appropriate. Given the low likelihood of a spill, the minimal anticipated volume and the emergency response procedures, no significant environment effects are expected from spills to the aquatic environment.

6.2 Vessel Accidents / Collisions

During the Project there is the potential for Project vessels / barges to collide with transportation vessels. The risk of collision between vessels is expected to be extremely low based on compliance with standard procedures and low travel speeds.

The management of all vessels during Project activities in the Jellicoe Cove area will be under the jurisdiction of the Canadian Coast Guard's Thunder Bay Marine Communication and Traffic Service (MCTS) based in Thunder Bay, Ontario. All large vessel traffic movement in the Canadian waters of Lake Superior must report to the Thunder Bay MCTS at specified points in the lake. Berthing accidents would be expected to be infrequent and minor. Should deleterious substances be accidentally spilled, emergency response and contingency plans will be in place by the vessel contractors to ensure containment of any spills (see Aquatic Spills above).

Standard operating procedures would be developed to reduce the risk of collisions between ships and may include the issuance of a Notice to Mariners and notification to approaching vessels by radio operators. The distance at which a mariner would receive notification would depend on the direction and speed of the approaching vessel and the existing weather conditions. An emergency response plan will be in place in case of large-scale navigational accidents. While the environmental effect from vessel accidents / malfunctions may be moderate, these events are considered to be unlikely and so the potential for significant effects is low.

6.3 Failure of Safety / Mitigation Measures

Should shoreline modification and infrastructure improvements be required as part of the Project (*e.g.,* to improve laydown areas or access roads), erosion and sediment control failure could potentially occur. A potential exists for the failure of such measures due to extreme precipitation events. Such a failure could result in the release of silt-laden runoff to receiving water bodies with adverse effects on water quality, fish and fish habitat. Erosion and sediment control measures will be implemented according to the Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites (MNR *et al.* 1987), the Ontario Provincial Standard Specification (OPSS – Construction Specification for Temporary Erosion and Sediment Control Measures (OPSS 2006), industry best practices and standard requirements from MOE, DFO and MNR. Plans for erosion and sediment control measures, as well as emergency response procedures in the event of a control failure will be developed by the Contractor prior to the commencement of construction activities as a part of the Project-specific EPP, and will be implemented to minimize impacts to water quality from construction activities. These measures are provided in Table 22. An erosion and sediment control failure leading to a significant adverse effect on any VEC / VSC is considered unlikely.

In addition to the failure of erosion and sediment controls, there is potential for inadvertent damage to the cap's integrity, which could result in exposure and re-suspension of contaminated sediment. Damage to the cap could potentially result from more extreme weather events and / or vessel / barge movement. Such a failure could result in the exposure and re-suspension of contaminated sediment to the aquatic environment with adverse effects on water quality, fish and fish habitat. Release of contaminants will likely be of short duration, as the cap will be repaired as soon as possible. The effects of such an event on water quality are not expected to be significant.

To minimize the potential for inadvertent damage to cap integrity, the TLC will be designed to withstand anticipated activity in the Harbour (*i.e.,* propeller wash from vessel traffic) and storms. Proximal to the location of the historical shipping channel adjacent to the MPI Pier, a slightly coarser gradation was selected to improve resistance to displacement should the pier be reopened to shipping. It is noted that the coarser graded material is not designed to withstand all potential vessel traffic but rather nominal usage as projected in a shear stress analysis (ENVIRON 2009). No significant effects on the environment are expected from TLC damage.

Table 22 Accidental Events Residual Environmental Effects Assessment Matrix

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Accidental Events							
Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Terrestrial Spills	Injury or Mortality (A) Alteration and Disruption of Habitat (A)	• Based on site conditions, an appropriate Spill Prevention and Emergency Response and Contingency Plan will be submitted by the Contractor for review; • The EPP will designate properly designed and secured areas, to be agreed upon by the client, for storage of construction materials; • Adherence to environmental practices for fuelling and equipment maintenance on the part of the Contractor will be necessary to reduce the potential for impacts. The Contractor is obliged to ensure that no release of contaminants into the environment occurs; • All fuel and lubricants must be stored in designated areas, designed, and secured with containment areas in accordance with applicable regulatory standards and guidelines; • Refuelling of mobile equipment will be conducted in a designated, low permeability area of the construction laydown and material storage area. Equipment operators will remain with the equipment at all times during refuelling; • Any equipment leaks must be prevented, and / or corrected as soon as identified using appropriate means; • Secondary containment for pumps and leaks shall be implemented; • All spills or leaks or hazardous substances into the environment (*i.e.,* ground, water, drains, sewer systems, roads, parking areas, etc.) shall be promptly contained, cleaned up, and reported to the Proponent and to the 24-hour environmental emergencies reporting system immediately if the reporting trigger is reached; and • Spill containment and cleanup materials (absorbent pads and dry chemicals) will be available for trained personnel to handle small spills. All material that has been contaminated as a result of the spill or leak will be collected and stored in a manner which ensures that it will not be re-released into the environment until it is transported to an approved treatment or disposal facility.	1	1-2	1/1	R	2
Aquatic Spills	Injury or Mortality (A) Alteration and Disruption of Habitat (A)	• Machinery must be checked for leakage of lubricants or fuel inspected and found to be clean, free of leaks and in good working condition. The Contractor must monitor all equipment on-site to ensure all hydraulic hoses, oil and fuel lines are in good condition with no leaks. Hoses and tanks are to be inspected on a regular basis to prevent fractures and breaks. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality or the aquatic environment; • Refuelling must be done on level terrain, ideally on a prepared impermeable surface, and must be at least 30 m away from any water body. Runoff must be controlled to ensure wash materials and / or other substances do not enter the riparian zone or the water body; • The transfer of fuel from shore based tanks to marine vessels and equipment will be supervised and conducted in a manner which will eliminate or reduce the risk of spills or leaks; • Basic petroleum spill clean-up equipment including a 250 L oil spill cleanup kit must be on-site during the entire length of the Project. Clean up equipment for aquatic spills in water bodies must also be present; and • Contractors will be required to confirm and if necessary, show evidence, that hydraulic fluid used for the Project is appropriate for marine construction equipment at the request of the Contractor.	1-3	1-2	1/1	R	2
Vessel Accidents / Collisions	Injury or Mortality (A)	• A Notice to Mariners or similar public notice will be issued prior to the construction phase and the Project-specific EPP will contain detailed response procedures to follow in the event of a vessel collision; • Collisions will be mitigated through controlling vessel speed, scheduling and coordinating activities with other vessels, Transport Canada (TC) and the Canadian Coast Guard (Thunder Bay MCTS), and posting Notices to Mariners, which would result in permanent markings being established on the appropriate navigation charts; and • When vessel radio operators are present they will notify approaching vessels of their presence and the presence of the cap.	1-2	1	1	R??	2
Failure of Safety / Mitigation	Injury or Mortality (A) Alteration and Disruption of	• Scheduling site activities to minimize disturbance; • Avoiding leaving excavations open for long periods and compacting / covering loose materials;	1-2	1	1/1	R	2

