Canadian Environment Assessment Act

Comprehensive Study Report

Southern Head Marine Terminal and Associated Works Related to the Crude Oil Refinery Development Proposal

Newfoundland and Labrador Refining Corporation
Marine Terminal Project
CEAR Reference Number: 07-03-24726
Southern Head, Placentia Bay, NL

Prepared pursuant to Subsection 21.1(1)(a) of the *Canadian Environmental Assessment Act*

Submitted By:

Transport Canada
&
Fisheries and Oceans Canada

Prepared By:

SNC– Lavalin Inc.

December 2007

Executive Summary

Newfoundland and Labrador Refining Corporation (NLRC) proposes to construct, operate and eventually decommission a 300,000 barrel per day (bpd) crude oil refinery, that could be expanded to 600,000 bpd at some future date.

The refinery and the marine terminal and its associated infrastructure are, together, referred to as the Development Proposal and are proposed to be built at Southern Head on the peninsula between North Harbour and Come By Chance Bay at the north end of Placentia Bay, Newfoundland and Labrador.

The marine terminal and associated infrastructure, comprising the Project, are the components of the Development Proposal included within the federal scope and provide the focus of the Comprehensive Study required under the *Canadian Environmental Assessment Act* (the CEA Act).

The Project is located at Southern Head and will be designed to handle vessels larger than 25,000 Dead Weight Tonnes (DWT) and to receive crude oil and to export refined products and two by-products, coke and sulphur.

Transport Canada (TC) and the Department of Fisheries and Oceans (DFO) are Responsible Authorities (RAs) under the CEA Act. The Comprehensive Study Report (CSR) fulfills their obligations to assess the environmental implications of the Project through consultation with other federal authorities (FAs), the provincial government and the public. TC and DFO delegated preparation of the CSR to NLRC. The conclusions and recommendations in the CSR are made jointly by the RAs, with the support of FAs.

TC has determined their scope of the Project to include:

- The potential lease requirement for the waterlot within the Harbour of Come By Chance;
- The construction, operation, modification, decommissioning, and/or abandonment of the Marine Terminal (causeway, access trestle, jetty (phase 1), jetty expansion (phase 2)), heavy lift construction dock, tug berth, desalination plant water intake and outfall in the marine environment; and
- The stream crossings over Come By Chance River, Watson's Brook, and North Harbour River (pursuant to the *Navigable Waters Protection Act (*NWPA)).

DFO has determined their scope of the Project to include:

- The construction, operation, modification, and decommissioning (including closure and reclamation) of the Marine Terminal (causeway, access trestle, jetty (phase 1), jetty expansion (phase 2)), heavy lift construction dock, tug berth;

- The marine intake and outfall;
- The stream crossing structures for the access road; and
- The infilling of streams and ponds within the footprint of the Development Proposal.

The Newfoundland and Labrador Department of Environment and Conservation required an Environmental Impact Statement (EIS) for the Development Proposal. The federal and provincial assessment processes were coordinated to the extent possible. The federal and provincial governments jointly developed environmental assessment guidelines to aid NLRC in preparing an EIS and this Comprehensive Study Report (CSR). As well, the 50-day public review of the EIS was used by the RAs to fulfill the requirements of Section 21.2 of the CEA Act.

Although the federal and provincial governments have coordinated their respective environmental assessment processes, each level of government will make decisions on matters within their own legislative mandates and responsibilities.

The CSR presents a description of the Project and Development Proposal; public consultations; environmental effects of the Project and mitigation measures designed to eliminate or reduce adverse environmental effects of the Project; and RA conclusions regarding the significance of the environmental effects of the Project after taking into consideration the implementation of mitigation measures.

The scope of this document is based on the respective scopes of both TC and DFO. All decisions regarding significance of effects or potential effects of this proposed Project have been made jointly by both TC and DFO, along with support of the FAs.

Based on information contained in the CSR and taking into account the implementation of mitigation measures, the RAs conclude that construction, operation and decommissioning phases of the Project are not likely to cause significant adverse environmental effects.

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Acronym/Abbreviations	Definition
ABS	American Bureau of Shipping
ADCP	Acoustic Doppler Current Profiler
AES	Atmospheric Environment Services
BATEA	Best Available Technologies Economically Achievable
bpd	Barrels per day
BIO	Bedford Institute of Oceanography
BTEX	Compounds - Benzene, Toluene, Ethyl benzene and Xylene
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of Environment
CEAA	Canadian Environmental Assessment Agency
CEA Act	Canadian Environmental Assessment Act
CEAR	Canadian Environmental Assessment Registry
CO	Carbon Monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canada Standards Association
CSR	Comprehensive Study Report
CSZ	Construction Safety Zone
CWS	Canadian Wildlife Service
dB	Decibel
DFA	Newfoundland and Labrador Department of Fisheries and Aquaculture
DFO	Fisheries and Oceans Canada
DNV	Det Norske Veritas
DWT	Dead Weight Tonnes
EA	Environmental Assessment
EC	Environment Canada
ECRC	Eastern Canada Response Corporation
EEM	Environmental Effects Monitoring
EIS	Environmental Impact Statement
EPP	Environmental Protection Plan
FA	Federal Authorities
FEAC	Federal Environmental Assessment Coordinator
FFAW	Fish, Food and Allied Workers
FGVDCP	Fishing Gear and Vessel Damage Compensation Program
FICP	Fisheries Interference Compensation Program
FLC	Fisheries Liaison Committee
FLM	Fisheries Liaison Manager

Acronym/Abbreviations	Definition
GBS	Gravity Base Structure
GHG	Green House Gases
H_2S	Hydrogen Sulfide
Ha	Hectares
HADD	Harmful Alteration, Disruption or Destruction
HC	Health Canada
HEU	Habitat Equivalent Unit
IBA	Important Bird Area
IMO	International Maritime Organization
ISGOTT	International Safety Guide for Oil Tankers and Terminals
ISM	International Safety Management
Km	Kilometer
km^2	Kilometer squared
kPa	Kilopascal
LNG	Liquefied Natural Gas
LOA	Length Overall
LPG	Liquefied Petroleum Gas
m	Meters
MARPOL	Marine Pollution (Convention for the Prevention of Pollution from Ships)
MBCA	Migratory Birds Convention Act
MCTS	Marine Communications and Vessel Services
MEDS	Marine Environmental Data Service
MUN	Memorial University of Newfoundland
MWh/y	Megawatts/ year
NAFO	Northwest Atlantic Fisheries Organization
NARL	North Atlantic Refining Limited
NL	Newfoundland and Labrador
NLEA	Newfoundland and Labrador Environmental Association
NLH	Newfoundland and Labrador Hydro
NLNG	Newfoundland Liquefied Natural Gas
NLRC	Newfoundland and Labrador Refining Corporation
NOx	Nitrogen Oxides
NRCan	Natural Resources Canada
NTL	Newfoundland Transshipment Limited
NWPA	Navigable Waters Protection Act
OHF	Oil Handling Facility
ORI	Oil Residency Index
OPEP	Oil Pollution Emergency Plan

Acronym/Abbreviations	Definition
OPPP	Oil Pollution Prevention Plan
OPS	Operational Policy Statement
PAH	Polycyclic Aromatic Hydrocarbons
PIC	Public Information Centre
ppm	Parts Per Million
PM_{10}	Particulate Matter <10 microns
$PM_{2.5}$	Particulate Matter <2.5 microns
RA	Responsible Authority
RBOB	Reformulated Blendstock gasoline for Oxygenate Blending
RO	Response Organization
ROV	Remotely Operated Vehicle
SAEN	Salmonid Association of Eastern Newfoundland
SARA	Species At Risk Act
SECA	Sulphur Emission Control Area
SO_2	Sulphur dioxide
SOx	Sulphuric oxides
SOLAS	Safety Of Life At Sea
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
t/day	Tonnes per day
t/y	Tonnes per year
TOC	Total Organic Carbon
TC	Transport Canada
TCH	Trans-Canada Highway
TERMPOL	Technical Review Process of Marine Terminal Systems and Transshipment Sites
UA	Unit Area
VECs	Valued Ecosystem Components
VLCC	Very Large Crude Carrier
VTMP	Vessel Traffic Management Plan
VTS	Vessel Traffic Services
VBNC	Voisey's Bay Nickel Company
WHMIS	Workplace Hazardous Materials Information System
WHO	World Health Organization

1 Introduction

Newfoundland and Labrador Refining Corporation (NLRC) proposes to construct, operate and eventually decommission a 300,000 barrel per day (bpd) crude oil refinery, that could be expanded to 600,000 bpd at some future date.

The refinery and the marine terminal and its associated infrastructure are, together, referred to as the Development Proposal and are proposed to be built at Southern Head on the peninsula between North Harbour and Come By Chance Bay at the north end of Placentia Bay, Newfoundland and Labrador.

The marine terminal and associated infrastructure, comprising the Project, are the components of the Development Proposal included within the federal scope and provide the focus of the Comprehensive Study required under the *Canadian Environmental Assessment Act* (CEA Act).

The Project is located at Southern Head and will be designed to handle vessels larger than 25,000 Dead Weight Tonnes (DWT) and to receive crude oil and to export refined products and two by-products, coke and sulphur.

Transport Canada (TC) and the Department of Fisheries and Oceans (DFO) are Responsible Authorities (RAs) under the CEA Act. These two departments have a responsibility to conduct an environmental assessment of the Project pursuant to paragraphs 5 (1)(b) and (d) of the CEA Act. Responsibility is related to the issuance of a permit, license or other approval that is included in the Law List Regulations in place pursuant to the CEA Act.

Environment Canada (EC), Health Canada (HC) and Natural Resources' Canada (NRCan) have provided specialist or expert information and departmental knowledge in support of the environmental assessment process.

1.1 Scope of the CSR

The CSR presents a description of the Project in the context of the Development Proposal and the environmental effects of the Project as well as effects of the environment on the Project; a summary of the public consultations; mitigation measures designed to eliminate or reduce significant adverse environmental effects of the Project; and RA conclusions regarding the significance of the environmental effects of the Project after taking into consideration the implementation of mitigation measures.

This document is based on the respective scopes of both TC and DFO and all decisions regarding significance of effects or potential effects of this proposed Project have been made jointly by both TC and DFO, along with support of the FAs.

Details on the scope of this project as specified by TC and DFO can be found in Section 4.1.

Pursuant to Sections 21 and 22 of the CEA Act, the RAs must ensure that the public is provided with an opportunity to participate in the comprehensive study process.

The NLRC Development Proposal is also subject to a provincial Environmental Impact Statement (EIS) under the *Newfoundland and Labrador Environmental Protection Act*. The EIS was subject to a 50-day public review period. The RAs decided, with agreement from the Newfoundland and Labrador Environmental Assessment Division, that the 50-day EIS review period was also used to meet the requirements for section 21.2 of the CEA Act. Deadline for public comments was September 15, 2007. The EIS and required component studies can be viewed at: http://www.env.gov.nl.ca/env/Env/EA%202001/Project%20Info/1301.htm.

1.2 Purpose of the Comprehensive Study

If the RAs have determined that a Project is prescribed on the Comprehensive Study List regulations of the CEA Act then the RA(s) must ensure the comprehensive study process is conducted. Development Proposals that are usually assessed through a comprehensive study process are those large projects that may have the potential for significant adverse environmental effects. Such projects may also be of concern to the general public.

Pursuant to Section 16 of the CEA Act, the following factors must be considered in an environmental assessment conducted via the comprehensive study process:

> 16. (1) every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:
>
> (a) The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any 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;
>
> (b) The significance of the effects referred to in paragraph (a);
>
> (c) Comments from the public that are received in accordance with this Act and the regulations;

(d) Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and

(e) Any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, except in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered.

16. (2) In addition to the factors set out in subsection (1), every comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:

(a) The purpose of the project;

(b) Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;

(c) The need for, and the requirements of, any follow-up program in respect of the project; and

(d) The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

The public is given an opportunity to participate during the comprehensive study process. The CSR must also detail all the public concerns that were raised in relation to the Project during the comprehensive study process and how these concerns were addressed. Based on the potential environmental effects, cumulative effects, residual effects, and the public concerns the RAs must provide conclusions with respect to whether the Project is likely to result in significant adverse environmental effects. The RAs must also assess the need for and requirements of any follow-up programs to be implemented during any phase of the Project, as defined by the CEA Act.

The Canadian Environmental Assessment Agency (CEAA) will invite the public to comment on the CSR prior to the Minister of the Environment making a final decision. The Minister of the Environment may request additional information or require that public concerns be addressed further before issuing the environmental assessment decision statement. If the CSR is deemed adequate and all public concerns have been addressed then the Minister may issue an environmental assessment decision statement that includes:

- The Minister's opinion as to whether the Project is likely to cause significant adverse environmental effects, and;

- Any additional mitigation measures or follow-up programs that the Minister considers appropriate.

The Minister then refers the Project back to the RAs for the appropriate course of action and/or decision. If it has been determined that the Project is not likely to cause significant adverse environmental effects with the implementation of mitigation measures, the RAs may exercise any power or perform any duties or functions that would permit the Project, or part of a Project, to be carried out.

2 Description of Development Proposal and Project

2.1 Proponent Information

NLRC is a private company registered in Newfoundland and Labrador and based in St. John's.

Name of Corporate Body:

Name:	Newfoundland and Labrador Refining Corporation (NLRC)
Address:	Newfoundland & Labrador Refining Corporation P. O. Box 385 St. John's, NL A1C 5J9

Chief Executive Officer:

Name:	Brian Dalton
Official Title:	Managing Director
Address:	P. O. Box 385 St. John's, NL A1C 5J9
Telephone:	(709) 576-3442

2.2 Description of the Development Proposal

NLRC, the proponent, proposes to construct, operate and eventually decommission a 300,000 bpd crude oil refinery that could be expanded to 600,000 bpd at some future date. The Development Proposal would be located at Southern Head, on a peninsula between North Harbour and Come By Chance Harbour, at the head of Placentia Bay, Newfoundland and Labrador. Although there is considerable industrial activity in this area of Placentia Bay, Southern Head itself is a greenfield site.

This Development Proposal will require a capital investment in excess of US$4.6 billion for the construction of the facility. The facility will employ up to 3,000 people during the 4-year construction phase and approximately 750 permanent staff during the operational phase.

The refinery infrastructure will include the process facilities, marine facilities, storage tanks, access roads, transmission lines, pipelines, water treatment facility, desalination plant, and utilities. Medium and heavy, high sulphur crude oils will be processed into fuel products suitable for the export market. The main products of the refinery will be Ultra-low Sulphur Diesel, kerosene/jet fuel, reformulated gasoline blendstock for oxygenate blending (RBOB), gasoline and by-products include Liquefied Petroleum Gas (LPG - C3/C4), Sulphur and Petroleum Coke. Import and export of petroleum will be via a purpose-built marine terminal, the Project.

2.2.1 Location

The Development Proposal will be located at Southern Head, between North Harbour and Come By Chance Bay, at the head of Placentia Bay, Newfoundland and Labrador (Figure 2-1).

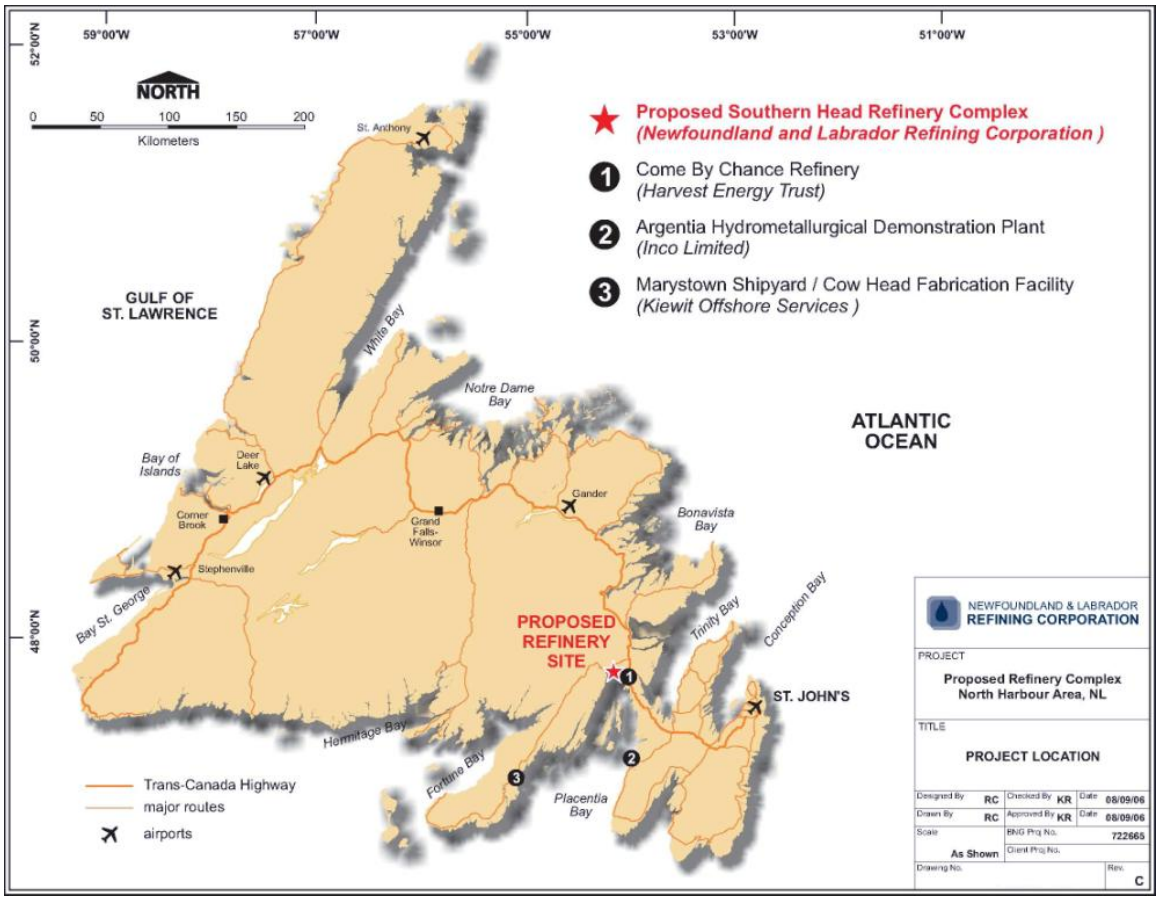


Figure 2-1 Development Proposal Location

Placentia Bay is a strategic geographic location in the global sourcing and marketing of petroleum. Placentia Bay is a deepwater, ice-free bay. It has the additional advantages of an established vessel traffic management system and existing oil-related industrial infrastructure, with an existing operating refinery, major fabrication facilities and oil transshipment terminal as well as an experienced, highly skilled workforce.

2.2.2 Land Facilities and Activities

The area required for the Development Proposal site is approximately 5 km^2, with a portion of the footprint covering bogs, streams, and ponds. There will be two access roads to the site, the main access will be from Come By Chance to the Northeast and an alternate access from North Harbour to the Northwest (Figure 2-2). The access road from Come By Chance is approximately 9.2 km in length, and the alternate access road

from North Harbour will be approximately 12.1 km. The access roads will be a 10 m wide structure including a 7.5 m two lane asphalt driving surface.

The access roads will cross a total of 38 small streams, brooks and rivers, the majority of which are classified as intermittent. These crossing are within the watersheds of Come By Chance River, Watson Brook and North Harbour River. All stream crossings will consist of either culverts or bridges. There are three locations that require bridge crossing; Come By Chance River, Watson's Brook and North Harbour River. These bridges will be of concrete construction with clear spans and dry abutments. The Watson's Brook crossing will have a clear span of 10 m and the North Harbour River and Come By Chance crossings will have a larger clear span of 30 m. All three streams are scheduled Atlantic salmon streams.

None of the existing watercourses will be used for a water supply for the site. All freshwater for the Development Proposal will be supplied from a desalination plant on-site. There will be a marine pipe intake seawater cooling system in Holletts Cove and a marine outfall pipe for treated effluent discharge. Desalinated seawater will be used for process water, steam and potable water. Cooling will be provided by a closed loop sea water system. Additional make-up water and firewater will be taken from runoff/stormwater collected in sedimentation ponds and/or recycled treated water. Some settlement ponds will be man-made, while others will utilize the natural water holding areas. These natural water holding areas will be selected to minimize any impact on fish and fish habitat, however if any fish should be contained in a pond area that is to be infilled, they will be removed and transferred to another suitable freshwater site. Some of the large bog areas may be utilized as natural filters before the bog is removed from the construction area.

There will be no dams constructed on site. Where partial infilling of a pond is required, as is the case with Pond P1, a silt curtain will be installed at the point between the pond area that is to remain and the area to be infilled. Infilling will start with clean rock fill at the silt curtain location and will proceed along the length of the infill area until the area is infilled with rock fill. Water in the infill area will be removed as per approved dewatering procedures and filtered through a settlement pond.

The Development Proposal will have a process area for the processing of crude oil into refined products (Figure 2-3). There will be a tank farm that will accommodate 21 days of crude storage and 14 days of product storage. The tank storage area will be dyked and lined to provide containment in the case of an accidental spill and to prevent hydrocarbon escape into the surrounding environment. Contaminated process water will be treated in the plants wastewater treatment system for reuse or discharge.

Figure 2-2 Overall Site Plan with Access Roads

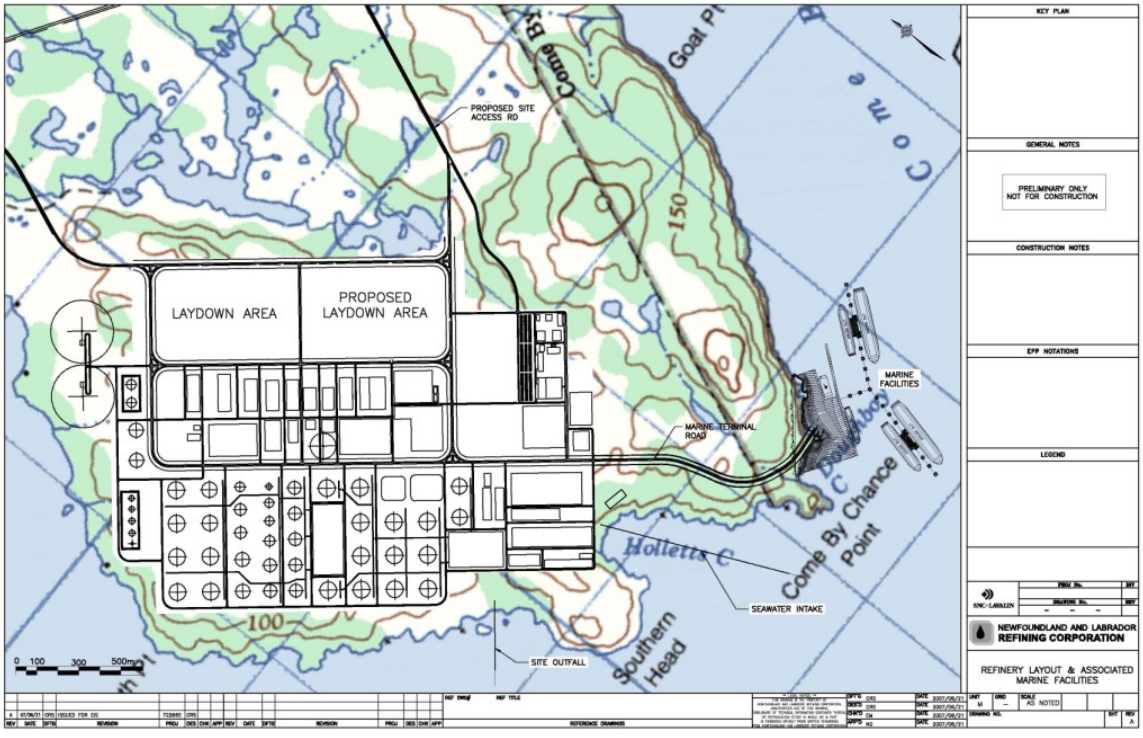


Figure 2-3 Detailed Site Plan

The stormwater drainage system consists of a network of drains and catchment basins (sedimentation ponds) interconnected with an underground piping system. This system will handle surface water drainage and all clean water runoff from non-process areas.

Contaminated stormwater drainage from the refining process area, tank farm, coke and sulphur storage area, and Marine Terminal laydown areas will be collected and treated before discharge. This water may contain elevated levels of suspended solids, hydrocarbon products and their potential contaminants, and will be collected in specially designed ponds (sedimentation ponds which are lined with an impermeable liner). The water in these ponds or tanks will be tested and if contaminated, will be directed to the wastewater treatment plant. The treated water will then be discharged to the marine environment via the outfall diffuser or recycled in the plants fresh water make-up.

Uncontaminated storm water drainage from the site will be directed into conventional stormwater ponds (man-made sedimentation ponds) to settle the suspended solids. These ponds will have sufficient capacity (retention time) to reduce the suspended solids below the regulatory limit (30 ppm). This water may be used for firefighting and process make-up, etc. The residual water will be discharged to the marine environment through the plant diffused outfall.

2.3 Description of the Project – Marine Terminal and Associated Infrastructure

The new Marine Terminal and associated works (the Project) will be located at the southeast corner of the Southern Head peninsula, Doughboy Cove (Figure 2-3). Figure 2-4 shows the location of the proposed Marine Terminal, bathymetry, vessel traffic lanes, etc.

The Marine Terminal and associated infrastructure will be designed to handle approximately 400 ships per year and possibly as many as 450 ships per year. Crude delivery will be made in Very Large Crude Carrier (VLCC) tankers (300,000 DWT, one tanker per week) and/or in Suezmax size tankers (150,000 DWT, one tanker every 3 days). The Coke (at 5,000 t/day) and Sulphur (at 800-1,000 t/day) will be shipped out by bulk carriers of various capacities (10,000 - 50,000 DWT).

Marine facilities and structures considered under the RAs scope consist of the following primary elements:

- The Marine Terminal, marine wharf and offshore berthing structures;
- Seawater Intake;
- Marine Outfall.

The Marine Terminal is located to the west and slightly north of Come By Chance Point in Come By Chance Harbour. The location was selected based on available water

depth, shelter from prevailing southerly and southwesterly wind and ease of vessels maneuvering to and from the berths. Consultations with the local fishermen have significantly influenced the decision on the final location of the Marine Terminal and associated works based on efforts by NLRC to minimize interruption to local fishing activities. The layout and location was reviewed by the Placentia Bay Traffic Committee and the Placentia Bay Pilots. Both groups gave favourable comments on the proposed location and layout. The Marine Terminal consists of both the marine wharf and offshore berthing facilities. See Figure 2-5 for a view of the jetty and wharf and overall plan view.

The Marine Wharf consists of the following components:

- The heavy lift construction dock;
- The tug berth;
- Bulk material-dry product berth (Berth No. 1).

The Offshore Berthing Facilities consists of the following components:

- The access trestle;
- Jetty 1 (Berth No. 2 and Berth No. 3);
- Jetty 2 (Berth No. 4 and Berth No. 5).

The Project components described above provide the basis for assessment. It should be noted that the terminology used above to describe the Marine Terminal facilities has provided the basis for assessment for both provincial EIS and the federal CSR. The RAs (TC and DFO) have used slightly different terminology when defining their scope (i.e.: heavy lift dock, tug basin). In particular, both RAs initially referred to jetty (phase 1) and jetty (phase 2): the Project includes both jetties (See also Section 4.1).

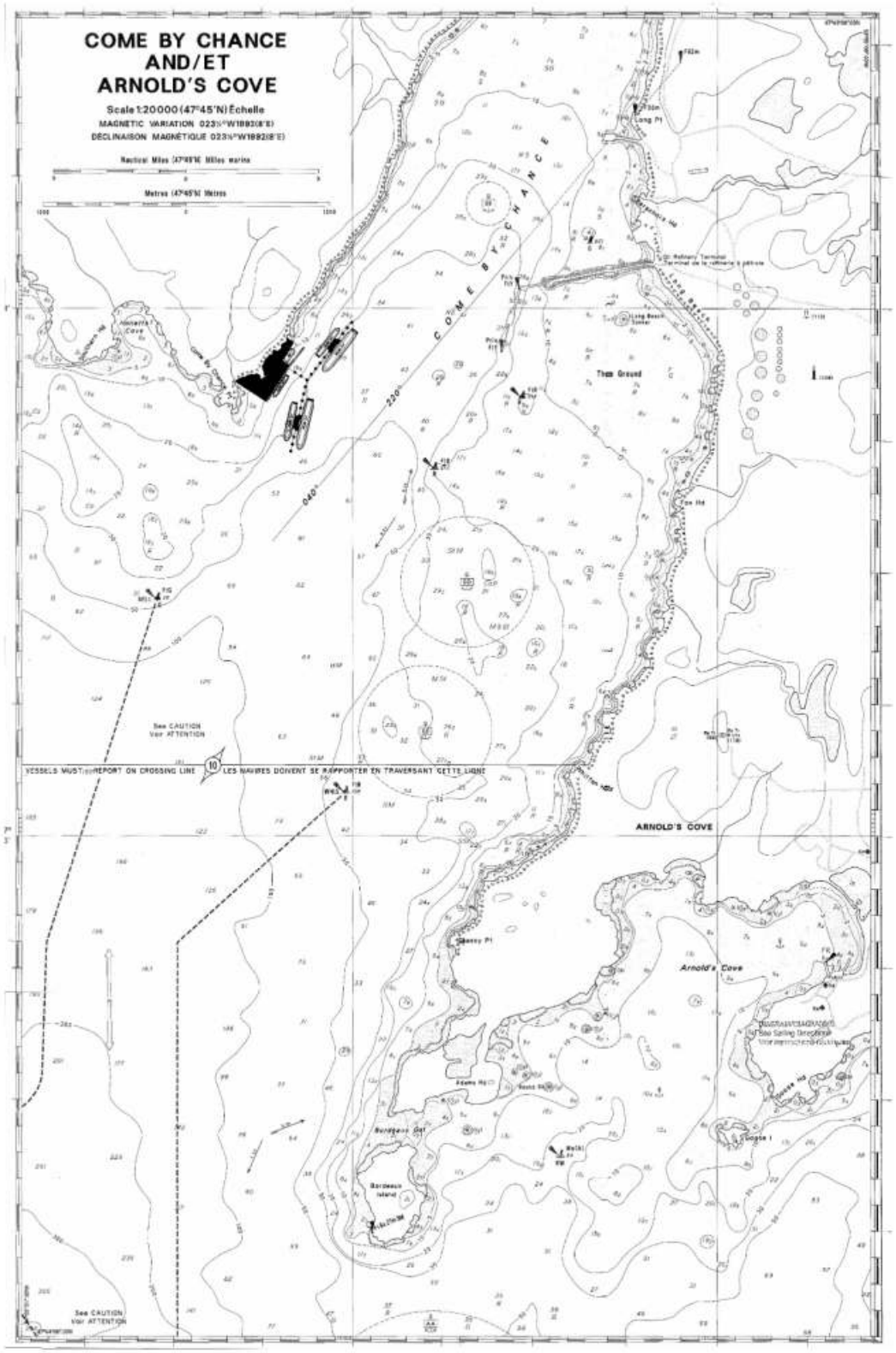


Figure 2-4 Come By Chance Bay Bathymetry

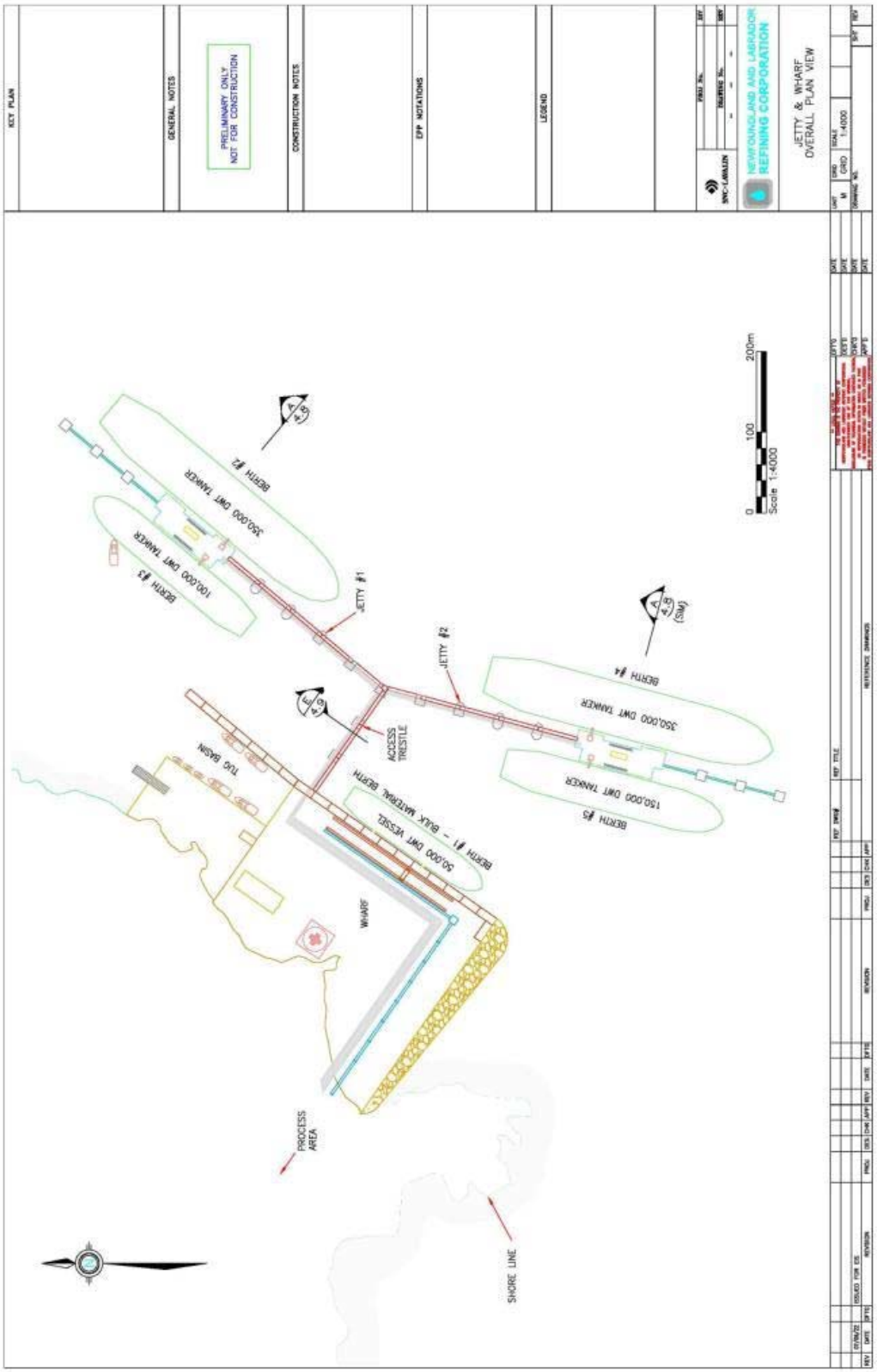


Figure 2-5 Jetty and Wharf Overall Plan View

2.3.1 Description of Marine Wharf Structures

The Marine Wharf facilities comprise all the land–based structures for the Marine Terminal and are shown in Figure 2-6 for wharf plan view and Figure 2-7 for wharf cross-section and equipment offloading. These facilities include a tug berth and construction dock, a dry product berth for loading petroleum coke and sulphur products, a small boat basin, central control building and emergency response warehouse. The marine wharf area will be constructed by infilling the existing marine area with rock fill from on–site excavations. The east side will be protected and supported with concrete caissons, sheet pile cells or sheet pile bulkhead walls. Armour stone similar to that used in the existing causeway at the North Atlantic Refinery will be used as wave protection to the South.

The heavy lift construction dock will be incorporated into the tug berth and will be designed to accept large pre-fabricated modules and construction supplies for the construction phase of the Project. Large deck, low draft barges will be used to transport construction supplies and large construction modules ranging in size from 100 to 5,000 tonnes. Most heavy packages (greater then 100 tonnes) will be transported with roll-on/roll-off barges via multi-wheeled transporters. Heavy packages can be rolled off the side or end of the barge depending on which direction is more advantageous for transport. Smaller packages can be handled by mobile cranes and placed into temporary storage areas on the wharf and from there transported to the main site.

The tug berth is located on the north-eastern portion of the marine wharf facilities. Figure 2-8 shows the tug basin plan view and Figure 2-9 shows the cross sections. The minimum depth at the berth will be 7 m at low normal tide. Berthing facilities will be provided for tugs sized to handle VLCC size tankers (350,000 DWT) in the sea conditions characteristic of Placentia Bay. After the construction phase is completed, the area will mainly be used as a tug berth, but will also be used for general docking of barges for unloading of equipment or supplies as needed during operations. The tug berth will also be used during emergency response to launch and dock oil spill response vessels. The northern portion of the tug berth will serve to dock small-sized watercraft (5 m – 15 m length). It will also be equipped with a concrete boat launch ramp for deploying spill response equipment in the event of an emergency. The ramp will also be capable of deploying small rescue craft.

The southern portion of the marine wharf facilities will serve as a dry product berth for the export of sulphur and coke products. This berth will be capable of docking bulk carriers as large as 60,000 DWT and will have a minimum average water depth of 14 m at low normal tide. The berth will service the vessels via a dual stock traveling shiploader with interchangeable telescopic chutes. A closed dual conveyor system and

reclaimer will feed the shiploader from the coke and sulphur storage areas. The closed conveyor will eliminate fugitive dust emissions from both products. Handling rates for the dry products will average 2,500 tonnes per hour. Figure 2-6 shows the bulk materials wharf plan view. Figure 2-7 shows a cross-section of the bulk material berth and materials handling system.

The Jetty Control Building and Emergency Response Warehouse will provide facilities to control all aspects of the Marine Terminal operations. It will contain a dedicated control centre to monitor all operational aspects, safety and security. Real-time video monitors will provide instant and close-up examination of conditions at critical locations in the terminal.

Control interfaces will monitor and control:

- Offloading of crude;
- Loading of fuel products, coke and sulphur;
- Monitoring environmental conditions such as wind and wave conditions;
- Monitor mooring line loads and mooring hooks;
- Gas detection devices;
- Fire control systems.

The control room will be staffed on a 24-hours/7 day a week basis. Strict access control to the marine facilities will be maintained as required by the new port security regulations (*Marine Security – International Ship and Port Facility Security Code* (2004)).

The building itself will be located near the middle of the wharf structure and will have office and warehouse facilities suitable for both regular operations of the Marine Terminal and associated works, as well as operation during emergency response conditions. The warehouse will provide storage for oil spill response equipment.

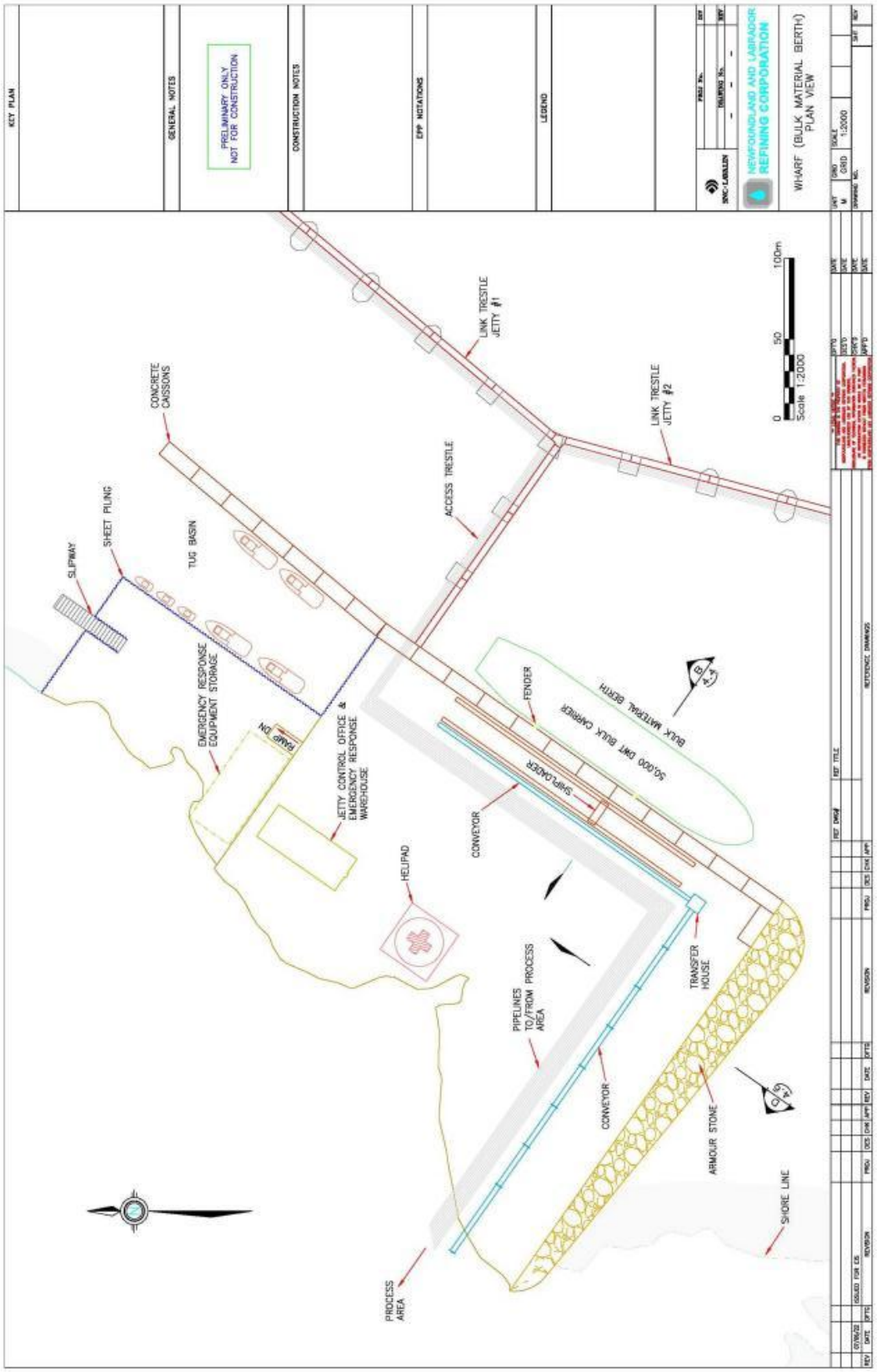


Figure 2-6 Marine Plan View

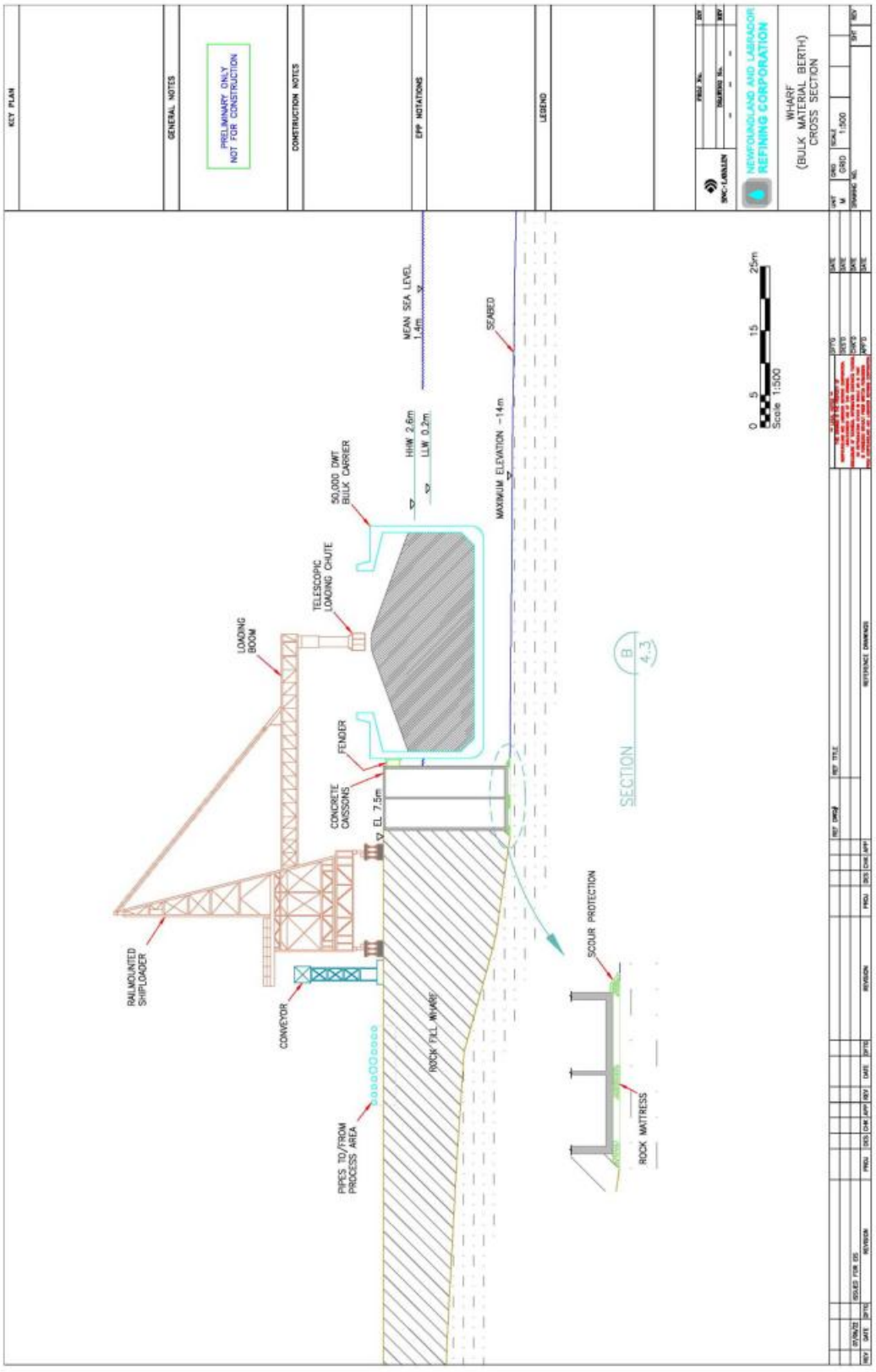


Figure 2-7 Wharf (Bulk Material Berth) Cross Section

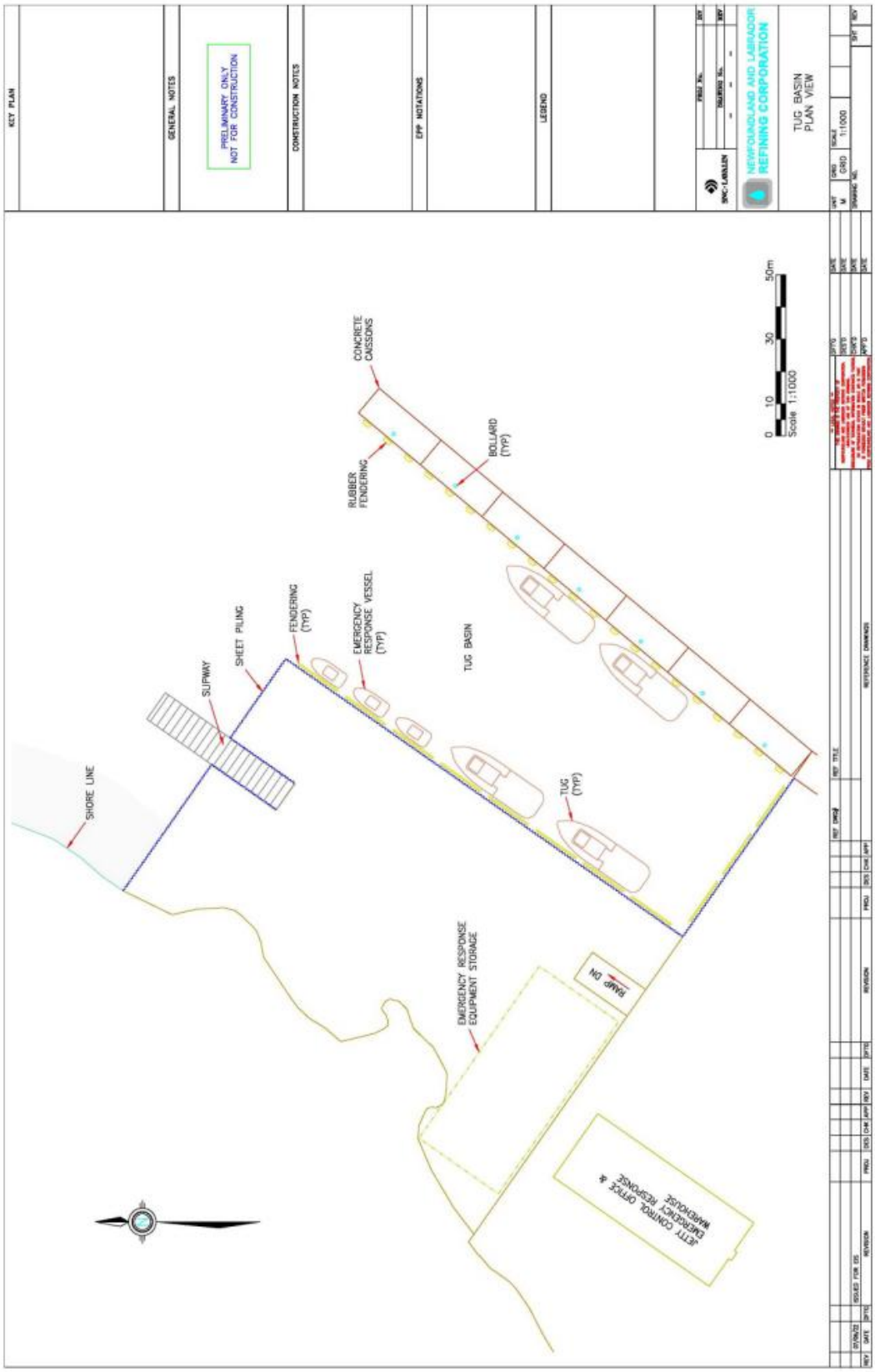


Figure 2-8 Tug Basin Plan View

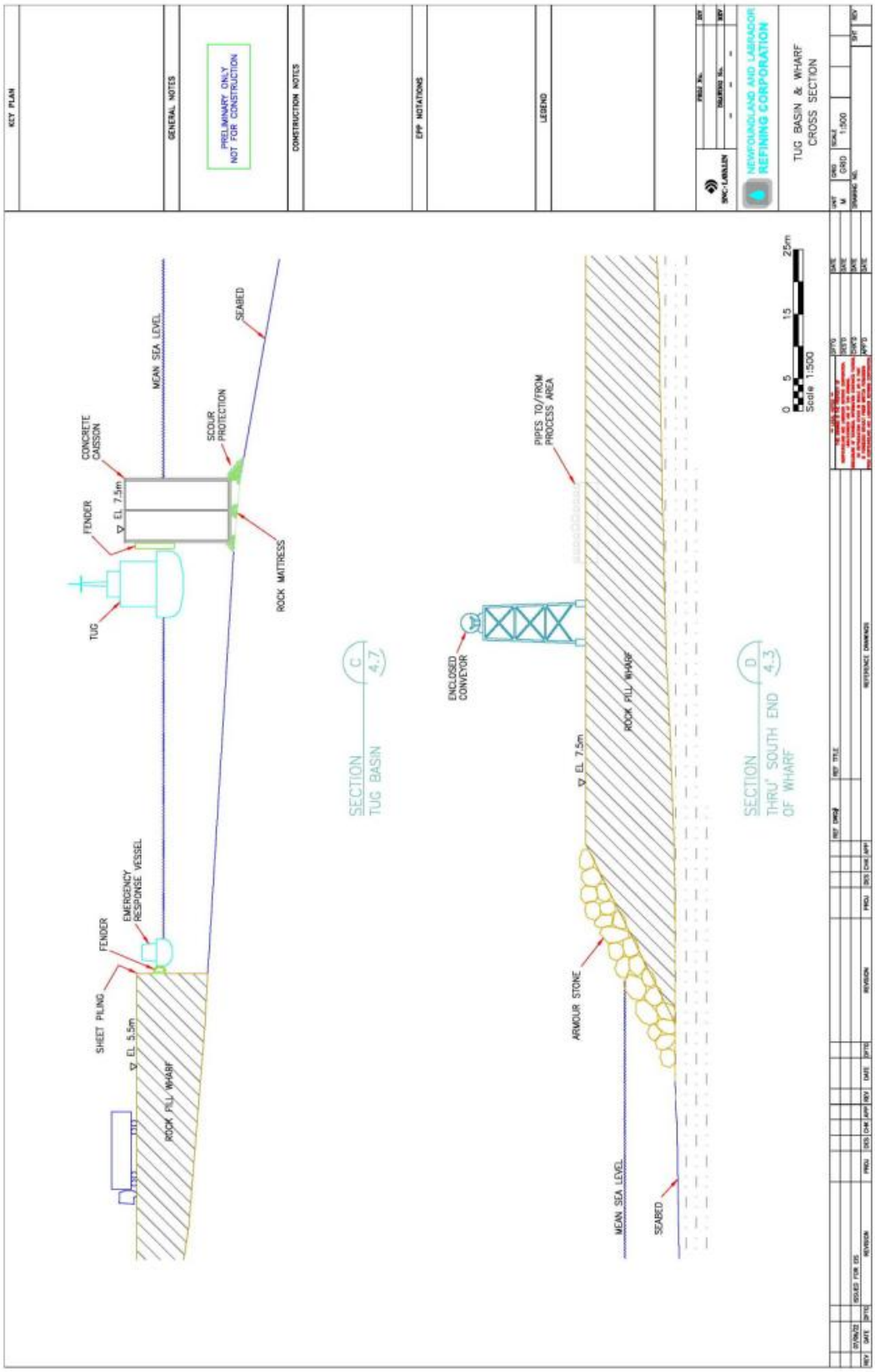


Figure 2-9 Tug Basin and Wharf Cross Section

2.3.2 Description of Offshore Berthing Structures

The jetty and offshore berthing facilities portion of the Marine Terminal is located from 300 m to 400 m from shore and has a total length of approximately 800 m. The facility consists of two (2) offshore Jetties connected to the Marine Wharf area by an access trestle.