Residual Environmental Effects Assessment Matrix Valued Environmental Component: Accidental Events

Project Activity (see Section 2.4 for details regarding specific activities)	**Potential Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Evaluation Criteria for Assessing Residual Adverse Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration / Frequency**	**Reversibility**	**Ecological / Socio-Economic Context**
Measures	Habitat (A)	• Compacting soils as soon as excavations, filing or levelling activities are complete; • Installation of sediment control measures to minimize the transport of silts; • Implementing measures to control sedimentation and erosion and ensuring that construction personnel are familiar with these practices and conduct them in the appropriate manner; • The area required for the construction laydown and material storage will be kept as small as possible to accommodate construction equipment and material storage; • Although not yet confirmed, it is expected that the location of the construction laydown and staging area will be situated within areas which have been previously disturbed, are void of vegetation and unrepresentative of natural habitat, such that it is unlikely that clearing, grubbing or topsoil stripping activities will be required; • Plans for erosion and sediment control will be developed as part of the Project design and specific plans will be developed by the Contractor for the specific laydown area selected. The Contractor has the ultimate responsibility to install, monitor and maintain erosion and sediment controls until the erosion risk has ended. • Best Management Practice (BMP)s for erosion and sediment control measures will be implemented prior to any shoreline construction and will be left in place until the vegetation and re-grown. These control measures may include the installation of silt fences, sand bags and / or straw bales, and the storage of construction materials and equipment at least 30 m away from the shoreline to the extent possible; • Soil piles will be stabilized to eliminate or reduce wind or water erosion; • Soil piles will be placed in a location which will not erode into a water body • Dewatering, if necessary, will not occur on, between or, beside soil piles or into a water body; • Soils handling will not occur during high wind to reduce the risk of wind erosion; • Soils will not be handled in extremely wet weather to reduce soil erosion; • Soil will be monitored to ensure no erosion occurs; • Soils prone to rutting will not be handled during sensitive conditions (*e.g.,* wet, frozen soils); • At the first sign of soil rutting, activities on soils will be suspended or altered to eliminate further rutting (*e.g.,* wooden matting); • Controlling runoff during the construction phase; • Monitoring any runoff to ensure total suspended solids levels are within acceptable ranges; • In the unlikely event that runoff exceeds acceptable ranges for total suspended solids as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from down gradient water systems) or through filter bags for additional filtration and / or the implementation of additional sedimentation ponds or erosion and sedimentation control structures. Remedial action will be rapidly taken as necessary; • In the event of a failure, Project construction will be halted until controls are restored; • In the event of damage to the cap's integrity the cap will be repaired as soon as possible; and • Regular monitoring during construction will also serve to identify any integrity issues that may arise.					

Legend

Magnitude[1]:
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2
6 = > 10,000 km^2

Duration:
1 = < 1 month
2 = 1 – 12 months
3 = 13 – 36 months
4 = 37 – 72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11 – 50 events/year
3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological / Socio-Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.
N/A = Not applicable
A = Adverse
P = Positive

7. Effects of the Environment on the Project

An environmental effect by definition under *CEAA* includes any change to the proposed Project which may be caused by the environment. Potential effects of projects could include seismic activities, wave and current activity, changes in lake levels, climate and meteorological conditions (*i.e.,* wind, rain, storms), and icing and winter operations. In specific regards to this Project, potential effects of the environment are limited to wave and current activity, climate and meteorological conditions (*e.g.,* heavy precipitation).

Wave and current activities have the potential to cause sediment re-suspension, resulting in disturbance of the TLC in Jellicoe Cove. Currents in the proposed Project area average 0.04 m/s primarily in a west-northwest to east-southeast direction, however, the strongest currents are from the west-northwest (Skafel 2006, 2007). Sediment stability experiments indicate that ambient water current velocities are approximately two (2) orders of magnitude lower than the calculated threshold for erosion events to occur; however, sediment particle size data shows the presence of sand horizons which may be indicative of episodic events that transported sand within the study area and possibly displaced fine-grained material (Biberhofer and Dunnett 2005). Material selected for the TLC will have enough substance and granular material that in the event of re-suspension, cap material will not be dispersed beyond the Project site. The TLC will be designed and placed such that there will be no substantial net scour or erosion. Mounding may occur during storm surges and severe events; however, it is expected that there would be subsequent redistribution of materials over the cap area.

Long term monitoring developed for the Project will include monitoring of the cap performance and recovery of the capped area.

Extreme weather events have the potential to cause schedule delays and potential environmental damage associated with erosion and sediment control during Project phases when there is ground disturbance. Vessels / barges and equipment to be used for the Project are designed to operate outdoors in most weather. Mitigation measures include the consideration of weather conditions when scheduling activities and scheduling of activities to accommodate any weather interruptions. As noted previously, a total of three (3) additional weeks or 50% buffer has been scheduled into the construction to account for both weather and equipment down time.

A number of information sources will be used to monitor for potential extreme weather events including weather forecasts and advisory and warning bulletins issued by EC (http://text.weatheroffice.gc.ca/canada_e.html). These bulletins typically include a meteorological description of the event, information on the coastlines that are most likely to be affected, a discussion of complicating factors such as waves and pack ice, as well an assessment of the severity of the event. While there remains potential for an extreme weather event to occur during the construction period, the likelihood is considered to be low. In the event of an extreme weather event, construction will cease until when it is safe and practicable to resume operation. Regular monitoring will also serve to identify any integrity issues that may arise.

Given the limited extent of the footprint and the duration of construction, extreme weather events are not considered to result in a significant adverse environmental effect as the cap material has been designed to withstand the greatest wave height in historical record. In summary, climate and meteorological conditions are not anticipated to significantly affect the Project.

8. Cumulative Effects

8.1 Methodology and Approach

Environmental and socio-economic interactions of individual projects have the potential to overlap spatially and temporally to create a cumulative interaction. In some cases cumulative effects may interact in an additive fashion, creating an effect equal to the sum of the individual project effects. In other cases cumulative effects may interact synergistically, creating an effect greater than those of the individual projects. Cumulative effects may have important regional consequences in the context of large project development, or in the context of smaller projects, result in local, incremental changes.

Subsection 16(1)(a) of *CEAA* requires that every assessment of a project conducted pursuant to *CEAA* include an assessment of the "cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out". The cumulative effects assessment for the Project has been undertaken in accordance with the CEA Agency's Operational Policy Statement *Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act* (Agency 2007) and Cumulative Effects Assessment Practitioners Guide (CEA Agency 1999).

The cumulative environmental effects assessment requires a consideration of the temporal and spatial boundaries of the assessment and interactions among environmental effects of the Project and past, present and future projects and activities. This assessment considers potential cumulative environmental and socio-economic effects for each project VEC / VSC, as required by *CEAA*. Specifically, the assessment will determine the extent to which the Project will contribute to the total cumulative effects of developments and human activities within the region.

The cumulative effects assessment does not consider the effects of accidents and malfunctions because they are considered to be hypothetical and significant adverse effects following a major accidental event or malfunction have a very low probability of occurrence. Similarly, the effects of the environment on the Project were not considered to be cumulative in nature, because they were considered to be hypothetical and significant adverse effects following a major weather / climatic event have a very low probability of occurrence.

Generally, the evaluation of cumulative effects can be considered as the following sequence of steps:

- Identification of environmental and socio-economic effects of the Project;
- Identification of other projects / activities that could interact with Project related effects;
- Elimination of the effects of other projects / activities that are unlikely to act in combination with Project related effects;
- Identification of likely effects that could result from the interaction of Project related effects with other projects / activities and mitigation to avoid or minimize those effects; and
- Evaluation of the significance of likely cumulative environmental and socio-economic effects.

8.2 Scoping of Other Projects and Activities

The purpose of the proposed Project is to reduce the risk to biota, and transport of contaminated sediments from Jellicoe Cove to the rest of Peninsula Harbour. The cumulative interactions with past and present projects and activities have generally been included in the discussions of the existing environment in the Project area (Section 3.0) and are therefore included in the environmental effects assessment.

The consideration of potential future projects / activities for cumulative effects assessment will be limited to certain and reasonably foreseeable projects and activities, and typically will not include speculative project and activities. Projects and activities considered as being certain or reasonably foreseeable will have (at least) submitted applications for regulatory approval or have undertaken some advanced planning.

8.3 Cumulative Effects Analysis

Some future approved projects are relatively well defined, while other likely activities are more difficult to define in terms of potential spatial and temporal interactions with the Project. Current and ongoing vessel traffic related to recreational fishing and tourism may interact cumulatively with Project related activities; however, there are no anticipated changes to current activities (*i.e.,* increases) and Project related interactions with these VSCs have been assessed in the Environmental Effects Assessment, Section 5.0 of this document. The potential for adverse effects associated with the Project will be reduced by the proper implementation of mitigative measures contained throughout this environmental assessment and through adherence to applicable legislation, guidelines and BMPs.

Since the closing of the MPI facility in March 2009, current shipping in and out of Jellicoe Cove, in particular, the MPI dock, essentially does not exist. The sale of the former MPI facility is not yet complete. Protocol Energy International Inc. proposes to purchase the plant and convert it to a bio-mass wood pellet production facility. At a high level, the proposed work will include removal of land-based facilities and equipment that are not required and installation of new equipment for production. Dredging will be required and it will be approximately 150 ft wide by 700 ft long with approximately 8 feet in depth along the pier. The proposed dredging will accommodate ships approximately 80 ft by 700 ft. Product will be shipped to international markets. It is anticipated that dredging would take place in the fall of 2011 or spring of 2012 by Purvis Marine from Sault Ste. Marie, and that the facility would be up and running within one (1) year from purchase. The EA for dredging has not been initiated (R. St. Jules, pers. comm. 2011); however it is anticipated that DFO and Transport Canada would be potential responsible authorities for this Project. Alternate uses of the facility that result in discharges to the Harbour or require dredging along the existing pier to accommodate shipping would be subject to provincial and / or federal approvals (as well as evaluation under existing administrative controls (see Appendix E and discussion in Section 9.0)).

In addition to the potential re-development of the MPI facility, it is understood that the Town of Marathon is pursuing a Sustainable Waterfront Development Plan to look at options to utilize the Lake Superior waterfront for economic / tourism development purposes (D. Skworchinski Town of Marathon Economic Development Manager pers. comm. 2009). It is anticipated this work will be completed in the near future and, as such, the details and any potential developments that may arise from the plan are not available for the purpose of this cumulative effects assessment.

MOE is undertaking an investigation into assessing the contamination at the former MPI facility. The status of the investigation is not known; however, in the event that a contamination source is identified, source control will be undertaken on land to prevent contamination of the Cove. There is insufficient information at this time for the assessment of cumulative effects.