The access trestle is approximately 100 m long and will form the link between the wharf facilities and the offshore berthing facilities. It will also be used for vehicle access during plant operation to access the jetty loading platforms for operations and maintenance as well as emergency response and firefighting. The access trestle carries the pipe racks for crude and refined products to and from the offshore berths and the tank farm.

There will be two jetties for berthing large oil tankers. Jetty No.1 is located to the north of the marine facilities and Jetty No. 2 is located to the south. The original scoping document for the Project indicated that the Jetties would be built in two phases, the proponent has since decided that both jetties to be built within the given construction period. The construction of two jetties at this time will reduce usage of existing anchorages in Placentia Bay by allowing more berthing space for vessels. All effects evaluations and compensation plans have been completed based on the construction and operation of two jetties.

Jetty No. 1 will be located in the northeastern corner of the marine facilities area. This jetty will be approximately 400 m long and have two vessel berths (Figures 2-11 and 2-12). The eastern or seaward berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 350,000 DWT (VLCC size tankers) will be used as a crude import and product export berth. This berth will have a minimum water depth of 34 m at low normal tide. The western or shore side berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 100,000 DWT and will primarily be used for the export of petroleum products. This berth will have a minimum water depth of 20 m at low normal tide. Both berths will have sufficient water depth for the largest design vessel when considering fully-loaded draft with wind, wave and tidal conditions at the site.

Jetty No. 2 will be located in the southeastern corner of the marine facilities. This jetty will be approximately 400 m long and will also have two vessel berths. The eastern or seaward berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 350,000 DWT (VLCC size tankers) and will be used as both a crude import and product export berth. This berth will have a minimum water depth of 32 m at low normal tide. The western or shore side berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 150,000 DWT (Suezmax) and will primarily be

used for the export of petroleum products, but will also be capable of offloading crude from Suezmax size tankers. This berth will have a minimum water depth of 24 m at low normal tide. Both berths will have sufficient water depth for the largest design vessel when considering fully-loaded draft with wind, wave and tidal conditions at the site.

Each marine jetty will include a loading platform incorporating fendering systems, mooring dolphins, and catwalks connecting the mooring and loading platform, a vessel access tower, and other dock structures. Other associated equipment will include the mooring system, cranes, utility and control shack, fire protection systems, spill prevention and containment equipment, and product piping systems.

Large rubber fenders will be mounted on the loading platform which forms the fender line, with which the moored ship will be in contact. The fender line is approximately 300 m to 400 m from the shoreline. The loading platform is the larger rectangle in the centre of the berth that supports the loading arms, pumps and the utility and control shack. The smaller structures are mooring dolphins, which hold the mooring lines that secure the ship in place at the berth. Ships of various sizes will use the appropriate mooring dolphin to maintain the correct mooring line geometry at the berth.

All structures will be designed to withstand ship berthing loads (the loaded ship bumping the dock and the mooring lines pulling on the dock and mooring dolphins), wave loads, passing vessel loads and wind loads, all in accordance with recognized national and international standards for the design of marine terminals. The structures will be supported on steel piles or steel jackets complete with a corrosion protection system.

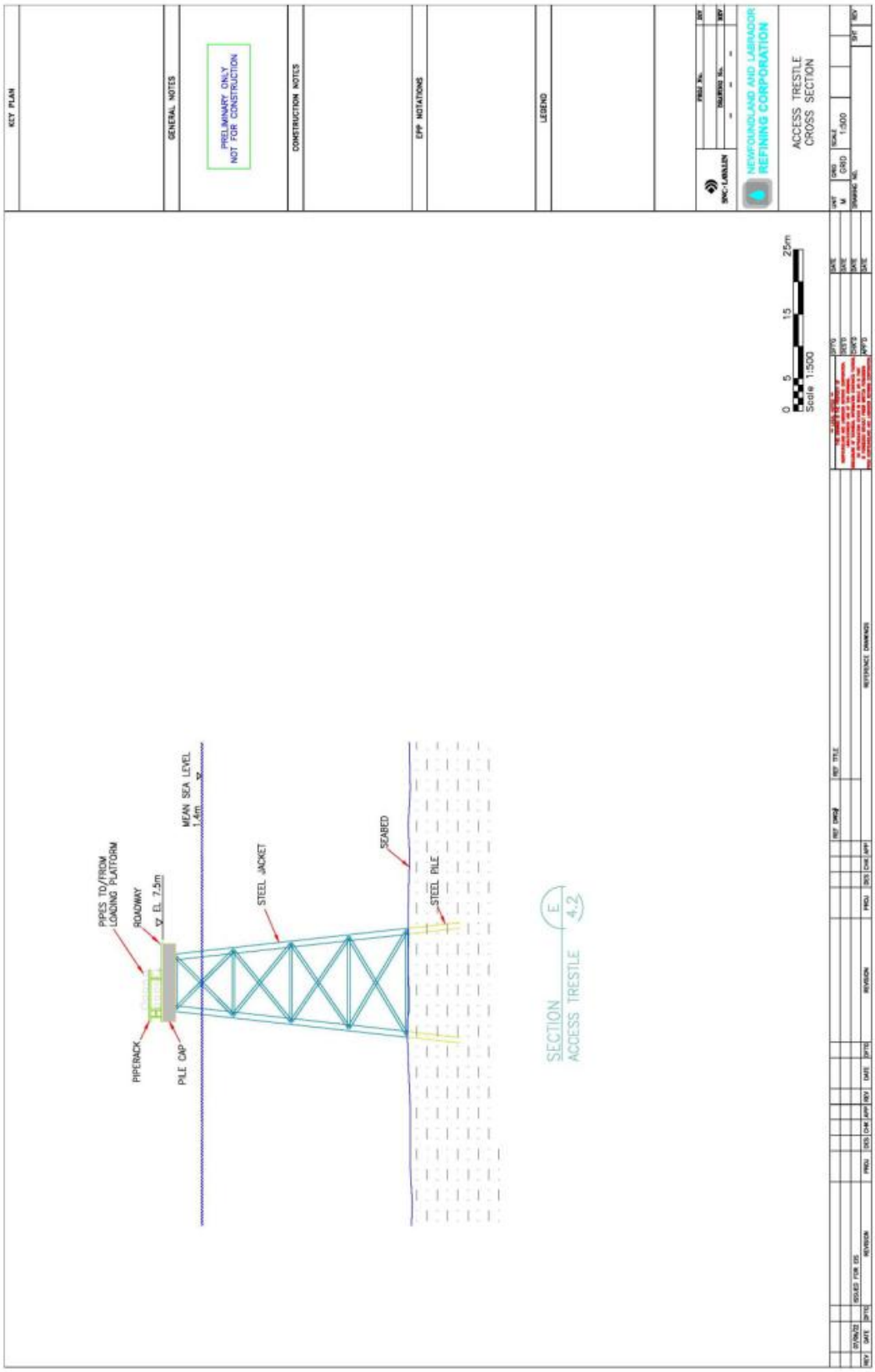


Figure 2-10 Access Trestle Cross Section

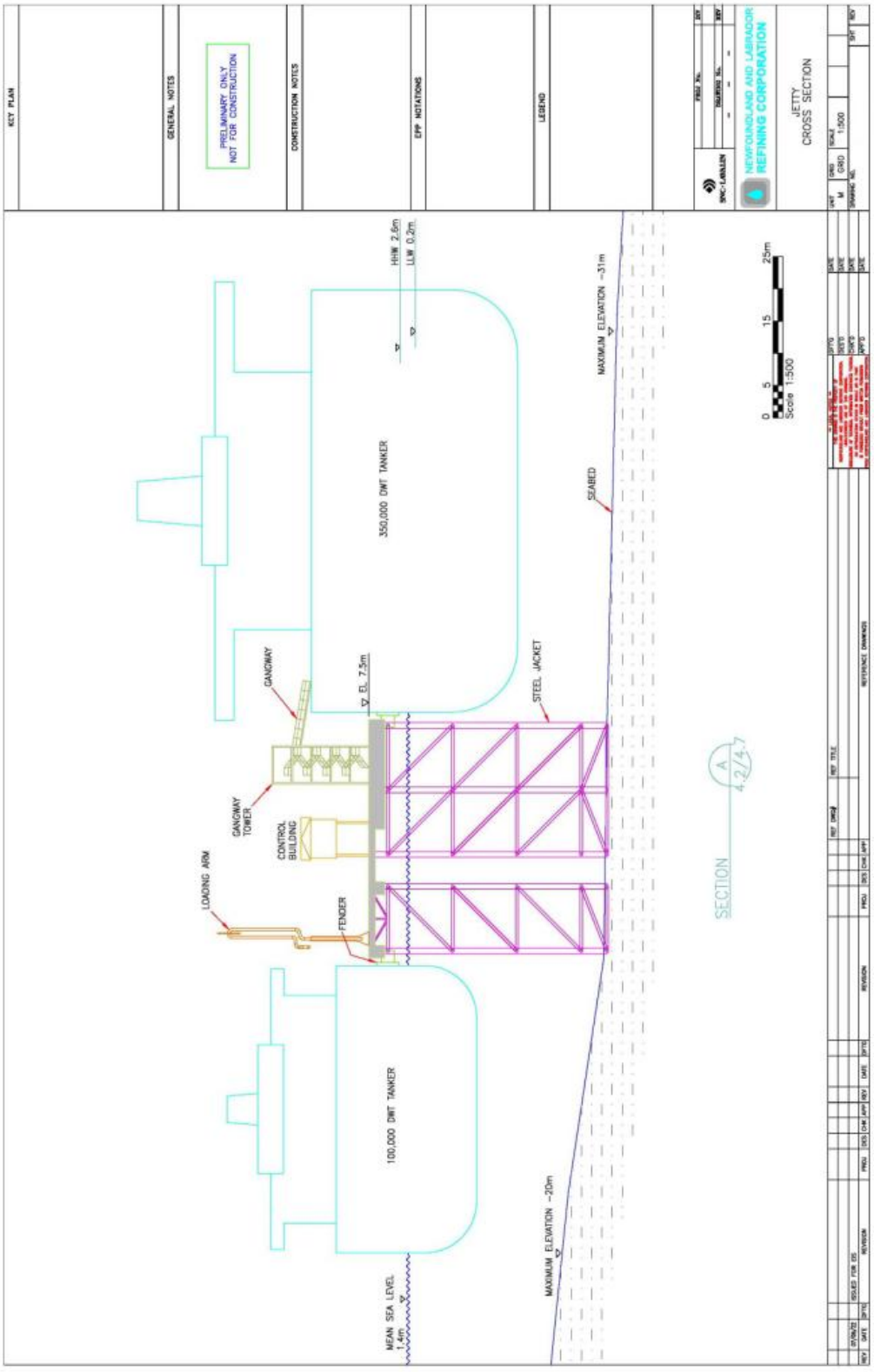


Figure 2-11 Jetty Cross Section

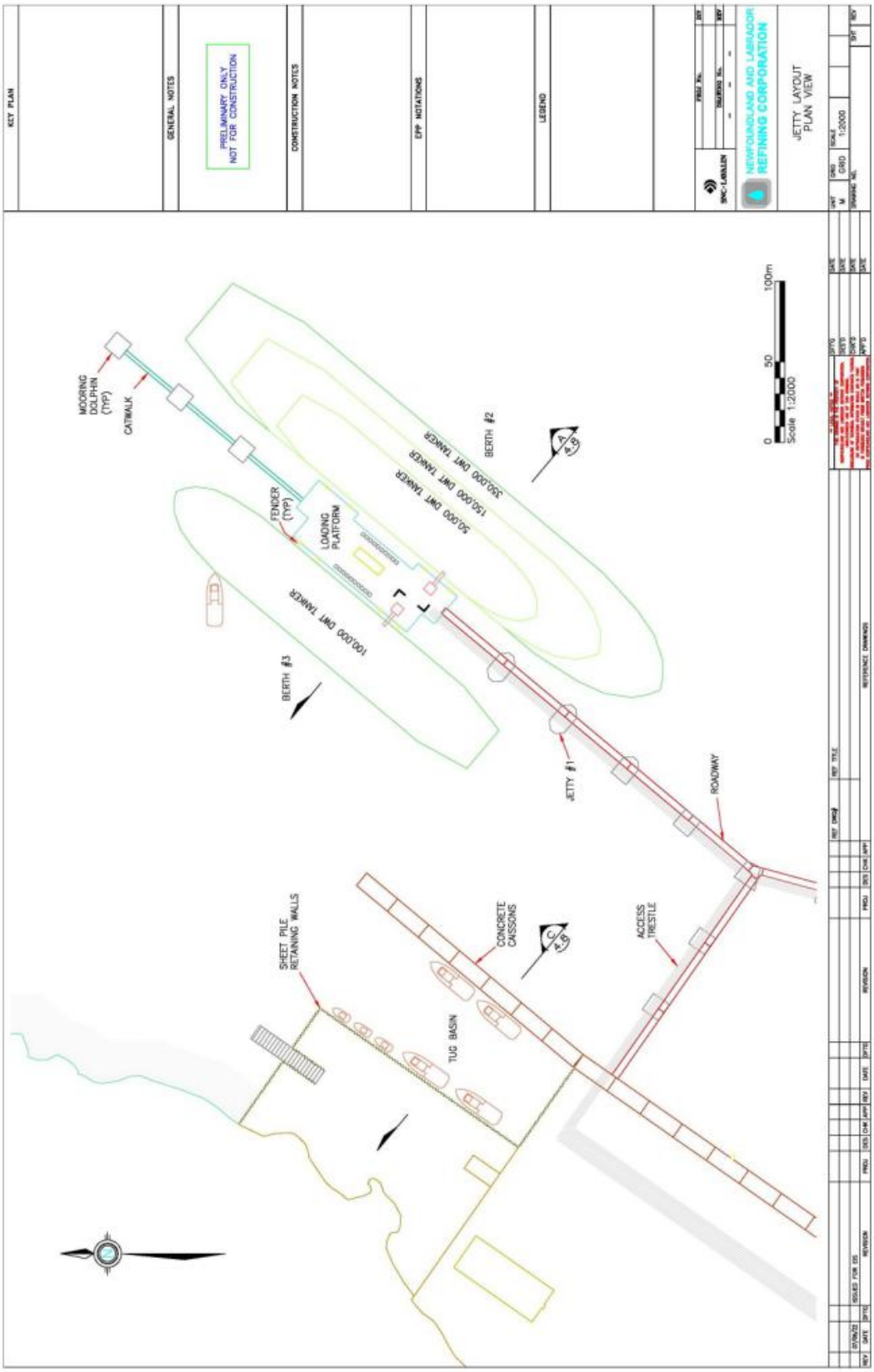


Figure 2-12 Jetty Layout Plan View

2.3.3 Seawater Intake

The seawater intake will consist of two (2) 1.2 m diameter high-density polyethylene pipes that will extend from the intake wet well at the shoreline to the seawater collection point approximately 985 m from shore. The pipe will be installed such that it is buried in the inter-tidal zone at the shoreline for protection from erosion and land-fast sea ice. It will be anchored with concrete bocks over the entire exposed length to prevent floating. The depth of the end of the intake will be at 18 m below low normal tide.

A wedge-wire or V-wire screen (Johnson Screen™) will be used at the end of the intake pipe to reduce the inlet velocity below 0.15 m/s. This reduced inlet velocity protects the surrounding aquatic species and serves to prevent debris from clogging the screen. The screen is also equipped with an air cleaning system in which a periodic blast of compressed air is backwashed through the screen assembly to remove any accumulated debris. The screen material will be selected specifically for the application to prevent corrosion and biofouling.

Water that passes through the intake will enter a wet well at or near the shoreline where the intake pumps will pump it through a pressurized water line to the treatment system. The peak seawater intake rate is estimated to be 43,320 USgpm (2.73 m^3/s). This is made up of seawater cooling tower makeup and desalination intake (Table 6.5).

Table 2-1 Sea Water Intake Flow Rates

Seawater Intake	
Sea Water Cooling Tower Makeup	13,300 USgpm (0.84 m^3/s)
Desalination Intake	30,020 USgpm (1.89 m^3/s)

2.3.4 Marine Outfall

There will be one outfall pipe approximately 400 m long with a 100 m diffuser at its end, located west of the Southern Head point. Discharge from the sedimentation ponds will be directly to the marine environment via a specially designed outfall pipe fitted with appropriate controls in accordance with permitting requirements. All discharged treated effluent will meet all applicable federal and provincial regulations.

The diffuser is designed to provide the required mixing, to minimize the zone of influence of the effluent discharges into the marine environment (to less than 100 m radius from the diffuser).

Treated wastewater from the plant that meets those requirements will be combined with other discharges from the site: cooling water from the main closed loop cooling system,

cooling water from the thermal desalination process, and desalination brine from the thermal desalination process. The principal components of concern in the combined discharge are high salinity and temperature. Site-specific models will be prepared to ensure these parameters fall within acceptable ranges for marine discharge.

Evaluations of estimated water flowrates and parameter concentrations have undergone the first phase of modeling. Given the influent characteristics of 32.2 psu salinity and 4.72°C temperature at a maximum flowrate of 43,320 Usgpm (2.73 m^3/s), the processes were evaluated for discharge conditions. The final combined effluent leaving the Project site for outfall discharge will have an estimated flowrate of 42,518 Usgpm (2.68 m^3/s); 800 Usgpm (0.05 m^3/s) will be consumed. The discharge salinity will be 33.18 psu, which does not vary substantially from the influent salinity concentration and should be easily assimilated and dispersed through the diffusion provided by the outfall. The maximum effluent temperature will be 32°C which, after mixing with ambient seawater, will be in compliance with the regulations governing discharge to the marine environment.

2.4 Ancillary Facilities and Activities

Other construction activities include the clearing and leveling of the site, construction of buried utilities, transmission lines, pipelines, process plant infrastructure, and support buildings including administrative and engineering offices, warehouses, maintenance buildings, laboratory, along with miscellaneous support buildings. Development Proposal activities are divided into three phases, construction, operations and decommissioning.

2.4.1 Construction

The construction phase includes construction of access and service roads, and conventional clearing using excavation equipment and blasting. Blasting will be undertaken by licensed contractors, and will not occur in marine areas or in the presence of wildlife. The main activities during construction will include leveling of the site, construction of buried utilities, transmission lines, pipelines, process plant infrastructure, tank farm, support buildings and the Marine Terminal and associated works. All construction activities will comply with environmental protection plans (EPP), which will deal with erosion avoidance, removal of surface water, dust generation and protection of water bodies and fish habitat, both freshwater and marine.

2.4.2 Operations

The facility operations include the importation of crude oil through the Marine Terminal facilities, storage of the crude in a purpose built tank farm and processing of the crude into marketable refined petroleum products and export of these products through the Marine Terminal. Both the process plant and the Marine Terminal will operate 24 hours a day 365 days of the year. Onsite onshore and jetty fire fighting capability and onsite spill

containment and clean-up equipment will be provided. NLRC has committed to ensuring that national and international standards, as well as established industry guidelines will be incorporated into the design of facilities and operational practices, and that all applicable federal and provincial regulations will be adhered to.

The Marine Terminal and associated works will be operated and maintained by trained, knowledgeable and experienced personnel following proven standard practices that result in a safe, efficient and environmentally responsive workplace. Management systems will be in place that comply with all regulatory requirements. These systems will cover, but not be limited to, the following:

- Operating and maintenance manuals and procedures;
- Equipment monitoring and inspections;
- Equipment and unit turnarounds;
- Risk management and mitigation systems;
- Loss control management;
- Equipment drawing and design specification data;
- Vendor equipment and catalogues;
- Continuous improvement protocols/tools;
- Emissions and discharges monitoring and control procedures;
- Operations training;
- Emergency response; and
- Workplace safety training.

2.4.3 Decommissioning

The initial design life of the Project is 25 years. However, with continuous maintenance, re-fit, expansion, upgrading, modifications, etc., the final operating life will be much longer and could extend to 50 years or more, at which time it will be decommissioned. The decommissioning and abandonment phase will help to reduce and remediate environmental impacts that are a result of Project infrastructure and activities. Re-usable equipment and machinery will be transported to other locations. Above-ground installations will be removed and underground installations will be either removed or left in place, depending on the environmental benefits of each option if there are any. Environmental contamination, if any, will be remediated in accordance with applicable environmental regulations and guidelines. Upon abandonment, the site will either be rehabilitated to a semi-natural state, or used for an alternate industrial or commercial development.

The proponent has committed to the development of site-specific EPPs for the construction, operation and decommissioning phases of the Project. A draft EPP table of contents can be found in Appendix A, the format of which will be finalized prior to the commencement of construction activities. These plans will be submitted to the appropriate regulatory agencies for review and approval at an early stage of Project implementation.

2.5 Development Schedule

The proponent indicates the construction phase of the Development Proposal is expected to begin early in 2008, with production anticipated to commence late 2011. The construction phase would require approximately 3,000 employees, while operation of the refinery would require 750 employees. The design lifespan of the facility is 25 years however operating life of the facility could be extended much longer with regular scheduled maintenance and upgrades.

2.6 Need for the Project

Tankers are the only viable means to move large volumes of petroleum in a global market. The Project (the Marine Terminal and associated works) provides the necessary vessel loading and off-loading facilities for the refinery proposed in the Development Proposal. Stream crossings are required to provide access to the Refinery. Intake and outfalls are required to provide a water supply to the refinery and to discharge treated effluent.

2.7 Purpose of the Project

The purpose of the Marine Terminal is to ensure that the facilities and procedures are in place for safe, efficient and environmentally sound loading and offloading of crude oil, refined products and by-products at Southern Head. In addition, the terminal will support the associated tugs and site emergency response infrastructure.

3 CEAA Environmental Assessment Process

An environmental assessment (EA) of a Project is required under the CEA Act if a federal department is required to exercise certain powers or perform certain duties or functions in respect to the Project for the purpose of enabling the Project. Under Section 5 of the CEA Act, a federal environmental assessment may be required when, in respect of a Project, a federal authority proposes to:

- Be the proponent;
- Make or authorize payment or any other form of financial assistance to a proponent;
- Sell, lease or otherwise dispose of land; or
- Issue a permit, or licence or other form of approval pursuant to a statutory or regulatory provisions identified in the *Law List Regulations.*

These functions are known as triggers. Once a federal department has triggered the CEA Act then that department becomes an RA. The RAs have a responsibility to ensure that an environmental assessment is conducted in accordance with the CEA Act prior to taking any action that could enable the Project.

3.1 Responsible Authorities

TC and DFO have determined that the Project will likely require specific regulatory authorizations and/or approvals from each department under the *Navigable Waters Protection Act* (NWPA) or the *Fisheries Act,* therefore triggers the need for an environmental assessment under Section 5 of the CEA Act. Due to their decision-making responsibilities relative to the above components, TC and DFO are RAs and must ensure that an environmental assessment of the Project pursuant to the CEA Act is conducted.

If the RAs have determined that a Project is prescribed on the Comprehensive Study List regulations of the CEA Act then the RA(s) must ensure the comprehensive study process is conducted. Pursuant to Section 21(2) of the CEA Act, the RA(s) must report to the Minister of the Environment after public consultation on the following aspects:

- The scope of the Project, the factors to be considered in the environmental assessment, and the scope of those factors;
- Public concerns in relation to the Project;
- The Project's potential to cause adverse environmental effects; and
- The ability of the comprehensive study to address issues relating to the Project.

The RA(s) must also recommend to the Minister of Environment whether the environmental assessment should continued by means of a comprehensive study or whether the Project should be referred to a mediator or review panel. After considering

the Subsection 21(2) report and recommendation, the Minister of the Environment will decide whether to refer the Project back to the RA(s) to continue with the comprehensive study process, or refer the Project to a mediator or review panel. If the Minister of the Environment decides that the Project should continue as a comprehensive study then the Project cannot be referred to either a mediator or review panel at a later date.

If the Minister of the Environment determines that the environmental assessment process will continue as a comprehensive study then the public will be given an opportunity to participate during the comprehensive study process. Once completed, the CSR will be submitted to the Minister of the Environment and also to CEAA.

CEAA will invite the public to comment on the CSR prior to the Minister of the Environment making a final decision. The Minister of the Environment may request additional information or require that public concerns be addressed further before issuing the environmental assessment decision statement. Once the Minister of the Environment issues the decision statement the Project will be referred back to the RAs for appropriate action.

Whether the environmental assessment proceeds by means of a comprehensive study or is referred to a mediator or review panel, participant funding will be made available by CEAA to facilitate public participation.

3.2 Expert Federal Authorities

An expert FA is any federal department or agency that has determined they have an obligation to provide any specialist or expert information or knowledge that it possesses with respect to a Project. This expertise can be used during any stage of the environmental assessment, from the commencement of the environmental assessment to the implementation of the mitigation measures or any follow-up program.

In relation to this Project, EC have participated within this environmental assessment process because the department has determined that they possess specialist and/or expert information related to the *Environment Act, Fisheries Act* (Section 36)*, Canadian Environmental Protection Act* (CEPA)*, Canada Water Act, Canada Wildlife Act,* and the *Migratory Birds Act*. EC's focus within each of these statutes are focused primarily on promoting sustainable development, protecting the environment, conserving certain renewable resources, and reporting on environmental conditions.

NRCan have participated within this environmental assessment process because the department has determined that they possess specialist and/or expert information related to geological incidents (earthquakes, landslides, flooding, deep water hazards,

tsunamis, and geomagnetism), landscape process and stability (coastal, fluvial Aeolian slope) and their response to climate change, marine environment and marine resource geosciences.

HC have participated within this environmental assessment process because the department has determined that they possess specialist and/or expert information related to minimizing the potential risks to human health related that could arise in relation to the Project.

4 Scope of the Environmental Assessment

The "scope" defines what is included or excluded from the federal environmental assessment analysis. It focuses the information gathering and analysis activities on the appropriate and important elements related to a specific project or environmental component. It can greatly influence the outcome of an environmental assessment by defining what will be assessed. Therefore, scoping establishes the boundaries of the federal environmental assessment.

4.1 Scope of the Project Related to Federal Authorities

The scope of the Project is defined as the components of a proposed undertaking relating to a physical work, or a proposed physical activity not relating to a physical work, that are determined to be part of the Project for the purposes of the environmental assessment (CEAA, 2006). Freshwater fish and fish habitat considerations include the 38 stream and river crossings associated with the two access roads in the Development Proposal, one from the Burin Highway and one from the Trans-Canada Highway (TCH) near the community of Come By Chance. All navigable waters potentially affected by the access roads area also included in the spatial scope of the assessment.

TC has determined, based on 1) a potential lease requirement for the waterlot within the harbour of Come By Chance that is administered by TC, and; 2) an anticipated NWPA Authorization listed on the *Law List Regulations* of the CEA Act, that the scope of the Project for the purposes of TC's environmental assessment will include:

- The construction, operation, modification, decommissioning, and/or abandonment of the Marine Terminal (causeway, access trestle, jetty (phase 1), jetty expansion (phase 2)), heavy lift construction dock, tug berth;
- Desalination plant water intake and outfall in the marine environment; and
- The stream crossing over Come By Chance River, Watson's Brook and North Harbour River (pursuant to the NWPA).

TC added Watson's Brook and North Harbour River to their original scope with the addition of a second access road to the Project site. TC's original scope referred to jetty (phase 1) and jetty (phase 2): the Project will include both jetties.

DFO has determined, based on the anticipated *Fisheries Act*, Section 35(2) trigger under the Law List Regulations of the CEA Act, that the scope of the Project for the purposes of DFO's environmental assessment will include:

- The construction, operation, modification, and decommissioning (including closure and reclamation) of the Marine Terminal (causeway, access trestle, jetty (phase 1), jetty expansion (phase 2)), heavy lift construction dock, tug berth;

- The marine intakes and outfalls;
- The stream crossing structures for the access roads; and
- Infilling of streams and ponds within the Development Proposal footprint.

DFO's original scope also included dam and intake structures on ponds; drawdown of ponds; and pipeline stream crossings. However, due to project development since the project registration and scoping it has now been determined that the Project design will not include any dams, pond drawdown or pipeline stream crossings and these are not considered further. Note that, as in TC's scope, both jetties are part of the Project.

Shipping is not part of the federal scope. Operation of the Marine Terminal includes docking and de-berthing of vessels but does not include shipping (i.e., access channel, marine traffic, anchorage, etc.). These factors will be assessed during the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) assessment, currently bring coordinated by the Marine Safety Branch of TC.

While the scope of this document is based on the respective scopes of both TC and DFO, all decisions regarding significance of impacts or potential impacts of this proposed Project are made as joint decisions by the RAs, with support of the FAs.

As expert FAs, EC, NRCan, and HC have also provided specialist or expert information and departmental knowledge in support of the environmental assessment.

Currently, TC and DFO have slightly different scopes related to their regulatory responsibilities, however, a single comprehensive study report has been prepared with each RA having decision-making authority respective to their individual scopes.

In accordance with Section 15 of the CEA Act, the RAs have determined that the scope of the proposed Project would include the construction, operation, modification and decommissioning of the following Project components:

- Construction of the Marine Terminal (causeway, access trestle, jetty and jetty expansion (Phase 2));
- Construction of heavy lift construction dock;
- Construction of tug berth;
- Installation of desalination plant water intake and marine outfall into marine environment;
- Construction of a stream crossing over Come By Chance River, Watson's Brook, and North Harbour River;
- Construction of stream crossings along proposed access roads;
- Infilling of freshwater habitat within the refinery footprint; and
- Operation of the Marine Terminal including docking and de-berthing of vessels (does not include shipping).

Recognizing that vessel transport to the proposed NLRC facility will utilize an existing shipping/traffic corridor that has established vessel traffic services and aids to navigation, the implications of accidental oil spills or catastrophic events along the shipping route are considered outside the scope of this Project assessment; however these issues will be addressed as part of the environmental aspects of the TERMPOL process. The TERMPOL process is a TC review process that is also guided by expert advice from other federal and provincial agencies that applies to new marine facilities. The requirements of TERMPOL address issues such as ship safety (including accidental events), route safety, as well as, environmental concerns associated with the location, construction, and operations of terminals. TC, Canadian Coast Guard (CCG), and representatives of other federal and provincial agencies, will participate on the TERMPOL committee established for the proposed NLRC facility, and interact with the public/stakeholders in the area, to address any other issues relevant to the proposed NLRC facility.

As defined in the CEA Act, "comprehensive study" means an environmental assessment that is conducted pursuant to Section 21 and 21.1, and that includes a consideration of the factors required to be considered pursuant to subsections 16(1) and (2). Comprehensive studies are required for large projects having the potential for significant adverse environmental effects. They may also generate public concerns. Such projects are prescribed in the Comprehensive Study List Regulations of the CEA Act.

Upon review of the Development Proposal, the RAs determined that the Project as scoped was subject to a comprehensive study under the CEA Act pursuant to paragraph 28(c) of the Comprehensive Study List Regulations, which states:

> 28. The proposed construction, decommissioning, or abandonment of:
>
> (c) a marine terminal designed to handle vessels larger than 25,000 DWT unless the terminal is located on lands that are routinely and have been historically used as a marine terminal or that are designated for such use in a land-use plan that has been the subject of public consultation.
>
> Accordingly, a comprehensive study process was initiated for the Project by the RAs.

4.2 Scope of the Factors

The scope of assessment defines the factors proposed to be considered in the environmental assessment and the proposed scope of those factors. The RAs are required to consider the factors specified in Section 16 of the CEA Act, taking into consideration the definitions of the environment, environmental effect, and Project.

As defined under the CEA Act, "environmental effect" means, in respect of a Project:

> a) any change that the Project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act (*SARA*).*
>
> b) any effect of any change referred to in paragraph (a) on:
>
> i) health and socio-economic conditions;
>
> ii) physical and cultural heritage;
>
> ii) the current use of lands and resources for traditional purposes by aboriginal persons, or;
>
> iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or
>
> c) any change to the Project that may be caused by the environment
>
> whether any such change or effect occurs within or outside Canada;

Under Section 16 of the CEA Act, the following factors must be considered in an environmental assessment conducted as a comprehensive study:

> 16. (1) Every screening or comprehensive study of a Project and every mediation or assessment by a review panel shall include a consideration of the following factors:
>
> a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any 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;
>
> (b) the significance of the effects referred to in paragraph (a);
>
> (c) comments from the public that are received in accordance with this Act and the regulations;
>
> (d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
>
> (e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, except in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered.

> 16. (2) In addition to the factors set out in subsection (1), every comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:
>
> (a) the purpose of the project;
>
> (b) alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
>
> (c) the need for, and the requirements of, any follow-up program in respect of the project; and
>
> (d) the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

4.2.1 Scope of Factors to be Considered

The following list outlines the scope of the factors (or the Valued Ecosystem Components, VECs) to be considered within this environmental assessment:

- Marine Water Quality
- Sediment Quality and Transport;
- Marine Fish and Fish Habitat
- Freshwater Fish and Fish Habitat;
- Aquaculture/Commercial Fisheries;
- Migratory Birds;
- Species at Risk;
- Marine Mammals;
- Marine Safety, and;
- Human Health and Safety.

4.2.2 Accidents and Malfunctions

The probability of accidents or malfunctions associated with the any phase of the Project and the potential adverse environmental effects of these effects has been assessed (e.g. accidental spills, contingency measures for responding to emergencies, risks of facility malfunctions, etc.).

4.2.3 Cumulative Environmental Effects

The Project also has the potential to generate cumulative environmental effects. The cumulative effects assessment has evaluated the likely cumulative effects that may result in combination with other activities in the area as well as those activities that will occur in the foreseeable future.

NLRC has developed a Green House Gas (GHG) Inventory as part of the Development Proposal Environmental Assessment that includes emissions from the Marine Terminal. While it is recognized that the primary source of GHG emissions for the development

proposal will be process heaters and other process operations during operations, the proponent is aware that all emission sources have to be accounted for, including sources for the construction, operation and decommissioning of the Marine Terminal.

Detailed inventories will be developed for the Project in the next phase of detailed design. The Department of Environment is developing protocols to establish key assumptions used to estimate GHG emissions as well as the methods that will be used for verifying actual GHG emissions for refineries in Canada, as part of industry consultations that are ongoing.

Estimates of vessel operation emissions are provided below in Table 4-1.

Table 4-1 Estimates of Vessel Operations Emissions (t/year)

Products	CO_{2eq}
Crude Vessel 1, type 1	4,832
Crude Vessel 1, type 2	4,832
Crude Vessel 1, type 3	4,832
Crude Vessel 2, type 1	2,530
Crude Vessel 2, type 2	2,530
Crude Vessel 2, type 3	2,530
Gasoline Vessel 1	4,390
Gasoline Vessel 2	9,353
Gasoline Vessel 3	2,371
Kerosene Vessel 1	2,735
Kerosene Vessel 2	3,243
Kerosene Vessel 3	3,973
Kerosene Vessel 4	5,232
RBOB Vessel 1	3,795
RBOB Vessel 2	3,495
RBOB Vessel 3	4,592
Diesel Vessel 1	10,335
Diesel Vessel 2	10,502
Sulphur Vessel	15,270
Coke Vessel	5,694
Total	**10,7066**

4.2.4 Effects of the Environment on the Project

The environmental hazards that may affect the Project and their predicted effects including natural hazards such as extreme weather events, seismic activities, extreme seastate and tidal conditions (tsunami), fog events, and climate change has been evaluated.

4.2.5 Spatial and Temporal Boundaries

Spatially, the main Project site is located within a 5 km^2 parcel of land and a 2 km^2 section of marine environment located on the southern portion of Come By Chance Point, NL, it also includes the site access roads. The spatial boundary has been determined for each factor in order to effectively assess the potential environmental effects of the Project.

The temporal boundaries encompass the entire lifespan of the Project. The environmental assessment will discuss the effects of the Project on each factor in relation to the construction phase, operational phase (including any maintenance and modifications), and through to the completion, decommissioning and/or abandonment phases of the Project.

4.2.6 Follow-Up Program

This environmental assessment includes the consideration for the need for and requirements of an environmental monitoring and follow-up program.

5 Joint Assessment Process

The federal government and the Province of Newfoundland and Labrador do not have a formally coordinated environmental assessment process. However, both governments make efforts to coordinate the steps within the two processes. The two levels of government differ in the scope of the assessment. The federal assessment focuses primarily on the effects of the proposed Marine Terminal and associated works (the Project), any navigable waters potentially affected and both freshwater and marine fish and fish habitat as outlined in Section 4.0 of the CSR. The provincial government's assessment includes considerable detail on social and economic aspects of the Development Proposal as well the biophysical environment, with an emphasis on air quality.

5.1 Provincial Environmental Assessment Process

A registration document prepared by the Proponent was submitted to the Newfoundland & Labrador Department of Environment and Conservation on October 25, 2006 as required for the Newfoundland and Labrador *Environmental Protection Act*. This document, "Project Registration in accordance with the Requirement of the Newfoundland and Labrador *Environmental Protection Act* for the Newfoundland and Labrador Refinery Project at Southern Head at the Head of Placentia Bay, NL" contained a full project description, including a depiction of the existing biophysical environment. The registration document was reviewed by all provincial government departments, selected federal government departments, and the public for a 40-day period. The comment period on the Development Proposal ended on December 4, 2006.

On December 11, 2006, the provincial Minister of Environment and Conservation announced that an EIS would be required for this Development Proposal. An EIS is required when significant environmental effects are likely and/or there is significant public concern regarding the proposal. The provincial Minister of Environment and Conservation advised the proponent that an EIS was required to examine, among other things,: air quality, water quality, migratory birds, fish and fish habitat, water resources, fisheries and aquaculture, historic resources and the socio-economic environment. A provincial Environmental Assessment Committee (EA Committee) was appointed to provide scientific and technical advice to the Minister and to prepare draft guidelines for conducting the EIS.

Federal representatives from TC, DFO, and EC were appointed as members on the provincial EA Committee that developed the EIS guidelines to focus the provincial environmental assessment process. Although not directly represented on the EA

Committee, HC worked closely with the provincial Department of Health to ensure their concerns were addressed within the EIS. The provincial assessment has scoped the Development Proposal in its entirety.

It should be noted that the federal scope, as described in previous sections of the CSR, only covers parts of the Development Proposal including the Marine Terminal and associated works, marine intake and outfall, stream crossings, as well as, activities affecting fish and fish habitat.

5.2 Coordination of Provincial and Federal Processes

The federal environmental assessment process was coordinated with the provincial EIS process to the extent possible. Jointly, the provincial and federal governments prepared the environmental assessment guidelines to aid the Proponent in preparing an EIS and this CSR. Also, the 50-day public review period on the EIS was utilized by the RAs to fulfill the requirements of Section 21.2 of the CEA Act. The RAs considered all public comments submitted to the Newfoundland and Labrador Environmental Assessment Division pertaining to the scope of the Comprehensive Study.

Although the provincial and federal governments have coordinated their EA processes, each level of government will make decisions on matters within their own legislative authorities. Two environmental assessment reports were produced, an EIS, to satisfy the requirements of the Newfoundland and Labrador *Environmental Protection Act* and a CSR, to satisfy the requirements of the CEA Act.

6 Information Distribution and Consultation

6.1 Federal Project Team

CEAA received formal notification of the Development Proposal from the proponent and on September 12, 2006, pursuant to the *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements*, CEAA notified Federal Authorities of the Project to determine their potential roles in the environmental assessment. The notice was sent to TC, DFO, EC, NRCan, and HC.

By October 13, 2006, DFO and TC were identified as RAs, given each department's Section 5 trigger in accordance with the CEA Act. EC, NRCan and HC participated as FAs for the Project and provided expert and/or specialists information related to their departmental mandates. In accordance with Section 12.4 of the CEA Act, CEAA is the Federal Environmental Assessment Coordinator (FEAC) for the Project.

The Project team consists of representatives from each department, who have met on a regular basis and reviewed all relevant documents including the Scoping Document, Track Report, and draft CSR. The Scoping Document and Track Report were prepared by the RAs. Preparation of the CSR was delegated to the proponent.

6.2 Public Consultation Conducted by Proponent

In the early stages of the Development Proposal, NLRC contracted a Public Consultation Facilitator from the local area to assist with the consultation program, providing additional familiarity with local associations and interests. NLRC has held to date over 51 meetings attended by over 2,300 people. As well, NLRC established a Project website (www.nlrefining.com) and provided key documents and presentations on this site.

A record of public comments was maintained throughout the public consultation period based upon the questions and comments raised at the various public meetings, the top issues indicated in the Exit Surveys at the Open Houses, and the results of the Question and Answer periods of community meetings. The primary issues raised at these meetings were:

- Vessel Traffic;
- Air Emissions;
- Oil Spill Response;
- Feasibility of the Development Proposal; and
- Employment and local benefits.

Many established organizations active in the Project area (having local, regional or provincial scopes) have expressed an interest in the project. They are also able to bring the knowledge and experience of their respective membership to bear on relevant questions NLRC has had throughout the consultation process. These groups range from chambers of commerce to the provincial environmental industries association. NLRC has also met with a number of established committees in the area, including the Placentia Bay Traffic Committee, the Placentia Bay Integrated Management Planning Committee, and the Fish, Food and Allied Workers Union (FFAW) Placentia Bay Sub-Committee. An Air Quality Study Community Input Group was also formed and met twice during the EA process and again during the 50 day public provincial EA review process to review the findings of the Air Quality Study.

Six open-house public meetings have been held in communities throughout the Project area, including North Harbour, Come By Chance, Southern Harbour, Placentia, Clarenville and Marystown. In addition, six meetings were held between the proponent and commercial fish harvesters in communities all around Placentia Bay. Project information was widely distributed at these meetings, and was also mailed to dozens of groups throughout the environmental assessment process; such as high schools, Chambers of Commerce, municipal governments, zoning boards, libraries, harbour authorities, and all identifiable interested parties.

To ensure effective distribution of information regarding this Project, the proponent decided that a Public Information Centre (PIC) would be opened in the local area. In mid-March of 2007, the PIC was established at the main entrance of the Bull Arm Site Corporation on the TCH, between the Sunnyside/Come By Chance Interchange and the Arnold's Cove exit of the TCH. The PIC has an office, reception area, common area, and a boardroom – allowing a place to display information, house the Public Information Officer and host smaller meetings. It has undertaken the collection of résumés, developing a database of rental properties and boarding houses, answering enquiries and passing out information. The boardroom has also served as a meeting place for the Project team and other groups with a role in the Project as required.

Early consultation with the provincial government and with communities in the Project area provided important and useful guidance for the proposed Development Proposal design. Information from community consultations resulted in changes to Project plans and design including:

- Realignment of the jetty to avoid loss of cod harvesting grounds;
- Addition of a second access road to the Burin Peninsula Highway;
- Waste oil and ballast water treatment facilities at the refinery;
- FFAW conducted surveys to collect information on fishing activity in Placentia Bay with all parties having access to this information;

- Commitment that tanker trucks will not travel the road with fuel products for domestic markets - all NLRC products will be shipped out via tanker;
- The formation of an Air Quality Study Advisory Group by the proponent to ensure local residents are informed regarding air emissions;
- Commitment by the proponent to provide real-time information on air quality.

As this Project proceeds, the proponent has committed to continue sharing and exchanging information about the Project and Project effects with communities in the Project area to maximize local benefits and minimize negative effects.

6.3 Public Consultation Conducted by Province

Throughout the environmental assessment process, the province is required to undergo a number of public consultations stages. Following the submission of the Project Registration document by the proponent to the provincial government on October 16, 2006, the public was allowed a 35 day review period to submit written comments to the provincial Minister of Environment and Conservation. The deadline for these comments was December 4, 2006.

The provincial Minister of the Environment and Conservation issued a release on December 11, 2006 stating that the proposal would be subject to an EIS, which would examine, among other things: air quality, effluent quality, migratory birds, fish and fish habitat, water resources, fisheries and aquaculture, historic resources and the socio-economic environment.

The EA Committee was appointed on December 22, 2006 to provide scientific and technical advice to the Minister and to prepare draft guidelines for conducting the EIS.

A second review period was provided when the draft EIS guidelines, produced by the EA Committee, were released. The EA Committee developed these guidelines following meetings and consultations with the proponent, government agencies, and the public. These guidelines were under review by the public for a period of 40 days, after which the Minister released final guidelines on June 18, 2007.

The EIS was then produced by the proponent, in accordance with the final guidelines, and submitted to the provincial government on July 27, 2007. The public was permitted a 50-day review period of the EIS, during which they could submit written comments to the Minster regarding the proposed refinery project and the content of the EIS. On October 5, 2007, the EIS, having been reviewed by the EA Committee and made available to the public, was deemed acceptable under Section 11.(7) of the *Environmental Assessment Regulations (2003)*, subject to the approval of a satisfactory amendment to the EIS by the Minister.

6.4 Public Participation under CEAA

CEAA requires that public consultation be conducted a minimum of three times during a comprehensive study:

- During the preparation of the scoping document [subsection 21(1)];
- During the preparation of the comprehensive study report (section 21.2); and
- During a review of the completed CSR prior to the Minister of the Environment's issuance of an environmental assessment decision statement (section 22).

6.4.1 CEAA Section 21 – Public Participation Regarding Proposed Scope of the Project

The public consultation process, as outlined under subsection 21(1) of the CEA Act, sought public comments on the federal scope of the Project. The scoping document was prepared by the RAs and included information on the purpose of the document, the environmental assessment process, opportunities for the public to make comments and other public participation opportunities.

In relation to the scoping document, the following public consultation and communications initiatives were undertaken:

- Information on the Project and the environmental assessment is publicly available on the Canadian Environmental Assessment Registry (CEAR) website. The CEAR reference number for this Project is 07-03-24726. The CEAR includes the Notice of Commencement (January 12, 2007), the notice regarding the opportunity for public comment on the scoping document (January 31, 2007), and the notice advising on the availability of participant funding (January 31, 2007).
- Notices advising of the public comment period on the scoping document were placed in the following newspapers: The Telegram (on January 27, 2007) and The Clarenville Packet (on January 29, 2007). The notices provided information on the length of the public comment period, how to obtain a copy of the scoping document, the availability of participant funding, and how to provide feedback.
- Copies of the scoping document were also made available for viewing at the Come By Chance Town Office, Arnolds Cove Town Office, and Sunnyside Town Office.

In addition to the public notices, copies of the scoping document were forwarded to key stakeholders prior to advertising public notices. These stakeholders included the following;

- Town of Come By Chance;
- Town of Arnolds Cove;
- Town of Sunnyside;
- Harbour Authority of Arnolds Cove;
- Harbour Authority of Fair Haven;
- Harbour Authority of Garden Cove;
- Harbour Authority of Mount Arlington Heights;
- Harbour Authority of North Harbour;

- Harbour Authority of Southern Harbour;
- FFAW;
- Newfoundland and Labrador Department of Fisheries and Aquaculture, and;
- Newfoundland and Labrador Department of Environment and Conservation.

The public and key stakeholders were invited to comment on the following specific points during the consultation period which ran from January 27, 2007 to March 2, 2007: 1) the proposed scopes of the Project for purposes of environmental assessment; 2) the factors proposed to be considered in its assessment; 3) the proposed scope of those factors; and 4) the ability of the comprehensive study to address issues relating to the Project.