Stillwater Canada Inc.'s Marathon PGM-Cu Mine project is a mining operation proposal located approximately 10 km north of the Town of Marathon, Ontario. The project consists of an open-pit mine and milling operation. Ore will be processed (crushed, ground, concentrated) at on-site processing facilities. A final concentrate product containing copper and platinum group metals (gold, platinum, palladium; or PGMs) will be transported off-site via road and rail to a smelter and refinery for subsequent metal extraction and separation. The total mineral reserve is estimated to be 91 million tonnes. During the Operations Phase of the project, production will be approximately 22,000 tonnes per day. The operating life of the mine will be approximately 11.5 years. The total resource is estimated to be 85.7 million tons. Stillwater Canada Inc. continues the federal and provincial environmental permitting and approvals process for the Project. In December 2008, the project was accepted into the Major Projects Management Office (MPMO) initiative. A Project Description was submitted to the Canadian Environmental Assessment Agency (CEAA) in March 2010, which triggered the Federal Environmental Assessment process. On October 7, 2010 the Project was referred to a Joint Review Panel to address both federal and provincial environmental assessment requirements. According to the proponent's website, all federal and provincial approvals are expected to be received in 2013 whereby construction would begin immediately for an estimated start of commercial production in 2015.

Based on the limited information available on the Marathon PGM-Cu Project (*i.e.,* Project Description dated March 2010 and amended in July 2010, project and agency websites), it is understood that there is unlikely to be a temporal overlap between cap placement activities with the Marathon PGM-Cu Project. Furthermore, it is further understood that effluent from the mine will (eventually) drain to Lake Superior, more specifically, to Peninsula Harbour a few kilometers north of Jellicoe Cove. Given the distance between the cap area and the proposed effluent discharge location, there is very limited potential for spatial overlap of the environmental effects of the two projects.

Aside from the above, no future development projects, or changes to current activities have been identified which are expected to overlap spatially and temporally with the Project. A review of the provincial and federal Environmental Assessment registries does not reveal any other newly proposed future projects that will overlap temporally or spatially with the Project.

8.4 Key Mitigative Measure for Future Projects and Activities

In recognition of the importance of the former MPI facility and dock to the economic strength of the Town and, therefore, the subsequent likelihood of its re-development along with other potential future developments and activities, there is a need to carefully evaluate any potential future projects and activities in Jellicoe Cove that could interact with the cap to ensure that its integrity is not compromised. This can be accomplished with the implementation of existing administrative controls for Jellicoe Cove (Section 9.0 and Appendix E).

8.5 Summary

Implementation of the mitigative measures contained in this screening report and adherence to applicable legislation and guidelines will ensure that significant adverse environmental effects associated with this Project will not be likely. Furthermore, with proper and consistent implementation of existing administrative controls, cumulative interactions are not likely to result in any significant adverse environmental effects.

9. Administrative Control Guidance Document

Existing administrative controls (Act / Regulations / policies, standards, procedures and guidelines) were evaluated to assess whether the existing administrative controls are sufficient to manage / regulate future activities in and around the cap. Detailed assessment is presented in Appendix E.

The evaluation includes the following questions:

1) Are effective administrative controls currently in place?
2) What types of activities pose the greatest disturbance?
3) Which agencies are involved in administering these controls?
4) Are there activities which are not presently controlled?
5) Can we improve the current process?

This evaluation concludes that:

1) Existing administrative controls are sufficient to manage potential future projects and activities that could interact with the cap and current process is sufficient.
2) Dredging activities pose the greatest disturbance risk.
3) The following agencies are involved in administrative controls in Peninsula Harbour: Ontario Ministry of Natural Resources (MNR), Ontario Ministry of the Environment (MOE), Department of Fisheries and Oceans (DFO), Transport Canada (TC), and Environment Canada (EC).

There are many regulations that govern future works in Jellicoe Cove. The list of applicable regulations is presented in Table 2 of the guidance document (Appendix E) and some examples include:

- The Public Lands Act administered by MNR requires work permits for:
  - Construction of a building on public land;
  - Construction of a trail, road and water crossings on public lands;
  - Dredging of shore lands (includes both crown and private land);
  - Filling of shore lands;
  - Removal of aquatic vegetation from specific shore lands; and
  - Construction on shorelines that occupies more than 15 square metres.

- The Fisheries Act administered by DFO requires an authorization for activities that may harmfully alter, disturb, or destruct fish habitat.

- The Navigable Waters Protection Act administered by TC requires a permit for work that is built or placed in, on, over, under, through or across navigable water in Canada.

The presence of contaminated sediment and the thin-layer cap will be taken into account by agencies prior to permitting any development in this area.

10. Monitoring

In order to verify the predictions and conclusions outlined in this Environmental Screening Report and to assess the effectiveness of the proposed mitigation measures, a follow-up monitoring program will be conducted based on the following:

- Studies done to date established the baseline conditions of the existing benthic community, contaminants in fish and benthic tissue, aquatic vegetation, sediment chemistry, grain size and bathymetry.
- Construction Monitoring (water quality), to determine short term effects of the cap placement on water quality and establish any contingency measures to control turbidity.
- Post Construction Monitoring, to determine long term effects on the benthic community, fish tissue, aquatic vegetation, sediment chemistry and bathymetry.

The results of the follow-up monitoring program will assist in determining the effectiveness of the TLC in improving aquatic biota and sediment chemistry in the project area, and in informing any adaptive management strategies that may be necessary to ensure the long term sustainability of the TLC.

10.1.1 Pre-Construction Monitoring

Before and during construction, workers will keep an eye out for common nighthawks and if a common nighthawk is observed within the zone of influence of the Project, CWS will be contacted.

10.1.2 Construction Monitoring

10.1.2.1 Turbidity Monitoring Plan

The proposed sediment capping project in Jellicoe Cove could potentially increase turbidity during active construction. Regular turbidity monitoring will quickly identify an increase in suspended sediment so that the problem can be identified and resolved as soon as possible. A turbidity monitoring plan will be established and in place prior to construction. All employees will be familiar with the turbidity monitoring plan. A complete turbidity monitoring plan is provided in Appendix C.