The RAs received sixteen (16) written submissions on the proposed scope of the environmental assessment of the Project. Submissions were received from various organizations, including fishers operating within Placentia Bay, the FFAW who represent these same fishers, the Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA), and the One Ocean Corporation. These comments were considered by the RAs and those comments reflective of the scope of the Project were incorporated into the environmental assessment.

The Participant Funding Program is designed to promote public participation in the evaluation and review process of comprehensive studies, mediations and assessments by review panel. On January 31, 2007, CEAA announced the availability of $50,000 to help individuals and organizations to take part in the comprehensive study of the proposed Project. A deadline of March 2, 2007 was provided to receive applications. One applicant was received and on June 19, 2007, CEAA announced that it had awarded $41,500 to the FFAW to support its participation in the comprehensive study.

6.4.2 CEAA Section 21.2 - Public Participation in the Comprehensive Study

Pursuant to subsection 21.2 of the CEA Act, the second round of public consultation was coordinated with the Newfoundland and Labrador Department of Environment and Conservation's 50-day public review period (July 27, 2007 to September 15, 2007) on the EIS. The EIS review fulfilled Section 21.2 of the CEA Act due to the fact that all federally scoped elements, as outlined in Section 4, were included in the provincial EA process.

Notice of the Section 21.2 public consultation was posted on CEAR on August 1, 2007 and copies of the notice were mailed to relevant stakeholders

During the public comment period, complete sets of the EIS were made available for viewing at Project area chambers of commerce, economic development boards, and

town halls. Others groups, such as the FFAW, Friends of Cape St. Mary's, North Atlantic Refining Limited (NARL), Newfoundland Transshipment Ltd. (NTL), Argentia Management Authority and the Placentia Bay Traffic Committee were also provided with copies of the EIS.

The RAs considered all public comments submitted to the Newfoundland and Labrador Environmental Assessment Division pertaining to the scope of the federal comprehensive study.

Of the submissions received by the Newfoundland and Labrador Environmental Assessment Division, two pertained to the federal scope. The FFAW Union submitted comments on the potential impacts on fishers related to increased marine traffic, construction of marine infrastructure, potential for oil spills, and the potential for the introduction of invasive species. The RAs are confident that the implementation of mitigation measures identified in the CSR, compliance with the applicable regulations of the *Canada Shipping Act* and the existing vessel management separation scheme in place in Placentia Bay can mitigate these concerns.

In addition, the proponent is participating within a TERMPOL Review Process. TERMPOL focuses on marine safety issues related to a vessel's selected route in waters under Canadian jurisdiction to its berths at a proposed marine terminal or transshipment site and, specifically, to the process of cargo handling between vessels, or off-loading from ship to shore or vice-versa. TERMPOL, in addition to existing regulations, should address the concerns raised by the FFAW.

The second public comment was received from the Newfoundland and Labrador Environmental Association (NLEA). The NLEA requested that additional monitoring of marine bird colonies be conducted by the proponent. The RAs, with assistance and advice from EC, may consider additional monitoring of marine birds during the development of a Follow-Up Program.

6.4.3 CEAA Section 22 – Public Access to the Comprehensive Study Report

Pursuant to Section 22 of the CEA Act, a third opportunity for public input on the Project and the associated environmental assessment will occur through a public review period on this report. CEAA will facilitate public access to the CSR, including administering the formal comment period. All comments submitted will be provided to the RAs and will become a part of the public registry for the Project.

6.5 Consultations with Federal Authorities

Throughout the comprehensive study process the FAs have been consulted and provided an opportunity to comment on the Scoping Document, Track Report, and the draft CSR. Each FA was asked to provide comments specific to their respective departmental mandates. Comments outside the scope of the Project were not incorporated into the CSR unless the FA agreed to accept responsibility for the implementation and follow-up of those components outside the legislative mandates of the RAs.

6.6 Consultations with Aboriginal Persons

Aboriginal Traditional Knowledge is defined as the knowledge that is held by, and unique to Aboriginal peoples. It is a living body of knowledge that is cumulative and dynamic and adapted over time to reflect changes in the social, economic, environmental, spiritual and political spheres of the Aboriginal knowledge holders. It often includes knowledge about the land and its resources, spiritual beliefs, language, mythology, culture, laws, customs and medicines (CEAA, 2006). Aboriginal Traditional Knowledge may be considered within the environmental assessment of a proposed project if that project is likely to cause an indirect effect on the environment.

Currently, there is only one aboriginal community located on the island portion of Newfoundland and Labrador. The Miawpukek Band Reserve is located in Conne River, on the South Coast of Newfoundland. The Reserve covers an area of approximately 36 square kilometers with a population of approximately 700. Currently, the Miawpukek Band does not use lands or resources in the Project area for traditional purposes.

The Project is located at the head of Placentia Bay, on the southern portion of the Avalon Peninsula, in the province of Newfoundland and Labrador. The Project is not located within land settlement areas or areas where Aboriginal groups use lands or resources in the Project area for traditional purposes. The Miawpukek Band Reserve is located approximately 450 km from the proposed Project site by road and approximately 1,400 km by sea.

Aboriginal consultation, and the inclusion of Aboriginal Tradition Knowledge, was not deemed necessary within this environment assessment given, 1) there is no known traditional Aboriginal fishing or hunting areas near the proposed Project site, 2) the distance of the Miawpukek Reserve from the Project site, and 3) traditional rights are not established outside the boundaries of the Miawpukek Reserve.

6.7 Other Federal or Provincial Regulatory Consultation

In addition to the public consultation requirements pursuant to the CEA Act, the proponent must conduct a public notification period for the construction of the Marine Terminal required as a condition of obtaining a Section 5(1) Authorization under NWPA. The proponent is required to submit a set of engineered drawings to the local town office for public display for a period no less than 31 days. In addition, public notices will be published in the Canada Gazette, The Telegram, and The Packet. The Town of Come By Chance has also held public consultations regarding the Marine Terminal as part of the provincial process for amending Municipal Plans.

6.8 Federal Consultation Summary

The initial public consultation period for this Project was conducted in accordance with Section 21(1) of the CEA Act. A Scoping Document was available to the public for review and comment for a 34-day period between January 27, 2007 and March 2, 2007. A total of 16 comments were received and considered by the RAs during the remainder of the EA process.

The second public consultation conducted pursuant to Section 21.2 of the CEA Act was coordinated with the 50-day public review period on the provincial EIS document. TC and DFO considered all those public comments submitted to the Newfoundland and Labrador Environmental Assessment Division pertaining to the scope of the federal comprehensive study during the preparation of this CSR.

As stated under Section 22 of the CEA Act, a public review period of this completed CSR will be provided. CEAA is responsible for publishing a notice setting out the following information:

(a) the date on which the CSR report will be available to the public;

(b) the place at which copies of the report may be obtained; and

(c) the deadline and address for filing comments on the conclusions and recommendations of the report.

7 Description of Existing Environment

A detailed summary of the existing environment in Placentia Bay and specifically in the area of the Southern Head Project area as related to the scope of this CSR, are presented in the following sections.

7.1 General Features of the Study Area

Placentia Bay is a large bay on the south coast of Newfoundland, with entrance between Cape St. Mary's (46°50' N, 54°12'W) on the east side and Ferryland Head, about 50 miles to the west. The Bay extends about 60 miles in a NNE direction, and the head of the bay, locally known as the bottom of the bay, reaches the narrow isthmus joining the Avalon Peninsula to the Island of Newfoundland.

The coastline of Placentia Bay is irregular with numerous bays, sounds, harbours, inlets and islands. The bathymetry of Placentia Bay is also very irregular with many banks and troughs. Merasheen Island, Long Island, and Red Island divide the inner bay into three channels. The eastern channel between the eastern shores of the bay and the eastern shores of Red and Long Island is the widest, the deepest and the least obstructed by shoals. The eastern channel, (the main navigation channel controlled by the Vessel Traffic Services (VTS) management system) has depths extending to approximately 300 m. Shoals, inlets and rocks obstruct the western channel between the west side of Merasheen Island and the Burin Peninsula. A deep channel exists south of Merasheen Island spans from a northwest/southeast direction across the bay and has a maximum depth of 350 m. The water depth at the mouth of the bay at its center is over 200 m. The bathymetry of Placentia Bay is illustrated in Figure 7-1. Detailed bathymetric survey will be carried out by NLRC at the detailed design stage of the Project.

The numerous islands of Placentia Bay south and west of the Marine Terminal and associated works provide an important natural sheltering of the marine facilities from ocean waves (swell) as well as locally wind generated waves (sea wave) due to shorter fetch.

7.2 Geology

The regional geology of the Project region has rocks that have been classified as the Musgravetown Group of the Avalon Zone, a large area of Late Proterozoic shallow marine, siliciclastic, sedimentary and associated volcanic rock. The geology of the site consists of the green, gray, and red graded and cross-bedded sandstone and pebble conglomerate with inter-bedded black shale and conglomerate. The North Harbour

River Fault separates these rocks from the Swift Current Granite on the northwest end of the site.

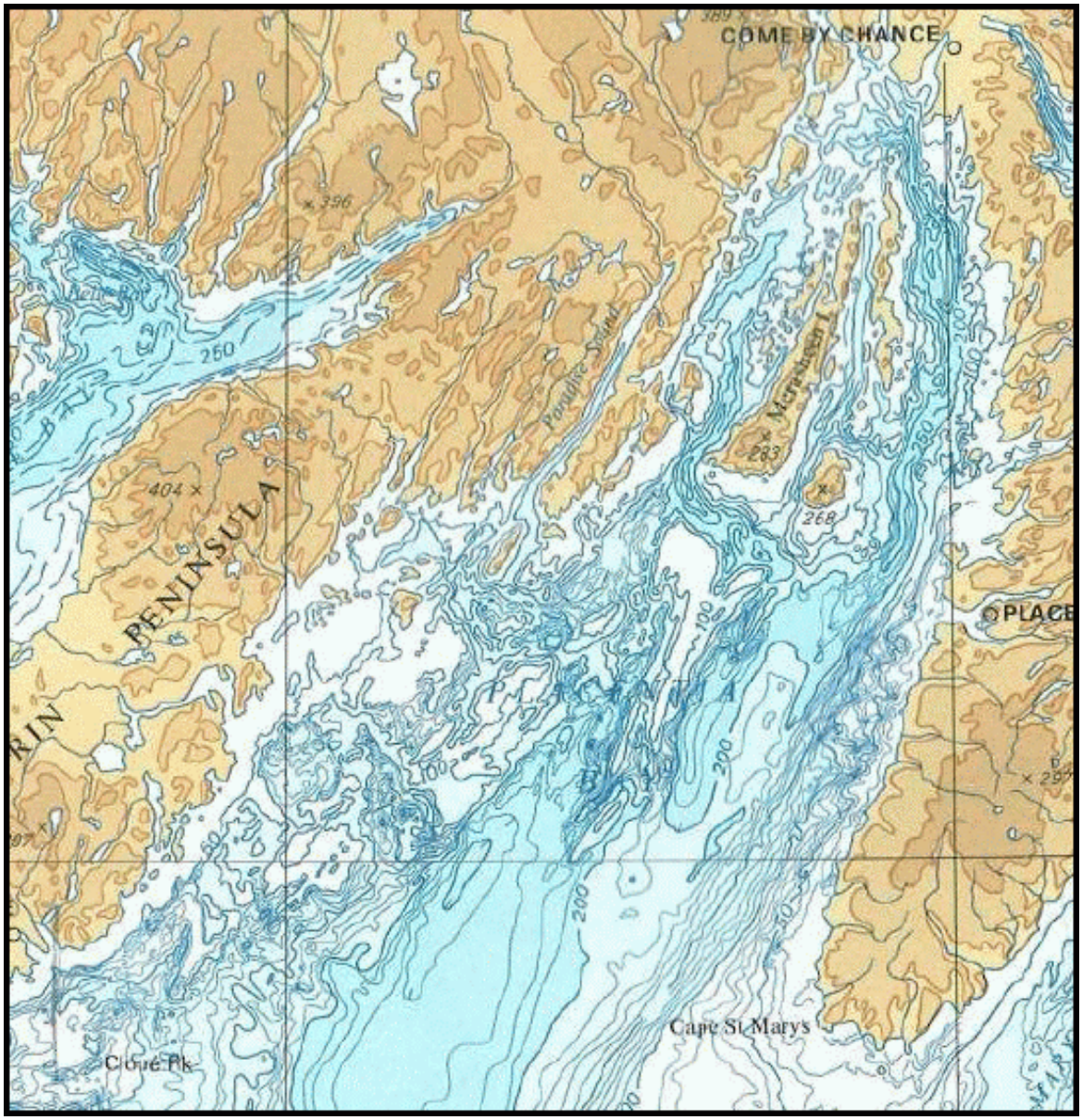


Figure 7-1 Placentia Bay Bathymetry

The Project site is characterized by a narrow beachhead in the area of the Marine Terminal jetty, which rises steeply to a low plateau with rolling topography in the tank storage area. Only a thin veneer of glacial till remains over most of the site as a result of stripping by glacial action. The Project footprint contains approximately 30 % bedrock exposure of which 50 % is covered with thin glacial till, and 20 % covered with bog and

water. Raised marine beach material was found at two investigation sites between the 20 and 35 m contours, possibly indicating a periglacial sea level.

NLRC conducted preliminary investigations of the Project site to characterize the geotechnical characteristics of the Southern Head site. These investigations included a review of existing published information regarding the Project area as well as a field program consisting of test pit excavation and evaluation, bog probe investigations, and a laboratory program for analysis of soil and rock samples collected during field operations. Detailed geotechnical investigations will be carried out by the Proponent at the detailed design stage.

A qualitative and quantitative characterization of the seabed as related to marine habitat was conducted within the footprint of the proposed marine facilities (see section 7.3.11) for details). The main features are summarized below.

7.2.1 Marine Terminal

Substrate distribution within the Marine Terminal / tug berth area (zone 1) consists of cobble and small boulder. The southern portion of Zone 1 transitions into a region of course gravels interspersed with occasional bedrock outcrops, followed by a region predominated by sand and fine gravel. The northern portion transitions from the nearshore cobble and small boulder to a region typified by sand and fine gravels. The substrate in the marine jetty area (zone 2) is uniform throughout the entire zone consisting primarily of sand with small amounts of gravel and isolated small boulders.

7.2.2 Marine Water Intake (zone 3)

Nearshore substrates are predominantly cobble with lesser amounts of sand and gravel and isolated small boulders and bedrock, with the northern half of the zone (near shore) consists primarily of gravel and sand, with lesser amounts of cobble and isolated boulder. The southern half transitions to compositions consisting of large bedrock outcrops interspersed with small boulders, and gulches dominated by cobble.

7.2.3 Marine Outfall (zone 3)

Substrates in the nearshore area (shoreline – 40 m) are predominantly small boulder with lesser amounts of cobble and gravel. Further south sediment composition changes to consist primarily of bedrock and large boulder interspersed with cobble and gravel. Sand and gravels with occasional cobble patches dominate the southern portion of the zone.

7.3 Marine Environment in the Study Area

7.3.1 Meteorology and Climate

Newfoundland experiences a maritime climate as a result of coastal and offshore waters having a moderating effect on temperature. The south coast of Newfoundland, influenced by southwesterly winds, is considered to be the area of Newfoundland showing the most marked maritime influence. Ocean currents and prevailing wind conditions during the winter provide warmer temperatures than most other areas of Newfoundland, whereas southwesterly winds during the summer months produce cooler conditions than continental climates. In general, Newfoundland's south coast has short, cool and wet summers, and winters are moderately mild and wet.

Furthermore, a maritime climate tends to be fairly humid; resulting in reduced visibilities and low cloud heights, and receives significant amounts of precipitation. Coupled with the fact that the south coast lies directly in the path of Atlantic storms that pass over Newfoundland, the region receives the highest yearly precipitation of any region in Newfoundland and is the wettest in Atlantic Canada.

Wind patterns vary seasonally and local topographical effects are extremely significant in many embayments along the south coast. Westerly and southwesterly winds are more prevalent throughout the year, although winds may originate from any direction. The southwesterly winds generally bring warm, moist air to the region from the warmer ocean surface waters in the south. Along the exposed shorelines, the extensive fetch in conjunction with southwesterly winds may develop intense waves.

Reduced visibility is most common during the spring and summer, when fog forms as relatively warm and moist air is cooled by the cool surface waters along the coast. Coastal fog is often thinned or eliminated by offshore winds and increased temperatures over land. The prevalence of fog is greatest in those areas most influenced by southwest winds, particularly open coastline.

7.3.2 Met/Ocean Data Sources

The available wind & wave data used in this study are:

Meteorological Data from weather stations around Placentia Bay including:

- St. Lawrence (on the Burin Peninsula at the western entrance of Placentia Bay (1966-1995);
- Argentia (1976-1996);
- Arnolds Cove (1971-1993);
- Come By Chance (1968-1993);
- SmartBay Buoy #1 (46º58.9378'N, 54º41.1746'W) started in August 2006 (wind & waves); and

- SmartBay Buoy #2 (near the Marine Terminal jetty at: 47º47.7'N, 54º02.3'W) it is also fitted with an Acoustic Doppler Current Profiler (ADCP) for current measurements.

Wave Measured Data:

- Mobil Oil Canada Hibernia Gravity Base Structure (GBS) wave measurement program in Placentia Bay (Dec. 1, 1985 to Dec 31, 1986). This presents the best and most applicable measured data for the Project Marine Terminal. It represents a full year data at three locations simultaneously. Locations are:
    - 47º46.95'N, 54º02.30'W;
    - 47º45.40'N, 54º07.93'W;
    - 47º42.28'N, 54º04.70'W.
- Marine Environment Data Service (MEDS) buoy data at different locations in the Bay; and
- SmartBay Buoy, two buoys one at the entrance of the bay and the second is near the proposed Marine Terminal. Data recording is on-going.

Long Term (wind & wave) Hindcast Data:

- MacLaren Plansearch Limited (1991) Wind and Wave Climate Atlas – Volume 1: East Coast of Canada (provides wind and wave statistics and extremes for the East Coast including the Grand Banks and the approached to Placentia Bay (excellent reference for offshore Placentia Bay and entrance).
- SNC-Lavalin 30 years site-specific Wave Hindcast (at Come By Chance Bay & Arnolds Cove Transshipment Terminal). This provides the only long-term wave climate at the proposed Marine Terminal. It also provides extreme wave analysis for the site. (SNC-Lavalin Inc./BAE-Newplan, 1996).
- Canadian Climate Centre (1991) Wind/Wave Hindcast Extremes for the East Coast of Canada. Provides contour maps for wind and wave extremes of 50 and 100 year return periods for the East Coast including the Grand Banks and the south coast of Newfoundland including the entrance of Placentia Bay. It used 68 most severe storms in the period of 1957-1988.
- AES40 which modeled initially the entire 40-year time period from 1858 to 1997 and was updated to cover the period from July 1954 to June 30, 2005. It utilized global reanalysis of wind fields as input to third generation spectral wave model (ODGP 3G by Oceanweather Inc (Swail et. Al., 2006)).
- MSC50 was to improve the AES40 database by modeling the Canadian East Coast at significantly higher resolution (0.1 degree grid) and to incorporate shallow water physics using the same 3G model used in AES40. This database provides the best and latest long term wind and wave Hindcast data for the East Coast including most of Placentia Bay, (50 years from 1954-2005).

The primary information sources are the National Climate Data and Information Archive, operated and maintained by EC, which contains data from climate and weather stations surround Placentia Bay. Data from climate stations at Arnold's Cove (1971-1993), Come By Chance (1971-94), and Argentia (1976-1996) is of particular importance because of its proximity to the Project location. Cloud and visibility data are only available for

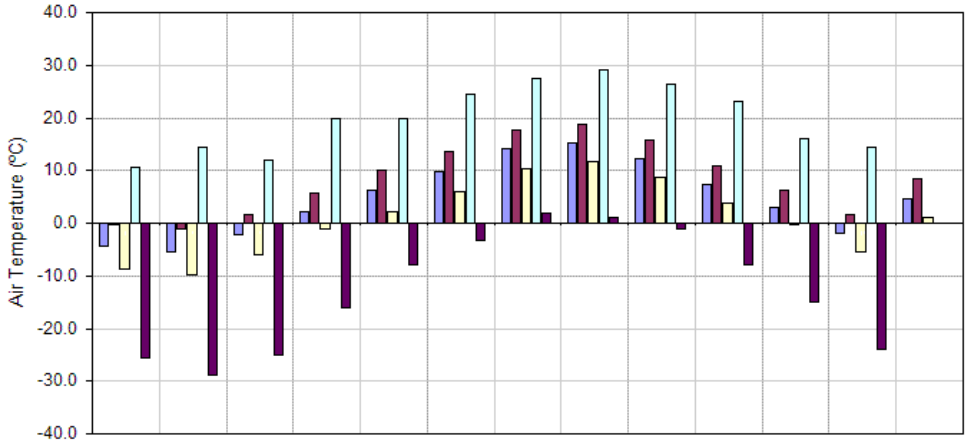
stations that have had a manned observation station in the past. However, there are no weather stations situated around Placentia Bay that currently operate a manned observing program. Therefore, historic climatic data for outer Placentia Bay has been extracted from the MAST database (a marine and atmospheric database, created by Atmospheric Environment Services (AES) of EC).

Wind and wave extremes were determined from long-term hindcast database for the study area and analysis of the most severe storms that hit the southern coast of Newfoundland and the Grand banks. The MSC50 database also provides extreme wind and wave predictions (for 1, 5, 10, 25, 50, 75, 100 and 200 year return periods), It provides excellent data set for the Placentia Bay area south of the island (i.e. offshore the Project location). This data can be used to provide input to site-specific wave propagation (wave refraction and shoaling) at the site. This will provide required data for the design and operation of the marine facilities, which accounts for the most severe storms in the study area.

7.3.3 Air Temperature

Air temperature data obtained from the Come By Chance climatic station covers a time period from 1968 – 1993 and is presented in Figure 7-2. The average air temperature has an extreme daily max-min range from –9.7 °C to 18.9 °C. February is the coldest month with a daily average temperature of –5.4 °C and extreme minimum temperature of – 28.9 °C. The warmest month is August, which has an average temperature of 15.3 °C and extreme maximum of 29.0 °C.

Monthly over water air temperatures obtained from SmartBay Buoy 1, covering a time period from August 2006 to June 2007, shows air temperature at the mouth of the bay has a max-min range from –18.9 °C to 19.8 °C. Monthly mean temperature range from – 0.9 °C to 15.9.3 °C.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average (°C)	-4.4	-5.4	-2.2	2.2	6.2	9.9	14.1	15.3	12.3	7.4	3.0	-1.8	4.7
Daily Maximum (°C)	-0.4	-1.0	1.5	5.6	10.0	13.7	17.7	18.9	15.8	10.9	6.2	1.7	8.4
Daily Minimum (°C)	-8.6	-9.7	-6.0	-1.2	2.3	6.0	10.4	11.6	8.8	3.9	-0.2	-5.4	1.0
Extreme Maximum (°C)	10.5	14.5	12.0	20.0	20.0	24.5	27.5	29.0	26.5	23.0	16.0	14.4	
Extreme Minimum (°C)	-25.6	-28.9	-25.0	-16.0	-8.0	-3.3	2.0	1.0	-1.0	-7.8	-15.0	-24.0	

Figure 7-2 Come By Chance Air Temperature (1968-1993).

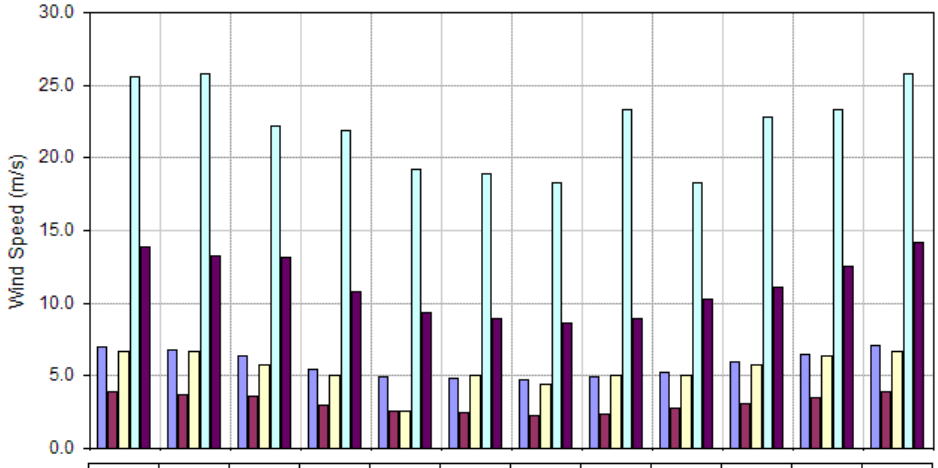
7.3.4 Wind

The wind climatology at the Arnold's Cove station is considered as representative of the study site, however it should be noted that wind statistics for Southern Head may possibly be slightly stronger, due to greater exposure. The wind statistics at the Come By Chance and Argentia sites are also considered relevant to this study. Argentia is largely exposed to Placentia Bay to the west and south-southwest.

The wind statistics for Arnold's Cove station are calculated based on the measurements of hourly wind speeds and directions at this station from July 1971 to July 1993. The statistics are shown in Figure 7-3. The monthly mean hourly wind speeds range from 4.7 m/s to 7.1 m/s. The lowest monthly maximum wind speed is 18.3 m/s and the highest monthly maximum is 25.8 m/s. The upper 95 % wind speed limits ranges from 8.6 m/s to 14.2 m/s.

The annual wind rose plot the for Arnold's Cove station is shown in Figure 7-4. As shown, the most frequent wind directions are from the southwest in most months. On an annual basis, approximately 28 % of winds are from southwest, 13% to 15% are from the northeast, northwest and south, and 5% to 9% are from the east, north, west, and southeast.

A more detailed analysis using additional and more recent wind observations (including those from other locations) will be considered in future studies for the detailed design stage,



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	7.0	6.8	6.4	5.4	4.9	4.8	4.7	4.9	5.2	6.0	6.5	7.1
Standard Deviation	3.9	3.7	3.6	3.0	2.6	2.5	2.3	2.4	2.8	3.1	3.5	3.9
Median	6.7	6.7	5.8	5.0	2.6	5.0	4.4	5.0	5.0	5.8	6.4	6.7
Maximum	25.6	25.8	22.2	21.9	19.2	18.9	18.3	23.3	18.3	22.8	23.3	25.8
Upper 95% Limit	13.9	13.3	13.1	10.8	9.4	8.9	8.6	8.9	10.3	11.1	12.5	14.2
Most Frequent Direction	SW	NW,SW	SW	SW	SW	SW	SW	SW	SW	SW	SW,NW	SW,NW
Number of Observations	13255	11759	14660	14163	13986	13581	13414	13080	12387	12440	12957	13048

Figure 7-3 Wind Statistics for Arnolds Cove (1971-1993)

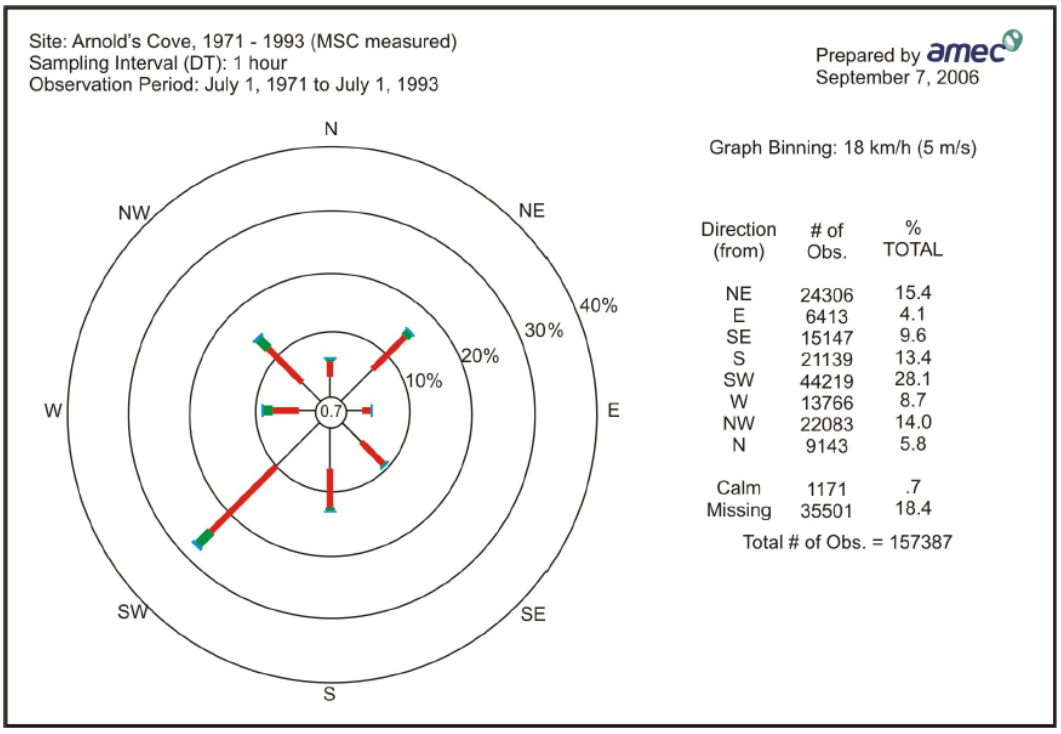
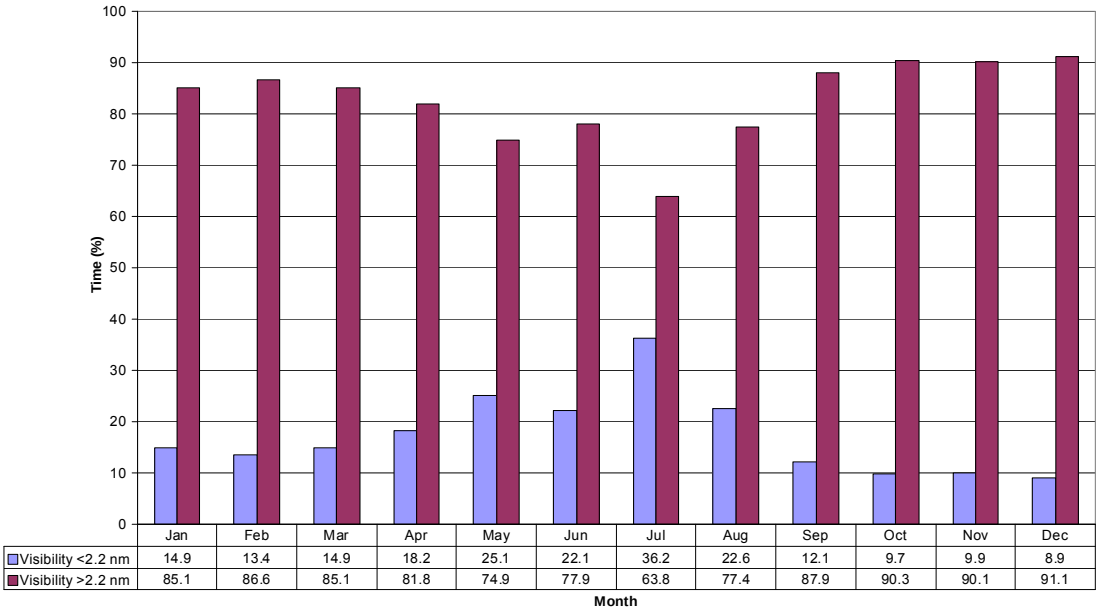


Figure 7-4 Annual Wind Speed and Direction at Arnolds Cove

7.3.5 Visibility

The frequency of the fog in Placentia Bay is often associated with southwesterly winds. Reduced visibility due to fog and low ceiling is common at the head of Placentia Bay from April to the end of August. During winter months, prevailing winds are generally from the west and the air mass tends to be drier. This results in a marked decrease in the amount of fog within the bay. However, during the winter months, snow and blowing snow account for the majority of poor visibility.

Good shipping weather is defined as visibility greater than 2 nautical miles (nm) and wind less than 25 knots. Figure 7-5 shows the monthly percentage of visibility greater than 2.2 nm and visibility less than 2.2 nm. Visibility less than 2.2 nm is more frequent in July, May and August, where as December has the highest frequency of visibility greater than 2.2 nm.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visibility <2.2 nm	14.9	13.4	14.9	18.2	25.1	22.1	36.2	22.6	12.1	9.7	9.9	8.9
Visibility >2.2 nm	85.1	86.6	85.1	81.8	74.9	77.9	63.8	77.4	87.9	90.3	90.1	91.1

Figure 7-5 Percentage Frequency of Visibility in Nautical Miles (1886-1989)

7.3.6 Water Level

Tides in Placentia Bay are semi-diurnal with a mean tidal range of 1.6 m and a large tide of 2.4 m.

The design water level at the Marine Terminal is calculated to include the maximum tide, storm surge, extreme wave crest height, free board air gap, and allowance for sea level rise due to global warming. Detailed estimate of these heights will be part of the detailed design stage.

7.3.7 Currents

Memorial University of Newfoundland (MUN) collected data on marine currents in Placentia Bay in 1999 and by the Bedford Institute of Oceanography (BIO) in 1998. The most recent site-specific current measurements near the Marine Terminal and at the entrance of the Placentia Bay were collected by the SmartBay buoy program, which is an on-going program. NLRC has also collected its own site-specific oceanographic data including an ADCP current meter which was deployed at the proposed marine outfall/diffuser location

Currents within the bay generally flow in a counter-clockwise circulation pattern, but much local variation exists. Surface current speed is approximately 17.6 cm/s (6.3 km/hr) coming up the east side of the bay and generally slow down until reaching the mouth of the bay. On the west side surface current speed is approximately 7.1 cm/s (2.5 km/hr). There is data that indicates that a similar counter clockwise current flow occurs in deeper water to about 55 meters.

The currents in the vicinity of the large islands in the inner reaches of the bay are particularly influenced by the local bathymetry. Historic data and newly obtained current meter data indicate that current flow exhibits a range of directions at the head of the bay.

Current measurements taken at the proposed outfall pipe location indicate that both the bottom and mid-depth currents have a dominant direction of northwest and southeast. The surface current has a dominant direction of northeast and southwest. Wind effects most likely contribute to this difference in direction. The mean bottom currents at two sampling locations within the Development Proposal footprint were 0.027 m/s and 0.038 m/s; while the mean surface currents are 0.129 m/s and 0.064 m/s. Ocean current measurements of sea state are on-going at the SmartBay Buoy #2 near the Marine Terminal and associated works.

Extreme current velocity near the Marine Terminal was estimated to be in the order of 0.80 +/- 0.65 m/s (SNC-Lavalin, 1996).

7.3.8 Wave Climate

In characterizing the sea state of Placentia Bay, wind generated waves, swell, and wind generated waves in combination with one or more swell groups are considered. The magnitude of wind-generated waves (sea) is controlled by wind velocity, duration, and fetch. As wind speed increases so to does the intensity of waves, given that the wind blows long enough and the fetch is adequate in length. Swells are usually not formed locally by wind but may form at some distance away and propagate to the vicinity of the observation area. Swell waves travel out of stormy or windy areas in the direction of the

wind that originally formed them as wind waves. Waves in a large embayment may intensify when locally formed wind-generated waves combine with the swell.

Measured wave data in the vicinity of the Marine Terminal and associated works is limited to the recent SmartBay Buoy and a full year wave measurements by Mobil Oil from Dec 1, 1985 to December 31, 1986 at three locations south of the proposed jetty (section 7.3.2), as shown in Figure 7-6 below (B1, B2 and B3 are waverider buoy locations). Buoy B1 provides the best data site for Marine Terminal at the Southern Head.

There is a vast database of long-term wind and wave hindcast for the east coast of Canada, and particularly the Grand Bank on the southern coast of Newfoundland. This provide an excellent data for the entrance of the Placentia Bay, but not the head of the bay where shallow water effects, and the effect of the islands in the bay, would significantly alter such predictions.

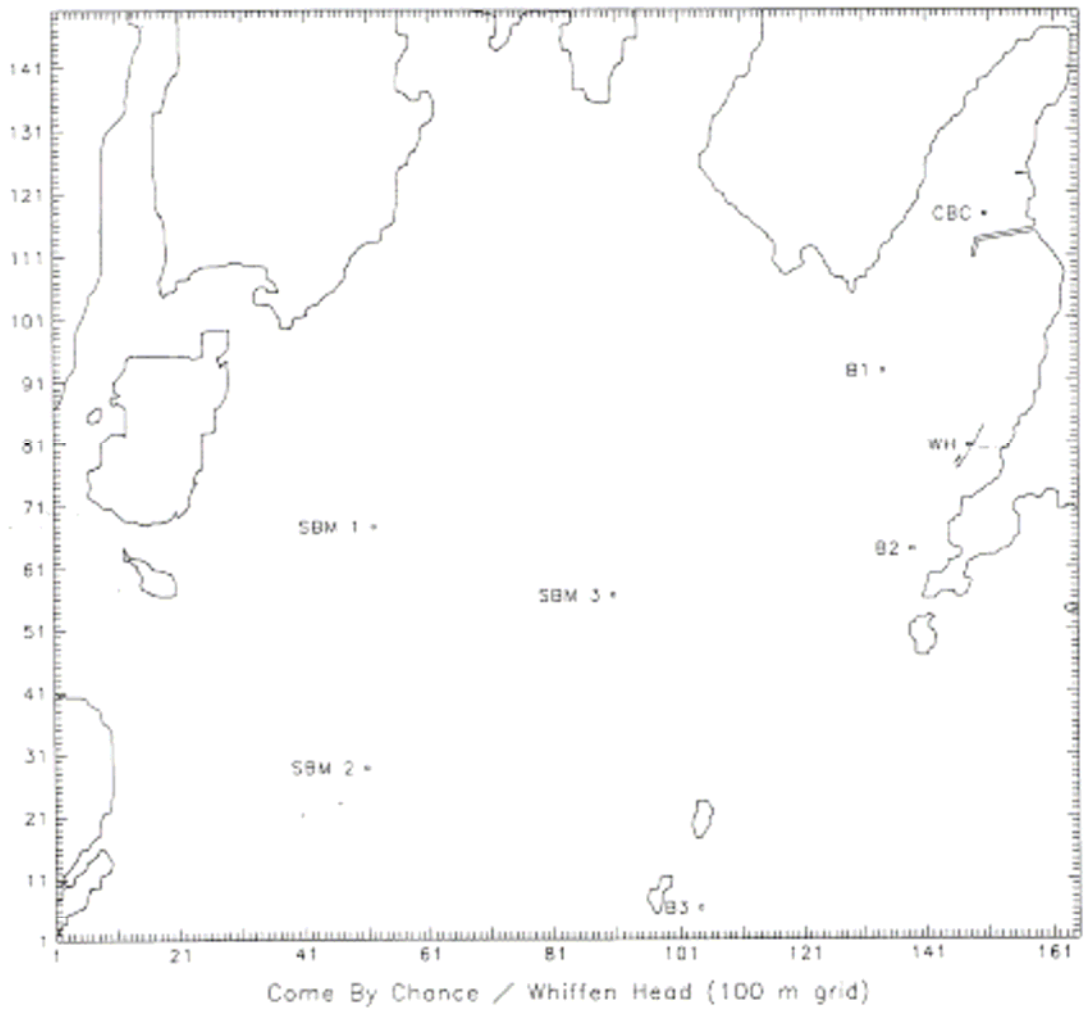


Figure 7-6 Wave measuring locations (Dec 1, 1985 – Dec 31 1986)

In order to provide accurate prediction of the wave climate in the study area at the proposed marine facilities, a long-term measured data is required. This is not a problem with wind as there are a number of long-term meteorological stations in the Placentia Bay area. However, wave hindcast is the only way to provide the required data for waves. The following wave hindcast databases have been considered

7.3.8.1 AES40

AES40 is a project undertaken by Oceanweather Inc. for the Meteorological Service of Canada, formerly Atmospheric Environment Service (AES), to produce the first 40-year (1958-1997) wind and wave hindcast of the North Atlantic (AES40), which now extends from July 1954 to June 2004 to provide 50 year database. The objective of the study

was to use the re-analysis of wind field on a high-resolution grid to produce a high-quality, homogeneous, long term wind and wave data base for assessment of the wave climate of the North Atlantic Ocean, its trend and variability. The most important feature of the hindcast was the rigorous attention devoted to producing the wind fields used to drive the wave model.

7.3.8.2 MSC50 Hindcast

MSC50 is the most recent and accurate wind and wave hindcast database currently available. It is an update to the AES40 hindcast in Canadian waters. The MSC50 applied a shallow version of the Oceanweather third generation model (OWI-3G) on a 0.1 degree grid covering much of the Canadian east coast waters. The MSC50 database will be used to provide the offshore boundary conditions for the site-specific, shallow-water wave propagation model for the study area (for both long-term hindcast and extremal analysis). This will be done at the detailed design stage of the Project. More recent wave measurements from the SmartBay buoy will also be used to verify model predictions.

Wave roses (annual and monthly) are shown in Figure 7-6 and 7-7, which are based on AES40 grid point #5616 (46.875°N, 55.0°W), at the mouth of Placentia Bay. As shown, the predominant wave direction is from south and southwest. Maximum significant wave height in these directions is 6m.

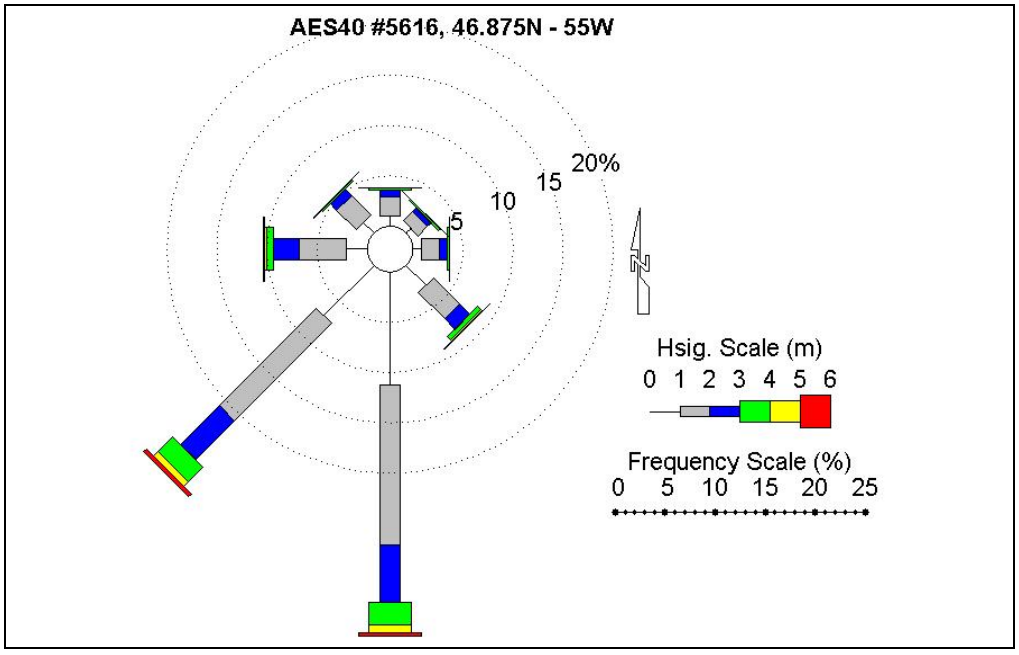


Figure 7-7 Annual Wave Rose at the entrance of Placentia Bay

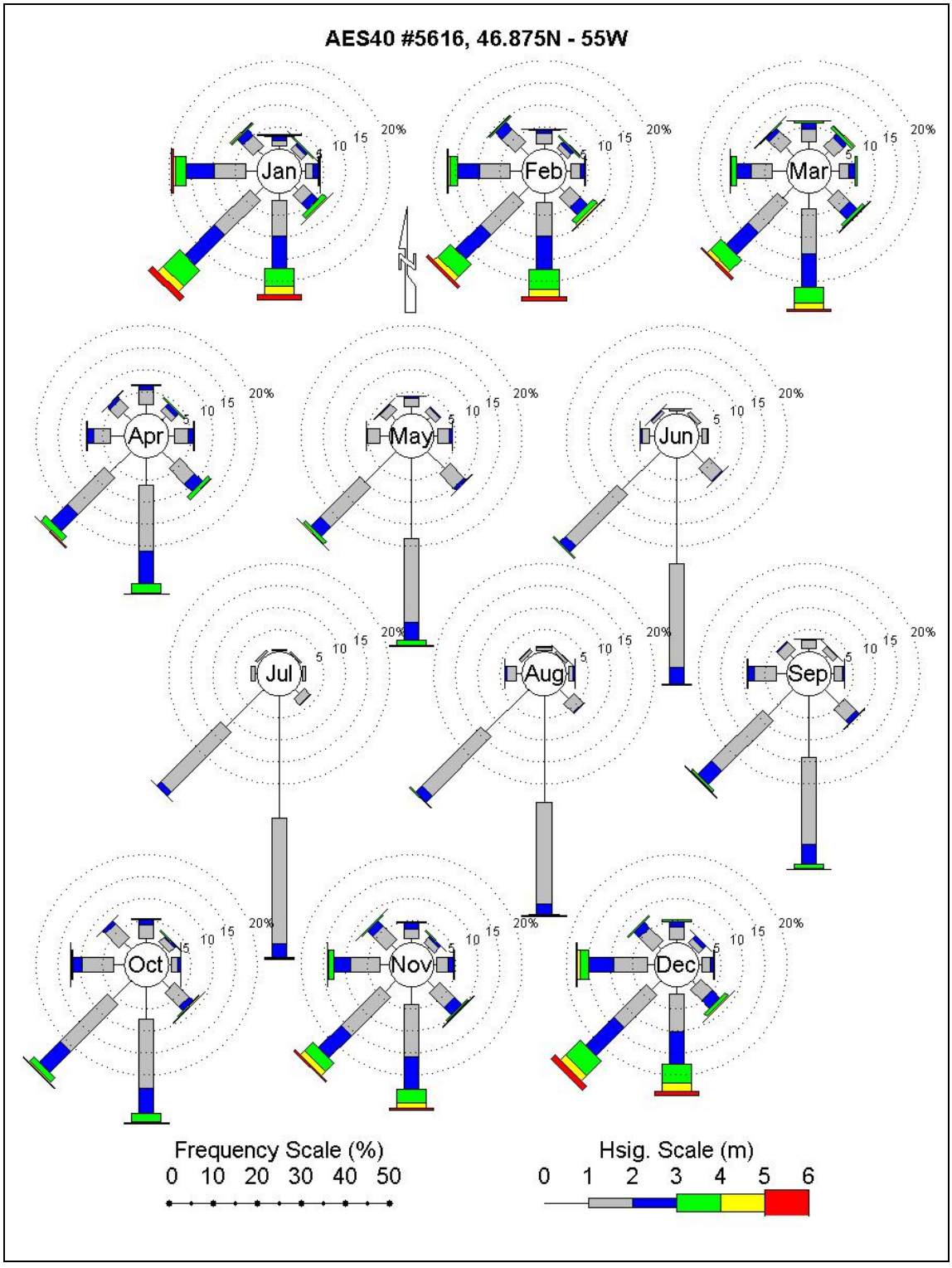


Figure 7-8 AES 40, Monthly Wave Roses

For the purpose of this assessment, a long-term wave prediction data were obtained from a previous 30-year hindcast study (see SNC-Lavalin, 1996), as described in section 7.3.8.3 below. The 30 year model hindcast in the vicinity of the Project area indicated that the mean significant wave height is less than 1.0 m, and maximum significant wave height is 3.0 m. The estimated 100 year return period design significant wave height (H_s) is 3.75 m (upper 90% confidence), with associated maximum wave height (H_{max}) is in the order of 7.0 m.

The extreme analysis results at the entrance of Placentia Bay for 5, 10, 25, 50 and 100 year return periods (source: MSC50 extreme analysis at grid point # 11170, located at 46.875^o N 55.0^o W) are presented below:

Table 7-1 Results at the entrance of Placentia Bay for 5, 10, 25, 50 and 100 year return periods

Return Period (Years)	Maximum Wind Speed (Ws) (m/s)	Sig. Wave Height (H_s) (m)	Maximum wave height (H_{max}) (m)	Peak Period (Tp) (s)
5	25.94	9.71	17.65	13.5
10	26.75	10.29	18.63	13.8
25	27.76	11.03	19.87	14.2
50	28.51	11.57	20.79	14.5
100	29.26	12.11	21.70	14.8

It should be noted that the MSC50 grid point # 12169 at 47.30 0 N, 54.100 0W at depth 216 m offshore Argentia may provide the best model grid point for the propagation of swell to the site, however, the archived wave spectral data does not exist at this location. Therefore we selected other locations listed above to provide such data, which is more present more conservative design conditions. The 100 year significant wave height at this grid point is 8.4 m versus 12.11 m. Note that due to refraction and shoaling this value will be significantly reduced at the proposed Marine Terminal site, as shown below. It should also be noted that the above peak periods are those associated with the peak wave heights during these events. Higher peak periods do occur (e.g. 16 – 19 seconds); these are normally considered in evaluation of ship motion and mooring design.

7.3.8.3 Site-Specific Wave Hindcast

In order to provide an accurate prediction of the wave climate at the proposed Marine Terminal, long-term measured data is required. This is not a problem with wind data, as shown in the previous section. However, very limited measured wave data is available at or near the site (with the exception of the full Mobil wave data shown above), which

although an excellent data set, it only covers one year. It provides three hourly values of significant wave height, peak wave period, and maximum wave height. Long-term wave hindcast is required to provide the design data for the marine facilities. Since the site is protected from the south by the islands in Placentia Bay, the locally generated sea is by wind (fetch limited seastate) plus swell propagation from the open water south of the islands. The data from MSC50 hindcast will be used as input for a shallow water wave propagation model (refraction and shoaling).

A simplified wind driven wave hindcast model was developed by SNC-Lavalin (1996) for the NTL site selection study. The model used SMB method (U.S. Army Corps of Engineers, Shore Protection Manual, 1986). The measured winds from the Argentina and St. Lawrence weather stations were used as input to the wave prediction model. The swell component was estimated using refraction/shoaling coefficients which were determined from SNC-Lavalin Shallow water wave propagation analysis program (see Figure 7-9 for an example of southerly wave propagation into the site).

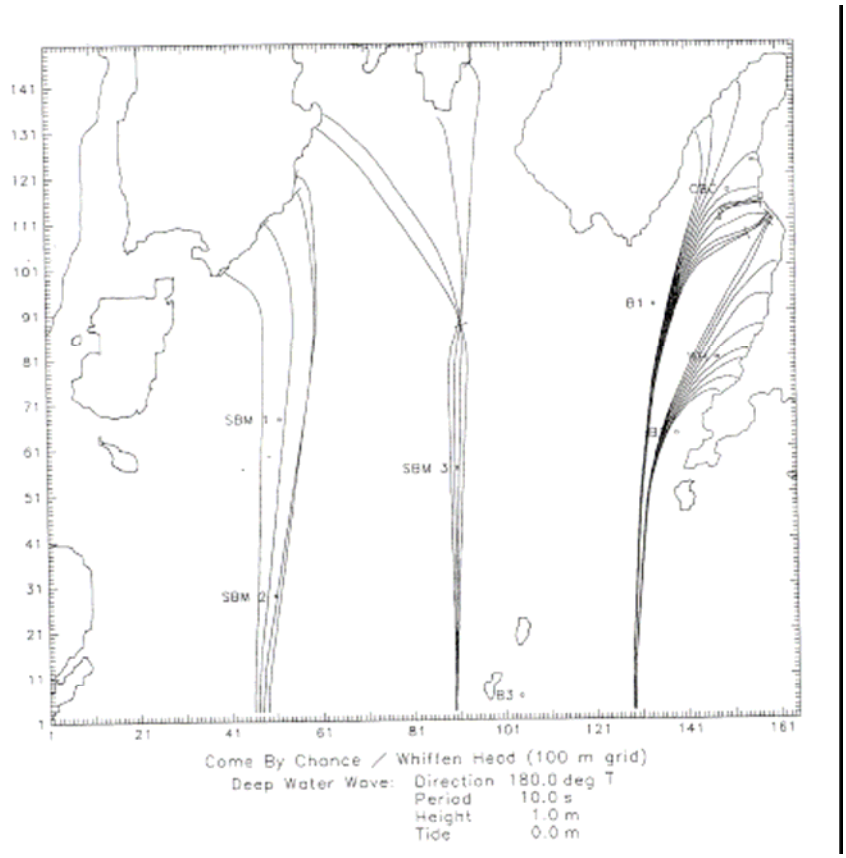


Figure 7-9 Example of wave refraction model result for Southerly Swell

The combined significant wind wave (sea) and swell wave (swell) height was calculated as follows:

$Hs = \sqrt{H^2_{sea} + H^2_{swell}}$

The above model results were first validated by comparison with wave measurements (Mobil 1965-86 data). Excellent agreement was found between measured and hindcast values (see SNC-Lavalin 1986 for details).

The wave hindcast was then carried out for 30 years (from 1966 to 1996). The results are summarized below.

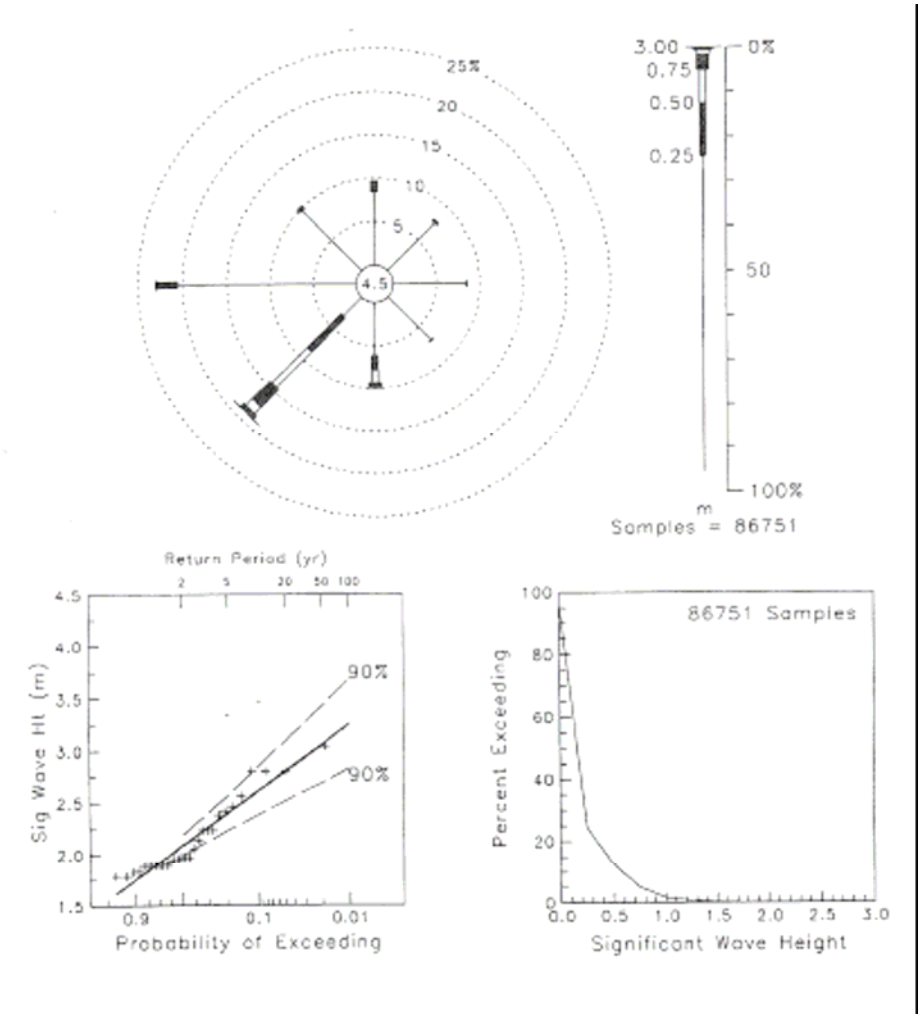


Figure 7-10 30 year Wave Hindcast Results at the Proposed Marine Terminal

7.3.9 Marine Water and Sediment Quality

Pre-development water and sediment quality samples from the area immediately offshore of Marine Terminal site were collected. Analysis of the water samples taken from three depths at five stations show that levels of chlorophyll, pH, oxygen, salinity, particulates, total oil and grease and other typical parameters were not outside of the range expected for Placentia Bay. Figure 7-11 shows the location of water and sediment sample sites, as well as the boundaries of defined marine zones. Tables 7-2 and 7-3 give results from the marine water chemistry analysis of zones 3 and 4, the respective locations of the intake and outfall.

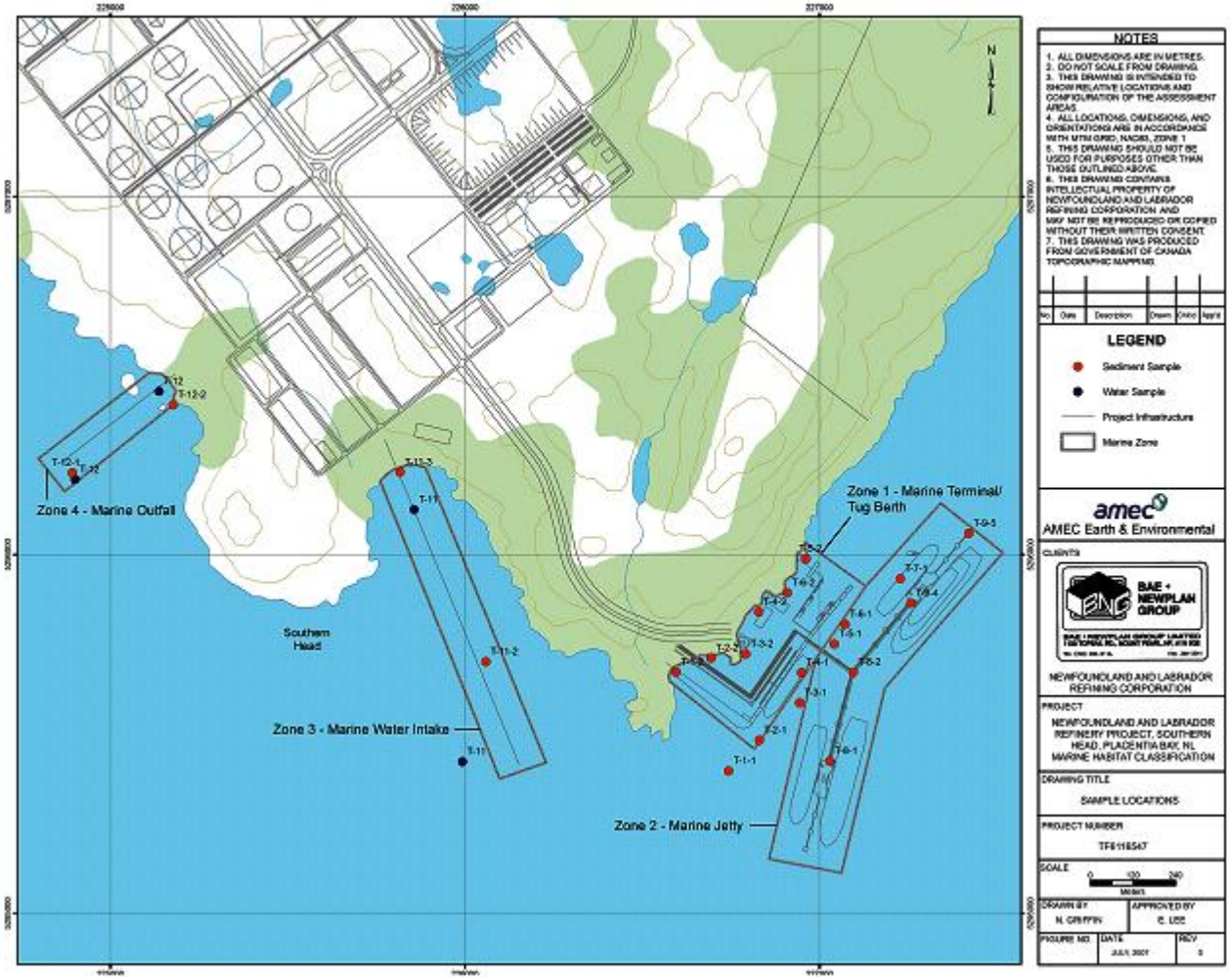


Figure 7-11 Water Sample and Sediment Collection Locations

Table 7-2 Water Chemistry: Zone 3

			Site Name:	Marine Water Intake					
			Sample ID:	T11-1-Top Outside	T11-1-Mid Outside	T11-1-Bot Outside	T11-2-Top Inside	T11-2-Mid Inside	T11-2-Bot Inside
			Sample Area:	47°47'35.0"N	47°47'35.0"N	47°47'35.0"N	47°47'57.7"N	47°47'57.7"N	47°47'57.7"N
			Sample Location:	54°03'07.0"W	54°03'07.0"W	54°03'07.0"W	54°03'14.7"W	54°03'14.7"W	54°03'14.7"W
			Depth (m):						
			Depth relative:						
			Project Number:	TF6116547	TF6116547	TF6116547	TF6116547	TF6116547	TF6116547
			Lab ID:	S2007-08402	S2007-08403	S2007-08404	S2007-08405	S2007-08406	S2007-08407
			Sample Class:	MWS	MWS	MWS	MWS	MWS	MWS
			Sample Number:						
			Sample Type:	P	P	P	P	P	P
			Date Sampled:	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07
			Client Description:						
Parameters	CCME	Method	MDL	Units					
Aluminum	ng		0.001	mg/L	<0.001	<0.001	<0.001	0.001	0.005	0.010
Arsenic	0.0125		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	ng		0.0005	mg/L	0.0046	0.0045	0.0047	0.0046	0.0045	0.0044
Beryllium	ng		0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	ng		0.0005	mg/L	0.0012	0.0007	<0.0005	<0.0005	<0.0005	0.0015
Cadmium	0.00012		0.000015	mg/L	0.000287	0.000170	0.000206	0.000528	0.000316	0.000383
Calcium	ng		0.5	mg/L	341	344	351	354	352	337
Chromium	ng		0.001	mg/L	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Cobalt	ng		0.001	mg/L	0.001	0.001	0.001	0.001	0.001	0.001
Copper	ng		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Iron	ng		0.001	mg/L	0.036	0.033	0.043	0.033	0.032	0.034
Lead	ng		0.001	mg/L	0.019	0.022	0.024	0.025	0.027	0.026
Magnesium	ng		0.02	mg/L	1460	1490	1490	1540	1510	1420
Manganese	ng		0.001	mg/L	0.001	0.001	0.001	0.001	0.001	0.001
Molybdenum	ng		0.002	mg/L	0.008	0.007	0.007	0.007	0.007	0.007
Nickel	ng		0.001	mg/L	0.005	0.006	0.004	0.003	0.003	0.004
Phosphorous	ng		0.002	mg/L	0.095	0.101	0.098	0.098	0.104	0.105
Potassium	ng		0.02	mg/L	499	507	517	509	492	475
Selenium	ng		0.001	mg/L	<0.001	<0.001	<0.001 (<0.001)	<0.001	<0.001	<0.001
Silver	ng		0.0001	mg/L	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001
Sodium	ng		0.5	mg/L	11900	12100	12600	13200	12700	12800
Vanadium	ng		0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc	ng		0.001	mg/L	0.002	0.002	0.002	0.006	0.005	0.004

MSS - Marine Sedime P - Primary Exceeds Metals (CCME ISQG 2006)
N/A - Not Applicable D - Duplicate
NS - Not Sampled
Results in (brackets) represents lab replicate
ng - No Guideline

Table 7-3 Water Chemistry: Zone 4

			Site Name:	Marine Water Outfall					
			Sample ID:	T12-1-Top Outside	T12-1-Mid Outside	T12-1-Bot Outside	T12-2-Top Inside	T12-2-Mid Inside	T12-2-Bot Inside
			Sample Area:	47°48'00.0"N	47°48'00.0"N	47°48'00.0"N	47°48'01.1"N	47°48'01.1"N	47°48'01.1"N
			Sample Location:	54°04'00.0"W	54°04'00.0"W	54°04'00.0"W	54°03'48.7"W	54°03'48.7"W	54°03'48.7"W
			Depth (m):						
			Depth relative:						
			Project Number:	TF6116547	TF6116547	TF6116547	TF6116547	TF6116547	TF6116547
			Lab ID:	S2007-08395	S2007-08396	S2007-08397	S2007-08398	S2007-08399	S2007-08400
			Sample Class:	MWS	MWS	MWS	MWS	MWS	MWS
			Sample Number:						
			Sample Type:	P	P	P	P	P	P
			Date Sampled:	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07	18-Jun-07
			Client Description:						
Parameters	CCME	Method	MDL	Units					
Aluminum	ng		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.0125		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001 (<0.001)	<0.001
Barium	ng		0.0005	mg/L	0.0046	0.0047	0.0046	0.0047	0.0047	0.0046
Beryllium	ng		0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	ng		0.0005	mg/L	0.0027	<0.0005	0.0021	0.0012	0.0013	<0.0005
Cadmium	0.00012		0.000015	mg/L	0.000419	0.000626	0.000533	0.000563	0.000529	0.000247
Calcium	ng		0.5	mg/L	365	371	361	358	349	346
Chromium	ng		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	ng		0.001	mg/L	0.002	0.002	0.001	0.001	0.001	0.001
Copper	ng		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	ng		0.001	mg/L	0.036	0.030	0.030	0.035	0.038	0.033
Lead	ng		0.001	mg/L	0.023	0.023	0.021	0.023	0.022	0.019
Magnesium	ng		0.02	mg/L	1530	1580	1570	1530	1530	1460
Manganese	ng		0.001	mg/L	0.001	0.001	0.001	0.001	0.001	0.001
Molybdenum	ng		0.002	mg/L	0.008	0.008	0.007	0.007	0.007	0.007
Nickel	ng		0.001	mg/L	0.005	0.004	0.004	0.004	0.004	0.004
Phosphorous	ng		0.002	mg/L	0.105	0.098	0.102	0.105	0.098	0.106
Potassium	ng		0.02	mg/L	549	559	532	546	527	512
Selenium	ng		0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	ng		0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	ng		0.5	mg/L	12800	13300	13100	12900	12900	11700
Vanadium	ng		0.002	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc	ng		0.001	mg/L	0.013	0.008	0.011	0.006	0.006	0.002

MSS - Marine Sediment Sample Exceeds Metals (CCME ISQG 2006)
N/A - Not Applicable
NS - Not Sampled
ng - no guideline
Results in (brackets) represents a lab replicate
P - Primary
D - Duplicate

Additional water quality data was collected in 2002 by Seatech to provide information for the existing oil refinery at Come By Chance. Samples were collected from 5 sites, one of which is in close proximity to the proposed Project. Of the remainder, 3 stations are near the existing refinery and the last station, considered to be a control site, is located outside Bar Haven. The results from these stations are typical of coastal seawater in the study area, and are shown in Tables 7-4 to 7–8.

Table 7-4 Water Quality Data for Station 1.

Stn 1: 47°49.02' N, 54°01.42' W			
Parameter	**Top**	**Middle**	**Bottom**
Ammonia (mg/L)	<0.1	<0.1	<0.1
Chlorophyll A (mg/m3)	0.96	3.57	0.14
Chlorophyll A (mg/m3)	2.48	4.05	1.80
Chlorophyll C (m-SPU/m3)	14.22	20.76	2.13
Carotenoids m-SPU/m3)	1.12	<0.01	0.02
Cyanide (mg/L)	<0.02	<0.02	<0.02
pH	8.3	8.3	8.3
Phenol (mg/L)	<0.05	<0.05	<0.05
Salinity (ppt)	31.2	31.2	31.3
Sulfate (mg/L)	2830	2890	2800
Sulfide (mg/L)	<0.5	<0.5	<0.5
Suspended Particulate Matter (mg/L)	5	4	2
Temperature (C)	10.7	10.7	10.6
Dissolved Oxygen (mg/L)	9.45	9.57	9.63
Total Oil and Grease (mg/L)	<0.01	<0.01	<0.01
Total Organic Carbon (mg/L)	5	14	<5
Turbidity (NTU)	0	0	0

Table 7-5 Water Quality Data for Station 2.

Stn 2: 47°48.68' N, 54°00.58' W			
Parameter	**Top**	**Middle**	**Bottom**
Ammonia (mg/L)	<0.1	<0.1	<0.1
Chlorophyll A (mg/m3)	2.65	11.6	1.66
Chlorophyll A (mg/m3)	3.28	10.29	1.98
Chlorophyll C (m-SPU/m3)	15.88	68.56	15.92
Carotenoids m-SPU/m3)	<0.01	<0.01	<0.01
Cyanide (mg/L)	<0.02	<0.02	<0.02
pH	8.5	8.5	8.5

Stn 2: 47°48.68' N, 54°00.58' W			
Parameter	**Top**	**Middle**	**Bottom**
Phenol (mg/L)	<0.05	<0.05	<0.05
Salinity (ppt)	31.2	31.2	31.2
Sulfate (mg/L)	2770	2590	2730
Sulfide (mg/L)	<0.5	<0.5	<0.5
Suspended Particulate Matter (mg/L)	2	<1.8	<1.8
Temperature (C)	10.7	10.7	10.7
Dissolved Oxygen (mg/L)	9.70	9.70	9.70
Total Oil and Grease (mg/L)	<0.01	<0.01	<0.01
Total Organic Carbon (mg/L)	<5	<5	<5
Turbidity (NTU)	0	0	0

Table 7-6 Water Quality Data for Station 3.

Stn 3: 47°47.96' N, 54°00.49' W			
Parameter	**Top**	**Middle**	**Bottom**
Ammonia (mg/L)	<0.1	<0.1	<0.1
Chlorophyll A (mg/m3)	N/A	0.96	1.80
Chlorophyll A (mg/m3)	N/A	2.67	3.78
Chlorophyll C (m-SPU/m3)	N/A	11.37	18.05
Carotenoids m-SPU/m3)	N/A	9.92	<0.01
Cyanide (mg/L)	<0.02	<0.02	<0.02
pH	8.6	8.6	8.6
Phenol (mg/L)	<0.05	<0.05	<0.05
Salinity (ppt)	31.1	31.1	31.2
Sulfate (mg/L)	2774	2800	2810
Sulfide (mg/L)	<0.5	<0.5	<0.5
Suspended Particulate Matter (mg/L)	4	<1.8	<1.8
Temperature (C)	10.5	10.5	10.5
Dissolved Oxygen (mg/L)	9.70	9.78	9.73
Total Oil and Grease (mg/L)	<0.01	<0.01	<0.01
Total Organic Carbon (mg/L)	<5	<5	<5
Turbidity (NTU)	0	0	0

Table 7-7 Water Quality Data for Station 4.

Stn 4: 47°47.82' N, 54°02.87' W			
Parameter	**Top**	**Middle**	**Bottom**
Ammonia (mg/L)	<0.1	<0.1	<0.1
Chlorophyll A (mg/m3)	0.54	3.12	1.49
Chlorophyll A (mg/m3)	0.86	3.84	1.02
Chlorophyll C (m-SPU/m3)	5.08	23.22	10.54
Carotenoids m-SPU/m3)	1.65	<0.01	<0.01
Cyanide (mg/L)	<0.02	<0.02	<0.02
pH	8.6	8.7	8.6
Phenol (mg/L)	<0.05	<0.05	<0.05
Salinity (ppt)	31.2	31.2	31.7
Sulfate (mg/L)	2770	2780	2850
Sulfide (mg/L)	<0.5	<0.5	<0.5
Suspended Particulate Matter (mg/L)	4	2	24
Temperature (C)	10.6	10.6	10.5
Dissolved Oxygen (mg/L)	9.47	9.68	9.66
Total Oil and Grease (mg/L)	<0.01	<0.01	<0.01
Total Organic Carbon (mg/L)	<5	<5	<5
Turbidity (NTU)	0	0	0

Table 7-8 Water Quality Data for Station 5.

Stn 5: 47°42.83' N, 54°12.33' W			
Parameter	**Top**	**Middle**	**Bottom**
Ammonia (mg/L)	<0.1	<0.1	<0.1
Chlorophyll A (mg/m3)	<0.01	0.66	1.11
Chlorophyll A (mg/m3)	0.11	0.01	2.00
Chlorophyll C (m-SPU/m3)	4.45	23.95	7.75
Carotenoids m-SPU/m3)	<0.01	<0.01	<0.01
Cyanide (mg/L)	<0.02	<0.02	<0.02
pH	8.0	8.1	8.2
Phenol (mg/L)	<0.05	<0.05	<0.05
Salinity (ppt)	31.2	31.3	31.3
Sulfate (mg/L)	2820	2810	2750
Sulfide (mg/L)	<0.5	<0.5	<0.5
Suspended Particulate Matter (mg/L)	<1.8	<1.8	<1.8
Temperature (C)	10.6	10.5	10.5
Dissolved Oxygen (mg/L)	9.47	9.48	9.60

Stn 5: 47°42.83' N, 54°12.33' W			
Parameter	**Top**	**Middle**	**Bottom**
Total Oil and Grease (mg/L)	<0.01	<0.01	<0.01
Total Organic Carbon (mg/L)	<5	<5	<5
Turbidity (NTU)	0	0	0

Marine sediment samples were collected from 25 locations in the vicinity of the proposed refinery site. Of that 25, 14 were collected near the Marine Terminal, 4 were collected near the Jetty, 5 were collected at the water intake location and 2 were taken at the outfall location. The sediments were analyzed for a variety of parameters: PAHs, BTEX, TPH, PCB, TOC, metal-hydrides, and particle size distribution. The guideline used is the Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines.

None of the sediment samples collected exceeded the Interim Sediment Quality Guidelines for PAHs, BTEX, TPH, PCB, and TOC. However, there is a noticeable higher PAH concentration at the water intake locations (T11-1) than at other sampling locations. For TOCs, there is a high degree of variability. The detected level ranges from 6 to 520,258 mg/kg.

While most of the metal concentrations from the majority of sampling locations are below guideline values, there are some exceedance cases. The Arsenic concentrations of 7.8 mg/g and 12.6 mg/g at T9-4 and T12-1 are higher than the guideline value 7.24 mg/g. The copper concentrations of 27 mg/g 19 mg/g, and 19 mg/g at T2-2, T5-2 and T12-1 are higher than the guideline value 18.7 mg/g.

7.3.10 Commercial Fisheries and Aquaculture

Placentia Bay supports an important and diverse inshore fishery that exploits a wide range of species chief among which are cod, crab, lobster and scallop. The commercial fishery in the area has undergone drastic changes since the imposition of moratoria limiting access to groundfish stocks. The industry has proven to be resilient, evolving by diversifying into other, more valuable, species. Aquaculture also plays an increasing role in Placentia Bay, with 15 existing and 8 planned operations involved in cod grow-out and mussel farming. The nearest aquaculture facility is 25 km away from the Marine Terminal.

For the purpose of establishing a baseline picture of the commercial fisheries and aquaculture industries in the general area of the Development Proposal, NLRC considered all of Placentia Bay, encompassing the North Atlantic Fisheries Organization (NAFO) Unit Area 3PSc.

Figure 7-12 shows the overall quantity of fish taken by fishers over the last twenty years. Commercial fishing occurs year-round in Placentia Bay with peak harvesting months of June and July (Figure 7-13). Cod is still the most important (quantity and overall economic value) species harvested in the bay and, with snow crab, herring and lumpfish roe make up the major portion of the overall harvest.

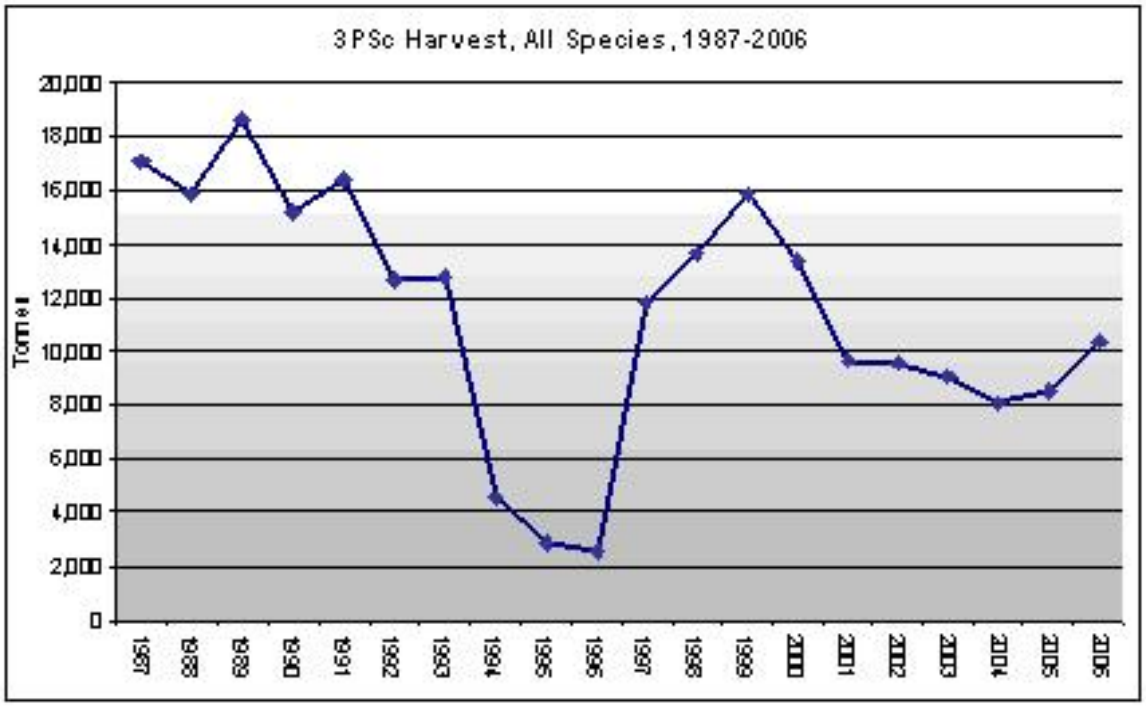


Figure 7-12 3PSc Harvest All Species 1987-2006

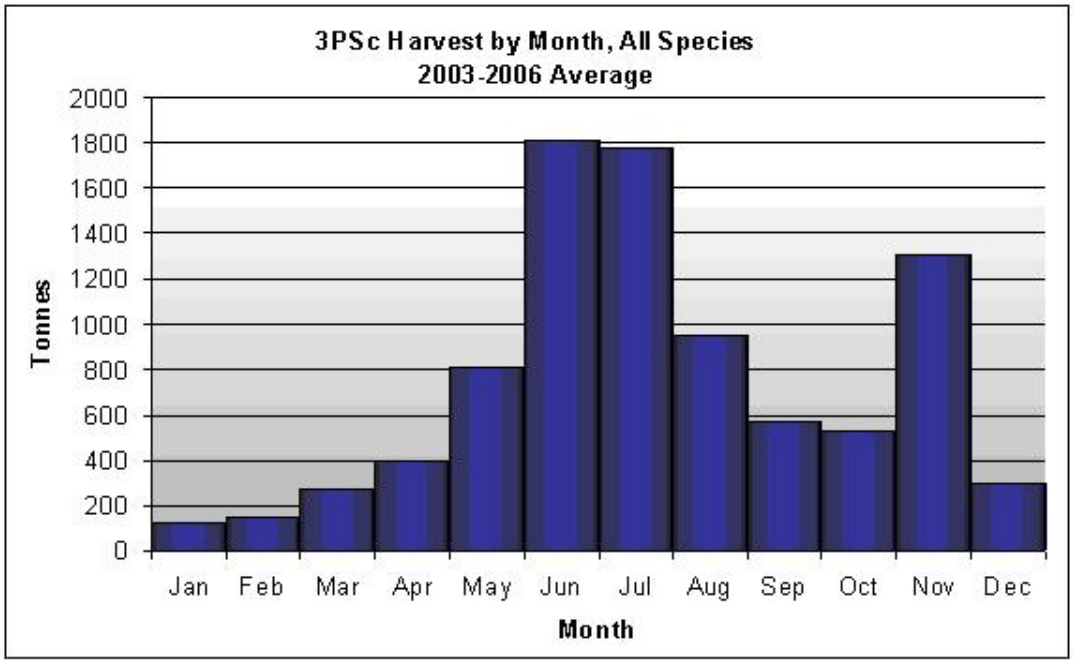


Figure 7-13 3PSc Harvest Groundfish 1987-2006

Based on NLRC's consultation with local fishers, DFO Fishery officers (Placentia Detachment) and as reported in DFO's Coastal Communities Resource Inventory work the only commercial fishery in the Marine Terminal and associated works "footprint" is for lobster. Exploratory/experimental fisheries have been intermittently attempted within the project marine footprint for scallop, urchin and lumpfish but species abundance did not support commercial exploitation. There is a seasonally important cod grounds just outside the Project area: NLRC realigned and relocated the proposed wharf and jetty to avoid this area.

The diver and remotely operated vehicle (ROV) did not observe lobsters in significant numbers during undersea surveys of the Marine Terminal footprint, likely due to the primarily nocturnal nature of lobster movement. However, lobster pot buoys were plentiful in the terminal area during the Project's 2007 surveys and fish harvesters with historical attachment to the area have confirmed that there has been a longstanding lobster fishery in this location.

The lobster fishery is known to occur relatively close to fishers' home wharves, along rocky shorelines and near shore islands, using small boats. While this fishery makes up less than 1 % of the overall 3PSc harvest in terms of quantity, lobster accounted for almost 7 % of the value of the bay's harvest and almost 20 % in the inner bay (Canning and Pitt, 2007).

Overall in Placentia Bay there are 477 core fishing enterprises (DFO's Fishing Area 10) and 51 non-core enterprises. A core fishing enterprise is a commercial fishing enterprise holding key species licenses under a system put in place by DFO in 1996. Non-core enterprises hold other (possibly a single) species licenses. The majority of the core enterprises are vessels less than 35 feet Length Overall (LOA): 379 are less than 35 feet LOA and 98 are in the 35 to 64 foot LOA category. There are also 304 recreational licenses for Placentia Bay.

7.3.11 Marine Fish and Fish Habitat at the Project Site

NLRC has studied the marine habitat that will be directly affected by the footprint of the Marine Terminal and associated works, as well as the intake/outfall pipes. Combined, the Marine Terminal and tug berth, jetty, the facility's water intake and wastewater outfall will affect approximately 90,338 m^2 of seafloor benthic and fish habitat (See Section 10.3.2.1 for more detail). Each one of these areas corresponds to an identified marine zone, as follows:

- Zone 1 – Marine Terminal/Tug Berth;
- Zone 2 – Marine Jetty;
- Zone 3 – Marine Water Intake; and
- Zone 4 – Marine Outfall.

Habitat characterization consisted of field and diver observations and a quantitative review of videos captured along transects (Figure 7-14 below), as per DFO protocol for determination for harmful alteration, disruption or destruction (HADD) of the marine habitat. The surveys have provided the basis for NLRC's Fish Habitat Compensation strategy and for DFO's quantification of HADD. Nine transects were conducted in a grid pattern within the proposed Marine Terminal/tug berth area (Zone 1). Transects were run perpendicular from the shoreline and spaced at 100 m increments encompassing the entire Marine Terminal/tug berth footprint. One transect was parallel to the shoreline and ran north to south along the outside margin of the Marine Terminal/tug berth footprint. Another transect ran north to south along the shoreline within the Marine Terminal/tug berth footprint.

Three video transects were conducted along the linear footprint of the proposed marine jetty (Zone 2), one transect conducted from the shoreline in a southerly direction along the linear footprint of the proposed marine water intake pipe (Zone 3), and one transect conducted from the shoreline in a southerly direction along the linear footprint of the proposed marine outfall pipe (Zone 4).

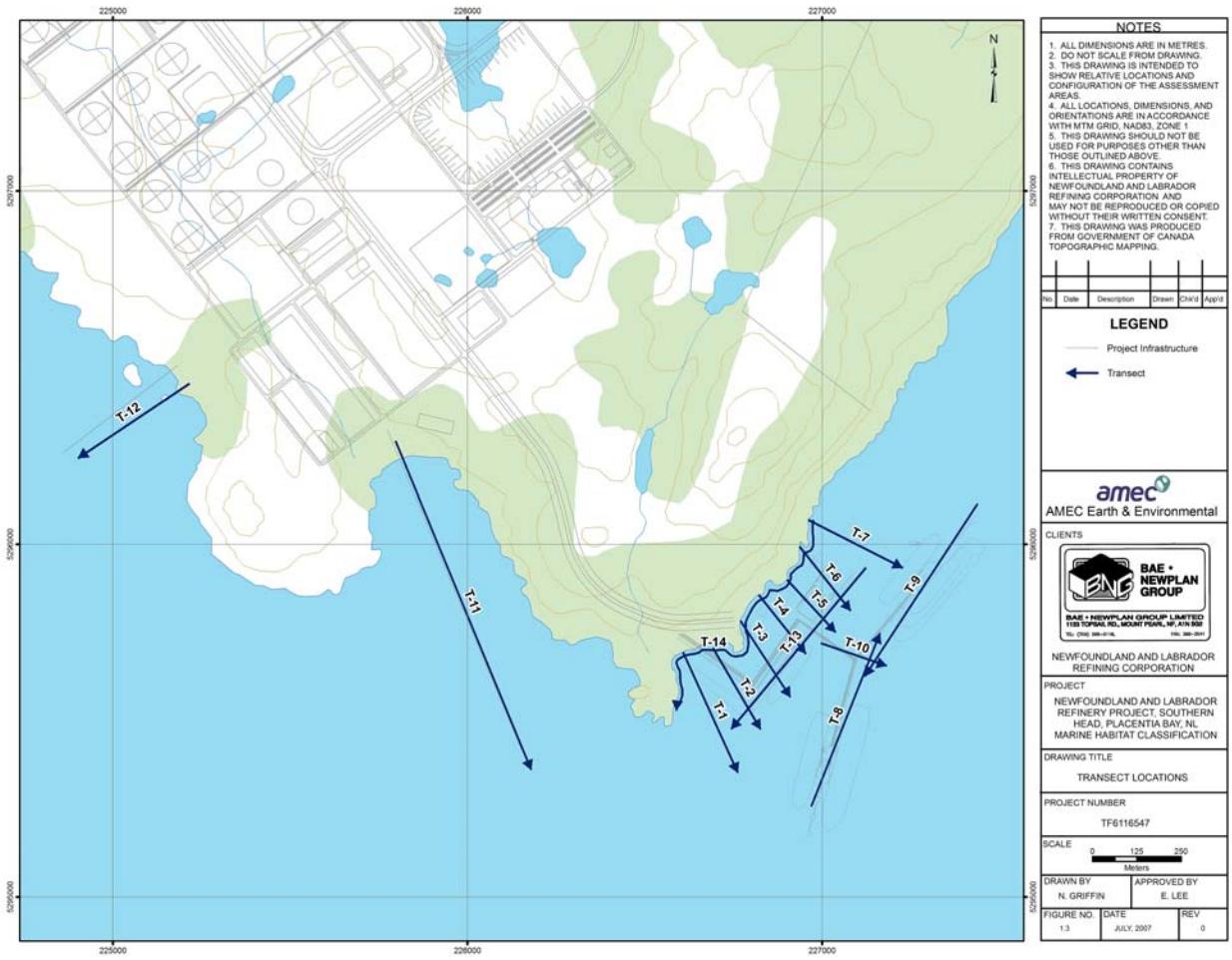


Figure 7-14 Transect Locations

Seafloor habitats that may be affected by the Project include the rock faces, outcrops and shelves, boulders, cobbles, sands and gravels that are typical of shorelines in Placentia Bay. The bedrock, boulder and cobble of the shoreline changes to a patchy intermix of boulders, cobbles, gravels and sands in deeper water. This patchy intermix of hard surfaces, clean gravels and sands supports a wide variety of marine algae providing a diverse habitat overall. The rocks and boulders and coarse gravels provide attachment points for the marine algae ranging from the commonly seen rockweed along the shorelines, to crustose marine algae that grow on rock throughout the area, to various species of kelp along shorelines in the intertidal zones and deeper waters.

As might be expected these nearshore rock/gravel/sand habitats and their attendant marine algae shelter a variety of species from anemones, barnacles and sponges, sea urchins and sand dollars to mussels and scallop and hermit crabs to lobsters, and small numbers of cod, flounder and plaice.

7.3.11.1 Zone 1 – Marine Terminal and Tug Berth

Crustose algae is consistently encountered on hard substrates in densities ranging from <25 to 50 %. Sour weed was also ubiquitous on all substrates except fine sand, although the highest densities are usually observed on small boulder substrate. Edible kelp (*Alaria* sp.) is common on large substrates with the highest densities generally associated with the shoreline and intertidal areas. Low densities of sea colander are found in deeper water at distances greater than 100 m from the shoreline. Shoreline algal species are dominated by rockweed and knotted wrack, interspersed with lesser amounts of green filamentous, black whip weed, sea lettuce, coral weed, red tubed weed and dulse.

Moderate-to-low numbers of sea urchins and starfish inhabit both hard/coarse and soft/fine substrates from the shoreline to the outer limits of Zone 1. Slightly higher numbers of urchins are associated with areas consisting primarily of large boulder and bedrock. Blue mussels and horse mussels are found sporadically on large substrate and bedrock outcrops. Horse mussels are generally encountered in deeper water >10 m, although blue mussels also inhabit the tops of large boulders at these depths. Periwinkles are found primarily on large substrates within 50 m of the shoreline in water depths < 10 m, but also inhabit large shallow substrates at greater distances.

Species found more sporadically on large substrates (independent of depth) include frilled anemone in low-to-high numbers and low numbers of tube worms. Sand dollars and winter flounder inhabit areas with fine gravel and sand substrates. Deep-sea scallop and American plaice are present primarily on soft substrates at deeper depths.

7.3.11.2 Zone 2 – Marine Jetty

Crustose algae are located sporadically in association with intermittent cobble and boulder substrate. Sour weed and edible kelp inhabit the isolated hard substrates on the shoreward portion. Storm tossed sour weed, sea colander, kelp (*Laminaria* sp.), and rockweed may be found intermittently throughout the entire area.

Relatively low numbers of sea urchins, starfish and deep-sea scallop occupy areas of sand and gravel substrates throughout the entire zone. Species observed infrequently included American plaice, Atlantic cod, skate, frilled anemone and tube worms.

7.3.11.3 Zone 3 – Marine Water Intake

Crustose algae inhabit most hard substrates in Zone 3. Sour weed are fairly abundant on all substrates in the northern half of the zone. The predominant shoreline and intertidal species include edible kelp, kelp (*Laminaria* sp.), black whip weed, hollow green weed, smooth chord weed, coral weed, green filamentous, red tubed weed and rockweed. Sea colander is found just outside the zones boundaries. Intermittent species include red fern and banded weed.

Sea urchins and starfish are found throughout the entire zone. Horse mussels, blue mussels and frilled anemone are found infrequently on large boulder and bedrock substrates. Uncommon species in the zone include hermit crabs, eel pout, deep-sea scallop and polychaetes.

7.3.11.4 Zone 4 – Marine Outfall

Crustose algae are found on hard substrates and sour weed on all substrates throughout the entire zone. Edible kelp is located in the shoreline/intertidal area and in a narrow band about 100 m from the shoreline. Less dominant shoreline/intertidal species include rockweed, knotted wrack, coral weed, red fern, sea lettuce, black whip weed and green filamentous.

Sea urchins, starfish and deep-sea scallops can be found throughout Zone 4. Sand dollars inhabit areas of fine substrate. Periwinkles are commonly found on large substrate within the shoreline/intertidal zone. Blue and horse mussels, frilled anemone, and barnacles are found sporadically on large substrates. Other species found in low numbers include hermit crabs, winter flounder, and skate.

7.3.12 Marine Mammals

Marine mammals are common visitors to the waters of Newfoundland and Labrador. Observed year-round, they are most common during highly productive summer months as the waters off Newfoundland and Labrador represent a primary feeding ground for a number of species. Eleven species of marine mammals are expected to occur in Placentia Bay, including eight species of cetaceans (Table 7-9) and three species of seals (Table 7-10).

Several additional species have been sighted in the vicinity of Placentia Bay or may occur there, but because of their rarity in the area are not considered in this document. However, two mysticete species, the blue whale (*Balaenoptera musculus*) and North Atlantic right whale (*Eubalaena glacialis*), whose occurrence would be considered rare

are reviewed in Section 7.5, as they are listed as Endangered under Schedule 1 of SARA.

Table 7-9 Cetaceans with expected occurrence within the Study Area.

Species		Occurrence	Season	Habitat	COSEWIC Status (date of most recent status report)	SARA Status[a]
Common Name	**Scientific Name**					
Baleen Whales	*Mysticeti*					
Humpback whale	*Megaptera novaeangliae*	Common	Spring to fall	Primarily nearshore and banks	Not At Risk (May 2003)	No status
Minke whale	*Balaenoptera acutorostrata*	Common	Year-round but primarily spring to fall	Continental shelf and coastal	Not At Risk (April 2006)	No status
Fin whale	*Balaenoptera physalus*	Common	Spring to fall	Continental slope and pelagic	Special Concern (May 2005)	Schedule 1: Special Concern
Toothed Whales	*Odontoceti*					
Long-finned pilot whale	*Globicephala melas*	Uncommon?	Year-round	Mostly pelagic	Not assessed	No status
Short-beaked common dolphin	*Delphinus delphis*	Uncommon	Summer	Continental shelf and pelagic	Not assessed	No status
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Common	Year-round but primarily spring and fall	Continental shelf and slope	Not assessed	No status
White-beaked dolphin	*Lagenorhynchus albirostris*	Common	Year-round?	Continental shelf	Not assessed	No status
Harbour porpoise	*Phocoena phocoena*	Common	Year-round?	Continental shelf	Special Concern (April 2006)	No schedule or status; referred back to COSEWIC

Notes: ? indicate uncertainty; a Species designation under SARA (COSEWIC 2007).

Table 7-10 Seals with expected occurrence within the Study Area.

Species		Occurrence	Season	Habitat	SARA/COSEWIC Status
Common Name	**Scientific Name**				
True Seals	*Phocidae*				
Grey seal	*Halichoerus grypus*	Common	Primarily summer	Coastal	Not assessed
Harbour seal	*Phoca vitulina*	Common	Year-round	Coastal	Not assessed
Harp seal	*Pagophilus groenlandica*	Uncommon	Late winter/early spring	Ice	Not assessed

Despite its biological richness, there is a lack of systematically-collected data on marine mammal distribution and abundance in Placentia Bay. This data gap was identified by the Proponent and marine mammal surveys of Placentia Bay were conducted to provide baseline data on abundance and distribution. Boat-based surveys were designed to sample three areas of Placentia Bay and provide data for a complete year. Surveys took place from August 2006 through August 2007.

Survey routes and all marine mammal sightings up to April 2007 are shown in Figure 7-15 below. Another source of information used in the assessment is a cetacean database maintained by DFO, St. John's, NL. This database contains records (incidental sightings, survey results, entanglements, and stranding data) collected by or reported to DFO since the 1970s. The DFO database only provides information on occurrence within a particular area, and caution should be made when interpreting relative abundance (temporal and spatial) given that observational effort is biased and limited in geographic scope.

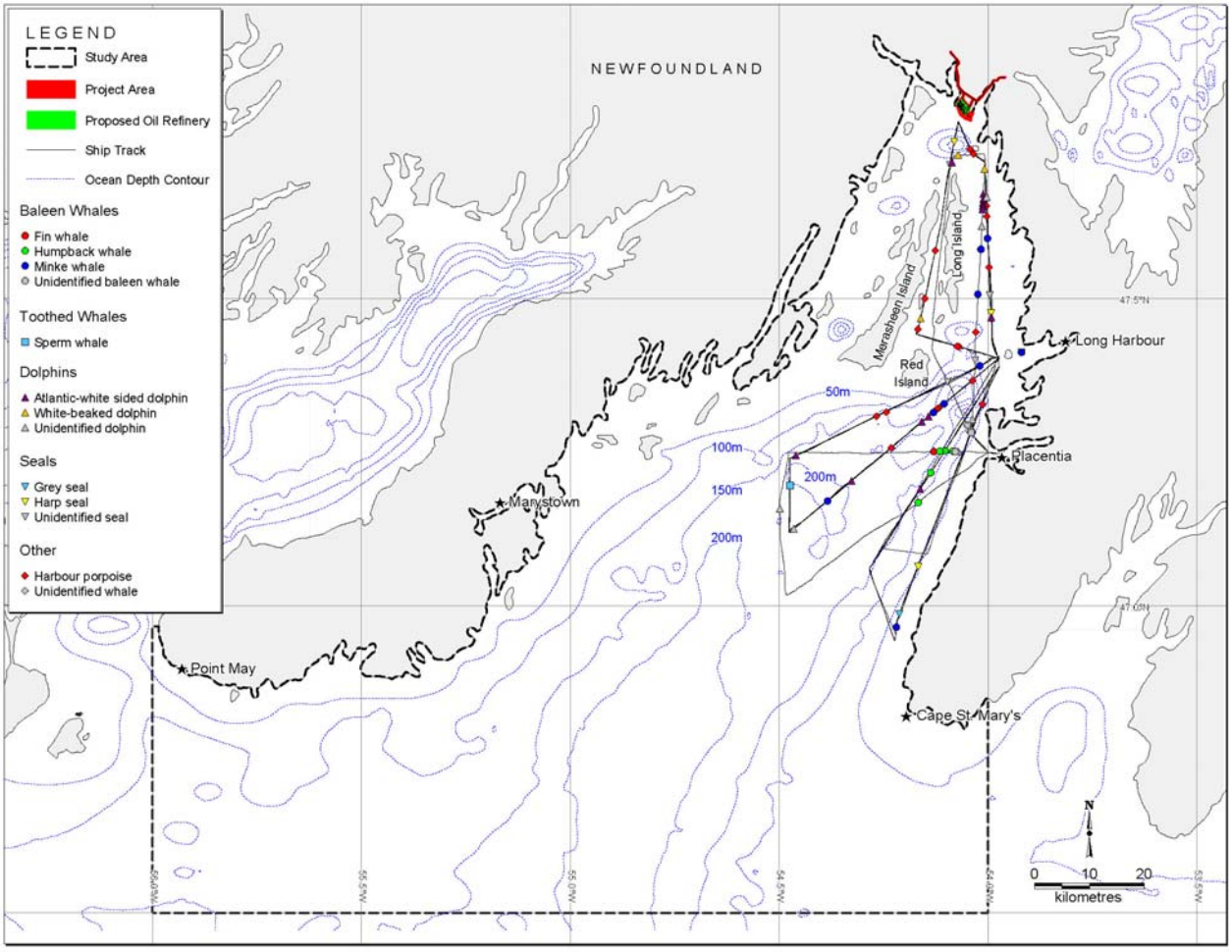


Figure 7-15 Sightings of marine mammals made during boat-based surveys in August 2006-April 2007.

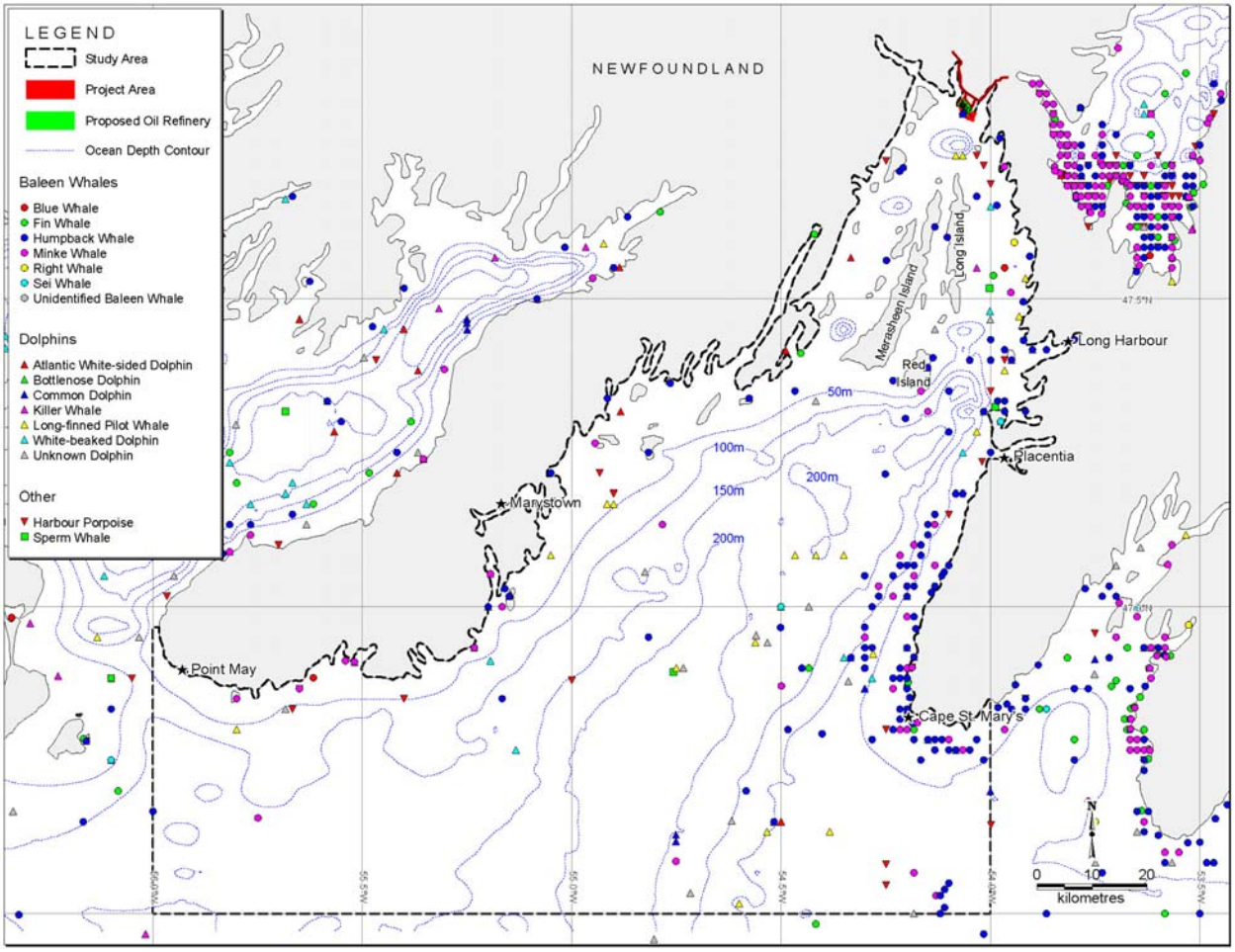


Figure 7-16 Sightings of marine mammals in the Study Area obtained from the DFO marine mammal sightings database.