The water quality monitoring program includes different frequencies during various phases of the capping operation (*e.g.,* baseline, initial intensive, standard, and conditional) and will be conducted by the Departmental Representative.

The methods to be used in the turbidity monitoring plan are outlined below:

- A separate small boat (*e.g.,* zodiac with small motor) will be required for turbidity monitoring in order to adequately monitor turbidity levels in multiple locations.
- Turbidity sampling locations will be established prior to construction as detailed in Section 2.4.2.4 and Appendix C. One control site will be located near the southwest access to Jellicoe Cove. The control

station location will be included as one of the baseline monitoring locations and as a background monitoring location during initial intensive, standard and conditional monitoring phases.

- Turbidity samples will be taken with a sampling device that can be used in deep water up to 20 m.
- Turbidity samples will be taken several times prior to construction in order to establish background turbidity for comparison during construction.
- The monitoring program includes different frequencies during various phases of the capping operation (*e.g.,* baseline, initial intensive, standard, and conditional). Once normal construction commences (following initial intensive), turbidity samples will be taken at pre-defined distances from the operation (see Appendix C) twice per week.
- The allowable increase in turbidity from background and control samples will be 50 NTU (rational is provided above and in Appendix I).
- Monitoring will include turbidity as well as temperature, dissolved oxygen and specific conductance.
- The plan also prescribes sampling requirements for laboratory analysis for TSS, total mercury and PCBs.

Contingency Plan for Turbidity Failure

If turbidity is found to be 50 NTU above background and the source is determined to be from construction activities, then construction will immediately cease. Action will be immediately taken to determine the reason for increased turbidity and an appropriate plan of mitigation will be determined (e.g., adjusting the height and rate of material placement). If the cause is due to poor weather conditions or high winds negatively interacting with Project activities, then construction activities will cease until weather conditions have returned to normal. Consideration to the use of turbidity curtains will be given in the event of consistent exceedances of turbidity readings at the 100 m compliance boundary (see Section 2.4.2.4 and Appendix C). Turbidity curtains will be immediately installed should monitoring indicate that elevated turbidity levels have occurred for a 24 hour period which could not be managed via adjustment placement methods. Other mitigation may include the instalment of a floating turbidity curtain around the barge.

The increase in turbidity levels will be reported to the provincial government and DFO within 24 hours of the release. Construction will recommence once turbidity levels have returned to background levels and an appropriate mitigation measure has been selected to reduce turbidity levels going forward. This process will be repeated until a solution is found to keep turbidity levels within the acceptable limits (≤ 50 NTU above background samples).

10.1.2.2 Monitoring of Cap Thickness

The construction phase monitoring program will also include monitoring of cap thickness to ensure adequate coverage of the capping area and the covering of contaminated sediments according to design and specification (refer to Section 2.4.2.3).

10.1.3 Post-Construction Monitoring Activities

Post construction monitoring developed for the Project includes monitoring of the cap integrity, as well as physical, chemical, biological, aspects of the ecosystem, and basic water quality measurements and sediment samples. The goal of the monitoring program is to assess the effectiveness of the TLC and the recovery of the area. The plan is included as Appendix D of this document. The Project has been designed to limit the requirement for maintenance and repairs following construction of the Project. The key components of the plan are as follows:

The survey will cover the entire capped area to help confirm placement as per design and specification.

Sediment Characterization – Surficial sediment collected (1 to 10 cm) for analysis of mercury and PCBs as well as other standard physical characteristics. Sampling and analytical methods will follow those of the 2009 baseline monitoring (undertaken by AECOM on behalf of EC) within Jellicoe Cove, Peninsula Harbour, and surrounding reference areas in and adjacent to the Peninsula Harbour (see Appendix D).

Benthic Community Structure – Identification of benthic community structure will be performed at the same stations as the sediment chemistry, following the sampling and analytical methods used for the 2009 baseline monitoring.

Benthic Macroinvertebrate Tissue Concentration – Benthic macroinvertebrates will be collected for tissue analysis for mercury and PCBs. Methodology and station number / location will follow that of the baseline sampling conducted in 2011 prior to cap placement (see Appendix D).

Fish Tissue Concentration – Sport fish will be collected for tissue analysis for mercury and PCBs, with samples collected from within Jellicoe Cove / Peninsula Harbour and surrounding reference areas following the procedures detailed by MOE (see Appendix D).

Submerged Aquatic Vegetation Survey – Submerged aquatic vegetation survey will be conducted to assess recovery of submerged aquatic vegetation from the capping Project. The video transects taken in the capping area in previous studies and baseline will be repeated. (see Appendix D). It is anticipated that the aquatic vegetation will recover to acceptable levels. If it does not, then agencies will discuss and take appropriate action.

Cap Movement Survey - Video transects will be undertaken with validation from grab samples to confirm the observed substrate types. Video transects and still photo images in the capped and surrounding areas will be used to compare to baseline substrate conditions. (see Appendix D).

Cap Thickness Study - One year after construction, cap thickness will be measured to understand consolidation and mixing of sand and native material. Details on data collection and analysis will be prepared collaboratively with other agencies.

Although not a formal delisting criterion, basic water quality measurements are also proposed at sediment collection stations similar to that performed during the baseline sediment chemistry characterization.

The following monitoring schedule is proposed assuming a 2012 construction of the TLC:

Year	Years Post-Cap	Activity
2012	0.2	Multi-beam bathymetry survey (need to be completed and submitted to TC within 6 months of project completion)
		Baseline - Submerged Aquatic Vegetation Survey
		Baseline – Cap Movement Survey

2013	1	Substrate Aquatic Vegetation Survey
		Cap Movement Survey
		Cap Thickness Study
2015	3	Submerged Aquatic Vegetation Survey
		Cap Movement Survey
2017	5	Submerged Aquatic Vegetation Survey
		BEAST Study and benthic tissue
		Fish Tissue Survey
		Sediment Characterization
		Cap Movement Survey
2022	10	BEAST Study and benthic tissue
		Fish Tissue Survey
		Sediment Characterization
		Cap Movement Survey
2027	15	BEAST Study and benthic tissue
		Fish Tissue Survey
		Sediment Characterization
		Cap Movement Survey
2032	20	BEAST Study and benthic tissue
		Fish Tissue Survey
		Sediment Characterization
		Cap Movement Survey

It is assumed that a review of monitoring data following each round of monitoring will likely result in modification of the overall program for the next round of monitoring. Modification may include, but is not limited to:

- Elimination of specific analytical parameters or elimination of overall monitoring components as delisting criteria are met;
- Additional years of submerged aquatic vegetation survey pending observed recovery;
- Pooling of samples into composites; and
- Addition / deletion / relocation of monitoring stations to address specific concerns.

In addition to post construction monitoring, future activities in and around the cap area will be managed by the existing administrative controls. The existing Administrative Controls are discussed further in Section 9.0 and provided in Appendix E. The intent of the existing Administrative controls is not to interfere with developments in the Jellicoe Cove area but to ensure that the environment is protected. These controls are discussed further in the previous Section 9.0.

Table 23 Summary of Follow-up Monitoring

Environmental Component	Description of Monitoring	Schedule
Bathymetry	Multibeam bathymetry survey covering the entire capped area following the methodology used in the baseline bathymetric survey.	• 2012 (Immediately Following Construction)
Sediment Characterization	Surficial sediment collected (1 to 10 cm) for analysis of mercury and PCBs as well as standard physical characteristics. Sampling will be conducted using a mini-box corer or Ponar / similar grab where the box corer is not effective. Sampling and analytical methods will follow those of the 2009 baseline monitoring (undertaken by AECOM on behalf of Environment Canada), and will include the 23 baseline monitoring stations within Jellicoe Cove, Peninsula Harbour, and surrounding reference areas in and adjacent to the Peninsula Harbour (see Appendix D). Basic water quality measurements are also proposed at sediment collection stations similar to that performed during the baseline sediment chemistry characterization.	• 2017 (Year 5) • 2022 (Year 10) • 2027 (Year 15) • 2032 (Year 20)
Benthic Community	Identification of benthic community structure at the same stations as the sediment chemistry, following the sampling and analytical methods used for the 2009 baseline monitoring. Benthic macroinvertebrates collected for tissue analysis for mercury and PCBs. Methodology and station number / location will follow that of the 2011 baseline sampling proposed prior to cap placement (see Appendix D).	• 2017 (Year 5) • 2022 (Year 10) • 2027 (Year 15) • 2032 (Year 20)
Submerged Aquatic Vegetation	Submerged aquatic vegetation survey will be conducted to assess recovery of submerged aquatic vegetation from capping Project. Some of the video transects taken in the capping area in previous studies will be repeated.	• 2012 (Year 0) • 2013 (Year 1) • 2025 (Year 3) • 2017 (Year 5)
Fish and Fish Habitat	Sportfish collected for tissue analysis for mercury and PCBs, with samples collected from within Jellicoe Cove / Peninsula Harbour and surrounding reference areas following the procedures detailed in the sport fish collection plan (see Appendix D).	• 2017 (Year 5) • 2022 (Year 10) • 2027 (Year 15) • 2032 (Year 20)
Cap Movement Survey	Video transects will be undertaken with validation from grab samples to confirm the video survey analysis. Video transects and still photo images in the capped and surrounding areas will be used to compare to baseline substrate condition.	• 2012 (Year 0) • 2013 (Year 1) • 2025 (Year 3) • 2017 (Year 5) • 2022 (Year 10) • 2027 (Year 15) • 2032 (Year 20)

10.2 Navigable Waters Approval Conditions

On January 19, 2010, an application for a *NWPA* Approval was submitted for the Project to TC to conduct work that is built or placed in, on, over, under, through or across navigable water in Canada. Approval was acquired from TC on September 29, 2010 and during the Project, all conditions of approval will be complied with. Conditions of the approval were as follows:

- A spotter vessel must patrol the work area and advise and assist approaching vessels accordingly;
- Any barges or other vessel(s) used during construction shall be lit in accordance with the Collision Regulations under the *Canada Shipping Act*;
- A post Project sounding survey showing the exact location and depth above the work must be submitted to TC within six (6) months of completion of the Project;
- The Proponent must notify the Canadian Coast Guard Vessel Traffic Centre Notship desk at 1-(519)-337-6360 at least 24-hours in advance of commencement and upon completion of the Project;
- The proposed work area shall, during all periods of reduced visibility, be marked with yellow flashing lights that are placed at 30 m intervals during the normal navigation season between April and October of any year; and
- The proposed work area shall be marked with cautionary buoys meeting the requirements of the Private Buoy Regulations under the Canada Shipping Act that are placed at 30 m intervals during the normal navigation season between April and October of any year.

11. Conclusions

This report is a screening level environmental assessment conducted for the Peninsula Harbour Contaminated Sediment Management Project. The screening is required under *CEAA*.

This screening identified potential Project interactions with the environment. It considered biophysical and socio-economic issues, focusing on issues of greatest concern known as VECs / VSCs, which were identified through the scoping process. Three (3) VECs and one (1) VSC were selected for assessment:

- Benthic Habitat and Sediment Quality;
- Fish and Fish Habitat;
- Wildlife; and
- Land and Resource Use.

The screening considered potential environmental effects during all Project activities, including the potential for malfunctions and accidental events.

The proposed mitigation measures will reduce or eliminate potentially adverse environmental effects. Adverse residual environmental effects were predicted to be not significant for all VECs / VSCs for all Project activities including potential malfunctions and accidental events. There are not likely to be any significant adverse cumulative effects of the Project with other past, present or future likely projects and activities assuming the proposed mitigative measures, including emergency response and contingency planning, and construction monitoring plans are implemented as outlined in this document and summarized in Table 24.