Table 7-11 Summary of monthly marine mammal sightings made during the Placentia Bay surveys (August, September, October, December 2006; March, April 2007).

Group (Species)	Number of Sightings (Number of individuals)						
	August	September	October	December	March	April	Total
Dolphins							
Atlantic white-sided dolphin	7 (75)	5 (83)	2 (30)	1 (1)	1 (6)	-	16 (195)
White-beaked dolphin	2 (20)	-	-	-	1 (8)	-	3 (28)
Unidentified	6 (17)	1 (10)	1 (3)	-	-	-	8 (30)
Baleen Whales							
Minke Whale	2 (2)	2 (2)	2 (2)	-	2 (2)	-	8 (8)
Fin Whale	1 (1)	-	-	-	-	-	1 (1)
Humpback whale	4 (5)	-	-	-	-	1 (1)	5 (6)
Unidentified	3 (3)	-	-	-	-	-	3 (3)
Toothed Whales							
Sperm whale	-	-	1 (1)	-	-	-	1 (1)
Others							
Harbour porpoise	1 (1)	-	-	2 (7)	16 (35)	2 (6)	21 (49)
Grey seal	-	-	-	1 (1)	-	-	1 (1)
Harp seal					2 (4)	1 (1)	3 (5)
Unidentified seal	1 (1)	-	-	-	3 (4)	-	4 (5)
Unidentified whale	1 (1)	-	-	-	-	-	1 (1)
GRAND TOTAL	27 (116)	8 (95)	6 (36)	4 (9)	25 (59)	4 (8)	75 (333)

7.3.13 Marine Associated Birds

Marine-associated birds for the purposes of this CSR are those species that spend time associated with the coastal and/or pelagic environment. Most species have either a coastal or pelagic distribution but some species, such as large gulls, spend time in both habitats. Seabirds largely depend on the marine environment for their life cycle, and include:

- Species that come to land only to nest, and spend the rest of their lives at sea, often beyond sight of land,
- Species like gulls and terns, which can occur inland but also utilize coastal habitats and spend considerable time at sea,
- Species of waterfowl, notably sea ducks, some dabbling ducks and diving ducks or Common Loons that occur inland during breeding but often winter on the marine coast, and
- Species of shorebirds that breed in interior Arctic and sub-Arctic biomes and occur in coastal habitats during the summer-fall migration, or winter in coastal areas.

The species known to occur in the Placentia Bay, including their status as breeding, wintering or migrant, and their monthly abundance are provided in Table 7-12 below. Areas shaded in grey represent species' presence during a particular month.

Table 7-12 List of marine-associated bird species known to occur in the Placentia Bay Area, including the areas where they occur and monthly presence.

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Canada Goose	Branta canadensis	C	Uncommon			■	■	■	■	■	■	■	■	■	■
Gadwall	Anas strepera	C	Rare	■	■	■						■	■	■	■
American Wigeon	Anas americana	C	Scarce				■	■				■	■	■	
American Black Duck	Anas rubripes	C	Common	■	■	■	■	■	■	■	■	■	■	■	■
Mallard	Anas platyrhynchos	C	Scarce	■	■	■	■	■				■	■	■	■
Blue-winged Teal	Anas discors	C	Scarce				■	■			■	■	■		
Northern Pintail	Anas acuta	C	Uncommon				■	■	■	■	■	■	■	■	
Green-winged Teal	Anas crecca	C	Uncommon				■	■	■	■	■	■	■	■	■
Ring-necked Duck	Aythya collaris	C	Uncommon				■	■	■	■	■	■	■		
Greater Scaup	Aythya marila	C	Uncommon	■	■	■	■	■					■	■	■
Lesser Scaup	Aythya affinis	C	Scarce				■	■				■	■	■	■
King Eider	Somateria spectabilis	C, P	Scarce	■	■	■	■	■					■	■	■
Common Eider	Somateria mollissima	C, P	Common	■	■	■	■	■				■	■	■	■
Harlequin Duck	Histrionicus histrionicus	C	Scarce	■	■	■	■					■	■	■	■
Surf Scoter	Melanitta perspicillata	C, P	Uncommon	■	■	■	■	■	■	■	■	■	■	■	■
White-winged Scoter	Melanitta fusca	C, P	Uncommon	■	■	■	■	■	■	■	■	■	■	■	■
Black Scoter	Melanitta nigra	C, P	Uncommon	■	■	■	■					■	■	■	■
Long-tailed Duck	Clangula hyemalis	C, P	Common	■	■	■	■						■	■	■
Bufflehead	Bucephala albeola	C	Scarce	■	■	■	■						■	■	■
Common Goldeneye	Bucephala clangula	C	Uncommon	■	■	■	■	■	■	■	■	■	■	■	■

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Barrow's Goldeneye	Bucephala islandica	C	Rare											■	■
Hooded Merganser	Lophodytes cucullatus	C	Rare										■	■	■
Common Merganser	Mergus merganser	C	Uncommon	■	■	■	■	■	■	■	■	■	■	■	■
Red-breasted Merganser	Mergus serrator	C, P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Red-throated Loon	Gavia stellata	C	Uncommon									■	■	■	■
Common Loon	Gavia immer	C	Common	■	■	■	■	■	■	■	■	■	■	■	■
Horned Grebe	Podiceps auritus	C	Scarce	■	■	■							■	■	■
Red-necked Grebe	Podiceps grisegena	C	Uncommon	■	■	■	■						■	■	■
Northern Fulmar	Fulmarus glacialis	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Greater Shearwater	Puffinus gravis	P	Common					■	■	■	■	■	■		
Sooty Shearwater	Puffinus griseus	P	Common					■	■	■	■	■	■		
Manx Shearwater	Puffinus puffinus	P	Uncommon					■	■	■	■	■	■		
Wilson's Storm-Petrel	Oceanites oceanicus	P	Scarce						■	■	■	■			
Leach's Storm-Petrel	Oceanodroma leucorhoa	P	Common				■	■	■	■	■	■	■		
Northern Gannet	Morus bassanus	P	Common			■	■	■	■	■	■	■	■	■	
Double-crested Cormorant	Phalacrocorax auritus	C, P	Common				■	■	■	■	■	■	■	■	
Great Cormorant	Phalacrocorax carbo	C, P	Common	■	■	■	■	■	■	■	■	■	■	■	■
American Bittern	Botaurus lentiginosus	C	Uncommon				■	■	■	■	■	■	■		
Great Blue Heron	Ardea herodias	C	Rare				■	■				■	■	■	
Osprey	Pandion haliaetus	C	Common				■	■	■	■	■	■	■		
Bald Eagle	Haliaeetus leucocephalus	C	Common	■	■	■	■	■	■	■	■	■	■	■	■
Black-bellied Plover	Pluvialis squatarola	C	Common							■	■	■	■	■	

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
American Golden-Plover	Pluvialis dominica	C	Common												
Semipalmated Plover	Charadrius semipalmatus	C	Common												
Spotted Sandpiper	Actitis macularius	C	Common												
Solitary Sandpiper	Tringa solitaria	C	Scarce												
Greater Yellowlegs	Tringa melanoleuca	C	Common												
Lesser Yellowlegs	Tringa flavipes	C	Scarce												
Whimbrel	Numenius phaeopus	C	Common												
Hudsonian Godwit	Limosa haemastica	C	Scarce												
Ruddy Turnstone	Arenaria interpres	C	Common												
Red Knot	Calidris canutus	C	Scarce												
Sanderling	Calidris alba	C	Uncommon												
Semipalmated Sandpiper	Calidris pusilla	C	Common												
Least Sandpiper	Calidris minutilla	C	Common												
White-rumped Sandpiper	Calidris fuscicollis	C	Common												
Baird's Sandpiper	Calidris bairdii	C	Rare												
Pectoral Sandpiper	Calidris melanotos	C	Uncommon												
Purple Sandpiper	Calidris maritima	C	Common												
Dunlin	Calidris alpina	C	Uncommon												
Short-billed Dowitcher	Limnodromus griseus	C	Uncommon												
Wilson's Snipe	Gallinago delicata	C	Common												
Red-necked Phalarope	Phalaropus lobatus	P	Uncommon												
Red Phalarope	Phalaropus fulicarius	P	Common												
Black-headed Gull	Larus ridibundus	C	Common												

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bonaparte's Gull	Larus philadelphia	C, P	Rare												
Mew Gull	Larus canus	C, P	Rare												
Ring-billed Gull	Larus delawarensis	C, P	Common												
Herring Gull	Larus argentatus	C, P	Common												
Iceland Gull	Larus glaucoides	C, P	Common												
Lesser Black-backed Gull	Larus fuscus	C, P	Scarce												
Glaucous Gull	Larus hyperboreus	C, P	Uncommon												
Great Black-backed Gull	Larus marinus	C, P	Common												
Sabine's Gull	Xema sabini	C, P	Rare												
Black-legged Kittiwake	Rissa tridactyla	C, P	Common												
Caspian Tern	Hydroprogne caspia	C, P	Rare												
Common Tern	Sterna hirundo	C, P	Common												
Arctic Tern	Sterna paradisaea	C, P	Common												
Great Skua	Stercorarius skua	P	Scarce												
South Polar Skua	Stercorarius maccormicki	P	Scarce												
Pomarine Jaeger	Stercorarius pomarinus	P	Uncommon												
Parasitic Jaeger	Stercorarius parasiticus	P	Uncommon												
Long-tailed Jaeger	Stercorarius longicaudus	P	Scarce												
Dovekie	Alle alle	P	Common												
Common Murre	Uria aalge	P	Common												

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Thick-billed Murre	Uria lomvia	P	Common												
Razorbill	Alca torda	P	Common												
Black Guillemot	Cepphus grylle	P	Common												
Atlantic Puffin	Fratercula arctica	P	Common												
Belted Kingfisher	Ceryle alcyon	C	Uncommon												
American Crow	Corvus brachyrhynchos	C	Common												
Common Raven	Corvus corax	C	Common												

Notes: Shaded areas represent the months when species may be expected. Abundances may vary by month.

[a] C = Coastal, P = Pelagic

[b] Common = likely present daily in moderate to high numbers; Uncommon = likely present daily in small numbers; Scarce = likely present regularly in very small numbers; Rare = usually absent, individuals occasionally present. Dark highlighted fields indicate presence of species in the area during that month.

7.3.13.1 Pelagic Birds

Placentia Bay is one of the richest bays in Newfoundland for seabirds. There are five Important Bird Areas (IBA) in and near Placentia Bay (Figure 7-17 below); four seabird colonies (Cape St. Mary's, Middle Lawn Island, Corbin Island and Green Island) and a 1675 km^2 area on the east side of Placentia Pay. Cape St. Mary's supports the largest Northern Gannet colony in Newfoundland and nearly 20% of the Atlantic Canada breeding population. Middle Lawn Island, Burin Peninsula, supports the only known sustainable breeding colony of Manx Shearwaters in North America.

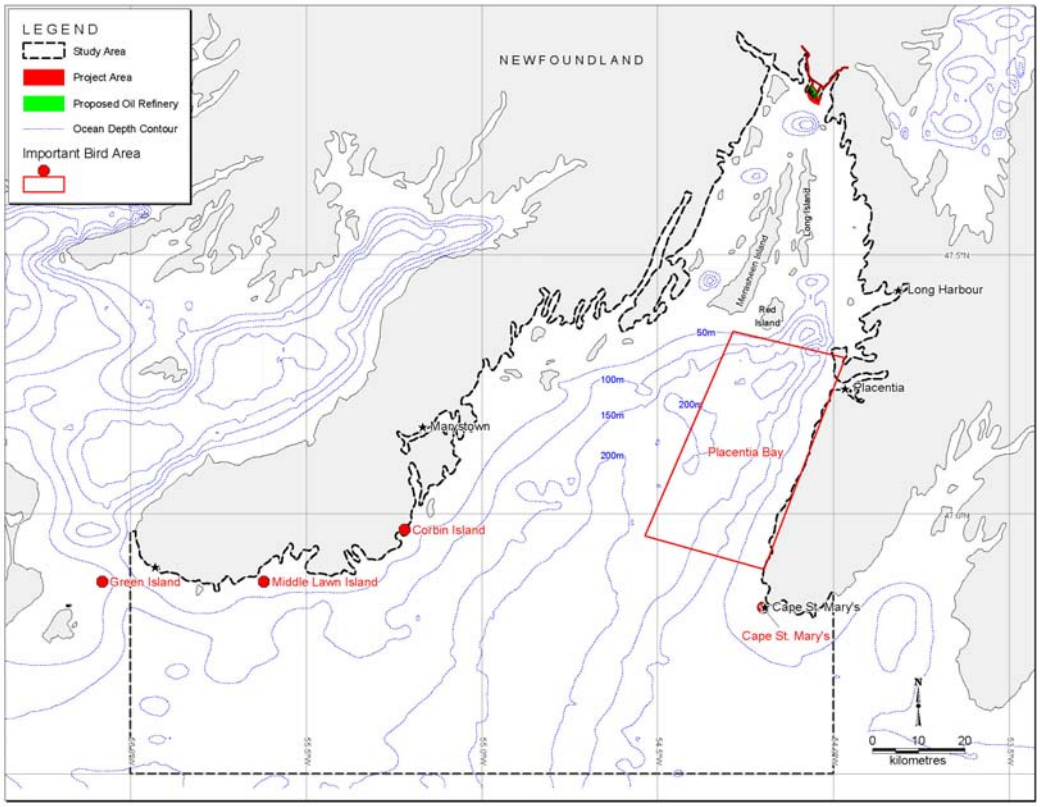


Figure 7-17 Important Bird Areas in Placentia Bay

Large numbers of Greater and Sooty Shearwaters that breed in the Southern Hemisphere during the NW Atlantic winter spend part of the Newfoundland summer in Placentia Bay, feeding on capelin and other fish while moulting flight feathers. Concentrations of summering shearwaters in eastern Placentia serve as the basis for designating that area as an IBA. Large numbers of Common Murres (> 10,000 pairs) breed at Cape St. Mary's and feed in Placentia Bay during the summer months. In winter both Common Murres, from Newfoundland breeding colonies, and Thick-billed Murres, from Arctic breeding colonies, use Placentia Bay. In the winter, aggregations of sea ducks such as Common Eider, Black Scoter, Long-tailed Duck and the eastern

Harlequin Duck are found in parts of Placentia Bay. There are over 365 islands in Placentia Bay, many of which support small colonies of Common and Arctic Terns, Herring, Great Black-backed and Ring-billed Gulls and Black Guillemots.

In order to address data gaps and update information on distribution and abundance of seabirds at sea in inner Placentia Bay during the non-breeding/wintering season, three boat-based survey routes were designed and surveyed by LGL Limited (Migratory Birds Component Study, 2007). Logistical constraints prevented surveying of the extreme outer portion of Placentia Bay. The proponent conducted fifteen surveys during the period of August 2006 to April 2007 with additional surveys on June 18, August 23, 24 and 28, 2007. Survey protocols involved conducting 10-minute counts using the Tasker Method. The survey routes are shown in Figure 7-18 below, with results up to April tabulated in Table 7-13.

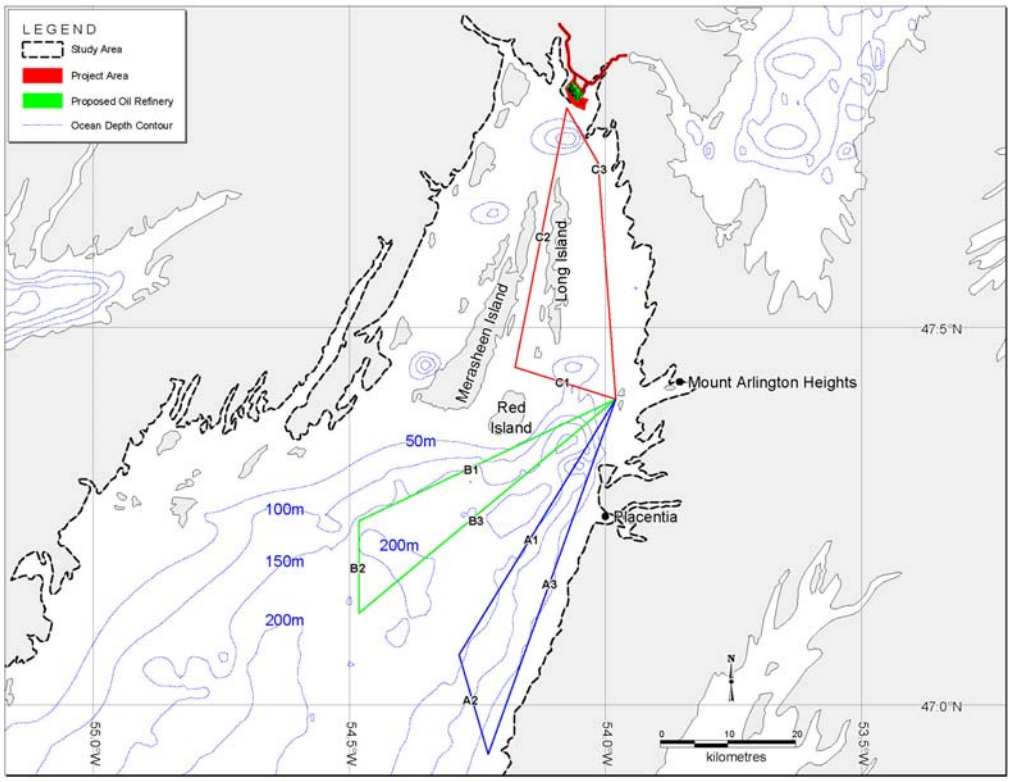


Figure 7-18 Seabird survey routes in Placentia Bay, August 2006 to April 2007

Table 7-13 Average density of marine-associated birds (per km^2) per 10-minute survey in Placentia Bay, August 2006 to April 2007

Species	Survey Route A				Survey Route B					Survey Route C					
	22 Sep	18 Oct	4 Dec	13 Apr	3 Aug	28 Sep	20 Oct	20 Dec	1 Mar	4 Aug	26 Sep	23 Oct	19 Dec	2 Mar	29 Mar
American Black duck	0	0	0	0	0	0	0	0	0	0	0	0.02	X	0	0
King Eider	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0
Common Eider	0	X	X	X	0	0	0	0.02	4.58	0	0	0.04	1.64	0	0
Long-tailed Duck	0	0	0.04	0.04	0	0	0	1.44	0.63	0	0	0	0.33	2.13	0.04
Red-breasted Merganser	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0
Common Loon	X	0	0	0	0	0	0	0	0	0	0	0	X	0	0
Red-necked Grebe	0	0	0	0.02	0	0	0	0	0	0	0	X	0	0	0
Northern Fulmar	X	0	0.02	0	0	X	0	0	0	0	0	0	0	0	0
Greater Shearwater	0	0	0	0	X	0	X	0	0	0	0	0	0	0	0
Sooty Shearwater	0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0
Manx Shearwater	0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0
Leach's Storm-Petrel	X	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0
Northern Gannet	X	0.46	0.08	0.14	0.18	1.50	0.38	0	0	0.02	0.04	0	0	0	0
Double-crested Cormorant	X	0	0	0	0.09	X	0	0	0	0	X	0	0	0	0
Great Cormorant	0	X	X	0.02	0	0	0.91	0.30	X	X	0	0.04	0.02	0.02	X
unidentified cormorant	0	0	0	0	0	0	0	0	0	0	0	X	X	0	X
Bald Eagle	0	X	X	X	0	X	0	0	X	X	X	X	0.13	0.02	X
Sanderling	0	0	0	0	0	0	0.04	0	0	0	0	0	0	0	0
Purple Sandpiper	0	0	0	0	0	0	0.02	0	0.32	0	0	0	0	0.06	0
Red Phalarope	0	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0

Species	Survey Route A				Survey Route B					Survey Route C					
	22 Sep	18 Oct	4 Dec	13 Apr	3 Aug	28 Sep	20 Oct	20 Dec	1 Mar	4 Aug	26 Sep	23 Oct	19 Dec	2 Mar	29 Mar
unidentified phalarope	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0
Ring-billed Gull	0	0	0	0.02	0	0	0	0	0	0.05	0	0	0	0	0
Herring Gull	X	1.02	0.39	0.26	0.83	1.07	1.11	0.08	0.04	0.18	0.43	0.77	0.61	X	0.26
Iceland Gull	0	0	0.04	0	0	0	0	0.06	0.02	0	0	0	0.20	0	0
Great Black-backed Gull	X	0.16	0.10	0.02	0.11	0.10	0.24	X	0.12	0.02	X	0.15	0.11	0.02	X
Black-legged Kittiwake	0	0.02	0.15	0.02	0.9	0	0.06	0.02	0.55	0.08	0	0.46	X	0.32	0.17
Common Tern	0	0	0	0	0.14	0	0	0	0	0.10	0	0	0	0	0
Arctic Tern	0	0	0	0	0.16	0	0	0	0	0.02	0	0	0	0	0
Pomarine Jaeger	0	0	0	0	X	0	0	0	0	0	X	0.04	0	0	0
Parasitic Jaeger	0	0	0	0	X	0	0	0	0	0	0	0.02	0	0	0
Dovekie	0	0.16	0.54	0	0	0	0.04	0.41	0.12	0	0	0	X	0.02	0.02
Common Murre	0	X	0	0.38	0.07	0	0	0.06	0.14	0.02	0	0	0	0.11	0.11
Thick-billed Murre	0	0	0.48	0.57	X	0	0	0.22	0.99	0	0	0	0.04	0.30	0.38
Unidentified Murre	0	0.02	0	0.10	0	0	X	X	0.04	0	0.02	0	0	0	0.15
Razorbill	0	0	0	0	0	0	0	0	X	0	0	X	0	0	0
Black Guillemot	0	0.12	0	0.18	X	0	0	X	0.04	0.13	0.02	0	X	0.09	0.02
Atlantic Puffin	0	0	0.12	0	0.25	0.02	0.12	0.47	0.10	X	0	0	0.02	0	0
All Species Combined	X	1.95	1.97	1.78	2.84	2.71	2.96	3.1	7.7	0.6	0.53	1.54	3.1	3.15	1.15

Notes: X = recorded off transect only.

7.3.13.2 Coastal Birds

Coastal birds include waterfowl, loons, grebes, cormorants, shorebirds, and birds of prey (raptors) that feed in nearshore waters or in the intertidal zone. Also included in this group is the Black-headed Gull species. The Proponent has supported shore-based surveys of coastal birds in an attempt to address data gaps about coastal bird distribution and abundance. More specifically, weekly or bi-weekly observations were conducted from August 2006 to April 2007 at sites located in Southern Harbour (four sites), Arnold's Cove (three sites), Come By Chance Bay (three sites), and North Harbour (four sites). Each site was visited for 20-30 minutes and all birds and other wildlife were recorded. The results of surveys conducted to date are included in the description of coastal birds.

Bald Eagles are year round residents in Placentia Bay. One of the densest breeding concentrations of the Bald Eagle in eastern North America occurs in Placentia Bay. Adult Bald Eagles were observed at all four shore-based survey sites and immature Bald Eagles were sighted at all sites except North Harbour. Bald Eagles were also observed regularly during other field studies for the proposed development including the documentation of five active nests between Bordeaux Island and Garden Cove during boat-based surveys for otters in May 2007.

Osprey are less numerous than the Bald Eagle in Placentia Bay but breed locally, and occur regularly from late April to September. Concentrations of up to four Osprey were recorded by the proponent at Come By Chance lagoon in August 2006, and low numbers were recorded at Arnold's Cove and North Harbour during shore-based surveys.

Incidental observations of raptors included Goshawk, Sharp-shinned Hawk, Northern Harrier and Merlin. These species are more typical of interior habitats. A Northern Harrier was observed in an open heath and peatland area of the proposed refinery footprint.

Among the coastal species that use Placentia Bay, both the Barrow's Goldeneye and the Harlequin Duck are recognized as species at risk under the federal *Species at Risk* legislation. The Barrows Goldeneye is rare but the Harlequin is more common. Proponent's surveys of coastal and pelagic birds in Placentia Bay has put particular focus on Harlequin Ducks in an effort to improve the knowledge of the distribution and occurrence of this species.

7.3.13.3 Shorebirds

Many species of shorebird occur in Newfoundland including Placentia Bay. Most of these are Arctic or sub-Arctic breeders that migrate through Placentia Bay in the late summer and fall. Spring migration routes typically occur west of Newfoundland. Shallow tidal flats, estuaries and kelp build-up on beaches offer the best feeding opportunities for shorebirds. Species breeding in Newfoundland include Spotted Sandpipers, Greater Yellowlegs and Least Sandpipers that occur commonly during spring and fall migration, but only the Spotted Sandpiper breeds in coastal terrain, e.g., grassy areas above highest tide line.

Seventeen species of shorebirds were recorded in late summer and fall 2006 during field studies for the proposed development, with notable aggregations of Greater Yellowlegs (with some Lesser Yellowlegs), Semipalmated Sandpipers, Semipalmated Plovers, and Ruddy Turnstones. Some shorebird species recorded during these recent surveys were considered uncommon or rare for the province, notably Red Knot and Baird's Sandpiper, respectively.

7.3.13.4 Breeding Waterfowl

Waterfowl breed in low densities throughout interior Newfoundland with relatively low numbers expected near the proposed development. The Project area is part of the Maritime Barrens Ecoregion and wetlands are typically acidic and dominated by peatland formations. There is little information on breeding waterfowl associated with wetlands on Southern Head. Species such as the Ring-necked Duck (*Aythya collaris*) and to a lesser extent the Black Duck (*Anas rubripes*) that exploit these oligotrophic habitats are expected to occur in the Project area. Aerial helicopter surveys were conducted in early September 2006 and late June 2007 as part of reconnaissance for vegetation and wetlands, and biologists participating in these surveys recorded the presence of waterfowl broods and indicated pairs.

Aerial surveys of the Southern Head area in early September 2006 confirmed the presence of broods of Ring-necked Ducks on wetlands in and immediately north of the footprint of the proposed development. A single Black Duck was observed at this time and believed to be a hatch-year bird (that is, hatched in 2006 and possibly local). In late June 2007, male and lone female Ring-necked Duck were observed on four wetlands, and a pair and single female Black Duck were observed on two wetlands in the Project area. These sightings are likely indicative of breeding as all individuals were flight capable, and no evidence of moulting waterfowl was documented in the area.

7.4 Terrestrial Environment

7.4.1 Water Resources

The proposed development will have direct and indirect effects on fish and fish habitat in four adjacent watersheds in the Southern Head area: the North Harbour River, Come By Chance River, Watson's Brook and Holletts Brook watershed. Of these, 4.2 % of Watson's Brook watershed and all of Holletts Brook (118 ha) will be within the footprint of the facility, and will be most affected due to the infilling of existing ponds and stream courses during site preparation and construction. The remaining watersheds will be affected only through stream and river crossings where required: these shall meet or exceed DFO requirements for water quality and protection of fish habitat.

Within the area of these watersheds the 1,200 ha of Southern Head encompassed by the site boundary was studied and mapped in detail. Approximately 65 ha of the existing surface area is open water in the form of ponds and streams. NLRC is participating in the federal & provincial hydrometric program in the province and has signed a Memorandum of Agreement with the Newfoundland and Labrador Department of Environment and Conservation to establish a Real-Time Water Quality Monitoring Network in the vicinity of the proposed new refinery. With the potential exception of deposition from air emissions from existing industries at the Head of Placentia Bay, there has been no other development on the Southern Head Peninsula to affect the natural water quality of these ponds and streams. Figure 7-19 shows the watersheds to be affected by the Development Proposal.

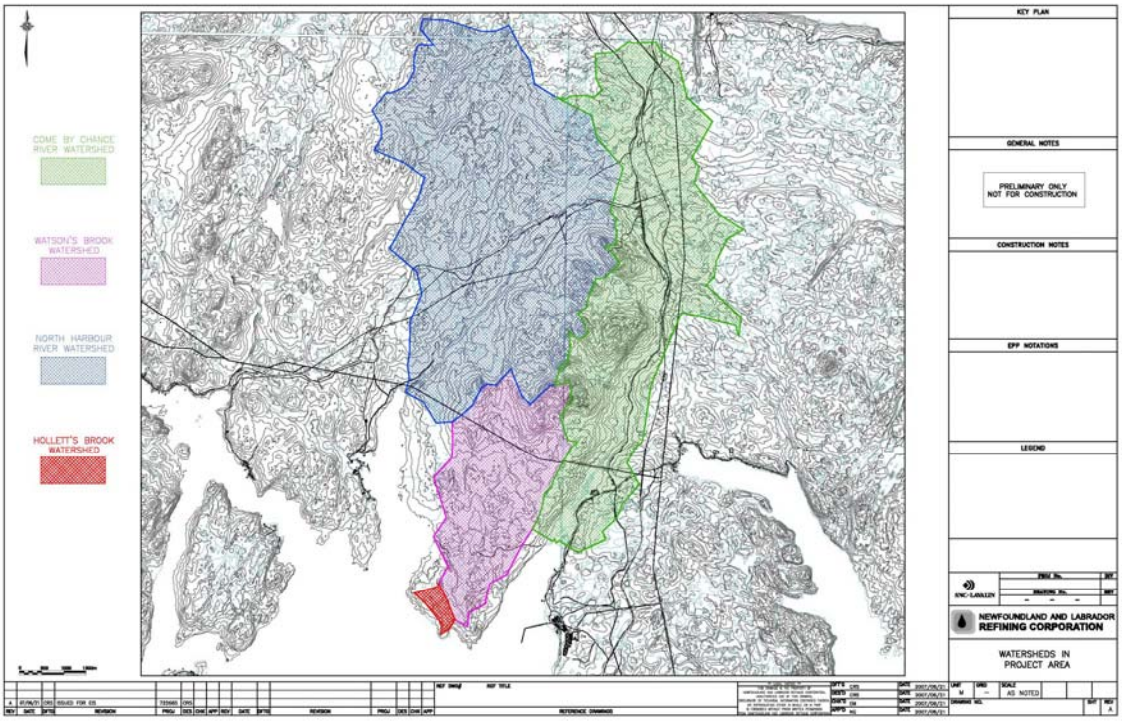


Figure 7-19 Watersheds Affected by the Development Proposal.

7.4.2 Freshwater Fish and Fish Habitat

NLRC conducted a thorough study of these resources to determine the type, extent and risk to fish and fish habitat. The freshwater fish species identified during field studies included Brook trout, Atlantic salmon, American Eel, and Three-spine stickleback. American Eel has been identified by COSEWIC as a "Species of Concern" and is discussed in Section 7.5. The North Harbour River, Come By Chance River, Watson's Brook, Holletts Brook and their tributaries form the major freshwater fish habitat in the area. Additional sampling effort using different types of sample gears was conducted on select ponds to determine that all species captured in the area were assumed to be throughout. It should be noted that some of the other streams and ponds within the study area are not considered fish habitat, as they did not contain fish or were small, flooded, overland flows with no suitable habitat. The overland flows are due to high flow runoff from the existing, isolated small ponds. These overflow areas had no defined banks or substrate other than non-aquatic grasses found in the area.

Loss of fish habitat will be subject to DFO's Policy for the Management of Fish Habitat, based on the No Net Loss of Productive Capacity of Fish Habitat Guiding Principle. The proponent has submitted a Fish Habitat Compensation Strategy to DFO and also incorporated several mitigation measures in the planning and design of the Project. Freshwater fish habitat within the proposed footprint of the refinery comprises approximately 198,979 m^2 in total area, however DFO will finalize the quantification of

HADD on the basis of the completed surveys plus additional field data on two ponds and calculation of flow in Watson's Brook.

7.4.2.1 Fish Habitat

There are four drainage basins within the area of the Development Proposal. A general description of each of the drainage basins within the footprint of the Development Proposal is provided below. Figure 7-20 below shows the delineation of ponds and streams that were identified and assessed as freshwater fish habitat.

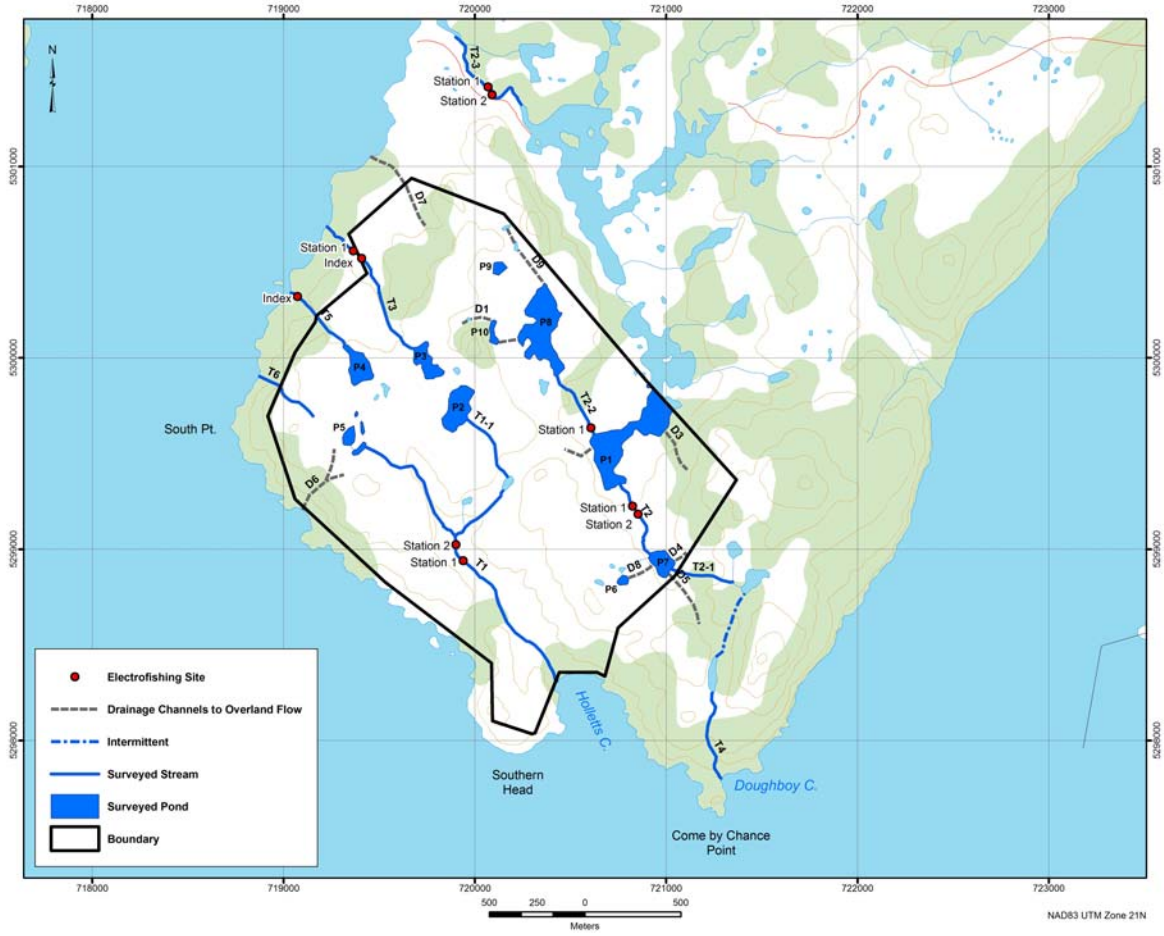


Figure 7-20 Delineation of Ponds and Streams

Holletts Brook (Tributary T1)

Holletts Brook (T1) and its tributary stream (T1-1) are located on the southwest side of Southern Head. It is a small drainage area directly within the footprint of the proposed refinery which flows south and drains into Holletts Cove, Placentia Bay. It extends

approximately 2 km inland from its outflow at the southern tip of Southern Head and drains approximately 1.5 km² (40% of the Project footprint area). Sample streams T1 and T1-1, when combined, measure a total of 2,412 m in length.

Holletts Brook and its small tributary flows primarily through sections of open bog. Both streams have riparian vegetation consisting of predominantly gramminoids with some conifers. The substrate composition of stream T1 is mostly bedrock and gravel. The substrate composition of tributary T1-1 was predominantly detritus and rubble. Both follow the surficial contours of the bog and for the most part have gradients of less than 10 %.

Both Brook trout and American eel were captured in Holletts Brook during electrofishing surveys. Habitat units defined within Holletts Brook were classified as 3.83 units of Steady, 12.78 units of Riffle, 4.04 units of Run, 0.61 units of Rapid and 0.67 units of Pool. There were also 4.82 units of Steady habitat at the mouth of Holletts Brook which had tidal influence and was therefore classified as brackish. Since both species found in Holletts Brook have life-cycle stages that could utilize this habitat even though it is not strictly freshwater, they were included in the quantified habitat. The small tributary was classified as containing 0.84 units of Riffle and 0.20 units of Steady. The remainder consisted of flow over grass (i.e. overland flow) that would be dry during low flow periods and hence is not considered fish habitat.

Pond P2

Pond P2 is located at the headwater of Holletts Brook. The surface area comprised 2.6 ha, of which 2.2 ha is littoral and 0.4 ha of non-littoral. The average depth of the pond was 3.1 m, while the deepest location in the pond was 5.6 m. The shoreline is generally comprised of cobble, gravel and rubble. A combination of fyke nets and baited minnow traps were all fished for 3 nights, yielding a total catch of 66 brook trout.

Watson's Brook (T2, T2-1 and T2-2)

Sample streams T2, T2-1 and T2-2 are part of the Watson's Brook drainage basin. The drainage area within the footprint is small (1.24 km²) which drains the northeastern portion of the development footprint. The area within the footprint comprises 4.2% of the Watson's Brook drainage basin (total drainage of 29.86 km²). All reaches within the Project footprint flow through sections of bog with shoreline vegetation consisting mostly of gramminoids and conifers. Substrate throughout is predominantly rubble and boulder. Brook trout, salmon, American eel and stickleback were found in the Watson's Brook waterbodies.

T2 itself drains from a small bog pond (Pond P7) on the eastern edge of the footprint to a larger pond (Pond P1) on the northern edge. It has a total length of 409 m (all within the project footprint), has an average gradient of less than 3% and contains a considerable quantity of overland flow. The habitat within T2 was classified as 0.72 units of Riffle, 0.70 units of Run and 1.52 units of Pool. There were also 1.29 units of overland flow.

Tributary T2-1 originates outside the eastern edge of the project footprint. It is a small tributary that empties into the eastern side of Pond P7. The stream itself measures approximately 343 m in length. The substrate composition of the steam is predominantly gravel and cobble. The shoreline vegetation is made up entirely of gramminoids and conifers. The stream for the most part was well defined and, with the exception of reach 4, has an average gradient of less than 1% to 4.8%. The habitat within the entire tributary was classified as 1.21 units of Riffle and 0.56 units of Cascade.

Stream T2-2 drains a pond toward the northern edge of the footprint (Pond P8) into Pond P1. It has a total length of 363 m (all within the footprint of the proposed development) and has a gentle gradient (less than 1%). The habitat was classified as 1.61 units of Riffle and 1.39 units of Pool.

In total, the streams provide an estimated 3.54 units of Riffle, 0.7 units of Run, 2.91 units of Pool, 1.29 units of overland flow and 0.56 units of Cascade.

Pond P1

The section of pond P1 that is located within the footprint of the Development Proposal was sampled. The section within the footprint has a total area 7.4ha; all littoral with an average depth of 1.0 m, being 1.2 m at its deepest. Littoral substrate was comprised of mainly muck, detritus and rubble. The shoreline was generally comprised of detritus and to a lesser extent rubble. A total of 56 brook trout, 40 Three-spine stickleback and 3 juvenile Atlantic salmon were captured within Pond P1.

Pond P7

Pond P7 is located along the southeast end of the Project footprint within Tributary T2. The total surface area is 1.25 ha with the deepest location being 0.65 m deep. The substrate was comprised of mostly aquatic vegetation, detritus, gravel and cobble. A total of 38 Three-spine sticklebacks and one Atlantic salmon were captured within Pond P7. Brook trout were not captured but are common throughout the Watson Brook drainage basin.

Pond P8

Pond P8 is a very shallow pond located in T2 in the northern portion of the Project footprint. The total surface area of Pond P8 is 5.78 ha and averaged a depth of 0.63 m, the deepest location measured 0.90 m deep. The substrate was comprised of gravel, cobble, detritus and sand. The larger substrate extended approximately half a meter into the pond which then changed to aquatic vegetation and detritus. A total of 53 brook trout, 81 Three-spine stickleback and 1 Atlantic salmon juvenile were captured within Pond P8.

Stream T3

Sample Stream T3 is a small stream that flows from sample Pond P3 and drains into North Harbour, a length of 863 m. Substrate composition is primarily gravel, cobble and detritus. The first 213 m of the stream was well defined, after which it becomes less distinct with sparse intermittent channels and overland flow to Pond P3. Brook trout were identified within the drainage basin.

Pond P3

Pond P3 is a shallow pond located along the western edge of the development footprint and is mostly surrounded by bog. The total surface area of Pond P3 is 1.47 ha; all littoral habitat. The average depth was 0.7 m, and the deepest location measured 0.9 m. The pond substrate consisted of mostly cobble, gravel and rubble. A total of 24 brook trout were captured in Pond P3.

Stream T5

Stream T5 is located to the south of Stream T3. While the stream was not intermittent or overland flow, it is not considered fish habitat. Electrofishing and fyke net results throughout this drainage basin did not capture any fish.

7.5 Species at Risk

In Canada, SARA provides the framework for identifying, monitoring and protecting species determined to be at risk due to natural causes or human activities. Species identified by this piece of legislation as pertaining to the scope of this report are listed below, as well as species' status as listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). See Table 7-14 below for a list of species at risk that could potentially occur in the Project area.

Table 7-14 Species at Risk that Could Potentially Occur in Project Area

Species	Federal *Species at Risk Act* Status	COSEWIC Status
Fish		
Atlantic Cod	Not listed	Threatened
Northern Wolffish	Threatened	Threatened
Spotted Wolffish	Threatened	Threatened
Atlantic Wolffish	Special concern	Special concern
American Eel	Not listed	Special concern
Marine and Coastal Birds		
Harlequin Duck	Special concern	Special concern
Barrow's Goldeneye	Special concern	Special concern
Piping Plover	Endangered	Endangered
Ivory Gull	Not listed	Endangered
Red Knot	Not listed	Endangered
Marine Mammals and Sea Turtles		
Blue Whale	Endangered	Endangered
North Atlantic Right Whale	Endangered	Endangered
Fin Whale	Special concern	Special concern
Harbour Porpoise	Not listed	Special concern
Leatherback Sea Turtle	Endangered	Endangered
Vegetation		
Boreal Felt Lichen	Special concern	Special concern

No species of Wolffish have been found during any fish surveys conducted by the proponent, however it is important to note that these species may occur in the area.

Recent concern regarding population decreases in the Great Lakes has prompted COSEWIC to list the American eel as a Species of Concern in 2006 (COSEWIC 2007). This designation is defined as a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. The designation as a Species of Concern does not enact any additional conservation measures outside those within the *Fisheries Act*.

There are four marine mammal species and one species of sea turtle considered at risk by COSEWIC and/or listed under Schedule 1 of SARA. The Blue whale and the North Atlantic right whale are considered rare in the area of Placentia Bay. Fin whales are expected to occur regularly in the Study Area, particularly during summer months.

Harbour porpoises are under consideration for listing on Schedule 1 of SARA, and are likely common (at least in small numbers) during all seasons.

Aerial and shore based surveys for Harlequin Ducks in outer Placentia Bay area were completed by the proponent in collaboration with Canadian Wildlife Services (CWS). The intent of the aerial surveys were to visit historical over-wintering locations for renewed use by Harlequin Ducks. The confirmation of only one isolated group of twelve Harlequin Ducks near Lamaline (Allens Island), Burin Peninsula, highlighted the continued scarcity of this species. Each listed as endangered by COSEWIC, the Barrow's Goldeneye, Piping Plover and Ivory Gull occur very rarely in Placentia Bay. Of these three species, the Piping Plover is the only one recognized under SARA.

The range of the leatherback sea turtle, listed as an endangered species, includes the outer portion of Placentia Bay. Leatherback turtles have been recorded in southern and central Placentia Bay and there is at least one record of a leatherback near the northern tip of Merasheen Island. Available data suggests that sightings of these turtles are most frequent in late summer and early fall. There are no available recovery strategies or action plans in place for marine mammals in Atlantic Canada. A recovery strategy for leatherback sea turtles is available, but no critical habitat has been defined.

Vegetation surveys of the Southern Head area conducted by the proponent both inside and outside the footprint of the Development Proposal have identified the presence of the Boreal Felt Lichen (*Erioderma pedicellatum*), a species at risk under federal legislation and sensitive to airborne emissions from Marine Terminal operations. While this species has not been recorded in the footprint of the proposed development, it has been recorded approximately 3 km from the northwest corner of the proposed development's boundary, on Southern Head in the conifer forest habitats that support it.

Apart from the species formally designated "at risk" under COSEWIC, the body of independent experts that advise the federal government have recommended several other species that occur in the area for protection under legislation. In the marine environment these include the porbeagle shark, the white shark, the short fin mako shark, the blue shark and the cusk.

8 Assessment of Alternatives

8.1 General

Section 16(2)(b) of the CEA Act requires that the assessment consider technically and economically feasible alternative means to carrying out the Project, including alternative locations for the Marine Terminal, were evaluated by the Proponent. Details of the alternative means and alternative locations are summarized below. This section of the CSR will discuss alternatives to the Project, as well as alternative means of carrying out the Project.

8.2 Alternatives to the Project

The proponent examined one basic alternative to the Project:

- Import/Export Pipelines.

8.2.1 Import/Export Pipelines

The possibility of using import/export pipelines and utilizing existing marine terminals in the area was evaluated. It was determined that both of the existing marine terminals in the area are at or near capacity and could not accommodate the expansion required to accommodate the increased volume of traffic, and therefore export/import pipelines from these terminals is not a viable option.

8.3 Alternative Means of Carrying out the Project

The proponent has considered various alternatives in the planning stage of the Project, including various alternative means of carrying out the Project, for example, different locations of the Marine Terminal and different ways of the construction of the Marine Terminal (e.g. blasting versus drilling, piling, infilling etc.); different locations of access roads, power supply, water usage, site development methods (e.g. disposal of unsuitable materials), stream crossings etc.

8.3.1 Alternative Locations

Several alternative locations for the jetty were considered. The proposed location near Come By Chance Point is based on consideration of prevailing winds and waves; accessibility from the shipping lane; water depth; topography; consultations with experienced pilots; and discussions with area fishers to avoid interference with specific, locally important fishing grounds. The jetty location selected allows the Project to take advantage of some of the key attributes of Placentia Bay; i.e., the deep water near shore, the vessel traffic management system, and an experienced fishers community.

8.3.2 Alternative Layouts for Development Proposal that Affect Federal Scopes

Other design alternatives were considered, includingadding a second access road as recommended by the community of North Harbour and residents of the Burin Peninsula, and building a new intersection that will serve the communities of Come By Chance and Sunnyside as well as the new refinery.

An alternative laydown area was initially considered approximately 2.2 km north of the Project site. This area was considered for the disposal of excess fill from the site and for use as a laydown area. It was determined that the alternative site was not the best choice for the Project as it would have a more detrimental effect on the Watson Brook watershed and that construction traffic to and from the site would pose some risk as well as cause increased air emission due to a longer haul distance.

8.3.3 Water Supply and Usage Alternatives

NLRC considered a number of options for water supply and surface water usage from existing resources (streams, ponds, runoff and groundwater, etc.). Due to the large volumes of freshwater required, the impact on existing water supply (surface water or ground water) would be high. The existing ponds and streams in the Project footprint or nearby area are shallow and not sufficient to provide required Project demands. The alternative is to draw water from Watson Brook (a scheduled Salmon river) that would have adverse impact on the brook. Therefore, desalination of seawater was considered and was selected as the preferred option.

8.3.4 Alternative to Watercourse Crossings

The location selected for the Project site lies on an undeveloped peninsula of land extending into Placentia Bay. Consequently, there are no existing accesses to the site and several watercourses lie on all routes to the Project site from existing developed highways. Three principal rivers isolate the Project site from currently developed areas and there is no alternative to crossing these rivers at some point in their footprint. The location for the watercourse crossings has been reviewed and will continue to be reviewed during design to minimize the impact of each crossing on each watercourse. The crossing for the Come by Chance River is located and will be designed to eliminate conflict with the Management Unit defined under the Stewardship Agreement the Town of Come by Chance has with the Eastern Habitat Joint Venture. The crossing points for North Harbour River and Watson's Brook have been located and will be designed to reduce the span of the crossing and to ensure that the footprint of each bridge does not encroach on the riverbanks. All crossings (particularly fish bearing streams) will be in accordance with DFO guidelines for stream crossing as well as DOEC and NWPA permit requirements.

8.4 Alternative Construction Methods for the Project

8.4.1 Marine Terminal/Tug Berth

There are two basic alternatives for the construction of the Marine Terminal Tug Berth. The alternatives are concrete caissons and sheet pile cells, both of these alternatives are gravity retaining structures which take up approximately the same marine footprint and have similar environmental impacts (HADD).