Table 24 Summary of Residual Effects

VEC / VSC	Description of Potential Project Interactions with VECs / VSCs	Mitigation Measures, Best Management Practices and Construction Monitoring	Residual Effects
Benthic Habitat and Sediment Quality	• Short-term injury or mortality; • Alteration and disruption of habitat; • Temporary re-suspension of contaminated sediment; • Long-term improvement in sediment toxicity; • Short-term increased turbidity; • Potential for leaks and spills during construction; and • Short-term disruption of benthic lifecycles.	• Ensuring the cap material has minimal (*i.e.,* less that 6%) fines via contract specifications and quality assurance / quality control monitoring; • Use of coarser sand in areas with higher vessel traffic and adjacent to the pier; • Monitoring placement methods and cap thickness (to ensure adequate coverage) during capping; • A floating turbidity curtain may be deployed if required; • Immediate installation of turbidity curtains should monitoring indicate that elevated turbidity levels have occurred for a 24 hour period which could not be managed via adjustment placement methods; • Monitoring of weather forecasts and adjusting or suspending placement activities during periods where it is determined unsafe by the contractors; • Conducting post construction monitoring of the cap area to confirm that the shifting of cap material is within the expected design threshold. Post construction monitoring is outlined in Section 5.2.5; • Strategies employed during cap design and placement (*e.g.,* grain size fraction, placement to allow for particle broadcasting, low application rate) will provide adequate protection against excessive disturbance and damage to adjacent aquatic habitats and organisms; • Turbidity monitoring during cap placement such that a onetime exceedance of 50 NTUs above background results in automatic cessation of operation to evaluate cause and action to reduce turbidity (*e.g.,* adjusting the height and rate of material placement); • Machinery must be checked for leakage of lubricants or fuel. When inspected, machinery must be clean, free of leaks and in good working condition. The Contractor must monitor all equipment on-site to ensure all hydraulic hoses, oil and fuel lines are in good condition with no leaks. Hoses and tanks are to be inspected on a regular basis to prevent fractures and breaks. All foreign material must be removed, including dirt, mud, debris, grease, oil, hydraulic fluid, coolant or other substances that may negatively impact the water quality or the aquatic environment; • Adherence to environmental practices for fuelling and equipment maintenance on the part of the Contractor will be necessary to reduce the potential for impacts. The Contractor is obliged to ensure that no release of contaminants into the environment occurs; • All fuel and lubricants must be stored in designated areas, designed, and secured with containment areas in accordance with applicable regulatory standards and guidelines; • Refuelling must be done on level terrain, ideally on a prepared impermeable surface, and must be at least 30 m away from any water body. Runoff must be controlled to ensure wash materials and / or other substances do not enter the riparian zone or the water body; • The transfer of fuel from shore based tanks to marine vessels and equipment will be supervised and conducted in a manner which will eliminate or reduce the risk of spills or leaks; • Equipment must be in good condition; • Any equipment leaks must be prevented, and / or corrected as soon as identified using appropriate means; • Secondary containment for pumps and leaks shall be implemented; • Basic petroleum spill clean-up equipment including a 250 L oil spill cleanup kit must be on-site during the entire length of the Project. Clean up equipment for aquatic spills in water bodies must also be present; • All spills or leaks or hazardous substances into the environment (*i.e.,* ground, water, drains, sewer systems, roads, parking areas, etc.) shall be promptly contained, cleaned up, and reported to the Proponent and to the 24-hour environmental emergencies reporting system immediately if the reporting trigger is reached; • The Contractor must develop and implement an EPP which is to include a Contingency Plan for dealing with potential effects identified in this CEAA Screening. The Contingency Plan shall deal with accidents involving hydrocarbons and other potentially hazardous products. The plan will also address who will pay for cleanup and restoration in the event of a spill and/or leak, and within what timeframe; • The EPP is required to designate properly designed and secured areas, to be agreed upon by EC, for storage of construction materials; and • Contractors will be required to confirm and if necessary, show evidence, that hydraulic fluid used for the Project is appropriate for marine construction equipment at the request of the Contractor.	The use of the appropriate mitigation measures listed will effectively minimize the extent of the effects of the Project and **no residual significant adverse environmental effects** are expected.
Fish and Fish Habitat	• Habitat alteration and disruption; • Long-term beneficial habitat alteration;	• As above; • Scheduling of the cap placement to avoid spawning and incubation periods for both warmwater and coldwater fish species established by MNR. A request to extend the in-water works has been submitted to and approved by MNR. MNR has voiced preference for the in water	The use of the appropriate mitigation measures listed will effectively minimize the extent of the effects of