8.4.2 Marine Terminal/Jetty

There are two basic alternatives to the construction for the jetties. The alternatives are steel piles which are driven into the sea bed individually, or prefabricated jacket structures that are installed on the sea floor. After installation on the sea floor, piles are driven through the jackets to secure them in place. The environmental effects of both systems are similar after installation (HADD), however jackets have the advantage of a shorter construction time in the marine environment. Both systems have been used in the immediate area, Phase 1 of the Whiffen Head transshipment terminal was a piled option and Phase 2 of the Whiffen Head transshipment terminal was a jacket option.

9 Consideration of Potential Significant Adverse Environmental Effects

9.1 Information Considered

As stated earlier, the scope of this CSR (TC and DFO) includes the Marine Terminal, the marine intake and outfall as well as stream crossings and both freshwater and marine fish habitat within the Development Proposal site. It does not include shipping activities outside the Marine Terminal and its approaches. That is the marine spatial boundary is assumed to extend north of 47° 45' N latitude (which includes Grassy Point - the site of the proposed LNG Transshipment and Storage Terminal).

The scope of factors (or VECs), as listed in the track decision for CSR, which are to be considered within this environmental assessment is as follows:

- Marine Water Quality;
- Sediment Quality and transport;
- Marine Fish and Fish Habitat;
- Freshwater Fish and Fish Habitat;
- Aquaculture/Commercial Fisheries;
- Migratory Birds;
- Species at Risk;
- Marine Mammals;
- Marine Safety; and
- Human Health and Safety.

Potential effects from the proposed Project on each of these factors or VECs was taken into consideration for each stage of the proposed Project, construction, operation and decommissioning, as well as in regards to potential accidents and malfunctions that may occur. More detail regarding effects on these components is given in Section 10 of the CSR.

9.2 Methodology for Assessing Environmental Effects

The environmental effects assessment followed well-established methods, consistent with those of CEAA. The federal government has provided specific requirements and supporting guidance throughout the assessment.

Initial Interaction Matrices were produced that were used to determine whether or not a particular activity would be likely to have a significant adverse effect on each environmental factor. Each of the previously mentioned environmental factors has been evaluated in relation to the following:

- Evaluation of the nature and risk of accidental events;
- Development of mitigation methods, including rehabilitation and management methods;
- Determination of the nature and significance of any residual effects;

- Determination of potential cumulative effects over the life of the Project; and
- Proposition of a monitoring program to confirm the accuracy of the mitigation measures identified in the CSR to identify any unanticipated effects of the Project.

An activity that was deemed to potentially have an effect on any environmental VECs was evaluated further using another residual effects table. These residual tables took into account mitigation measures and ultimately determined any cumulative environmental effects that might be present. Several criteria were taken into account when evaluating the nature and extent of any potential environmental effects. These criteria include:

- Magnitude;
- Geographic extent;
- Duration and frequency;
- Reversibility; and
- Ecological, social, cultural and economic context.

The following table provides definitions of CEAA criteria. The CEAA criteria are further defined in a June 2006 document prepared by TC, entitled "Proponents' Guide for Environmental Assessment, Pursuant to the Canadian *Environmental Assessment Act*". These descriptions are reproduced below and were used in the assessment for the Project.

Table 9-1 Definitions of Attributes and Ratings Used in Effects Assessment Process

Attribute	Definition
Direction	Describes the ultimate long-term trend of the effect (*adverse* or negative or *positive*)
Magnitude	Describes the severity or intensity of the effect; typical measurements of magnitude indicate gains or losses in features or changes in conditions.
Geographic extent	Describes the area over which the particular effect will occur and is similar to the spatial boundaries of the assessment
Duration	Refers to how long an effect will occur and is closely related to the project phase or activity that could cause the effect
Frequency	Associated with duration and refers to the number of occurrences that can be expected during each phase of the project
Reversibility	The ability of the community (i.e., economy, society and culture) to return to conditions that existed prior to the adverse project effect. If project effects are positive, this attribute is not applicable.
Level of Confidence	Enables the analyst to assign a level of confidence to the prediction based on an understanding of the limitations of the prediction exercise
Certainty and likelihood	Enables the analyst to assign a level of probability or the likelihood that the effects will occur
Mitigation or	Enables the analyst to determine how well mitigation contributes to

Attribute	Definition
Enhancement Success	lessening of adverse effects or how well enhancement measures contribute to positive effects
Significance	An overall measure of the effect on the receptor (significant or insignificant).

Magnitude refers to the predicted amount or level of disturbance to an existing condition. The magnitude of an effect is typically expressed as a measurable number or value. For example, the area of habitat lost, the level of noise anticipated, the concentration of a contaminant in water are typical measures or values. Where appropriate, these measures or values should be described in the context of existing conditions, relevant regulatory standards or other guidelines.

Magnitude describes the nature and extent of the environmental effect for each activity. Magnitude was defined as:

- *Negligible* An Interaction that may create a measurable effect on individuals but would never approach the 10 % value of the 'low' rating. Rating = 0.
- *Low* Affects >0 to 10 percent of individuals in the affected area (i.e., geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 1.
- *Medium or Moderate* Affects >10 to 25 percent of individuals in the affected area (i.e. geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 2.
- *High* Affects more than 25 percent of individuals in the affected area (i.e., geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 3.

Geographic extent refers to the area over which the effect is likely to occur or be noticeable. The geographic extent can be described according to specific study areas (i.e., site, site vicinity/local study area, regional), or more specifically in term of distance form the site or source of disturbance.

Duration refers to the length of time the effects of a project will last. The duration of an effect can be described qualitatively as either short, moderate or long term, or by listing the project phases (i.e. construction, operations, decommissioning) during which the effect is likely to occur. More quantitative descriptions are also possible by specifying time frames (days, months, years) for the duration of the effect. One should remember that the duration of an effect might be longer than the duration of the project activities that cause it. Therefore, one should not assume that once a project activity has ceased, its effects on the environment are no longer of concern.

Frequency refers to the rate of re-occurrence of the effect and /or the phenomenon or event causing the effect. The frequency of an effect can be described qualitatively as

rare, sporadic and frequent; or using more quantitative terms such as daily, weekly or number of times per year.

Permanence or Reversibility refers to the time the environment will take to recover from the initial effect after the source of the disturbance is removed or ceased. The reversibility of the effect can be either described in general terms as reversible or not reversible; or more quantitatively (e.g., less than one year or growing season, or between XX and YY years).

Ecological context refers to the sensitivity of the environment (e.g., wildlife habitat, terrestrial habitat, aquatic species) that will be affected by the project. Typical indictors for this criterion include percentage of population affected, importance of population and number of generations to recovery.'

Table 9-2 presents assessment ratings for each of the effects attributes used in the provincial assessment (EIS), which have also been applied to the CSR. In addition, definitions are provided for terms employed in describing mitigation success and significance.

Table 9-2 Effects Ratings Used for Assessing Environmental Effects

Direction		**Definition / Rating**	
Adverse		Effect is worsening or is not desirable. (-)	
Neutral		There is no effect. (zero)	
Positive		Effect is improving or is desirable. (+)	
Magnitude /Rating			
Negligible	0	Does not have a measurable effect on the VEC.	
Low	1	Has a measurable effect on VEC but is of short-term duration or extent.	
Medium	2	Has a measurable effect on VEC but is of medium duration or extent.	
High	3	Has a measurable and sustained effect on VEC.	
Spatial/Geographic Extent Rating			
1		< 1 km^2	
2		1-10 km^2	
3		11-100 km^2	
4		101-1000 km^2	
5		1001-10,000 km^2	
6		>10,000 km^2	
Duration / Rating			
1		< 1 month	very short term
2		1 – 12 months	short term
3		13 – 36 months	medium term

Direction	**Definition / Rating**	
4	37 – 72 months	medium to long term
5	> 72 months	long term
Frequency		
1	< 11 events/y	
2	11-50 events/yr	
3	51-100 events/yr	
4	101-200 events/yr	
5	> 200 events/yr	
6	Continuous	
Reversibility	**(refers to population)**	
R = Reversible	VEC is capable of returning to an equal, or improved, condition once the disturbance has ended.	
I = Irreversible	VEC is not capable of returning to an equal, or improved, condition once the disturbance has ended.	
Ecological Context		
1	Relatively pristine area or area not adversely affected by human activity	
2	Evidence of existing adverse effects	
Level of Confidence		
Low	Information provided considered as having a low probability of being absolutely accurate.	
Medium	Information provided considered as having a medium probability of being accurate.	
High	Information provided should be considered as having a high probability of being accurate.	
Certainty		
Low	The effect can be considered to have a low probability of occurring.	
Medium	The effect can be considered to have a medium probability of occurring.	
High	The effect can be considered to have a high probability of occurring.	
Significance *		
Negligible or none	No effects.	
Minor	Low-level effects are distinguishable. These are usually limited to the short-term and are geographically circumscribed but are not considered disruptive even if widespread and sustained.	
Moderate	Effects are clearly distinguishable and result in elevated awareness or concern among stakeholders or materially affect the well-being of defined populations/communities. Usually are short- to medium- term in duration and are amenable to management if they occur over the longer term.	
High	Effects are highly distinguishable and result in strong concern or support among stakeholders or result in substantive changes in the well-being of defined populations/communities.	

Direction	Definition / Rating
* NLRC has determined that effects are ***Significant*** **(S)** or ***Insignificant*** **(IS),** based on criteria set forth in the CEAA guidance document on determining significance (CEAA, 2003). The proponent has determined that where the project is likely to cause significant adverse environmental effects – the effect is significant. If the activity does not cause significant adverse environmental effects, the effect is insignificant. In this assessment: "Negligible" and "Minor" will be rated as Insignificant, "Moderate" may be rated as Insignificant or Significant depending on the duration and extent, etc. "High" will be rated as "Significant"	

9.3 Mitigation Measures

Most effects, including potentially significant ones, can be mitigated by additions to or changes in equipment, operational procedures, timing of activities, or other measures. The CEA Act, Section 16d states that: " Every screening or comprehensive study of a project … shall include a consideration of … measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project."

Mitigation measures appropriate for each effect predicted in the effects matrix were identified and the effects of various Project activities (i.e. within Project cumulative effects) were then evaluated assuming that appropriate mitigation measures are applied. Effects predictions were made taking into consideration both standard and Project-specific mitigations and can thus be considered "residual effects." If all other mitigative measures fail, compensation becomes a form of mitigation (e.g. Fish habitat compensation strategy).

9.4 Cumulative Effects

The methodology for cumulative impact assessment is further described in Section 11.4. Projects and activities considered in the cumulative effects assessment include:

- Existing oil refinery at Come By Chance;
- Existing oil transshipment terminal at Whiffen Head, Arnold's Cove (NTL);
- Proposed LNG Transshipment and Storage Terminal at Grassy Point; and
- Proposed Southern Head Oil Refinery and Marine Terminal.

9.5 Residual Environmental Effects

Upon completion of the evaluation of environmental effects, the residual environmental effects (effects after Project-specific mitigation measures are imposed) are assigned a rating of significance for the following:

- Each Project normal activity or accidental scenario;

- Cumulative effects of Project activities within the Project.

The analysis and prediction of the significance of environmental effects encompasses the following:

- Determination of the significance of residual environmental effects;
- Establishment of the level of confidence for prediction; and
- Evaluation of the scientific certainty and probability of occurrence of the residual impact prediction.

The guidelines used to assess these ratings are discussed below.

9.5.1 Significance Rating

Significant environmental effects are those that are considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable.

An effect can be considered **significant**, or **insignificant**, negative (adverse) or positive (benefits).

9.5.2 Level of Confidence

The significance of the residual environmental effects is based on a review of relevant literature, consultation with experts, and professional judgment. In some instances, making predictions of potential residual environmental effects is difficult due to the limitations of available data (for example, technical boundaries). Ratings are therefore provided to indicate, qualitatively, the level of confidence for each prediction.

9.5.3 Likelihood

As per CEAA guidelines, the following criteria for the evaluation of the likelihood of predicted significant effects are used:

- Probability of occurrence; and
- Scientific certainty.

9.5.4 Final Determination of Significance

The final determination of significance of environmental effects rests with the Responsible Authority (TC and DFO) in collaboration with the other relevant federal agencies.

9.6 Project - Environment Interaction Matrix

The interaction matrix of Project activities with environmental VECs is shown in Table 9.3.

Table 9-3 Interaction Matrix of Project Activities with Environmental Components

ENVIRONMENTAL COMPONENTS (VECs) / KEY PROJECT ACTIVITIES / PROCESSES	Marine Water Quality	Sediment Quality and Transport	Marine Fish and Fish Habitat	Freshwater Fish and Fish Habitat	Aquaculture/Commercial Fisheries	Migratory Birds	Species at Risk	Marine Mammals	Marine Safety	Human Health and Safety
CONSTRUCTION										
Site Preparation at Shoreline (Clearing, Grubbing, etc)	X	X	X	X	X	X	X	X		
Site Access Roads, Pipelines				X		X	X			
Wharf, Construction Dock, Tug Berth			X		X	X	X	X	X	X
Jetties: Berthing Facilities, Loading Platform, Trestle Structures			X		X	X	X	X	X	X
Jetties: Underwater and sub-sea structures (pilings)	X	X	X		X			X	X	X
Intakes/Outfalls	X	X	X		X	X	X	X		
Accidents or Malfunctions	X	X	X	X	X	X	X	X	X	X
OPERATIONS										
Vessel Loading and Off-Loading at Tug Berth and Jetty					X	X	X	X	X	X
Seawater Intake			X		X	X	X	X		
Outfall	X	X	X		X	X	X	X		
Accidents or Malfunctions	X	X	X	X	X	X	X	X	X	X
DECOMMISSION/ ABANDONMENT										
Land Activities										
Marine Activities					X	X	X	X	X	
Reclamation / Rehabilitation	X	X	X	X	X	X		X	X	X

9.7 Construction Activities and Schedule

Pre-construction activities will commence immediately upon receipt of the environmental approvals and necessary permits. Clearing and grubbing of the access road and site would begin as soon as possible. Other early site preparation activities include leveling/in-filling and installation of temporary offices with associated services (power, potable water cooler/storage systems, temporary sanitary facilities) and will commence as soon as the access road is completed sufficiently for equipment and personnel to access the site.

Construction of the Development Proposal, associated utilities and support systems is proposed to begin in January 2008 and is expected to be complete within three and a half years. Construction of the Marine Terminal and associated works will also occur during this time frame. Commissioning will take place unit by unit as the facility is completed and will take approximately six months. It is anticipated that the first shipments of crude will be loaded before the end of 2011.

9.7.1 Access Roads and Utilities

The Project site is currently accessible only by boat, helicopter or all-terrain vehicle, and a new access road is required to connect the site into the provincial highway network. The proposed principal access point will be from the TCH near the Town of Come By Chance. A new interchange will be constructed approximately 1 km north of the existing intersection to provide a connection point for the main access road. The access road from the TCH to the main Project site will be 9.2 km long.

In order to expedite work on the site while the access road is being constructed, a temporary access will be built consisting of a tote road located at or near the permanent road location. Where practical, the tote road will be designed in such a way it will be incorporated into the permanent road structure. A temporary modular bridge will also be used for the Come By Chance River crossing during construction and removed upon completion of the permanent bridge.

The permanent bridge over the Come By Chance River will be a concrete structure with a clear span of 30 m and dry abutments (will not interfere with fish habitat). Once permanent access has been established from the Come By Chance area, an alternate access road will be extended to the North Harbour area to connect into provincial Route 210. This extension will provide an alternate route for employee access from the Burin Peninsula, as well as second access for emergency purposes.

This portion of the access road will require two additional river crossings, one at Watson's Brook and one at North Harbour River. Both bridges will be of concrete construction with clear spans and dry abutments. The Watson's Brook crossing will

have a clear span of 10 m and the North Harbour River Crossing will have a larger clear span of 30 m. The length of this alternate access road is 12.1 km.

The initial supply of power for construction purposes will be obtained from Newfoundland Power from the provincial grid using a temporary power line to be constructed adjacent to the main site access road. Temporary power generation (diesel generators) may be required at early stage of construction, which will be used later as an emergency/standby power source.

Power for facility operations will be obtained from Newfoundland and Labrador Hydro (NLH) and will be on a new, dedicated power transmission line to the Project site. Where possible, the transmission line will run adjacent to the access road; however, the final alignment location will be determined during design and will depend upon the connection point into the NLH system.

9.7.2 Site Preparation

The site will require excavation to level the site. Standard earthmoving procedures will be employed (in accordance with the EPP), including drilling and blasting, mechanical busting and mechanical excavation, as required. A large portion of the material to be moved on the site consists of rock. Till and unusable material can be excavated using conventional mechanical means including excavators, loaders and dozers.

All surficial root mat, topsoil, grubbing, peat, and weathered glacial till will be removed prior to cut/fill operations. Unusable material will be placed on the southeast edge of the Project site to provide a berm to act as a visual screen of the Project area from the shoreline. Organic material will be stockpiled in the same area. This stockpile will be used for surface preparation of the berm and other areas to be revegetated.

Blasting will not be undertaken in marine areas. In order to minimize the seismic impact, blasting patterns and procedures will be used to reduce the shock wave and noise. Overblasting will not be permitted. Blasting activities will be co-ordinated and scheduled to minimize the number of blasts required per week. Time-delay blasting may be used as necessary to control debris scatter. Prior to any blast, the site will be surveyed to identify the presence of any sensitive animals (black bear, caribou, etc.). Presence of such animals will result in delay or cancellation of the blast until such time that they are no longer present.

9.7.3 Water Bodies and Stream Crossings

Water bodies within the immediate footprint will be effectively removed from site and will not exist in the Project area upon completion of construction. Those water bodies with fish habitat will be electrofished to remove any fish, which will be relocated to an area of

similar habitat that will remain unaltered (as described in the fish habitat compensation strategy). The water body will be dewatered in a manner to prevent siltation, incorporating silt control measures. Unusable material from the drained water body will be excavated and removed to the unusable material waste site. Partial infilling of one pond may occur (pond # P1). In this case a berm will be built at the separation point (which will be chosen to be at the narrowest part of the pond), silt curtain will be set at the protected side of the pond. The infilling operation will be conducted at the time of lowest water level in the pond as much as possible, and not during fish spawning period.

Water bodies outside the Project footprint will have a minimum 15 m buffer zone as required by the regulatory agencies to preserve the shoreline.

Crossing of streams will be required for the construction of site roads and Project infrastructure. Culverts will be installed at stream crossing locations on the site access roads. Where streams are deemed to be fish habitat, culvert installations will be designed to allow the passage of fish and to preserve habitat. Cylindrical culverts will be countersunk below the streambeds so that there is sufficient depth of water for fish passage. This will be accomplished in multiple culvert installations by installing one culvert at a lower elevation than the others. For larger or more sensitive crossings, bridge structures will be installed to preserve the natural substrate for resident fish populations, including Come By Chance River, Watson's Brook and North Harbour River. The stipulations of DFO will be incorporated as required during design and construction as will the input of conservation and stewardship interests.

All stream crossings will be constructed in accordance with the procedures outlined in the NLRC EPP and will meet or exceed the requirements of the Department of Environment and Conservation, DFO and TC pursuant to the NWPA. Consultations with local conservation and stewardship interests will also be undertaken prior to this work.

9.7.3.1 Ongoing Rehabilitation

Temporary erosion and sedimentation control measures will be installed and maintained throughout the construction phase. Following completion of construction, there will be a site-wide review and implementation of stabilization and reclamation.

9.7.4 Marine Construction

The Marine Wharf facilities include the tug berth and heavy lift construction dock, a dry product berth for loading petroleum coke and sulphur products, a small boat basin, central control building and emergency response warehouse. The marine wharf area will be constructed by infilling the existing marine area with rock fill from on-site excavations. The east side will be protected and supported with concrete caissons, sheet pile cells or

sheet pile bulkhead walls. Armour stone similar to that used in the existing causeway at North Atlantic Refinery will be used as wave protection to the South.

The heavy lift construction dock will be incorporated into the tug berth/small boat basin and will be designed to accept large pre-fabricated modules and construction supplies for the construction phase. Large deck, low draft barges will be used to transport construction supplies and large construction modules ranging in size from 100 to 5,000 tonnes. Most heavy packages (greater then 100 tonnes) will be transported with roll-on/roll-off barges via multi-wheeled transporters.

These facilities will be constructed in a 30-month period, with most marine components installed in the first 20 months of construction.

It is anticipated that marine wharf construction, including the tug and dry products berths, will require 18 months to complete the primary structures and an additional 12 months to install equipment and piping.

The current design involves the use of bulkhead walls consisting of caissons filled with rock and affixed to rock mattresses. Rock mattresses will be put in place with a barge with suitable handling equipment. Caissons will be floated into place using small tugs for positioning. Once in position, the caissons will be sunk to the rock mattress and filled with rock offloaded from a barge.

It is anticipated that within 8-10 months of the start of marine wharf construction, construction will begin (concurrently) on the jetties, which are located 300-400 m from shore.

Jetty construction is anticipated to take 12 months for the installation of marine components and eight months for the installation of topside mechanical equipment. Each jetty will consist of jackets that sit on the seabed with piles driven through them. Some portions of the jackets will require drilling for placement of tension anchors.

Drilling is expected to occur via a self-elevating platform or jack-up barge (that typically has four legs) placed on the seafloor with the platform above sea level. Drilling will be completed after all the jackets are in place and would carry on for two months.

Vessel traffic during jetty construction will consist of tugs for positioning jackets and shuttling personnel, barges equipped with cranes for placement of heavy components, barges equipped with rock placing equipment, and a self-elevating platform. At any one time, no more than six vessels will be operating during this phase of construction.

During the construction phase of the Project, vessel noise will be concentrated in the area of the Marine Terminal and jetty. Specific sound levels or estimates are not available for the specific vessels or the cumulative noise levels from vessels, but it is expected that the greatest and most continuous noise source during construction of the Marine Terminal and associated works will be tugs and barges.

9.7.4.1 Construction Safety Zones

Before the start of marine construction activities, NLRC will establish a Construction Safety Zone (CSZ) of approximately 500 m x 1000 m in the Come By Chance Point nearshore area. This exclusion zone will encompass the marine area in which the construction dock/tug berth, and later the jetty, will be built. For safety and security purposes, and also to allow marine construction activities to take place in an efficient and timely manner, the CSZ will be closed to all fishing activities and fishing vessel transits, at least until the Construction Dock is operational, expected to be September 2009.

In addition, two other CSZs will be established for the installation of the seawater intake at Holletts Cove and for the outfall pipe off Southern Head. Both of these components will be installed at the same time. The safety zone for the intake pipe will be approximately 100 m x 1000 m, and the zone for the outfall will be approximately 100 m x 250 m. Fishers will have to avoid both of these marine construction areas during the three months or so they will take to install.

At any given time, there would likely be no more than six vessels operating concurrently on the marine wharf. The noises from ships associated with construction are not expected to be different from those usually associated with other vessels in the bay, such as fishing boats and other marine industries.

9.8 Operations Phase Project Activities

9.8.1 Marine Operations

During the operational phase, permanent marine facilities (wharf, tug basin and jetty) will occupy an area 400 m wide along the shoreline and extending out a distance of about 800 m from the Come By Chance Point. This area is deemed to be the operations phase Marine Terminal.

Other marine facilities include the intake and outfall pipes. When installed, the seawater intake pipe will extend out 985 m from the shoreline at Holletts Cove and the intake end will be at a depth of 18 m. The outfall will extend approximately 400 m from the shoreline

at Southern Head to a depth of about 15 m. These facilities will be partially trenched and buried in the tidal zone, but will lie on the seabed along most of their route.

It is expected that there will be an average of 17 vessel movements a week associated with refinery operations. This includes inbound and outbound bulk crude oil and refined product tankers; there will be many additional movements by tug, pilot and support vessels.

A typical time needed for offloading a cargo of crude oil is 18 hours, with 24 hours a maximum. A typical loading time for a dry bulk carrier (for sulphur or coke) or for a cargo of refined product is 18 to 24 hours.

Placentia Bay is within the Placentia Bay VTS Zone, and vessels 20 m (24 m for fishing boats) or more in length are managed under VTS Zone Regulations under the *Canadian Shipping Act*, as administered in the area by the CCG. The CCG maintains a Marine Communications and Traffic Services (MCTS) facility in Argentia, Placentia Bay. Participation in the Placentia Bay VTS system will be mandatory for all tankers arriving or departing from the Marine Terminal.

10 Environmental Effects

The environmental effects of the construction, operation and decommissioning of the Marine Terminal supporting the proposed refinery are summarized below for the VECs identified in Section 4.3. While the focus of the assessment is on the immediate Project area of Southern Head, the proponent also considered all of Placentia Bay for the migratory birds and aquaculture and commercial fisheries VECs. The study area is shown in Figure 10-1.

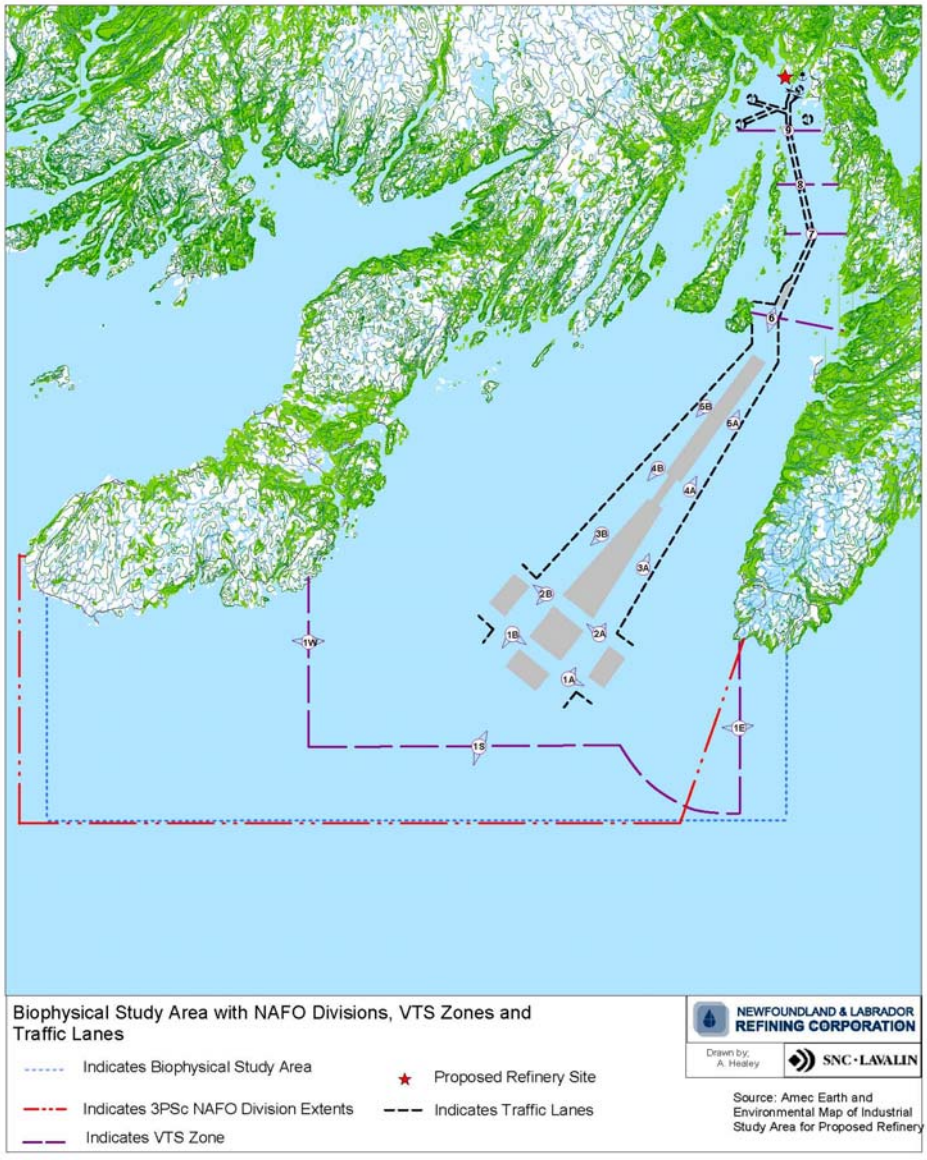


Figure 10-1 Project Study Area

10.1 Marine Water Quality

10.1.1 Potential Effects and Mitigation

10.1.1.1 Construction

Effects

Construction of the Marine Terminal and associated works will include on-land clearing and site preparation at the shoreline as well as the placement of sheet piling and infilling for the wharf and pile-driving and placement of the jetty supports: these activities have the potential to lead to sedimentation in the immediate offshore area, potentially affecting health and habitat of marine species in the area.

The wharf will also serve as the construction wharf during construction of the refinery and other parts of the Marine Terminal, handling a range of vessels, such as tugs, barges and heavy-lift vessels. There should not be effects on marine water quality other than those typical of existing vessel traffic in the area.

Mitigation

Permits, authorizations and the site EPP will establish the requirements for the prevention and management of sedimentation, including measures for erosion control and dust generation. DFO provides numerous guidelines and publications on controlling sedimentation, run-off and erosion from construction sites.

Prior to beginning marine works, silt curtains will be put in place around marine activities to prevent sediment from entering the water column outside the work area. Only clean rock (containing less than 5% fines and non-acid generating) will be used for infilling. Amour stone will be placed progressively to minimize shoreline erosion and prevent loss of in-fill material. No marine blasting will be used.

10.1.1.2 Operations

Effects

The purpose of the Marine Terminal is to receive and export hydrocarbons as well as export sulphur and coke. The terminal also includes a tug berth and emergency response facility. During routine operations, there should not be effects on water quality other than those typical of existing vessel traffic in the area.

The extensive surface area of the wharf and associated roadway creates the potential for surface run-off during storms which could carry contaminants into the marine environment.

Mitigation

Marine Terminal operations will be carried out in accordance with established national and international regulations, standards and codes of practice. In addition, the terminal will develop specific standards and operational procedures for the terminal and present these in a 'Marine Terminal Regulations and Information' Manual to all vessel owners, operators, charterers and masters of vessels intending to use the terminal.

The terminal will have facilities to handle and treat both ballast water and bilge water if necessary. In compliance with the *Ballast Water Control and Management Regulations* of the *Canada Shipping Act,* discharge of bilge water or untreated ballast water into the marine environment at the Marine Terminal will not be allowed in order to avoid contaminants, including potential invasive species.

Stormwater will also be managed throughout the Project area to ensure that contaminated stormwater is routed to the wastewater treatment plant prior to discharge to the waters of Placentia Bay. Holding ponds for uncontaminated stormwater will be used to prevent discharge of sediment from the Development Proposal.

The wastewater effluent will consist of the refinery's process water, cooling tower circulation water (heated water), the desalination discharge (heated and high brine water) and contaminated stormwater runoff from the plant site, the tankfarm, etc. The wastewater will be directed to the marine outfall, where a sampling control point will be installed on land (a manhole or chamber) just before entering the marine outfall pipe. This point will provide "the last control point" to ensure effectiveness of the wastewater treatment system and the characterization of both the influent and the effluent in relation to the ability of the treatment system to meet the requirements (concentration limits) of both federal and provincial legislations. The details of the type of sampling (on-line automated or manual), sampling frequency, substances, etc. will be determined at the detailed design stage and permitting and approvals process.

The following is a list of chemical constituents, and characteristics, that are typically found in refinery effluent:

- Flow
- Temperature
- Pressure
- pH
- Benzene
- PAH
- Other HC
- Sodium (Na)
- Silver (Ag)
- Cadmium (Cd)
- Cobalt (Co)
- Chromium (Cr-total)

- COD
- BOD
- NH_3/NH^{4+}
- $H_2S/HS/S^{2+}$
- TSS
- TDS
- Oil & Grease
- Hardness (Ca^{2+}/Mg^{2+})
- TOC
- PO_4
- Phenols
- Calcium (Ca)
- Magnesium (Mg)
- Chloride
- Sulphate
- Ammonia
- Cyanides
- Sulphides
- Molybdenum (Mo)
- Titanium (Ti)
- Beryllium (Be)
- Arsenic (As)
- Cr(Vl)
- Copper (Cu)
- Iron (Fe)
- Mercury (Hg)
- Nickel (Ni)
- Lead (Pb)
- Selenium (Se)
- Vanadium (V)
- Zinc (Zn)

Wastewater treatment system effluent will be designed and monitored to ensure compliance with all applicable regulations, both provincial and federal. Sampling of water quality at the outfall location will be conducted to ensure parameters meet the provincial *Environmental Control Water* and *Sewage Regulations* under the *Water Resources Act*, the federal *Petroleum Refinery Liquid Effluent Regulations* under the *Fisheries Act*, and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life. These regulations and guidelines do not cover all of the parameters identified as wastewater contaminants; however, they are covered under sections 34 and 36 of the *Fisheries Act*.

The proponent is also committed to monitoring within the effluent discharge "zone of influence" (e.g., within 100 m radius from the diffuser). This effects/compliance monitoring program (sampling locations, frequency and substance to be sampled) will be detailed as part of permitting and approvals. Due to the diverse nature of crude supply and the processing required, precise effluent parameters and concentrations will not be determined until the selection of the feedstock and the design of the process is complete.

Potential effects of air emissions on marine water quality from loading and unloading operations at the Marine Terminal will be minimized and/or avoided though operational procedures such as no-splash loading for petroleum liquids and covered conveyor systems for dry products (coke and sulphur). No maintenance dredging will be required.

NLRC has committed to a fish habitat compensation strategy under DFO's No Net Loss of Productive Capacity of Habitat Guiding Principles and Section 35(2) of the *Fisheries Act*. Fish Habitat Compensation is discussed in more detail in Section 10.3 of this document.

Marine water quality monitoring will be in place through compliance monitoring; the effects monitoring plan; and/or the marine Fish Habitat Compensation plan developed under the Fish Habitat Compensation strategy agreed with DFO.

10.1.1.3 Decommissioning

Effects

The Marine Terminal and associated works will support the refinery throughout its operating life which is anticipated to be twenty-five years or more. Upon decommissioning of the refinery, the Marine Terminal may be retained for other uses. If it is decommissioned, comparable activities to construction will be necessary with the same potential effects on water quality in the immediate Project area.

Mitigation

Procedures comparable to those used in construction will be followed during decommissioning to avoid effects on marine water quality.

10.1.2 Residual Effects

10.1.2.1 Construction

With the application of the EPP, good construction practices, wastewater treatment, pollution controls and compliance with permit and authorization conditions, as well as, other appropriate mitigation measures by the proponent in place, it is concluded that there will not be significant adverse residual effects on marine water quality in the Project area.

10.1.2.2 Operations

With effective application of the best available technologies, effluent treatment and pollution control, as well as, permits, authorizations, site EPP and monitoring programs in place, it is concluded that there will not be residual effects on water quality as a result of Marine Terminal operations.

10.1.2.3 Decommissioning

With effective permits, authorizations, site EPP and monitoring programs in place, it is concluded that there will not be residual effects on water quality as a result of decommissioning the Marine Terminal.

10.1.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

With the implementation of the proposed mitigation measures, the RAs have concluded that construction, operation and decommissioning of the Project are not likely to cause significant adverse environmental effects on marine water quality.

10.2 Marine Sediment Quality and Transport

10.2.1 Potential Effects and Mitigation

10.2.1.1 Construction

Effects

Marine sediment support important benthic habitat and source of food species for marine organisms and can also be a sink for organic and inorganic matter, including pollutants. Surveys for marine sediment quality by NLRC have shown that marine sediments in the area of the wharf and jetties, intake and outfall areas are generally within accepted criteria, as outlined in CCME's Interim Sediment Quality Guidelines. There were slightly higher levels of both copper and arsenic in sediment samples at the proposed outfall location and slightly higher levels of copper at two sampling locations at the wharf and jetty 1 locations.

Sediment contamination could result from hydraulic fluid, lubricant or other petroleum products entering the water and eventually the sediments directly or via materials entering the marine environment through erosion or sedimentation. The loss of uncured concrete into the marine environment could affect sediments temporarily as it is very alkaline.

Mitigation

The EPP will specify prevention measures (including permits and authorizations) and operating procedures to avoid sediment contamination.

Heavy equipment will be properly maintained to avoid leakages. No major repairs will take place within 30 m of water. No refueling will take place within 30 m of water. Storage and handling will follow the provincial *Storage and Handling of Gasoline and Related Products Regulations*. Heavy equipment will only be used on stable terrain on dry land or barges specifically equipped as construction barges. Spill kits will be situated on barges, boats and at the Marine Terminal itself. Trained personnel will be on site at all times while work is ongoing.

All concrete formwork will either be prepared on land and placed into position once dry or be placed using leak-proof forms. Equipment and procedures will ensure that concrete will not spill into the sea during pouring operations.

All wood used near or in the marine environment will have been deemed safe for use per DFO's Guidelines to Protect Fish and fish Habitat from Treated Wood Used in Aquatic Environments in the Pacific Region.

No dredging or blasting will be required. In the areas where the intake and outfall pipes will be trenched where they cross the intertidal area, rock splitting mortar will be used: this expansive mortar is packed into a series of drilled holes to split the rock which is then removed mechanically.

Sedimentation ponds will be constructed with sufficient capacity and retention time to prevent suspended solids from entering marine environment

10.2.1.2 Operations

Effects

Sediment contamination during operations could result from run-off from the wharf and/or jetty areas or accidental events. Accidents and malfunctions are addressed in Section 11.1 of this document.

Mitigation

The EPP will specify prevention and operating procedures for all types of activities at the Marine Terminal. The terminal will be a designated Oil Handling Facility (OHF) with the required plans, equipment and trained personnel in place. All vessels using the terminal will have the required insurance, Oil Pollution Emergency Plan (OPEP) and contract with a recognized Response Organization (RO) in place.

Equipment located at the Marine Terminal during operations will contain only small quantities of hydrocarbons. Only hydraulic fluid and medium oils (for fixed equipment gear boxes) will be used at the terminal and storage will be at least 30 m from water within secure storage, including secondary containment.

There will be continuous observation and monitoring at the Marine Terminal. During active loading and/or unloading operations, both terminal and vessel personnel will monitor operations.

No maintenance dredging will be required. A sediment quality monitoring program will be in place during operations.

10.2.1.3 Decommissioning

Effects

Sediment contamination could result from hydraulic fluid, lubricant or other petroleum products entering the water and eventually the sediments directly or via other materials entering the marine environment.

Mitigation

The EPP will specify prevention measures (including permits and authorizations) and operating procedures to avoid sediment contamination during decommissioning activities. Activities and environmental protection measures will be comparable to those identified under Construction.

10.2.2 Residual Effects

10.2.2.1 Construction

With the necessary permits, approvals, authorizations and EPP in place, it is concluded that there will not be any residual effects on sediment quality and transport associated with construction of the Marine Terminal.

10.2.2.2 Operations

With the necessary permits, approvals, authorizations and EPP in place, it is concluded that there will not be any residual effects on sediment quality and transport. It is concluded that monitoring will detect measurable changes in sediment quality and allow for corrective measures to be put in place with negligible residual effects.

10.2.2.3 Decommissioning

A specific EPP and approved procedures for the various steps in decommissioning will ensure that there area no residual effects on sediment quality.

10.2.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

The RAs have concluded that, with the specific mitigations specified by the proponent, the permits required as well as the planned monitoring program in place, the

construction, operation and decommissioning of the Project is not likely to cause significant adverse environmental effects on marine sediment quality and transport.

10.3 Marine Fish and Fish Habitat

10.3.1 Potential Effects and Mitigation

10.3.1.1 Construction

Effects

During construction of the Marine Terminal and associated works there is potential for sedimentation, erosion, run-off and dust to enter the marine environment to the extent that there are negative effects on flora and fauna as well as their habitat. Effects can include smothering of individual organisms or covering their preferred habitat. There is also potential for chemical contamination through hydraulic fluid or oil leaks. Blasting (on land) can also cause harm to marine organisms. Noise and disturbance will also cause some animals to leave the immediate area.

The main effect on marine fish and fish habitat will be from infilling along the shoreline to create the wharf and tug berth which will remove the existing habitat. Installation of the trestle and jetties and the intake and outfall pipes will also affect habitat in the immediate area of these structures. The loss of fish habitat associated with this physical footprint will require an Authorization under Section 35(2) of the *Fisheries Act* for HADD and as such will require a Fish Habitat Compensation Plan acceptable to DFO.

Mitigation

Any activities within the marine environment will be conducted in strict compliance with all federal and provincial permits, approvals and authorizations, as well as the EPP and the agreed fish habitat compensation strategy.

Infilling practices have been outlined in Section 10.1.2 and 10.2.2. There are numerous guidance documents for good construction practices that prevent erosion, sedimentation, dust and run-off that will be followed during construction of the Marine Terminal.

No blasting will take place in the marine environment and blasting on land will be done in accordance with accepted practices and guidelines such as DFO's 1998 Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright, D.G., and G.E. Hopky, 1998).

10.3.1.2 Operations

Effects

Effects on fish and fish habitat during routine operations (vessel movements, loading and offloading) will be limited to potential contamination from operations, such as dust from coke or sulphur loading. There may be some attraction to the marine intake and outfall pipes because physical structures may attract fish and provide shelter and habitat for them.

Mitigation

The management and operational procedures that will be in place for the Marine Terminal and associated works (Marine Terminal Regulations and Information manual) will ensure effects on fish and fish habitat area avoided or minimized.

The seawater intake pipe will be designed to minimize effects on marine organisms. The pipe will be buried in the inter-tidal zone and anchored with concrete blocks over the entire length to prevent floating. Specially designed screening will be used at the end of the pipe to reduce the intake velocity and protect marine organisms from being taken in. The outfall pipe will also be buried in the inter-tidal zone and anchored to the seafloor using concrete blocks. The design of the diffuser will ensure that the zone of influence of the effluent is minimized and reaches allowable limits within a radius of 100 m.

Compliance monitoring associated with all marine structures and effects monitoring will detect abnormalities that must be addressed. The effectiveness of the fish habitat compensation plan will also be monitored and reported.

10.3.1.3 Decommissioning

Effects

By the time decommissioning is considered, marine communities will be well established on the wharf, jetty supports and marine pipes. The decision may be to leave some of these structures in place. Other infrastructure will be removed.

Mitigation

As marine communities will be well established on the marine structures, the preferred course of action determined by regulatory agencies at the time maybe to leave some infrastructure in place, removing the rest if it is not to be used for other purposes. Removal of marine structures would follow comparable practices as outlined under construction.

10.3.2 Residual Effects

10.3.2.1 Construction

Habitat lost due to the placement of marine infrastructure will be compensated under DFO's Policy for the Management of Fish Habitat. Based on DFO's evaluation of the NLRC's proposed Fish Habitat Compensation Strategy (November, 2007), it has been determined that the total area affected by the marine structures covers approximately 71,677 m^2 of natural rock outcrop, boulder, cobble, sand and gravel habitat. The habitat characterization and quantification surveys for the Project as outlined in Section 7.3.11 of the CSR and the Marine Fish and Fish Habitat Component Study provide the basis for quantification of the HADD of fish habitat and the Fish Habitat Compensation Strategy. NLRC has developed a satisfactory Fish Habitat Compensation Strategy that will address the loss of marine fish habitat. Based on the policy's priority on replacing 'like for like' habitat in the same area, the Fish Habitat Compensation strategy includes:

- incorporation of suitable substrates into the design of the marine facilities to provide habitat for adult lobster
- creation of artificial reef structures with habitat features suitable for various lifestages of lobster, winter flounder, sea urchin, and deep sea scallop.

These compensation options will be presented to the public for input prior to finalization of the Fish Habitat Compensation Plan.

Good construction practice and implementation of the EPP will lead to low potential for sedimentation, erosion, run-off, excessive dust, effects from blasting will avoid negative effects on marine fish and fish habitat.

Infilling practices have been outlined in Section 10.1.2 and 10.2.2. There are numerous guidance documents for good construction practice that prevent erosion, sedimentation, dust and run-off that will be followed during construction of the Marine Terminal, making any effects minor to negligible.

10.3.2.2 Operations

With adherence to the Fish Habitat Compensation strategy (and compensation plan to be developed in consultation with DFO) there will be no residual effects due to operations.

10.3.2.3 Decommissioning

There will be no residual effects from decommissioning.

10.3.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

The RAs have concluded that with the above mitigation measures and adherence to the agreed Fish Habitat Compensation strategy, the construction, operation and decommissioning of the Marine Terminal is not likely to have significant adverse environmental effects on marine fish and fish habitat.

10.4 Freshwater Fish and Fish Habitat

10.4.1 Potential Effects and Mitigation

10.4.1.1 Construction

Effects

The Project will affect four watersheds (see Figure 7-19), directly affect 100 % of Holletts Brook watershed and 4.2% of Watson's Brook watershed through the refinery footprint.

Water bodies (ponds and streams) in the immediate footprint of the refinery will be effectively removed from site and will not exist upon completion of refinery construction. Prior to de-watering, water bodies will be electro-fished to remove and relocate any fish present. Surveys found that Brook trout, Atlantic salmon, Three-Spine Stickleback and American eel occur in the area.

Although identified in DFO's original scope, the proponent has determined that, following further Project engineering, dams and intake structures for ponds drawdown will not be required for this Development Proposal. As well, all pipelines for petroleum will be within the Project footprint and will not cross any water bodies.

With the extensive clearing and earthmoving associated with site preparation and leveling, there is potential for sedimentation of streams and ponds outside the refinery footprint. Blasting at the refinery site could affect fish in neighbouring water bodies.

A total of 38 stream crossings have been identified for both the site roads and the two access roads: 8 streams were deemed to be fish habitat. (See Figure 10-2).

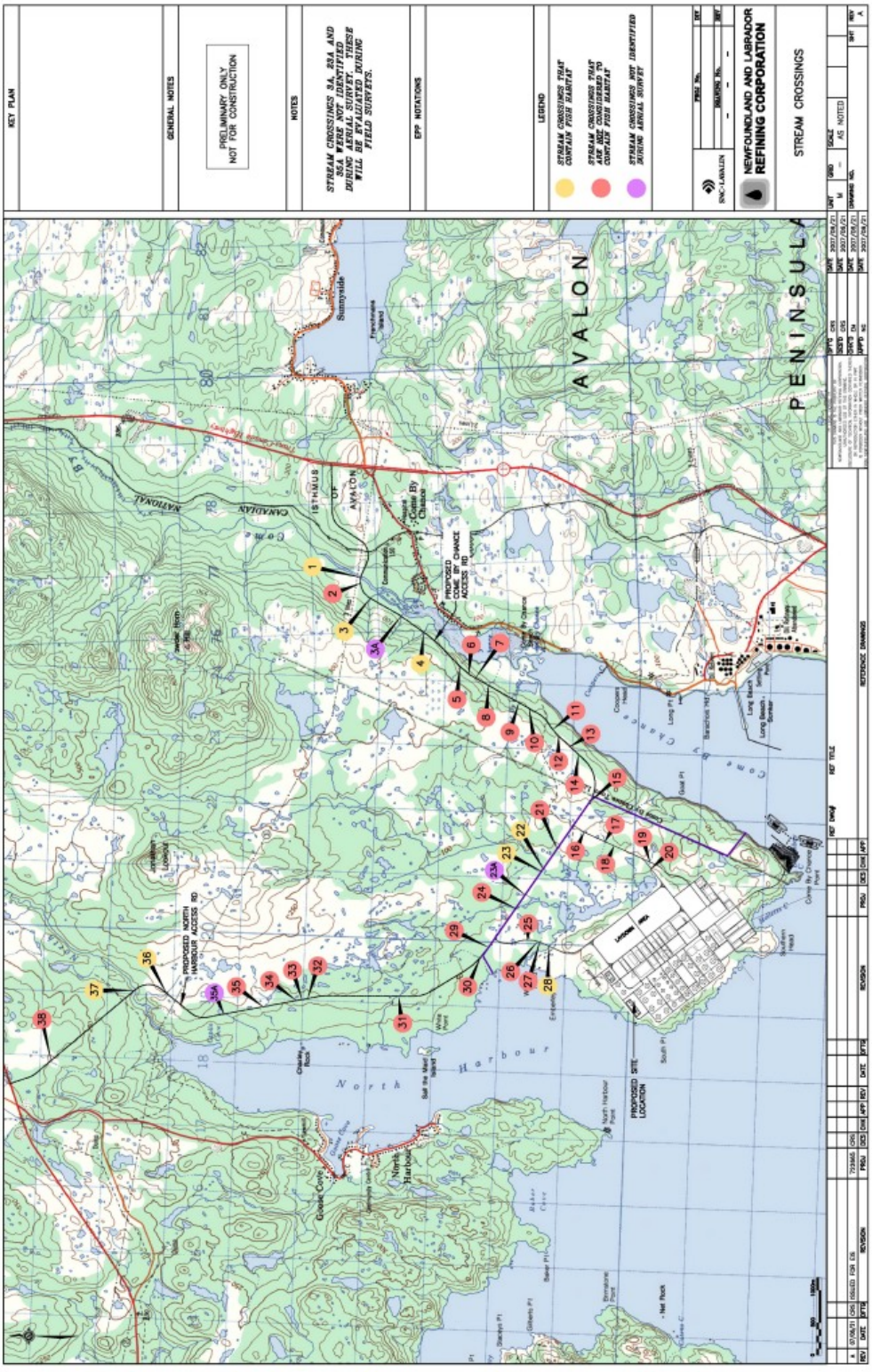


Figure 10-2 Stream Crossings

Site preparation (earthworks, clearing, grubbing, leveling) and construction within the physical footprint of the plant will negatively affect fish and fish habitat, i.e., the activity will result in the HADD of fish habitat. The loss of fish and fish habitat associated with the physical footprint will require an Authorization under Section 35(2) of the *Fisheries Act* and as such will require an acceptable fish habitat compensation strategy acceptable to DFO prior to any HADD of fish habitat.

Mitigation

Permits approvals, authorizations and implementation of the EPP will avoid or minimize effects on water bodies, both those in the footprint before de-watering and those outside the footprint throughout construction.

Only water bodies within the refinery footprint will be affected. Water bodies outside the footprint will not be affected. A 50 m buffer zone of undisturbed natural vegetation will be maintained between construction areas and all water bodies outside the Project area to prevent sediments from entering local waterways.

DFO provides numerous guideline publications on controlling sedimentation, erosion and runoff from construction sites. Specific mitigative measures will be utilized to minimize construction affects. Sedimentation control structures (i.e. silt curtains, sediment fences and sedimentation ponds) will be constructed prior to beginning any activities involving disturbance of the soil, work along the shoreline or near areas of high runoff potential. Soil disturbance will be minimized by limiting the area exposed at any one time, stabilizing exposed soil with anti-erosion devices (i.e. rip rap, filter fabrics, gravel or wood chips) and revegetation of disturbed areas.

Dewatering of the site will be undertaken in accordance with approved practices and with the objective of preventing drainage related issues in the area surrounding the site. The following mitigation measures will be followed: silt screening; perimeter ditching; velocity controls; settling ponds; and compliance monitoring.

All stream crossings on the access roads will be constructed in accordance with the procedures outlined in the EPP and will meet or exceed the requirements of the Department of Environment and Conservation as well as DFO's National Operational Statement for Clear Span Bridge Installations. DFO Fact Sheets and the Department of Environment and Conservation's Environmental Guidelines for Water Investigations will be used as a guide to working in and around water bodies.

A total of 38 potential stream crossings have been identified (see Figure 10-2). Eight streams were deemed be fish habitat. Three of the more substantial crossings (1, 28 and 37) will require the installation of bridges. The remaining five fish habitat stream

crossings (3, 4, 22, 23 and 36) will require culverts. Where streams are deemed to be fish habitat, culvert installations will be designed to allow the passage of fish and to preserve habitat. Cylindrical culverts will be countersunk below the streambeds so that there is sufficient depth of water for fish passage. This will be accomplished in multiple culvert installations by installing one culvert at a lower elevation than the others.

For larger or more sensitive crossings, appropriate structures will be installed to preserve the natural substrate for resident fish populations. Stipulations of DFO (such as appropriate sizing to prevent infilling, countersinking, as well as the addition of substrate and baffles) will be incorporated as required during design and construction. NLRC has also committed to considering the input of conservation and stewardship interests.

The design of culverts and bridge crossings, in particular that for the Come By Chance River, Watson's Brook and North Harbour River will also incorporate considerations of the *NWPA*.

NLRC has developed a satisfactory fish habitat compensation strategy. In order to comply with DFO's No Net Loss of Productive Habitat Guiding Principle and in efforts to provide the most preferred type of compensation, NLRC will seek to enhance riverine habitat within Watson's Brook and its tributaries to provide suitable habitat for salmonid species and eels, and to create/expand shallow ponds within the Watson's Brook watershed that will be interconnected with Watson's Brook to provide suitable habitat for salmonid species and eels. NLRC will continue to work with DFO, Salmon Association of Eastern Newfoundland (SAEN), and other stakeholders to achieve the objectives of the fish habitat compensation strategy. These compensation options will be presented to the public for input prior to finalization of the Fish Habitat Compensation Plan.

10.4.1.2 Operations

Effects

During operations, there is potential for sedimentation and run-off affecting water bodies within the Watson's Brook watershed. There is also potential for air emissions to affect water bodies, e.g. as acid rain.

Mitigation

The primary mitigation measure taken to avoid potential effects on the freshwater environment of the refinery area is the decision by NLRC to meet the refinery's water needs through desalination, not existing water bodies.

Permits, approvals, authorizations, use of the EPP and implementation of the fish habitat compensation strategy will be key mitigation measures to protect freshwater fish and fish habitat. This will include measures to control sedimentation and run-off, such as the use of silt curtains, the use of a covered conveyor system to eliminate fugitive emissions, and settling ponds.

With numerous ponds and several salmon rivers in the general vicinity of the proposed refinery, the potential for acid rain resulting from air emissions from vessels operating at the Marine Terminal was considered. Assessment of the results of the air emissions modeling indicate that there is no ecological risk resulting from the air emissions from the refinery (Human Health and Ecological Risk Assessment for the Opposed New Refinery at Southern Head of Placentia Bay, Newfoundland by SENES Consultants Limited, 2007).

The historic records of the water quality in streams adjacent to the existing refinery (e.g., Come By Chance River) or these at the site have not shown unusual low pH values in these watercourses as a result of acid rain from existing industry in the area. The predicted concentrations of NOx and SOx from the refinery operation are well within the NL government limits, including in combination with all existing sources of these pollutants.

Compliance monitoring and effects monitoring programs will be in place to confirm effectiveness of control measures and the fish habitat compensation strategy.

10.4.1.3 Decommissioning

Effects

There is the potential for sedimentation, erosion and run-off to affect water bodies within the Watson's Brook watershed during decommissioning work.

Mitigation

Decommissioning activities, such as cleaning and dismantling of site tanks and pipelines, will be done under the necessary permits and EPP in order to prevent effects on water bodies. Details of reclamation and rehabilitation will be developed with regulatory agencies and input from communities nearby.

10.4.2 Residual Effects

10.4.2.1 Construction

Habitat lost due to the placement of marine infrastructure will be compensated under DFO's Policy for the Management of Fish Habitat. Freshwater fish habitat within the proposed footprint of the refinery comprises approximately 198,979 m^2 in total area. The habitat affected encompasses both lacustrine (approx. 188,670 m^2) and stream (approx. 10,309 m^2) habitat in the Holletts' Brook and Watson's Brook watersheds. Approximately 4.2% of Watson's Brook watershed lies within the proposed footprint while Holletts Brook watershed lies totally within the proposed footprint.

The lacustrine habitat primarily consists of shallow (less than 1m depth) water and substrates of detritus (muck) throughout. Pond shorelines, however contain variable substrate combinations of predominantly boulder, rubble and cobble. The smaller streams within the proposed footprint that drain many of the ponds are predominantly overland flows with no defined channel and bottom substrates comprised of vegetation. The more defined streams consist of bedrock, boulder, rubble and cobble substrates and defined channels. These were generally located in Holletts Brook and at the outflows of the larger ponds in Watson's Brook.

Permits, approvals and authorizations; use of the EPP; and implementation of the Fish Habitat Compensation strategy are able to address the potential harmful effects of construction of the refinery on freshwater fish and fish habitat, making them negligible to minor in effect.

10.4.2.2 Operations

The use of Best Available Technologies Economically Achievable (BATEA); permits, approvals and authorizations; use of the EPP; implementation of the fish habitat compensation plan; and monitoring will ensure that there are negligible to minor effects on the freshwater fish and fish habitat.

10.4.2.3 Decommissioning

A site environmental audit and an approved decommissioning plan developed in consultation with regulatory agencies will ensure that effects of decommissioning activities on the freshwater environment are negligible. The terms of the final agreement regarding decommissioning may include reclamation and rehabilitation that result in additional freshwater habitat established.

10.4.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Taking into account the planned mitigation and compensation measures for the Project, the RAs conclude that the construction, operation and decommissioning of the Project are not likely to cause significant adverse environmental effects on freshwater fish and fish habitat.

10.5 Aquaculture and Commercial Fisheries

10.5.1 Potential Effects and Mitigation

10.5.1.1 Construction

Effects

Sedimentation from run-off or erosion affecting marine water quality could also affect aquaculture operations if it was severe or long term and affected the health of the farmed animals or the farm's nets and moorings. Excessive sedimentation could conceivably affect moored fishing gear as well and could cause fish to leave the area, as could underwater noise. Floating debris from Project activities could also affect fishing or aquaculture gear.

Vessel activity and the necessary CSZs associated with construction of the Marine Terminal and associated works will temporarily affect fishing operations in the immediate Project area through loss of access and interference with regular routes followed by area fishing vessels to fishing grounds. There may be increased risk of gear damage with construction related traffic entering and leaving the construction zone.

Mitigation

A major mitigating factor for the potential effects on aquaculture is the fact that existing and proposed facilities are located considerable distance away from the Southern Head area. The nearest aquaculture operation is located at a 25 km distance.

NLRC has committed to using good construction practices and the EPP to manage actual construction activities at the Marine Terminal. This should eliminate detrimental run-off, sedimentation or erosion. There will be no blasting in the marine environment and on-land blasting will follow DFO guidelines to avoid or minimize effects in the marine environment.

In addition, NLRC intends to have in place a Fisheries Liaison Manager to provide a dedicated link between the Project and the area fishers, as well as the aquaculture

industry in Placentia Bay. A Fisheries Liaison Committee with representatives from NLRC, FFAW and local fishing industry will also be put in place. NLRC has committed to gear and interference compensation and specific vessel traffic management practices in the Project area during construction.

A CSZ will be in place during the construction period to ensure safety for fishing and Project vessels and personnel. Lobster fishing will be able to resume in the wharf and jetty area as soon as safety permits. To the extent possible, construction activities at the intake and outfall locations will be scheduled to avoid periods of heavy fishing vessel traffic. There will be ongoing efforts to ensure that Project associated debris does not escape the site.

10.5.1.2 Operations

Effects

Increased vessel traffic in the Project area as vessels arrive and depart the terminal jetties and wharf could affect fishing activity in the immediate Project area through loss of access to specific fishing grounds, gear damage or interference.

Mitigation

A key mitigation by NLRC was to consult with Project area fishers early in the planning stage of the Project regarding the alignment and location of the wharf and jetties of the Marine Terminal. As a result of these discussions, these facilities have been designed and placed to enable area fishers to continue to fish a traditional and prolific cod ground off Southern Head. The revised drawings were presented at the Placentia Bay Traffic Committee meeting in early 2007.

NLRC has indicated that they will work with FFAW to establish a compensation program for economic loss by fishers (in addition to the gear damage compensation program) for loss of access caused by the presence of permanent facilities on established fishing grounds within the Marine Terminal area. The loss of fish habitat due to construction and operation of the Marine Terminal and associated works will be compensated through DFO's No Net Loss of Productive Capacity of Fish Habitat Guiding Principle and add new habitat suitable for lobster and the associated marine community typical of the Project area, e.g., algae, sea urchins, lumpfish, other invertebrates etc.

NLRC's Fisheries Liaison Manager and Marine Manager will work with the Fisheries Liaison Committee to establish Project vessel traffic management and routes associated with the vessel arrival/departures at the terminal. In addition, vessel berthing infrastructure and procedures will be reviewed in the TERMPOL review for the Marine Terminal.

10.5.1.3 Decommissioning

Effects

The potential affects on aquaculture and the commercial fisheries from decommissioning are comparable to those during construction.

Mitigation

Mitigation measures comparable to those in place for construction and operations would be used during decommissioning.

10.5.2 Residual Effects

10.5.2.1 Construction

With the intended mitigation measures in place and effective monitoring and communication between the Project and the fish harvesters by the Fisheries Liaison Manager, the residual effects on the commercial fisheries will be minor to negligible.

There will be no effects on aquaculture due to mitigation measures (e.g. debris management) and to the distance of aquaculture facilities from the Marine Terminal site.

10.5.2.2 Operations

NLRC's planned mitigation measures, including compensation programs for gear damage and loss of access as well as the dedicated on-site Fisheries Liaison Manager and Marine Manager will serve to make the potential effects of the Marine Terminal minor to negligible.

10.5.2.3 Decommissioning

Effects of decommissioning will be of short duration and limited to the immediate Project area and, as such, are negligible for commercial fishing activity. There are no residual effects on aquaculture.

10.5.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

The RAs have concluded that there are no residual effects on aquaculture as a result of the Project.

After consideration of the planned mitigation measures for the commercial fisheries, the RAs have concluded that, with implementation of these measures, the construction, operation and decommissioning of the Project are not likely to cause significant adverse environmental effects on the commercial fisheries.

10.6 Migratory Birds

10.6.1 Potential Effects and Mitigation

10.6.1.1 Construction

Effects

During construction activities for the Southern Head Marine Terminal, clearing, noise and lighting will affect birds and bird habitat in the immediate area of the terminal. Other activities that could be detrimental include run-off and sedimentation, air emissions and liquid effluent, possible collisions with structures (e.g. marine barge cranes) and accidental release of harmful products into the environment such as fuel oil and other machinery products that may be in use.

The marine CSZ for the Marine Terminal and associated works includes an area of approximately 500 m X 1 000m at the wharf and jetty site and, smaller areas of shorter duration around the intake and outfall locations (approximately 100 m X 1 000 m and 100 m X 250 m respectively). The length of shoreline affected is approximately 500 m. The terminal site is in an area of narrow boulder and cobble beach and bedrock cliff.

Mitigation

Conditions associated with permits, approvals and authorizations and implementation of the EPP will address the requirements of the *Migratory Birds Convention Act* (MBCA) and associated regulations, in particular Section 6 of the Migratory Birds Regulations and Section 5.1 of the MBCA.

Mitigation measures that NLRC plans to use to protect migratory birds during construction of the Marine Terminal include minimization of dust, run-off and associated

sedimentations, noise and lighting (when safe); heavy equipment maintenance; fuel oil specifications; use of best available technology; avoiding Bald Eagle and Osprey nest trees by 300m. In addition, NLRC has committed to a raptor monitoring program, avian collision mitigation and monitoring program (developed in consultation with EC), and follow-up nesting surveys in the Marine Terminal area.

Mitigation measures associated with lighting include the use of strobe lights only on tall structures at the minimum intensity and flash frequency allowable by TC, minimizing the number of lights, avoiding use of exterior decorative lights, and shielding of task lighting to shine only where needed.

10.6.1.2 Operations

Effects

Disturbance from noise and activity during operations is predicted to affect areas within 200 m. These disturbances are not predicted to have a significant effect on migratory bird populations. Lighting of the area during construction and operations may serve to attract some bird species with the risk of resultant mortality. Leach's Storm-Petrels in particular can be attracted to light, especially in fog or during storms. While Leach's Storm-Petrels are numerous in outer Placentia Bay with over 200 000 breeding pairs, they are likely infrequent in the Marine Terminal area. Some Leach's Storm-Petrels could stray to the inner most sections of Placentia Bay including the Marine Terminal area during periods of fog and strong south winds during the breeding season from May to October.

10.6.1.3 Mitigation

Mitigation measures to be used to protect migratory birds during operations will ensure that the requirements of the *MBCA* and associated regulations are met. Mitigation measures to be taken include minimization of noise and lighting (when safe); avian collision mitigation and monitoring program (developed in consultation with EC); the use of best available technology; implementation of the EPP. NLRC has indicated that, in the event of Storm-Petrel strandings at the Marine Terminal and attendant vessels, they will use the handling techniques outlined for Storm-Petrels in a protocol developed by Williams and Chardine which was established for use with offshore oil production operations.

10.6.1.4 Decommissioning

Effects

Effects from the decommissioning of the Marine Terminal on migratory birds are expected to be similar to those experienced during the construction phase. Issues to consider here will be runoff, sedimentation and the disturbance from noise and lighting.

Mitigation

Similar mitigation measures to control run off, sedimentation and will be used here as described above under construction mitigations measures.

10.6.2 Residual Effects

10.6.2.1 Construction

Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will enable construction of the Marine Terminal and associated works to have negligible effects on migratory birds. No residual effects on migratory bird populations are predicted during this phase, given that appropriate mitigation measures are in place.

10.6.2.2 Operations

Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will enable the Marine Terminal and associated works to operate within the requirements of the *MBCA* and its regulations and have negligible effects on migratory birds. No residual effects on migratory bird populations are predicted during this phase, given that appropriate mitigation measures are in place. On-site observation and monitoring plans will be in place to confirm this assessment.

10.6.2.3 Decommissioning

Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will ensure that decommissioning of the Marine Terminal will have negligible effects on migratory birds. No residual effects on coastal bird populations are predicted during this phase, given that appropriate mitigation measures are in place.

10.6.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Based on review of NLRC EA documentation and identified mitigation measures, consultation with federal authorities and the public and the commitments of NLRC, the RAs have concluded that construction, operation and decommissioning of the proposed Marine Terminal are not likely to cause significant adverse environmental effects on migratory birds.

10.7 Species at Risk

10.7.1 Potential Effects and Mitigation

10.7.1.1 Construction

Effects

Species at risk that occur or may occur in the Project area and/or Placentia Bay are listed in Section 7 of the CSR. Fish species at risk may be affected during construction of the Southern Head Marine Terminal primarily through run-off and sedimentation, blasting (on land) and pile driving (marine). Several freshwater ponds and streams will be in-filled or removed from the footprint of the Development Proposal. The two access roads will cross as many as 28 streams, including three salmon rivers, North Harbour River, Watson's Brook and Come By Chance River.

Marine-associated birds considered at risk that occur or may occur in the Study Area include Harlequin Duck, Barrow's Goldeneye, Ivory Gull, Piping Plover and the Red Knot. The Barrow's Goldeneye, Piping Plover and Ivory Gull are rare in Placentia Bay, with only one or two sightings in recorded history and none sighted during Project surveys. There is of lack of habitat for Piping Plover in Placentia Bay, and the bay is beyond the normal range for Barrow's Goldeneye and Ivory Gull. Only Harlequin Duck and Red Knot are known to occur on a regular basis in Placentia Bay. While Harlequin Duck is found in the outer areas of Placentia Bay, it has not been sighted in the Project area itself and suitable habitat for Harlequin Duck does not occur in or near the Marine Terminal site. Red Knot is an uncommon southbound migrant in coastal Newfoundland as its main migration route is west of Newfoundland.

Potential effects on avian species at risk during construction are similar to those presented in the discussion on migratory birds. Negative effects could result from noise, activity and lighting, as well as run-off, sedimentation, air emissions and the release of effluents.

In the case of marine mammals and sea turtles at risk, run-off and sedimentation may have an effect by increasing the turbidity of their surroundings, affecting visibility and possibly making it more difficult to find food. There are potential effects from noise (on-land blasting, marine pile driving) and the risk of collisions with vessels.

The Boreal Felt Lichen has not been found within the footprint of the Marine Terminal and associated works. However, it was found in one area in the vicinity of an access road for the Development Proposal. Surveys will continue in the Development Proposal footprint, including the Marine Terminal site.

Mitigation

Mitigation measures to control activities that may possibly affect species at risk will include the minimization of dust, run-off, sedimentation, noise and lighting (when safe); the use of best available technology; continued monitoring and surveys of species at risk including (*E. pedicellatum*) monitoring for mortalities at site; monitoring of water quality (freshwater and marine); having a contingency plan to respond to any unplanned events; as well as the implementation of release protocols.

Onshore blasting and pile driving will not be undertaken if marine mammals or sea turtle species are observed within a safety zone defined by a measured sound level. More specifically, mitigation and monitoring programs designed to minimize potential effects of construction activities on COSEWIC and/or SARA-listed marine mammals and sea turtles include measures such as:

- Adherence to DFO guidelines for blasting (setback distances to ensure sound pressure does not exceed 100 kPa in the water column);
- Acoustic monitoring to ensure sound levels do not exceed 100 kPa from blasting and for establishing 180 and 190 dB safety zones;
- Acoustic measurements to determine if sound levels from pile driving exceed 180 dB and if so, determine 180 and 190 dB safety zones;
- Visual monitoring by a trained individual of safety zones (180 and 190 dB) 30 min prior to nearshore blasting and pile driving activities;
- Delaying of pile driving or blasting operations if any marine mammal or sea turtle is sighted within a designated safety zone;
- Cessation of pile driving if a marine mammal or sea turtle enters a designated safety zone.

In terms of protecting the boreal felt lichen, NLRC intends to continue surveys for the lichen in the Project area. In the event boreal felt lichen occur, consideration will be given to leaving in place any trees that possess thalli or the proponent will make efforts to transplant trees that are providing habitat for this species.

10.7.1.2 Operations

Effects

Potential effects during routine operation of the Southern Head Marine Terminal include collision with vessels; noise from vessels; harmful effects resulting from effluent or an oil spill into the marine environment; attraction of birds to structures and lighting. Air emissions from tankers berthed at the jetty may affect boreal felt lichen if it occurs in the immediate area of the terminal.

Mitigation

Many mitigation measures will be identified as conditions of permit, approval or authorization and/or put in place as part of the EPP. Mitigation measures that will address potential effects on species at risk during operations include using best available technology; following all pertinent regulations regarding air emissions and liquid effluent; minimizing noise and the use of lighting whenever possible; implementing proven measures for avoiding harm to marine mammals or sea turtles (such as altering course to avoid any marine mammals or sea turtles; vessels maintaining consistent and/or reduced speed and travel direction; delaying start or shut down on land blasting if marine mammals or sea turtles are in 180/190 dB zone).

Marine loading and vessel air emissions estimates associated with the Marine Terminal and associated works are presented in detail in the provincial EIS. Estimates for SO_2 and NO_2 for vessel operations at the jetty based on air emissions modeling completed for the EIS and are given in Table 10-1 below.

Table 10-1 Maximum short-term predicted concentration outside the property line from the refinery and the unloading ships

Pollutant	Time Frame	Standard (µg/m³)	NLRC Refinery (µg/m³)	Ships (µg/m³)	Both (µg/m³)
SO_2	1-hour	900	734 Coast line South of refinery	414 Coast line West of jetty	734 Coast line South of refinery
	24-hour	300	64 Local summit 10 km north north-west of refinery	251 Coast line South of refinery	251 Coast line South of refinery

Pollutant	Time Frame	Standard (µg/m³)	NLRC Refinery (µg/m³)	Ships (µg/m³)	Both (µg/m³)
NO_2	1-hour	400	297 Coast line South of refinery	270 Coast line West of jetty	297 Coast line South of refinery
	24-hour	200	31 Local summit 10 km north north-west of refinery	163 Coast line West of jetty	163 Coast line West of jetty

These estimates indicate that the operation of the Marine Terminal and associated works will contribute a large amount to the short term concentrations of air contaminants around the Marine Terminal. 24-hour maximum concentrations for the area are governed by emissions from vessels. These levels are at 84% of the provincial air quality standards for SO_2 and 82% of the provincial air quality standards for NO_2.

If boreal felt lichen are found at the Marine Terminal site, management measures will be implemented (e.g. transplanting, a buffer). Species at risk will be a consideration in the design of effects monitoring plans. Both RAs and FAs will have input into monitoring programs associated with the Project. Mitigation measures for protection of boreal felt lichen from air contaminants include the use of BATEA, following all pertinent regulations to reduce contaminants in air emissions, monitoring for occurrence of lichen, protection of lichen found, air quality monitoring, and monitoring of contaminant uptake by lichen.

10.7.1.3 Decommissioning

Effects

The decommissioning activities are similar to construction activities and have comparable potential effects. The removal of marine infrastructure may have the potential to disturb habitat and increase the turbidity of underwater surroundings, potentially affecting the health, habitat and behaviour of fish, marine mammals and sea turtles. There is also the possibility of introducing oily wastes or residues into the marine environment.

Mitigation

Mitigation measures to be implemented here are similar to those outlined for the construction phase.

10.7.2 Residual Effects

10.7.2.1 Construction

Construction activities at the proposed Marine Terminal are not expected to interact with Harlequin Ducks and pose little risk to Red Knot (due, in part to its uncommon occurrence in coastal Newfoundland), or other species of marine-associated birds considered at risk. With mitigation measures in place, construction activities are predicted to have no residual effect on marine-associated bird species, marine mammals, sea turtles or lichen species considered at risk (Table 7-14). Construction activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)) for these species.

10.7.2.2 Operations

Operation activities at the proposed Marine Terminal are not expected to interact with Harlequin Ducks and pose little risk to Red Knot or other species of marine-associated birds considered at risk. With mitigation measures in place, routine operation activities are predicted to have no residual effect on marine-associated bird species considered at risk, nor will they have a significant effect (physical or behavioural) on blue whales, right whales, fin whales, harbour porpoises, or leatherback sea turtles, thus operation activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)). Effects on species at risk will only be significant in the case of a major accidental event, such as a marine oil spill. The possibility of such an event is very low, and is described more in detail in Section 11.1.1.4.

10.7.2.3 Decommissioning

Decommissioning activities for the proposed Marine Terminal are not expected to interact with species of marine-associated birds, marine mammals or sea turtles considered at risk. If boreal felt lichen is at the Marine Terminal site, mitigation measures will have been in place and will be maintained during decommissioning. Decommissioning activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)) and the residual effect is insignificant.

10.7.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Based on review of NLRC EA documentation, consultation with federal authorities and the public, the planned mitigation measures and commitments of NLRC, the RAs have

determined that construction, operation and decommissioning of the Project are not likely to cause significant adverse environmental effects on species at risk.

10.8 Marine Mammals

10.8.1 Potential Effects and Proposed Mitigation

10.8.1.1 Construction

Effects

During construction of the Marine Terminal and associated works, activities that may impact marine mammals include noise, the possibility of collisions with vessels, as well as run-off and sedimentation. Surface and sub-surface noise is associated with almost every aspect of construction of the Marine Terminal and associated works, from shoreline clearing and leveling, placement of sheet piling, infilling and pile-driving and vessels and barges. Although there will be no marine blasting and on-land blasting operations will be intermittent in nature and sound pulses very short, temporary or permanent hearing impairment is a possibility when marine mammals are exposed to sound outside a certain range.

Vessel noise will be concentrated in the area of the Marine Terminal and jetty. At any one time, there will not be more than six vessels operating. During Marine Terminal construction, which is estimated to take place over a 30-month period, it is likely that some marine mammals will exhibit avoidance of the area where vessels are involved in construction activities. Disturbance effects from vessel noise should be of low magnitude.

Vessels will be within the CSZ and will be stationary or moving slowly during construction activities. There is minimal chance that marine mammals will be affected by the physical presence of these vessels, including potential collisions between them and vessels. It is likely that marine mammals will avoid the immediate area because of increased sound levels.

While it is possible that run-off and sedimentation may impact marine mammals by reducing the availability of some prey; the likelihood of such an impact is low, especially given that most marine mammals spend little time near or at the proposed Project site.

Mitigation

Mitigation measures for marine mammals during construction will be specified in the EPP. Measures will include adherence to DFO Guidelines for blasting as outlined in

Section 10.2. These Guidelines specify setback distances, acoustic monitoring, visual monitoring, delay/resumption criteria etc.

Use of the Guidelines and EPP will make it unlikely that marine mammals will be exposed to sound levels known to be high enough to cause any degree of hearing impairment. Blasting assessments will ensure that 100 kPa is not exceeded and that blasting is not permitted if a marine mammal is sighted within a designated safety zone (180 dB re 1 µPa rms).

To avoid marine mammal collisions within the CSZ, vessel operators will alter their course if a marine mammal swims in front of the vessel. Vessels will maintain consistent speeds and travel directions, and reduce speed whenever possible.

To protect marine mammals against run-off and sedimentation, settlement ponds and silt curtains will be used to contain suspended materials. All marine effluent and air emissions will be in agreement with governing regulations and make use of best available technology, so as to minimize the effects of these activities on marine mammals.

10.8.1.2 Operations

Effects

Effects on marine mammals during routine operations may be caused by noise, presence of structures, run-off, sedimentation, air emissions, effluent characteristics and lights. Increased tanker and tug traffic associated with operation of the Marine Terminal also increases the risk for a collision between marine mammals and tankers, even though most marine mammals typically avoid moving ships.

Some marine mammals will probably exhibit a larger zone of avoidance around the terminal, given that sound levels will be higher. Considering the life of the Project (>25 years) and that tanker traffic will be consistent from day to day, some marine mammals, especially those that occur year-round, may habituate to tanker noise (Bowles et al., 1991).

Few seals have been observed near the Marine Terminal site where most of the vessel traffic will be concentrated. Seals in the water often approach vessels but those hauled out will often flee to the water when a vessel approaches. During operation of the Marine Terminal and associated works, some may exhibit avoidance of the area where tankers, bulk carriers, and tugs are operating.

New structures will be introduced into the marine environment including an outfall and an intake pipe as well as the marine wharf and jetties. Marine mammals other than seals and river otters are not expected to be impacted by this in-filled area given that they do not occur in this habitat. The jetties and outfall/intake pipes are located farther from shore (300-400 m and 500 m/950 m, respectively) and while marine mammals could interact with these structures, species that occur in the Project area are not known as bottom feeders so there is little potential for interaction with sub sea structures and there is no risk of entanglement in structures.

Air emissions from the vessels at the Marine Terminal during the operational phase have little potential to impact marine mammals given that predicted air concentrations of potential contaminants are so low that the inhalation pathway is considered negligible and chemicals emitted do not have the potential to biomagnify (SENES Consultants Limited, 2007).

Mitigation

Mitigation measures for marine mammals will focus on avoidance of interaction. Marine mammal protocols, based on proven measures from other areas and discussion with regional expertise such as the Whale Release and Stranding Program, will be established for vessel traffic associated with the terminal in both the EPP and the Marine Terminal Regulations and Information handbook to be prepared and issued by NLRC. Most lethal and severe injuries to large whales occur when vessels are traveling at high speeds. Vessels in the Marine Terminal area will be moving slowly as they approach and depart the wharf or jetty, thereby minimizing the risk of collision.

Mitigations against collisions during operations will include measures such as vessels altering course to avoid any marine mammals; vessels maintaining consistent and/or reduced speed and travel direction; reducing speed when possible. As vessels approach the terminal, speeds will decrease to 4 knots for maneuvering.

A program of marine mammal observations in the immediate terminal area will be implemented and any collisions or mortalities will be reported to DFO and investigated.

10.8.1.3 Decommissioning

Effects

Effects on marine mammals during decommissioning of the Southern Head Marine Terminal are expected to be similar to those experienced during construction of the Marine Terminal.

Mitigation

Mitigation measures will include permits, approvals, authorizations and implementation of the EPP and the Marine Terminal Regulations and Information handbook.

10.8.2 Residual Effects

10.8.2.1 Construction

Given the mitigation measures to be implemented, it is predicted that there will be no significant negative effect on marine mammals during construction. It is predicted that there will be no residual effect on marine mammals.

10.8.2.2 Operations

It is predicted that there will be no significant negative effect on marine mammals during operational activities, including those effects from noise, possible vessel collisions, the presence of structures, lighting, air emissions, liquid effluent, as well as run-off and sedimentation. Oil spills do not pose a significant effect on marine mammals, as many species tend to avoid these areas, and a comprehensive, preventative strategy will be in place to safeguard against any releases of petroleum products into the marine environment.

10.8.2.3 Decommissioning

With the outlined mitigation measures in place, decommissioning activities at the Marine Terminal are predicted to have no significant residual effect on marine mammals.

10.8.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Based on review of NLRC EA documentation, consultation with federal authorities and the public, and the commitments of NLRC for mitigation measures, the RAs have concluded that the construction, operation and decommissioning phases of the Project are not likely to cause significant adverse environmental effects on marine mammals.

10.9 Marine Safety

10.9.1 Potential Effects and Mitigation

10.9.1.1 Construction

Effects

There will be an increase in number as well as types of vessels in the sea area around the Marine Terminal site during construction. There is the potential for interference and/or gear and vessel damage with other vessels in the area throughout the construction period.

Mitigation

The primary mitigation measure will be the establishment of a CSZ around the Marine Terminal and, during their actual construction, around the intake and outfall pipe routes. These zones will be marked with surface buoys and indicated on local charts. In addition, the need, location, timing and operational concerns associated with the construction vessel traffic and the CSZ will be discussed with other marine users of the area through the Placentia Bay Traffic Committee, the Project Fisheries Liaison Committee and other appropriate mechanisms. The Argentia Marine Communications and Traffic Services (MCTS) Centre facilitates effective communication among the marine community, regarding vessel movements. NLRC also intends to investigate development of a vessel traffic management process for Come By Chance Bay with other users of the area to assist Project vessels as they enter or depart the Project site.

All vessels associated with construction will meet Transport Canada regulations and standards under the *Canada Shipping Act* as well as international regulations established by the International Maritime Organization. Barges will be inspected and approved for use by a recognized classification society such as Lloyds, Det Norske Veritas (DNV) or American Bureau of Shipping (ABS). The Project will retain a Marine Warranty surveyor to verify the transportation services put in place for safe vessel operation and transportation of goods and materials to the site.

10.9.1.2 Operations

Effects

The Marine Terminal and associated works will handle approximately 400 to 450 vessels a year, comprised mainly of tankers but with some bulk carriers (approx. 75 per year) associated with export of sulphur and coke. In addition there will be three or four tugs associated with the terminal. All vessels will berth either at the jetties or the wharf.

Existing anchorages will be used as necessary. Potential effects are as outlined during construction – interference and/or gear or vessel damage with other vessels in the area.

Mitigation

Marine Terminal operations will be carried out in accordance with established national and international regulations, standards and codes of practice. The terminal will develop a set of safety standards and operational procedures for the safe and efficient operation of the terminal as well a "Marine Terminal Regulations and Information" booklet. This information booklet will be provided to vessel owners, operators, charterers and masters of tankers and bulk carriers and will give all traffic using the terminal a description of the terminal facilities and available services, conditions for acceptance for a vessel to berth at the facility and the safety regulations to be followed.

NLRC will follow the International Safety Management (ISM) Code developed by the International Maritime Organization (IMO). The ISM code is designed to provide a clear link between the shore and sea staff in order to improve safety to personnel, vessel and environment. A key aspect of the Code is having a verifiable safety management system in place. The TERMPOL Review Process will consider these aspects of the Project in detail.

All tankers calling at the Terminal will be required comply with all applicable IMO Conventions and recognized industry standards such as the most current International Safety Guide for Oil Tankers and Terminals (ISGOTT). NLRC has committed to a vetting program for all vessels using the terminal. NLRC will also ensure that laden tankers arriving at the terminal have tug escort to assist with berthing. The TERMPOL Review Process will review these plans and procedures.

The terminal will have the appropriate equipment and support facilities to handle all anticipated vessel traffic at the berth including: central control room, loading and unloading facilities, mooring equipment, tugs, leak/gas detection, spill containment, firefighting equipment and spill response equipment. Terminal facilities, equipment and operating procedures will be reviewed during the ongoing TERMPOL Review.

During cargo transfer the following activities will be carried out to ensure the operation is proceeding safely:

- Continual observations by both tanker and terminal personnel of the tanker and Marine Terminal; if an abnormality is observed, cargo operations will be stopped and an investigation will be conducted. Cargo operations will not resume until it is safe to do so;
- The Marine Terminal will be equipped with flood lights and operational cameras and monitoring equipment to detect leakage, spills or a change in position of the tanker while at the berth for early detection of any problem;

- Weather, wind and wave conditions will also be continuously monitored. The monitoring equipment is located in the control room which is manned 24 hours a day. Established parameters will be used to determine when conditions warrant stopping the discharge operation. Cargo operations will not resume until it is safe to so;
- Loading/discharge operations shall be stopped in the event of electrical storms in the vicinity or when wind speeds reach a sustained 35 knots. Loading arms must be disconnected when wind speeds reach 40 knots;
- Tankers shall leave the berth if wind speeds reach a sustained 40 knots with a deteriorating forecast.

The facility will provide a safe working environment and Project personnel will be trained to operate and maintain the Marine Terminal equipment and to be first responders in the event of an emergency. Marine Terminal safety procedures are also considered in the TERMPOL Review.

10.9.1.3 Decommissioning

Effects

In the event that the marine facilities are dismantled, marine equipment comparable to that used for construction will be used. The potential effects are comparable to those during construction – interference with other marine users.

Mitigation

Well established communication and liaison procedures and mechanisms will be in place in the Project area that will avoid or minimize the potential negative effects of decommissioning activities. At the time of decommissioning, it may be decided to leave some of the seafloor structure in place: in this case the site would be marked and charted.

10.9.2 Residual Effects

10.9.2.1 Construction

With implementation of the proposed mitigation measures, in particular the CSZ and effective communication with other marine users, residual effects on marine safety will be negligible.

10.9.2.2 Operations

With implementation of the proposed mitigation measures, including the use of ISM and ISGOTT and the onsite Marine Manager, residual effects during operations will be minor to negligible.

10.9.2.3 Decommissioning

With implementation of the proposed mitigation measures, residual effects will be negligible.

10.9.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Taking into account the implementation of the mitigation measures including the TERMPOL Review, the RAs conclude that construction, operation and decommissioning of the Southern Head Marine Terminal and associated works are not likely to cause significant adverse environmental effects on marine safety.

10.10 Human Health and Safety

10.10.1 Potential Effects and Mitigation

10.10.1.1 Construction

Effects

During construction of the Marine Terminal and associated works, there will be an increase in number as well as types of vessels in the sea area around the Marine Terminal site during construction. There is the potential for interference and/or gear and vessel damage with other vessels in the area throughout the construction period. The increased numbers of vessels during the construction period will add additional air emissions to the local air shed. There will also be an increase in noise levels during the construction period. NLRC has recognized that in addition to the small boat commercial fisheries, there is a large recreational boating community in inner Placentia Bay and associated with the islands in central part of the Bay. There is no potential for interaction with aquaculture facilities as there are no facilities in the immediate Project area.

Mitigation

The primary mitigation measure will be the establishment of a CSZ around the Marine Terminal and, during their actual construction, around the intake and outfall pipe routes. These zones will be marked with surface buoys and indicated on local charts.

In addition, the operational concerns associated with the construction vessel traffic and the CSZs will be discussed with other marine users of the area through the Placentia Bay Traffic Committee, the Project Fisheries Liaison Committee and other appropriate mechanisms. Effective communication among the marine community regarding vessel movements will be facilitated by the Argentia MCTS Centre.

NLRC has established effective community communication mechanisms during preparation of the environmental assessment and has indicated that they will continue to work closely with communities in the Project area.

NLRC also intends to investigate development of a vessel traffic management process for Come By Chance Bay with other users of the area to assist Project vessels as they enter or depart the Project site. All construction equipment will have proper emissions control and noise reduction devices. Emissions and Noise levels will be monitored during construction for compliance.

The proponent will adhere to all provincial Occupational Health and Safety regulations.

10.10.1.2 Operations

Effects

NLRC indicates that the Marine Terminal will handle approximately 400 to 450 vessels a year, comprised mainly of tankers but with some bulk carriers (approx. 75 per year) associated with export of sulphur and coke. In addition there will be three or four tugs associated with the terminal. All vessels will berth either at the jetties or the wharf. Existing anchorages will be used as necessary.

Potential effects are as outlined during construction and include interference with other vessels in the area and/or gear or vessel damage. Air emissions from vessels could also have effects on human health.

Mitigation

The Project will work with other marine users of the area around the Marine Terminal and associated works to develop the approach/departure routes for vessels using the marine terminal. Terminal procedures will require Project vessels to stay within these

routes. The routes will be marked with surface buoys. The terminal will have a full time Marine Manager. The Project will also have dedicated fisheries liaison process in place.

In addition to using the established forums for marine users of Placentia Bay, such as the Placentia Bay Traffic Committee, NLRC will continue to use their community communication initiatives to inform other users of this area of the bay about the terminal's traffic, maneuvering areas and procedures. All vessels coming to and from the terminal will provide information to the Argentia MCTS Centre which makes this information available via marine broadcast.

The Project anticipates that it will be possible for the lobster fishery to resume close to the Marine Terminal and associated works once terminal operations are established: this will be negotiated with the relevant fish harvesters.

Air emissions from the tankers while at the terminal will be minimized through the use of best available technology and terminal procedures, such as vessels shutting down unnecessary engines while at the jetty. Covered conveyor systems for the loading of both coke and sulphur will minimize dust from these operations. Air emissions monitoring will be in place with results reported and available to the public.

10.10.1.3 Decommissioning

Effects

The potential affects on human health and safety during decommissioning are comparable to those during construction.

Mitigation

Mitigative measures would be comparable to those in place for construction. By this time, the vessel traffic routes associated with the Marine Terminal would be well established and other marine users in the area would be familiar with them.

10.10.2 Residual Effects

10.10.2.1 Construction

Implementation of the proposed mitigation measures including effective communication with other marine users will be able to reduce the residual effects on human health and safety to minor during construction.

10.10.2.2 Operations

Implementation of the proposed mitigation measures including effective communication with other marine users and ongoing liaison through key personnel such as the Fisheries Liaison Manager and Marine Manager will be able to reduce the residual effects to minor or negligible throughout terminal operations.

10.10.2.3 Decommissioning

With implementation of the proposed mitigation measures, residual effects will be negligible.

10.10.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Taking into account implementation of the proposed mitigation measures, the RAs conclude that construction, operation and decommissioning of the Project are not likely to cause significant adverse environmental effects on human health and safety.

11 Other Factors

11.1 Environmental Effects of Accidents and Malfunctions

11.1.1 Background

Accidents and malfunctions of primary concern for this CSR are those events that occur specifically at the Marine Terminal and jetty, ultimately having the potential to cause harm to the surrounding environment. Potential for incidents to occur exists during each stage of the Project, although risks and causes of possible accidents vary between stages of construction, operations and decommissioning. The primary type of accident and malfunction included in the scope of this report are oil spills, especially in the marine environment; however, fires, explosions, power interruptions, and chemical spills are also considered.

11.1.1.1 Risks and Risk Mitigation During Construction

During construction of the Marine Terminal and associated works, a release of oil may occur through fuel transfers, leaks, spills from vehicles as well as fire and explosions. In order to prevent any harmful effects to the environment, oil spill clean-up equipment will be located on-site at the Marine Terminal, workers will be trained in proper response techniques, and fuel storage tanks and drum storage area will be constructed with adequate containment areas and setbacks from water bodies and the sea. Arrangements for on-site marine spill response capability will also be in place during Marine Terminal construction.

Fuel handling and use are typical activities at for all phases of the Project. Diesel and gasoline use, transportation and storage will be conducted in accordance with the provincial *Storage and Handling of Gasoline and Associated Products Regulations* (2003). Fuel transfers and maintenance activities will be undertaken on level terrain, at a suitable distance from environmentally sensitive areas and on a prepared, impermeable surface with a drainage collection system.

Stored waste oil will be handled and stored by a licensed disposal agent in accordance with the Used Oil Control Regulations, and be regularly disposed of to prevent accumulation. Fuel, and other hazardous substances, will only be handled, stored, or disposed of by persons who are trained and qualified to do so in accordance with the manufacturer's instructions and governmental laws and regulations. Employees handling fuel and other toxic substances will be trained in the Workplace Hazardous Materials Information System (WHMIS).

The EPP will ensure there is a proactive approach to prevent leaks or spills, both at the terminal and to protect freshwater resources and fish habitat. Construction of the marine facilities (wharf, jetties and trestle) will require the use of heavy machinery, vessels and barges, each with the potential to leak hydrocarbons into the surrounding waters. Hydrocarbon releases from machinery and vehicles can be minimized through regular maintenance to ensure they are in good working order and thoroughly checked for leakage. Heavy equipment used during construction (e.g. cranes, dump trucks, loaders) will only be used on dry, stable, land or barges specifically designed for that purpose; with heavy equipment not operating from barges completing work below the high water mark during low tide. No refueling or repairs of construction equipment will be done on the Marine Terminal or within 30 m of any waterbody on land. Floating booms will be in place during all construction activities, which will contain potential leaks or spills. Spill kits, containing such items as absorbents capable of retaining and removing oil sheen and waste storage containers will be available on barges and boats required for construction and the terminal itself.

Some additional precautions proposed by the proponent to protect the marine environment during construction activities will include secondary containment for tanks, reservoirs and lines, the use of standard operating procedures with checklists, accountability by fuel handlers, as well as a mandatory watch for fuel transfers.

11.1.1.2 Risks and Risk Mitigation During Operations

During operation of the Marine Terminal and associated works, potential spills could occur from transportation and loading and unloading activities. Spills and leaks of crude, refined products, sulphur, coke and other chemicals could occur as a result of a pipeline rupture, flange or valve failure or malfunction. These risks will be mitigated through design features such as secondary containment, operator training, inspection, implementation of a reliability and maintenance program and the loss-control program. Movement of fuels, oils and chemicals will be restricted to smaller volumes where practical to reduce the extent of a potential spill.

Oil spill response will be an integral part of the Emergency Response Plans for the Marine facility. Accidents and malfunctions that may affect the marine environment during operation activities are of particular concern, and the proponent has committed to treat this issue with extreme importance. Oil spill response equipment will be stored on-site and slipway facilities will be provided for the launch of oil spill response equipment.

NLRC will execute a contract agreement with Eastern Canada Response Corporation (ECRC) for spill response services to meet *Canada Shipping A*ct requirements. The ECRC contract will be activated by NLRC to respond to all spills over 50 m^3 and for spills

under 50 m^3 at the discretion of NLRC, e.g. to ensure the best containment effort possible, especially in the area of the spill source.

Fires at the Marine Terminal could result from an accident, from inadvertent ignition of petroleum products, sabotage, or from natural sources such as a lightning strike. Explosions at the Marine Terminal area could result from an accident, over-pressure, sabotage, or as the result of a fire. A comprehensive leak and gas detection system will be in place to detect possible sources of ignition. A permit to work system will be in place to work in all areas of the plant and will be strictly controlled with regard to hot work in areas with a potential to have an ignition source.

Site security will tightly control access to the site to approved personnel, and there will be a system of remotely operated cameras to monitor all areas of the proposed development for unusual activity. The fire detection and alarm system will be monitored from the central control room and the fire brigade will train to minimize response time so that small fires are detected and extinguished before developing into a major incident.

NLH will provide power to the proposed development. In the event of a power outage there will be sufficient backup generation capacity to initiate a controlled shutdown. The proposed development will have dual hi-voltage transmission lines supplying the site from the inter-provincial grid for redundancy. Lighting arrestors will be installed on the transmission line to provide added protection.

Equipment located on the marine facilities will contain only small quantities of hydrocarbons. Only hydraulic fluid and medium oils (for gearboxes) will be used. The hydraulic fluid storage is to be located at least 30 m from any waterbody within a secure equipment room provided with secondary containment of at least 110% of the tank's capacity. Gearboxes will have catchment trays as would bearings where regular greasing occurs (as per manufacturer's specifications). Any machinery requiring minor repairs will be taken to a suitable location on land to be fixed, with no repairs of mobile machinery being performed on the Marine Terminal or within 30 m of any waterbody. Only minor repairs and maintenance of 'non-mobile' equipment (such as greasing of loading/unloading gear) will be performed on-site. All major repairs will take place offsite at an approved facility.

Fuel, and other toxic substances (as defined under Schedule 1 of CEPA), will only be handled, stored, or disposed by persons who are trained and qualified to do so in accordance with the manufacturers' instructions (e.g. Material Safety Data Sheets) and governmental laws, acts (e.g. CEPA), and regulations (e.g. *Storage and Handling of Gasoline and Associated Products Regulations; Used Oil Control Regulations*). Procedures will include:

- Having operators present for the duration of refuelling;
- Refuelling equipment and vehicles at least 30 m from any water body, and over a non-permeable surface;
- Having basic petroleum spill clean-up equipment on-site, with adsorbents being used to recover any hydrocarbon sheen on the water;
- Promptly containing, and cleaning up, all spills or leaks on land or in water and Reporting them to the 24-hour environmental emergencies report system (1-800-563-9089) as required by Environment Canada;
- Allowing no on-site bulk storage of fuel or oil;
- Not disposing of wastes in or near waterbodies; and
- Routine water testing as per criteria listed in Schedule A of the *Environmental Control Water and Sewage Regulations* (2003), under the *Water Resources Act* and ensuring any discharges from the site conform to CCME limits.

A Spill Contingency Plan will outline appropriate responses to accidental spills (such as those resulting from collisions, fires or structural failures), with spill kits (containing such things as floating booms and absorbents) being available on barges and service boats and the Marine Terminal itself. All water releases will meet the regulatory requirements of the *Petroleum Refinery Liquid Regulations*, Environmental Control (Water and Sewage) Regulations, and the CCME limits (e.g. metals, dissolved oxygen, hydrocarbons).

There will be continual observations by tanker and terminal personnel to detect any abnormalities. The terminal will be equipped with floodlights and operational cameras and monitoring equipment to detect leakage, spills or a change in position of the tanker while at the berth. Weather, wind and wave conditions will also be continuously monitored via a permanent weather buoy deployed adjacent to the terminal. The monitoring equipment will be located in the control room which will be manned 24-hours a day. Established parameters will be used to determine when conditions warrant stopping the discharge operation. If operating personnel detect a problem or the parameters are exceeded, cargo operations will be stopped and an investigation will be conducted. Cargo operations will not resume until it is safe to do so.

11.1.1.3 Risks and Risk Mitigation During Decommissioning

It is expected that decommissioning will have the same spill risk potentials and volumes as for the land and marine construction components. It will be a controlled operation with its own EPP to reduce the risk of accidents and any pollution release.

Decommissioning will have comparable spill risks and volumes as for the land and marine construction components. The volume estimate for spills to the sea from on-land decommissioning activities was a potential volume of 1 m^3 and from decommissioning of the Marine Terminal another 5 m^3. A spill prevention program with risk reduction

measures will further reduce the probability of a spill. Response capability will be available on site.

11.1.1.4 Oil Spill Statistics for Placentia Bay

Various sources indicate that the frequency of releases of petroleum products into the marine environment is going down. On a global scale, statistics show that the number of tanker spills is decreasing; Figure 11-3 in Section 11.1.2 clearly demonstrates that the general trend over the past few decades has seen a significant drop in large spills, i.e. over 700 tonnes. This definite downward trend can be mostly attributed to a risk-based approach to management. Numerous measures have been taken by governments and industry to reduce the risks associated with tanker hazards. That coupled with better technologies and better operational management practices is showing favourable results.

The amount of oil entering Canada's oceans has also dropped, likely due to increased prevention efforts and more elaborate/detailed monitoring and enforcement regimes. TC has recently released an oil spill risk assessment report for the south coast of Newfoundland (TC, 2007), which provides information and statistics on the threat for oil spills particularly in the region of interest for this CSR.

Oil spill statistics have been compiled for Placentia Bay (TC, 2007). Historical data (Table 11-1) from various sources was used to determine the frequency of oil spills in the study area, as well as predict future estimates for Inner Placentia Bay (Table 11-2).

Table 11-1 Historical Tanker Spill Rates for Crude and Refined Product

Spill Size, bbls	Spill rate[1], crude oil			Spill rate[1], refined products		
	In port	At sea	Total	In port	At sea	Total
1 to 49	6.59	8.41	15	31.61	40.39	72
50 to 999	0.83	1.06	1.89	6.80	8.70	15.5
1,000 to 9,999	0.26	0.19	0.45	1.29	1.52	2.81
10,000 to 99,999	0.06	0.19	0.25	0.049	0.164	0.213
100,000 to 199,999	0.009	0.017	0.026	0.043	0.086	0.129
>200,000	0.031	0.063	0.094	0.022	0.043	0.065
[1] Spills per billion (10^9) barrels of oil transported.						

Source, TC, 2007.

Table 11-2 Cumulative Spill Frequencies for Inner Placentia Bay

Spill size, bbls	Fuel oil	Crude oil	Refined product
1 to 49	7.0 x 10-2	9.55 x 10-1	7.44 x 10-1
50 to 999	1.9 x 10-1	1.20 x 10-1	1.60 x 10-1
1,000 to 9,999	1.0 x 10-2	3.77 x 10-2	3.04 x 10-2
10,000 to 99,999	-	8.69 x 10-3	1.16 x 10-3
100,000 to 199,999	-	1.30 x 10-3	1.02 x 10-3
>200,000	-	4.49 x 10-3	5.18 x 10-4
Total	0.27	1.13	0.94

Source, TC, 2007.