VEC / VSC	Description of Potential Project Interactions with VECs / VSCs	Mitigation Measures, Best Management Practices and Construction Monitoring	Residual Effects
	• Long-term improved water quality; • Short-term noise and vibration effects; • Short-term increased turbidity, sediment erosion; • Short-term potential for leaks and spills; • Short-term potential for temporary disruption of fish lifecycles; • Changes in prey distribution and abundance; and • Short-term potential increase in contaminant levels in water.	works to be started May 1 and completed by August 31. • To the extent possible, the Contractor will place the cap material in the nearshore areas first to ensure that work in these areas is complete so as to avoid in water work outside of the fish window in the event of a delay in construction; • The Contractor will ultimately be responsible for preparing the EPP and undertaking the actions set forth in the EPP for when turbidity / TSS exceeds limits. • Permit for the extraction of water pursuant to the Ontario Water Resources Act, depending on the placement method selected and the volume of water to be extracted (*i.e.,* greater than 50,000 L per day). Adherence to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (1995) will be followed, should this alternate placement method be selected; • The area required for the construction laydown and material storage area will be designed efficiently and kept as small as possible while still accommodating equipment and material storage; • Although not yet confirmed, it is expected that the location of the construction laydown and staging area will be situated within areas which have been previously disturbed, are void of vegetation and unrepresentative of natural habitat, such that it is unlikely that clearing, grubbing or topsoil stripping activities will be required; • BMPs for erosion and sediment control measures will be implemented prior to any shoreline construction and will be left in place until the vegetation and re-grown. These control measures may include the installation of silt fences, sand bags and / or straw bales, and the storage of construction materials and equipment at least 30 m away from the shoreline to the extent possible; • Soil piles will be stabilized to eliminate or reduce wind or water erosion; • Soil piles will be placed in a location which will not erode into a water body; • Dewatering, if necessary, will not occur on, between or, beside soil piles or into a water body; • Soils handling will not occur during high wind to reduce the risk of wind erosion; • Soils will not be handled in extremely wet weather to reduce soil erosion; • Soil will be monitored to ensure no erosion occurs. • Soils prone to rutting will not be handled during sensitive conditions (*e.g.,* wet, frozen soils); • At the first sign of soil rutting, activities on soils will be suspended or altered to eliminate further rutting (*e.g.,* wooden matting); • Initiating construction in May in the southeast section of the cap (closest to Shack Creek) and ending the construction in August in the northwest section. This mitigation measure should decrease the noise effects on early spawners in Shack Creek; • Using smaller vessels which do not exceed the thresholds for damage to fish hearing; and • Limiting noise as much as possible.	the Project and **no residual significant adverse environmental effects** are expected.
Wildlife	• Direct long-term improved prey quality (less contaminants); • Short-term potential direct mortality or injury of small Wildlife species; • Short-term loss or modification of habitat; • Short-term potential impact on certain bird species attracted to Project lighting; • Temporary potential short-term nest desertion in adjacent (non-disturbed) areas which in turn may result in temporary exposure of hatchlings and eggs and increased predation; • Temporary displacement of species resulting from noise and movement; and • Temporary increase in contaminant flux during cap placement which may	• As above; and • Artificial lighting required to work throughout the night will be kept to only what is required for the safe operation of vessels and equipment and will be angled in the direction of activity.	The use of the appropriate mitigation measures listed will effectively minimize the extent of the effects of the Project and **no residual significant adverse environmental effects** are expected.

VEC / VSC	Description of Potential Project Interactions with VECs / VSCs	Mitigation Measures, Best Management Practices and Construction Monitoring	Residual Effects
	disrupt the foraging due to sediment re-suspension during capping causes contaminant increases in fish.		
Land and Resource Use	• Short-term disruption of adjacent land and resource use, both in the immediate vicinity of the of the active construction site as well as adjacent to the material laydown and storage area and potentially along the material haul route; • Interaction with shipping and navigation both during construction and after construction is complete; • Temporary limitation of sport and recreational fishing.	• As above; • Construction generated noise will be minimized to the extent possible and will be reduced through proper selection, maintenance and inspection of vessels and equipment and will be kept within provincial guidelines; • To the extent possible, trucking activities will be restricted to daylight hours (e.g. 5 am to 5 pm) to reduce noise during evening and night time hours for the residents near the potential haul route; and • Adherence to conditions of *NWPA* Approval (see above).	The use of the appropriate mitigation measures listed will effectively minimize the extent of the effects of the Project and **no residual significant adverse environmental effects** are expected.

12. Assessment Decision and Course of Action

On the basis of this screening, under the *Canadian Environmental Assessment Act,* Environment Canada and Fisheries and Oceans Canada have reached the following decision;

_____X_____ The Project (taking into account appropriate mitigation measures) is not likely to cause significant adverse environmental effects – Project can be supported.The project has been screened in accordance with CEAA requirements. On the basis of this environmental assessment screening report, the Responsible Authority EC and DFO have determined in accordance with subsection 20(1) of the Act, that the impact of this project on the environment is as follows:

[X] The project is not likely to cause significant adverse environmental effects: the project may proceed provided the RA ensures the implementation of appropriate mitigation measures identified in this report. Section 20.1*)*(a).

__________ The Project (taking into account appropriate mitigation measures) is likely to cause significant adverse environmental effects that cannot be justified in the circumstances – Project will not be supported. *Section 20.(1)(b).*

__________ It is uncertain whether the Project will cause significant adverse environmental effects (taking into account appropriate mitigation measures) – Project deferred to the Minister of the Environment for referral to a Mediator or a Panel. *Section 20.(1) (c)(i).*

__________ Project is likely to cause significant adverse environmental effects (taking into account appropriate mitigation measures) and it is uncertain whether the effects can be justified in the circumstances – Project deferred to the Minister of Environment for referral to a Mediator or a Panel. *Section 20.1(c(ii)).*

__________ Public concerns warrant a reference to the Minister of the Environment for referral to a Mediator or a Panel. *Section 20.1(c(iii)).*

Approved by: ___________________________________ Date: __________________

Name, Title
EC

The above has read and understood this environmental assessment screening report and accepts responsibility for ensuring the implementation of mitigative measures and for ensuring the design and implementation of follow-up programs, if any, identified in this report.

Approved by: ___________________________________ Date: __________________

Name, Title
DFO

The above has read and understood this environmental assessment screening report and accepts responsibility for ensuring the implementation of mitigative measures and for ensuring the design and implementation of follow-up programs, if any, identified in this report.

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13.2 Personal Communications

Peter Addison. 2009. Upper Great Lakes Management Unit, Lake Superior Assessment Biologist. Telephone Conversation: 2009.

Ken Cullis. 2009. Upper Great Lakes Management Unit, Lake Superior Management Supervisor. Telephone Conversation: 2009.

Kim Kay. 2011. Environment Canada. Great Lakes Division. Great Lakes Areas of Concern Section. Sediment Remediation Specialist. Email Correspondence: May 3, 2011.

Lisa Nyman. 2009. Nipigon District Ministry of Natural Resources Species at Risk Biologist. Email Dated: December 1, 2009.

Daryl Skworchinski. 2009. Town of Marathon Economic Development Manager. Emails Dated: November 26 and 27, 2009.

Debbie Ming. 2011. Science and Technology Coordinator Fisheries and Oceans Canada. Email Dated May 6, 2011.

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