Past trends indicate that spill likelihood decreases as the size of the spill increases, meaning that bigger spills are less likely to occur.

The CCG has maintained a database of oil spills since 2002. NLRC has looked at spill statistics provided by the CCG as well as from an existing refinery and a large marine terminal both operating on Placentia Bay. Based on the CCG database, from Jan 1, 2002, to June 30, 2007, there have been 12 spills from tankers and oil handling facilities (OHF) on Placentia Bay. Tankers sitting at an OHF berth had seven spills for a total volume of 1.911 m3. Two tanker spills occurred at anchorage in the Port of Come By Chance away from an OHF (total volume was 21 litres). OHFs had one spill with a volume of 1 litre.

An analysis of these spills over 5.5-year period is presented in Table 11-3 below:

Table 11-3 Analyses of Taker Spills on Placentia Bay from January 1, 2002 to June 30, 2007.

Spill Source	Number of Spills	Actual Spill Volume (m^3)	Actual Spill Volume (Barrels)	Number of Spills Forecasted for NLRC Tankers Inside the Port of Come By Chance over a 5.5 year period
Tanker spills at OHF berth	7	1.911	12.4	
Tanker spills at anchorage	3	0.022	0.1	
Total Tanker Spills	**10**	1.933	12.5	**8.006**
OHF spills	1	0.001	0.01	
Total tanker and OHF spills	11	1.934	12.57	
Tanker Spills per year	**1.818**			**1.456**
OHF Spills per year	0.182			

Spill Source	Number of Spills	Actual Spill Volume (m^3)	Actual Spill Volume (Barrels)	Number of Spills Forecasted for NLRC Tankers Inside the Port of Come By Chance over a 5.5 year period
OHF & tanker spills per year	2			
Spills >200,000 barrel	0	0	0	0.043
Spills > 100,000 barrels	0	0	0	0.103
Spills > 10000 barrels	0	0	0	0.185
Spills 50 to 999 barrels	0	0	0	0.237
Spills 1-49 barrels	2	1.908	12.40	1.295
Spills under 1 barrel	9	0.026	0.17	Forecast unavailable
TOTALS		1.934	12.57	

(Derived from spill statistics supplied from Canadian Coast Guard database)

From this short period, it appears that NLRC forecast statistics reasonably match the actual experience. One assumption made earlier (that all small spills from tankers less than 999 barrels would occur within the Port of Come By Chance) is in full agreement with the CCG spill records. None of the spills occurred along the tanker route outside the Port of Come By Chance. The forecasted number of NLRC tanker spills was slightly less than the actual experience but they were for the next higher spill size. Unfortunately the data sample size is not large enough, and the sample period is too short, for statistical validity. The fact that nine of the actual spills were less than one barrel (where NLRC has made no forecast) explains part of the variation.

As part of its risk reduction plan, NLRC will participate in the TERMPOL Review Process led by TC to identify and consider the hazards and risks from tanker operations while at sea and while docked. Some of the risk areas include potential tanker grounding, collision, fire and explosion and the tanker interactions with the terminal.

The TERMPOL review will examine each component of the tanker traffic management system, including: tanker routes, traffic lanes, traffic density, convergence and separation, anchorages, potential traffic conflict and risk areas, navigation aids, pilotage and tanker escort, traffic services, communications, ship detection, tracking and identification systems, tanker requirements and operating procedures.

The probability and consequences of marine pollution incidents will also be considered. Given the known limits of spill response, prevention will be a priority focus.

11.1.2 Potential Effects and Proposed Mitigation

Incident prevention will be a vital policy and priority for the proponent. Investment in the Development Proposal will be substantial, and NLRC recognizes that the potential consequences from an incident will have environmental, social, and economic implications. NLRC will implement a number of measures during design, construction and operations, to reduce such risk. Prevention will be the best form of mitigation in regards to accidents, including oil spills. As a designated OHF, the Southern Head Marine Terminal will have in place an approved Oil Pollution Prevention Plan (OPPP) and OPEP. As well, the TERMPOL Review Process includes review and assessment of the facilities and operating procedures in place to prevent spills.

In the event of an oil spill on land or into the marine environment, NLRC will implement a well-defined chain of actions that will be followed by response personnel. Initial steps involve contacting the CCG Environmental Emergency Spill-line (1-800-563-9089), to make the federal authorities aware of the fact that there has been an oil spill; implementing shutdown procedures; and establishing clear lines of communication at all times. Depending upon environmental conditions at the time, the spill response capabilities of tankers, the Marine Terminal and associated works, the RO certified by TC and government agencies will work to the best of their abilities to contain and recover any spill.

NLRC's emergency preparedness plans will be based on a number of sources of information regarding management environmental emergencies, including:

- Canada Standards Association (CSA) *Emergency Planning for Industry* (third edition of CAN/CSA-Z731-03);
- 2004 Emergency Response Guidebook (ERG2004);
- CRAIM Risk Management Guide for Major Industrial Accidents (2002).

The following sections discuss potential effects to particular marine resources in the event of an oil spill.

11.1.2.1 Effects on Marine Water Quality

Accidents and malfunctions, particularly those that may lead to a release of oil or petroleum product or other chemicals into the marine environment, may occur very rarely. The high energy environment of much of Placentia Bay would quickly disperse spilled material.

NLRC will maintain on-site response capacity to effectively respond to a spill at the terminal, as well as, continue a program of water quality sampling for compliance

monitoring and in support of effects monitoring as determined necessary for follow-up programs. This program will serve a two-fold purpose, the first being the provision of additional baseline data, and the second purpose being to ensure continued monitoring of marine water quality to watch for any particular factors that may cause negative chronic effects.

The potential for adverse environmental effects from a spill of petroleum products during Marine Terminal construction and operations is likely to be low, provided that the proponent undertakes all reasonable mitigation measures. Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect marine water quality is insignificant.

11.1.2.2 Effects on Sediment Quality and Transport

It has been determined that the oils handled at the Marine Terminal will float on top of the water if they are spilled, therefore marine sediments will not be affected. If oil should reach the shoreline, sediments in the intertidal zone may be at risk of becoming oiled. NLRC in cooperation with Environment Canada has developed Shoreline Mapping and an Oil Residency Index (ORI) map for the Arnold's Cove, Come By Chance, Southern Head and North Harbour areas. These maps aid in the identification of more sensitive areas in terms of shoreline sediment type. By identifying areas on the ORI maps where oil may reside for a considerable period of time (i.e. months to years), NLRC can ensure that these areas receive primary consideration and protection in the event of a spill. The shoreline type and ORI maps can be seen in Figures 11-1 and 11-2.

The potential for adverse environmental effects from a spill of petroleum products during Marine Terminal construction and operations is low, with implementation of the proposed mitigation measures. Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect marine sediments is insignificant.

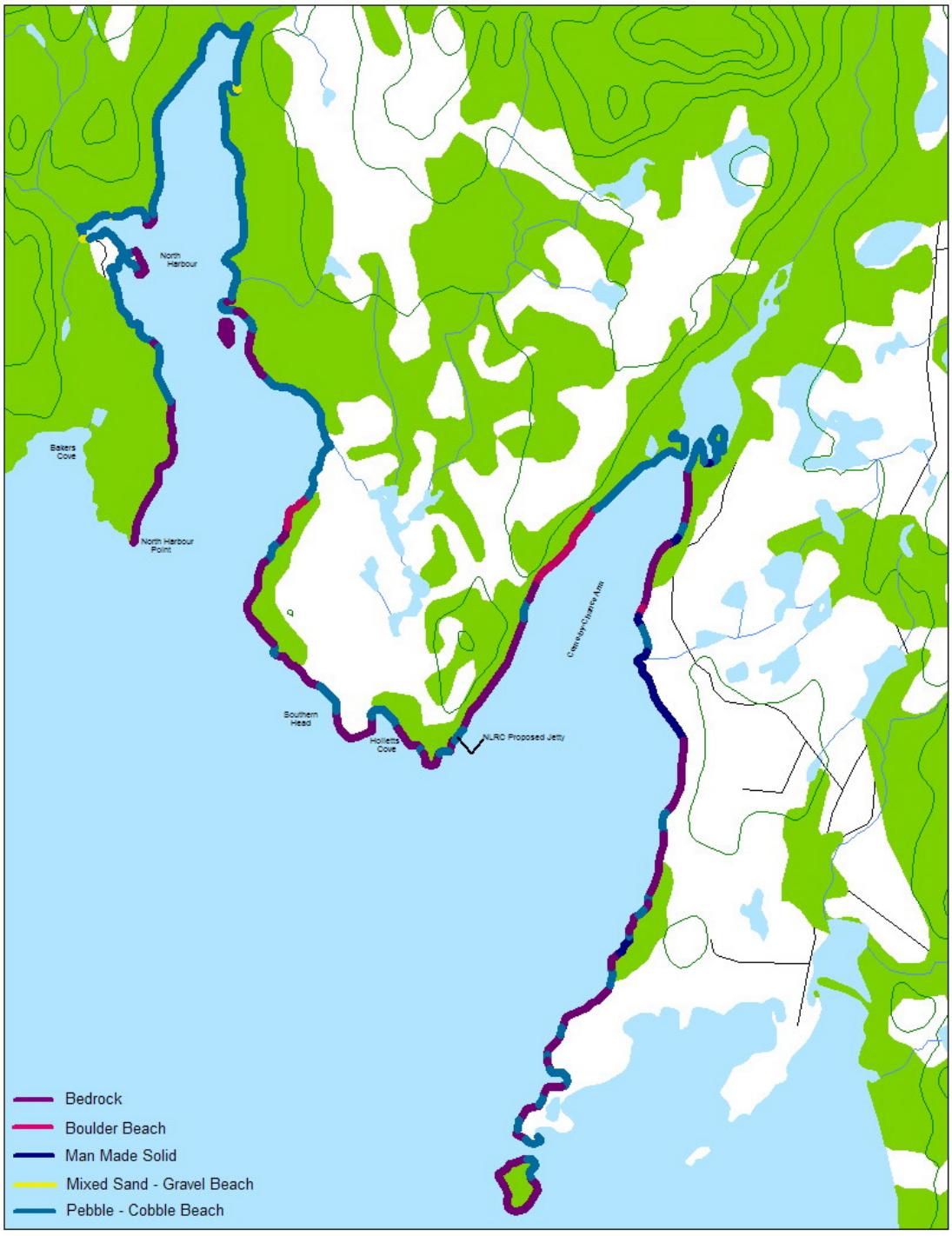


Figure 11-1 Shoreline Type Mapping

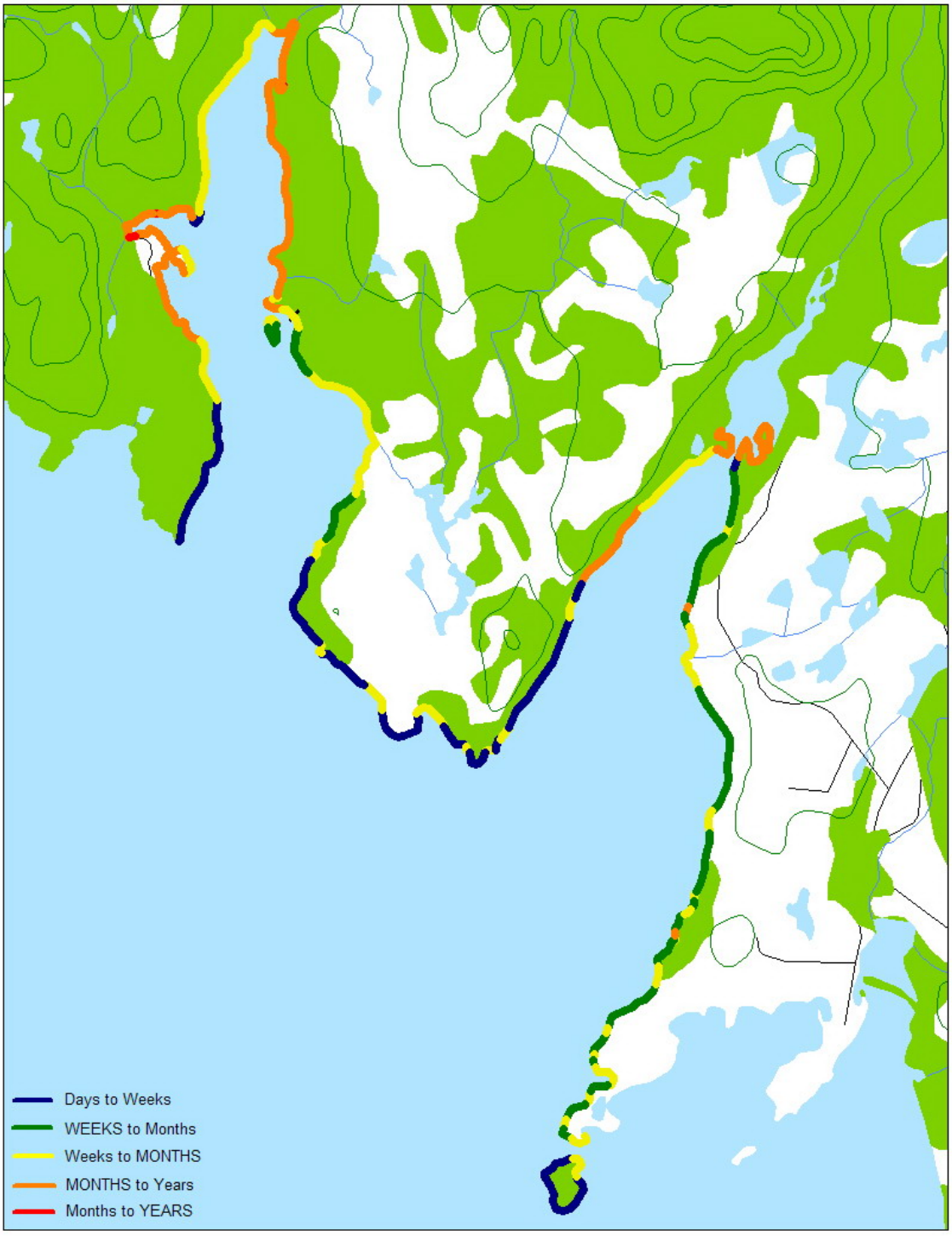


Figure 11-2 ORI Index

11.1.2.3 Effects on Marine and Freshwater Fish and Fish Habitat

NLRC has, as per section 16(1) of the CEA Act, assessed the potential for accidents or malfunctions related to the Project. The primary pathway with respect to potential environmental effects upon fish and fish habitat is the accidental release of hydrocarbons.

Effects from incidents such as hydrocarbon spills or leaks or sediment degradation from increased sedimentation may result in a change in the productive capacity of aquatic systems, and/or the HADD of fish habitat.

The Project boundaries with respect to marine fish and fish habitat include the shoreline and marine habitat within the direct footprint of the marine facilities and marine areas within any potential deposition or effluent zone of influence. This encompasses the locations of the Marine Terminal/tug berth and marine jetty, marine water intake, and marine outfall. The freshwater environment with greatest potential to be affected by an accident or malfunction would be the Come By Chance River estuary adjacent to Southern Head and the Marine Terminal and associated works.

Crude oil and petroleum products vary in their toxicity, and sensitivity of fish to these substances varies according to species. In general, chemicals in oil that pose threats to fish are BTEX compounds and PAHs. These chemicals have differing persistence and modes of action, however at sufficient concentrations each can adversely affect aquatic life at an acute or chronic exposure level. If exposed to low concentrations over a long time, bioaccumulation of these substances may occur within the body tissues of fish, leading to decreased health and longevity. If exposed to greater concentrations, for example in the event of an oil spill, fish may experience mortality as a cause of disease, loss of respiratory function and inability to obtain adequate food and protection.

That said, the likelihood that a significant number of fish will encounter these conditions is extremely low. Such effects are based on a worst-case scenario whereby oil can become integrated into the water column through wind and wave action. However, based on the properties of the crude oils and petroleum products expected to be handled by the Project, it is predicted that these materials will float on top of seawater, even after considerable weathering. Since most fish tend to be present lower down the water column, there will be no significant effects on them or their habitat in the event of an oil spill.

The site will be developed in such a way that will minimize the discharge of contaminants into streams or ponds. Oil spills or chemical spills and other accidents or malfunctions will be contained within the site. Cleanup will be carried out immediately

after such a spill. The EPP will cover such incidents. With prevention as the primary mitigation measure, the proposed development will have equipment and personnel ready to respond quickly and efficiently in the event of a spill. Specific details about the Come By Chance River estuary will be incorporated into contingency planning to allow the most effective response if an incident were to occur.

The potential for adverse environmental effects from a spill of petroleum products during Marine Terminal construction and operations is likely to be low, provided that the proponent undertakes all reasonable mitigation measures. Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect marine and freshwater fish and fish habitat is insignificant.

11.1.2.4 Effects on Aquaculture/Commercial Fisheries

Accidental events may affect aquaculture and commercial fisheries in a direct and an indirect manner. For commercial fish harvesters and the aquaculture industry, direct effects relate generally to damage to fish, loss of access to the resource, lost opportunity, increased operating expenses and damage to gear and equipment. Indirect effects relate more so to the economic impacts that may be incurred because of these direct effects, such as loss of markets.

Effects of oil spills on fish have been discussed above in the section on marine and freshwater fish and fish habitat.

The main effect of an oil spill that would be expected on most commercial fishing activity, would result from temporary loss of access to certain marine areas (i.e. closed or "off limits" zones) because of the presence of spilled oil or spill clean-up activities.

The effects would be largely dependent on whether the closed area coincided with active fishing grounds and seasons, and whether or not there were alternative harvesting locations available. For instance, as the harvesting location maps indicate, for some species, such as snow crab, lumpfish or sea urchins, fishing can occur throughout large parts of the bay or along extensive coastal areas. As such, unless the spill was very large, there might be adequate alternative grounds available.

Such closures would likely continue as long as a slick persisted, or while there were measurable hydrocarbons in the water. The extent of the economic impact would also be affected by the time the spill occurred within the fishing season, and where the fisher was in terms of harvesting his/her quota (in quota fisheries, such as snow crab).

Depending on the duration and persistence of a spill, a substantial portion of the fishing season might be lost, or only a small part.

Delays might result from having to fish on alternative fishing grounds. These activities might result in increased costs and decreased fishing efficiency, and/or lost opportunity to pursue other fisheries. Costs related to gear cleaning or replacement might also be incurred, particularly for fixed gear, as well as for vessels and coastal infrastructure, e.g., wharves.

If a spill were to occur, for instance, twenty or thirty years in the future, the species of interest, seasons and conservation measures in place might be very different. Currently underutilized species may have new and lucrative markets. The aquaculture sector may have expanded into many new areas with many new species in production.

Considering that any actual spill event will involve some unique combination of all of these factors and variables, it is not useful, or possible, to predict with any level of confidence what the actual economic consequences might be. These costs can only be known after the fact, when all the claims have been received and economic damage has been assessed.

Even without actual resource damage to fish stocks or to aquaculture facilities, economic effects may also occur if market confidence is lost. If there were a perception in the marketplace after a spill that fish from the area were of inferior quality, lower prices could result or buyers could be lost, even in the absence of actual physical effects. Such perceptions might be hard to overcome, and could persist long after the spill.

If a spill were to reach an aquaculture site there would be no alternative area, and the spill would likely shut down the entire operation. The operation's gear and equipment might be oiled, including shore facilities such as docks and holding facilities.

Market perceptions and buyer impacts might be more significant for an aquaculture operation (or for the entire aquaculture production area perceived to be affected) than a fishery, since fish farming operations are associated strongly with a specific geographical location. In certain situations, e.g. hydrocarbons from a spill becoming incorporated into nearshore and inter-tidal sediments, an aquaculture operation might have to abandon its location and re-establish elsewhere at a substantial cost (expenses as well as lost time and opportunity).

Any such economic effects described above (such as those caused by loss of access, gear damage, stock damage, increased expenses or changes in marketability or market value) could be considered significant to commercial fisheries and aquaculture

operators. However, the availability and use of economic compensation would reduce the potential impact to not significant.

11.1.2.5 Effects on Marine-Associated Birds

Seabirds are the marine biota most at risk from oil spills. Shorebirds, sea ducks, and other water birds (e.g., loons and grebes) are also at risk, as they use the marine environment to varying degrees. Effects on seabirds from oil spills vary depending on the type of oil, weather conditions, time of year, duration of the spill as well as the species affected.

The most common causes of mortality among oiled seabirds are hypothermia and starvation brought on by oiled plumage and ingestion of oil. Even a small area of oil on a seabird can lead to extreme declines of core body temperature leading to mortality. Placentia Bay supports some of the largest seabird colonies in Atlantic Canada and large numbers of Arctic breeding birds also occur there (CSR Section 7.2.6). This is also a moulting area for large numbers of non-breeding birds from the Southern Hemisphere, as well as being an important foraging area for migrant seabirds.

External exposure to oil occurs when flying birds land in oil slicks, diving birds surface from beneath oil slicks, and swimming birds swim into slicks. The external exposure results in matting of the feathers, which effectively destroys the thermal insulation and buoyancy provided by the air trapped by the feathers. Consequently, oiled birds may suffer from hypothermia and/or drown. Most deaths occur during the initial phase of oil spills when large numbers of birds are exposed to floating oil.

Oiled birds that escape death from hypothermia and/or drowning often seek refuge ashore, where they engage in abnormally excessive preening in an attempt to remove the oil. The preening leads to the ingestion of significant quantities of oil that can cause lethal effects. The extent of bioaccumulation of the chemical components of oil in birds is limited because vertebrate species are capable of metabolizing them at rates that minimize bioaccumulation. Birds generally excrete much of the hydrocarbons within a short time period. However, nesting seabirds that have survived oil contamination generally exhibit decreased reproductive success.

The primary mitigation measure to protect seabirds from the effects of oiling will be to prevent oil from entering the marine environment. Personnel trained and experienced in oiled bird recovery are available in the province and a bird recovery facility is situated in Placentia Bay. The proponent will utilize the help of CWS to establish a detailed program to describe particular actions to take and processes to follow in the event of a spill affecting seabirds, including a specific oil spill related monitoring plan.

Given that the proponent undertakes all reasonable mitigation measures, the magnitude of effects of accidents and malfunctions near the Marine Terminal on marine-associated birds is minor. It is important to note that the frequency and likelihood of a spill that will affect seabirds is very low, and that any actual effects will also be reversible, i.e. direct, long-term sublethal toxic effects on seabirds are unlikely.

Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions is not likely to cause significant adverse environmental effects onmarine-associated birds.

11.1.2.6 Effects on Species at Risk

In the event of a spill at the Marine Terminal, effects on species at risk are expected to be negligible, primarily because few species at risk individuals or species are frequent or regular in the area. The recently listed (as Endangered by COSEWIC; not presently listed on the SARA but could be upgraded during the life of the development) Red Knot is a shorebird species and it has been sighted (in small numbers) during late summer/early fall at the Come By Chance lagoon and the Southern Harbour estuary. It may also occur at other areas of suitable habitat in the Study Area, although this type of habitat is not common there. If these birds contacted oil they would likely die; they may also be at risk to more chronic effects of oiling. However, Newfoundland is east of the primary migration corridor for this species and as such only a very small proportion of the population would occur in the Study Area at a given time.

In the unlikely event that an oil spill occurs, follow-up monitoring (shore-based surveys) will be undertaken in an attempt to assess the impacts on Red Knot. The Proponent, in consultation with EC, will devise and implement a plan to deter birds from contacting a spilled substance; which will involve monitoring the area for birds and taking action if birds are present to direct the birds away from the spill. In addition, procedures will be developed to deal with oiled birds, oil spill cleaning kits will be available, and training will be provided to personnel.

An oil spill in the marine environment near the Marine Terminal is predicted to not significantly impact baleen (blue, right and fin whales) and toothed whales (harbour porpoise) and sea turtles (leatherback), including species considered at risk. Blue and right whale have not been recorded near the Marine Terminal, and baleen and toothed whales are not susceptible to the effects of oiling. Leatherbacks occur regularly in small numbers in outer Placentia Bay primarily during summer to early fall, with reported

sightings at the North end of Merasheen Island. Effects from exposure to oil are considered reversible.

The potential for adverse environmental effects from a spill of petroleum products during Marine Terminal construction and operations is likely to be low, provided that the proponent undertakes all reasonable mitigation measures. Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect species at risk is insignificant.

11.1.2.7 Effects on Marine Mammals

Most marine mammals exposed to oil are generally not at risk because they rely on a layer of blubber for insulation, and oiling of the external surface does not appear to have any adverse thermoregulatory effects. No significant long-term and lethal effects in marine mammals from external exposure, ingestion, or bioaccumulation of oil have been demonstrated.

Studies indicate that many marine mammals can detect oil spills, and will usually avoid such an area. This occurrence, coupled with oil spill countermeasures contained in the proponent's contingency plan and low occurrence in the Marine Terminal area, will likely reduce the number of marine mammals exposed to oil.

The potential for adverse environmental effects from a spill of petroleum products during Marine Terminal construction and operations is likely to be low, provided that the proponent undertakes all reasonable mitigation measures. Based on input from the FAs and the proponent's use of a preventative and precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect marine mammals is insignificant.

11.1.2.8 Effects on Marine Safety

Marine safety is intrinsically linked to the concept of accidents and malfunctions. By implementing measures and regulatory regimes that maximize and enhance marine safety, the risk of unplanned events such as oil spills is minimized. In the case of an isolated event whereby emergency procedures may be elicited, marine safety may be temporarily compromised to a small degree, due to the fact that a heightened level of concern and attention may be focused upon the incident at hand. For instance, regular procedures and operations may be delayed while the necessary action is taken to mitigate an accident or malfunction, which may lead to congestion or confusion in

adjacent marine surroundings. NLRC's marine procedures and facilities will be examined during the TERMPOL review.

By emphasizing preventative measures, ensuring that proper communication procedures are followed and providing appropriate training in emergency procedures for all personnel, the effects of accidents and malfunctions on marine safety should be negligible. Based on input from the FAs and the proponent's use of precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect marine safety is insignificant.

11.1.2.9 Effects on Human Health and Safety

Undoubtedly, an accident that may result in a large oil spill can have far reaching effects on the physical surroundings as well as the social environment. Human health would mostly be indirectly affected by an oil spill as opposed to being directly affected, however there are situations where human health may directly be at risk from such an accident or malfunction.

Those workers that are responsible for carrying out response activities, such as personnel within NLRC and ECRC and others, such as fishers that may be assisting in the clean up process are at risk of being exposed to large amounts of crude oil and petroleum products. In small amounts, these substances may not cause any harm, but most petroleum products contain potentially toxic components that may cause damage to human health in certain situations/cases. For example, Benzene and H_2S vapours can be fatal if inhaled at certain concentrations, whereas other compounds can be absorbed through the skin. These events are not expected however the crude oils that will be used at the proposed development will not have Benzene or H_2S concentrations high enough to pose this type of concern. The biggest risk for this would be during the first few hours of a spill, before these substances get a chance to dilute and spread out.

In the case of an oil spill, it will be vital to ensure that both trained and volunteer response personnel and area residents are not exposed to an environment where levels of these compounds could cause harm to human health.

Indirectly, a large oil spill may also temporarily reduce the quality of life for those living and working in the area, particularly those who depend on the sea for their livelihood. For example, a fisher who could no longer perform his regular harvesting activities may suffer both personal and economic loss, which would also transfer to his family. As well, an area that has experienced an oil spill may suffer negative effects for a period of time from a decreased level of consumer confidence in seafood harvested in the area.

By emphasizing preventative measures, ensuring that proper communication procedures are followed and providing appropriate training in emergency procedures for all personnel, the effects of accidents and malfunctions on marine safety should be negligible. Based on input from the FAs and the proponent's use of precautionary approach, the RAs have concluded that the potential for accidents and malfunctions to adversely affect human health and safety is insignificant.

11.1.3 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

Taking into account the implementation of mitigation measures and the unlikelihood of a major accident actually occurring, TC and DFO have concluded that accidents and malfunctions are not likely to cause significant adverse environmental effects.

11.2 Effects of the Environment on the Project

11.2.1 Background

As an industrial facility, the proposed development is designed to operate in a wide range of climatic conditions. The impact on the Project is generally minimal from all environmental systems, and such impacts are not likely to increase to a significant level with changes in climate during the expected life of the Project.

The physical environment will provide the dominant set of design criteria for the proposed development and will govern the design of many aspects of the proposed facility. The area is subject to high winds, large amounts of precipitation, both in the form of rain and snow, fog and cold temperatures. The head of Placentia Bay can experience severe storms with high winds that generate heavy seas with large waves. The proposed marine facilities will be designed using 100 year return period estimates for wind and wave parameters. All infrastructure and building will be designed in accordance with the most recent National Building Code and other applicable standards for seismic and extreme events. The design will also account for storm surges potential sea level rise due to global warming.

11.2.2 Potential Effects and Proposed Mitigation

The proponent has acknowledged that climate change will be incorporated into the design of the refinery's infrastructure.

In the case of the Southern Head area, regional climate change may result in concerns such as an increase in heavy precipitation events, potential increase in the frequency of strong storms in the next 100 years (Bruce et al. 2000), a cooling of Atlantic coast

temperatures (IC 2006) and sea level rise. The Intergovernmental Panel on Climate Change (IPCC) states that global sea level is anticipated to rise by 21-48 cm by 2090-2099 (IPCC 2007) and could be as much as 36 to 77 cm when local crustal subsidence is taken into account over the next century.

Coastal erosion should not pose a concern with respect to the project or the Marine Terminal's stability or operations. The Marine Terminal site contained a relatively narrow (approximately 2 m wide) beach of cobble/rubble/boulders leading to a steep hillside composed of areas of exposed bedrock or areas with shallow overburden and trees. Stive (2004) and Walkden and Hall (2005) both note than soft and sandy shores are much more prone to erosion and coastal retreat that steeper, rocky, shorelines. The shoreline and subsurface characteristics at the Marine Terminal site make it naturally resilient to erosional forces. While the structure has been designed to have at least a 30 year lifespan before major repairs are anticipated, it will still undergo regular inspections and maintenance. This will allow engineers to note any areas of concern and employ mitigative measures to account for changes in climate and erosional forces; with the Marine Terminal and associated works designed to allow adjustments if the need arises.

11.2.3 Conclusion on significance of Adverse Environmental Effects after Consideration of Mitigation

All structures either located on land or in the marine environment will be designed to withstand the maximum expected environmental loads with the appropriate safety factors to provide a robust design, and the proposed development will be designed to operate in a wide range of climatic conditions. TC and DFO have concluded that the environment is not likely to cause significant adverse environmental effects.

11.3 Capacity of Renewable Resources

11.3.1 Background of Renewable Resources in the Study Area

The commercial fishery is universally acknowledged as an important element in the society, culture, economic and aesthetic environment of Newfoundland and Labrador. Historically and at present, Placentia Bay has supported a rich and diverse commercial fishery.

Data taken from NAFO Division 3PSc landings information for the years 2003 – 2006 show that cod is still by far the most important species harvested in the area. Snow crab, herring and lumpfish (roe fishery) make up most of the remainder of the harvest. In terms of economic value, the area's commercial fishers usually depend on three high-value species – lobster, snow crab and cod – for the bulk of their annual fishing income.

In recognition of the importance of cod, the wharf and jetties have been relocated and realigned from the original proposed location in order that a seasonally important cod ground is unaffected. While lobster accounts for only a small percentage by weight of the annual catch, given its high value this species remains very important to many study area fishers, and tends to be fished quite close to shore. While fishers will be temporarily unable to access that area typically fished for lobster that is within the construction zone, the Project will make all efforts to schedule construction work so that these areas are made available again as soon as practical and safe. During operations, it is anticipated that most of the typical effort for lobster will be able to resume in the area near the terminal. Some lobster habitat will be lost due to the actual physical footprint of the Marine Terminal and associated works: The loss of this area will be compensated through the Fish Habitat Compensation plan. The herring fishery, although important (especially as bait), does not have the direct economic value of the other three fisheries.

Fish species recorded during freshwater Southern Head studies in the proposed Project area include Brook trout (*Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*), American eel (*Anguilla rostrata*) and Three-spine stickleback (*Gasterostreus aculeatus)*. There is no licensing required to fish trout in Newfoundland and Labrador.

Salmon fishing in the province is managed by the federal Department of Fisheries and Oceans and is a popular pastime for many people. In 2004, more than 15,500 salmon licenses were sold in the province. Three salmon rivers are located on Southern Head: Watson's Brook, Come By Chance River and North Harbour River.

In addition, there are a number of commercial aquaculture ventures (mostly blue mussel) in Placentia Bay. There are some 13 DFA-licensed aquaculture sites within the study area, only five of which are presently in commercial production. All of the commercially active operations are engaged in mussel farming; the remaining sites – all of which are licensed for Atlantic cod – are currently not in production.

11.3.2 Discussion

With the described mitigations in place, the magnitude of the effects on the commercial fisheries of lost fishing grounds because of the presence of the permanent Project facilities would be negligible though there will be some permanent loss of former grounds. The overall effects have been determined to be insignificant. With the described mitigations in place, the magnitude of the effects on the commercial fisheries of gear damage because of operational activity would also be negligible and the frequency rare. The overall residual effects on commercial fisheries due to gear damage is predicted to be insignificant.

While there have been no specific studies done on the effects of ship's noise on fish for the Placentia Bay area, noise from ships associated with operations are not expected to be different from those usually associated with other vessels in the bay, such as fishing boats and other marine industries. Research studies looking at the effects of seismic activities on some marine species have not documented any measurable reductions in fishing success due to vessel noise (Christian et al., 2003; Parry and Gason, 2006). Given this, the magnitude of the effects on the commercial fisheries of construction noise would be negligible and the frequency intermittent. The overall effects of noise from the ships on commercial fisheries is determined to be insignificant.

Construction activities will be continuous in some marine areas during the marine operations phase. However, with the various mitigations in place and additional planning and communications the magnitude of the effects on the commercial fisheries would be negligible. The overall effects will insignificant.

For a discussion of the impact of an accidental event on the fishery in Placentia Bay, see Section 11.1 – Environmental Effects of Accidents and Malfunctions.

Considering the lack of potential interactions, the magnitude of the effects on aquaculture operators because of routine Project operations would be negligible and the overall effects will be insignificant.

There is concern with the effects of noise and light emissions and general disturbances associated with the proposed development on the production and viability of the fox farm operation. These potential effects are most likely to be felt during construction, when there are more intense noise emissions, but also during operations when noise, light and air emissions may have an effect. NLRC will work directly with the operators of the fox farm to determine if specific mitigation measures are necessary.

Access roads to the Development Proposal site on Southern Head are expected to increase accessibility to the area for traditional activities. In the short term, increased accessibility could lead to resource competition (many hunters vying for the same moose). In addition, the site of the proposed development will remove parts of Southern Head from traditional use and could detract from the aesthetics of the area. Depending on the perspectives of traditional users and locations of primary areas of use, this may deter or limit traditional uses or displace uses to other regions. The exact locations of traditional activities (berry patches, camping areas) and the intensity of use of Southern Head, in comparison with other traditional use areas is not known.

11.3.3 Conclusion

By analyzing predicted effects and the mitigation measures proposed by NLRC, including compensation for loss of business or income, DFO and TC concluded that the proposed development will not have significant adverse environmental effects on the capacity of renewable resources in the Project area.

11.4 Assessment of Cumulative Environmental Effects

11.4.1 Methodology

The Operational Policy for Addressing Cumulative Environmental Effects under the CEA Act was issued by the CEAA to provide clarification and guidance to RAs on how cumulative environmental effects should be considered in EAs conducted under CEAA. Under this policy, CEAA endorses the Cumulative Effects Assessment Practitioners Guide (Hegmann et al., 1999) and the Reference Guide for the CEA Act: Addressing Cumulative Environmental Effects (CEAA, 2004).

A general practice for assessing cumulative effects is that the future projects:

- Have a reasonable possibility of occurring;
- Have been registered with either the NL Department of Environment and Conservation and/ or CEAA; and
- Should reflect the most likely future scenarios.

and:

- Other projects and activities will be subject to appropriate planning and management;
- Other projects and activities will be subject to the appropriate government regulatory requirements;
- Relevant government agencies will have adequate resources to effectively carry out their mandate with respect to environmental assessment and management;
- Adherence to existing regulatory requirements will not measurably change.

In situations where cumulative effects and effects management for construction and operations are similar, the discussion is combined and this has been done in the CSR for the Southern Head Marine Terminal. In most cases, mitigation or management lies with several projects and authorities (local through international) and in most cases will be regionally oriented.

11.4.2 Project Inclusion List and Description

Several projects and ongoing operations in the Project area were considered for the assessment of cumulative effects: the proposed Development Proposal (refinery and

Marine Terminal and associated works); the existing North Atlantic refinery; the NTL crude oil transshipment terminal; and the proposed liquefied natural gas (LNG) transshipment terminal at Grassy Point. The proposed VBNC nickel processing plant in Long Harbour and potential new aquaculture operations are outside the spatial boundaries of the cumulative effects assessment (Section 11.4.3). Relevant information about each of the operations or projects on the inclusion list is provided below.

11.4.2.1 Southern Head

The Development Proposal includes the proposed 300,000 barrel per day crude oil refinery and the Marine Terminal and associated works (the Project), located on the Southern Head peninsula between North Harbour and Come by Chance Bay at the north end of Placentia Bay.

The overall Development Proposal will take 3 to 4 years to construct and require a labour force of approximately 3,000 persons at peak. Construction is anticipated to begin in 2008 and be complete in 2011. The complex will employ approximately 750 persons during operations. Operations are anticipated to continue for 25 years or more.

The refinery will be designed and operating using Best Available Technology Economically Achievable. The refinery will produce a range of refined products from heavy sour crude oils. Crude oil and refined products will be shipped by sea via the Marine Terminal.

The refinery will also produce two by-products, coke (5,000 tonnes per day) and sulphur (800 to 1,000 tonnes per day). Both dry products will be stored on site in secure, purpose built storage sites and transported by covered conveyor to the Marine Terminal for export by marine bulk carriers.

The Marine Terminal and associated works (the Project) will be located in Come By Chance Bay. The wharf will incorporate the construction dock (also called heavy lift construction dock) and the tug basin and will extend approximately 450 m along the shoreline and extend out approximately 200 m into the bay. A trestle will join the wharf and the two jetties. The jetties will extend close to 350 - 500 m out into the bay and the combined length of the two jetties will be close to 1,000 m. The jetties will be able to accommodate four tankers at berth and the wharf will have a berth for a single vessel.

From 400 to 450 vessels a year will use the Marine Terminal: 325 to 375 being tankers and 75 bulk carriers. Crude oil will be delivered in VLCC tankers (2 million barrels cargo capacity/ 300,000 dead weight tonnes (DWT)) and/or Suezmax size tankers (1 million

barrels cargo capacity/150,000 DWT). Export or product tankers typically will be not larger than 80,000 DWT. Bulk carriers will be in the 10,000 to 50,000 DWT size range.

The Marine Terminal will be a designated OHF and will have the required prevention and response plans, equipment, trained personnel and procedures in place. The wharf layout includes an emergency response warehouse and slipway for spill response vessels and equipment.

11.4.2.2 Newfoundland Transshipment Limited

Newfoundland Transshipment Limited (NTL) crude transshipment terminal Whiffen Head was completed in September 1998, with an expansion completed in September 2000. The terminal presently handles Hibernia and Terra Nova crude oil.

The terminal receives approximately 350 tankers a year, 110 are the dedicated 150,000 DWT shuttle tankers and the others are smaller vessels.

NTL marine facilities include an approach causeway, tug basin, trestle, and two jetties, with berthing and marine topside facilities (crude transfer and control system). It is equipped with 2 berths accommodating 35,000 - 159,000 DWT tankers.

The terminal is a designated OHF and has on site capability for a 100 tonne spill. ECRC has a stockpile of equipment to respond to a 150 tonnes spill stored at the NTL site.

11.4.2.3 North Atlantic Refining Limited (NARL)

The North Atlantic Refinery, purchased in 2006 by Harvest Energy Trust, is a 108,000 bpd sour crude oil refinery located on the north side of Come By Chance Bay, across the bay from the site of the proposed new NLRC refinery.

The terminal receives approximately 325 tankers a year. The refinery has 2 jetties that can accommodate tankers from 90,000 to 326,000 DWT. The marine terminal includes two tugs and tug basin.

There is a 150 tonne oil spill response capability on site.

For several years the refinery produced large amounts of sulphur dioxide, as much as 64,000 tonnes a year. Since a major process overhaul, emissions have been greatly reduced. Emissions of sulphur dioxide were reduced to 14,000 tonnes by 2006. The refinery intends to reduce emissions farther to 12,000 tonnes a year.

11.4.2.4 Newfoundland LNG Limited

Newfoundland Liquefied Natural Gas (NLNG) Limited has proposed to develop an LNG Transshipment at Grassy Point, adjacent to the NTL facilities. The Terminal will provide LNG cargo transfer, LNG storage and a lay-up site for in-transit LNG carriers.

In the early years, e.g., 2010, the terminal will receive approximately 104 tankers a year and by ten years will handle approximately 400 LNG tankers a year.

The marine facility will enable larger vessels to offload their cargo and commence the return voyage. The terminal will provide storage for loading of smaller or specialized LNG carriers that are able to enter most LNG terminal ports in the United States.

The on-water foot print of the NLNG project marine structures will encompass a water lot boundary running southwest approximately 2,250 m from the eastern boundary of the existing NTL water lot boundary. The boundary will then turn southeast and extend approximately 700 m terminating at the southern most point of land at Adams Head. A wharf and three jetties with berthing capabilities for vessels up to 265,000 DWT. The construction of the three berths will be phased in over approximately 10 years. The berths will extend to a depth of 15 m and will not require dredging. Each berth will consist of a service platform, mooring dolphins, berthing dolphins, access trestle connecting the loading platform to shore and walkways connecting the mooring and berthing dolphins. The service platform will be equipped with fixed loading arms to facilitate loading and unloading of LNG product.

The Marine Terminal will include a tug basin. The dedicated tug basin will require a minimum of 7 m water depth and be capable of berthing two or three tugs. Dredging may be required for the tub basin, but the material will be disposed of on land. During the construction phase, the tug basin will also serve as an offloading point for construction supplies.

The expected life of the project is 50 years. The proposed schedule of site activities is as follows: construction from late 2007 through early 2010 with operations beginning later in 2010.

11.4.3 Spatial and Temporal Boundaries

The spatial boundaries for the consideration of cumulative effects within the scope of the CSR is the area of inner Placentia Bay where vessels would initiate specific procedures and manoeuvres to berth at either the LNG Transshipment Terminal, the Newfoundland Transshipment Terminal, North Atlantic refinery or Southern Head Marine Terminal. This

area encompasses part of the Harbour of Come By Chance and all of Come By Chance Bay. These boundaries remove the proposed VBNC project and aquaculture operations from further consideration under cumulative effects within the scope of the CSR.

The temporal boundary for the cumulative effects assessment used in the CSR is 25 years, the design life of the Marine Terminal.

11.4.4 Identification of VECs

The VECs used for the Project specific assessment are considered in the cumulative effects assessment with the exception of freshwater and marine fish and fish habitat. Fish Habitat Compensation strategies and the subsequent Fish Habitat Compensation plans required for each Project ensure that there is no cumulative effect on either freshwater or marine fish and fish habitat.

11.4.5 Potential Effects and Mitigation

11.4.5.1 Marine Water Quality

Effects

The increase in vessels coming into inner Placentia Bay could increase the potential for the introduction of alien invasive species. All existing and planned operations will be required to have permits and facilities to meet the requirements of both federal and provincial legislation and regulation for any discharge to the marine environment.

Mitigation/Management

Early in the planning of the Southern Head Marine Terminal, NLRC committed to including facilities to manage bilge water and untreated ballast water in the design of the Marine Terminal to avoid pollution and reduce the possibility of introducing alien invasive species. With the discovery in September 2007 of large numbers of the alien invasive species, green crab, in areas of inner Placentia Bay, operators and/or the federal government could add confirmation of ballast water exchange to their questions to in-coming vessels.

Permits and operational procedures should ensure that there are no significant cumulative effects on marine water quality.

11.4.5.2 Marine Sediment Quality and Transport

Effects

There is an established baseline measurement of marine sediment quality in the immediate area of each Project in inner Placentia Bay: this information is required as part of the characterization of fish habitat during environmental assessment. NLRC's marine sediment quality measurements indicate that levels of the various parameters measured are generally within accepted levels under CCME's Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2002) (Section 10.2) as were the measurements taken at the NTL site in 2006 ten years earlier (Newfoundland Transshipment Terminal Project: Environmental Assessment, Volume 2 Main Report, 1996).

Mitigation/Management

All existing and planned operations will be required to have permits and compliance monitoring programs in place. NLRC and possibly other operations will also have environmental effects monitoring (EEM) programs as well Fish Habitat Compensation monitoring in place which will detect any abnormalities.

There is no expectation of cumulative effects on marine sediment quality.

11.4.5.3 Commercial Fisheries and Aquaculture

Effects

There are no aquaculture operations within the area considered for cumulative effects. However, there are commercial fishing activities, primarily from vessels under 34 feet LOA. With the increased vessel traffic in inner Placentia Bay and potentially increased use of the existing anchorages, there will be increased interference with fish harvesting activities. Areas of the coast occupied by terminals are areas of loss of access for fishers.

Mitigation/Management

Each operator has established liaison with the fishing community. NLRC has committed to having a full time Fisheries Liaison Manager, starting during the construction phase. NLRC has indicated that there will be a gear and vessel damage program associated with their terminal, comparable to that in place through NTL, during all phases of the Project. NLRC will also comply with compensation requirements associated with marine spills at their Marine Terminal.

Each operator is active on the Placentia Bay Traffic Committee, a long standing voluntary committee that addresses marine traffic issues. With four separate operations contributing to the vessel traffic in the area, there will be a need for cooperation and coordination.

At present, the vessel traffic management system ends part way through inner Placentia Bay. To date, the Placentia Bay Traffic Committee, chaired by CCG, has been effective in ensuring this cooperation and can be a forum for continuing to address vessel traffic users. NLRC has indicated their support for a voluntary vessel management plan for the inner bay as well as their intent to continue to support and participate on the Placentia Bay Traffic Committee. NLRC intends to have a full time Marine Manager.

NLRC's Marine Terminal and the proposed LNG Transshipment Terminal are both undergoing review under the TERMPOL Review Process which will address vessel traffic issues associated with the increase in vessels in the area and as they approach and depart the terminals.

The FFAW, which represents the fish harvesters in the area, has established a Placentia Bay Sub-committee to work with operators. FFAW has also initiated discussions with the federal (and provincial) government to ensure there are measures in place so that fishers' livelihoods are not jeopardized.

With the above mitigation measures in place, no cumulative effects on commercial fisheries are anticipated.

11.4.5.4 Migratory Birds

Effects

All existing and planned operations are required to have permits and facilities to meet the requirements of both federal and provincial legislation and regulation for any discharge to the marine environment and to the atmosphere. These permits and operational procedures should ensure that there are no cumulative effects on environmental quality that could affect migratory birds.

An accidental event that resulted in an oil or chemical spill into the environment could affect birds in the area of the spill. In the event of a marine spill in inner Placentia Bay, sensitive bird habitat such as the Arnold's Cove lagoon and the estuary at the head of Come By Chance Bay could be affected.

Mitigation/Management

NLRC has committed to additional surveys for land-based bird habitat use in the Marine Terminal area and a raptor monitoring program. There may be opportunities for collaboration with other parties (industry, community, research, regulatory) for additional migratory bird surveys in the inner Placentia Bay area.

All operators will have on-site spill response capability that can be activated in the event of a spill at any of the terminals. See also Section 11.4.5.7.

No cumulative effects on migratory birds are anticipated.

11.4.5.5 Species At Risk

Effects

While there are several species at risk that can be expected to occur in Placentia Bay (Section 7), most of these species have not been found in inner Placentia Bay. Surveys for the Southern Head Marine Terminal found only three species at risk and only a few individuals of each: American Eel, the migratory bird Red Knot and *Erioderma pedicellatum*, a lichen.

Mitigation/Management

NLRC has indicated that there will be monitoring at site for bird mortalities and a program of observations for marine mammals and sea turtles in the Marine Terminal area as part of the EPP. NLRC will undertake additional surveys for the boreal felt lichen, *Erioderma*, in the Marine Terminal area and implement mitigation measures in consultation with regulatory agencies. NLRC is also planning to include *Erioderma* in the air quality monitoring program for the Development Proposal and Project.

No cumulative effects on species at risk are anticipated.

11.4.5.6 Marine Mammals

Effects

The increase in vessel traffic in inner Placentia Bay will increase the risk of collision with marine mammals.

Mitigation/Management

NLRC will include protocols for avoiding marine mammals and sea turtles in the Southern Head Marine Terminal Marine Terminal Regulations and Information manual. NLRC's manual will be provided to the Placentia Bay Traffic Committee for information.

The manual will be reviewed under the TERMPOL Review Process. No cumulative effects are anticipated.

11.4.5.7 Marine Safety

Effects

It is anticipated that large vessel traffic will increase from the current 675 vessels to close to 1180 in 5 years with both proposed projects proceeding and to a possible 1,525 in ten years. The additional increase between five and ten years would be due to increase in operations at the LNG Transshipment Terminal. Vessel traffic for the Southern Head Marine Terminal will be 400 to 450 vessels throughout operations as a 300,000 bpd facility. With the increased number of large vessel and associated tug movements, there will be a substantial increase in vessel movements in inner Placentia Bay.

Mitigation/Management

At present, this area of Placentia Bay is within the federal harbour of Come By Chance and the CCG managed vessel traffic management system extends part way through the area. Tankers and bulk carriers must have a pilot on board during any movement within this area and, typically, are assisted with tugs for berthing. There are four designated anchorages.

Marine traffic issues and concerns in Placentia Bay have been addressed effectively over the past twenty or more years through a voluntary all-user Placentia Bay Traffic Committee, chaired by CCG. The safety and operational aspects of both of the proposed projects are being reviewed under the TERMPOL Review Process. Safety issues associated with the terminals, including berthing and de-berthing maneuvers are included in the TERMPOL Review. The TERMPOL Review also considers the location and extent of fishing activity through a Fishery Resources Survey (TERMPOL Review Process 2001, Transport Canada).

Currently there is a definite downward trend worldwide for marine oil spills, attributed to a risk-based approach to management (Figure 11-3).

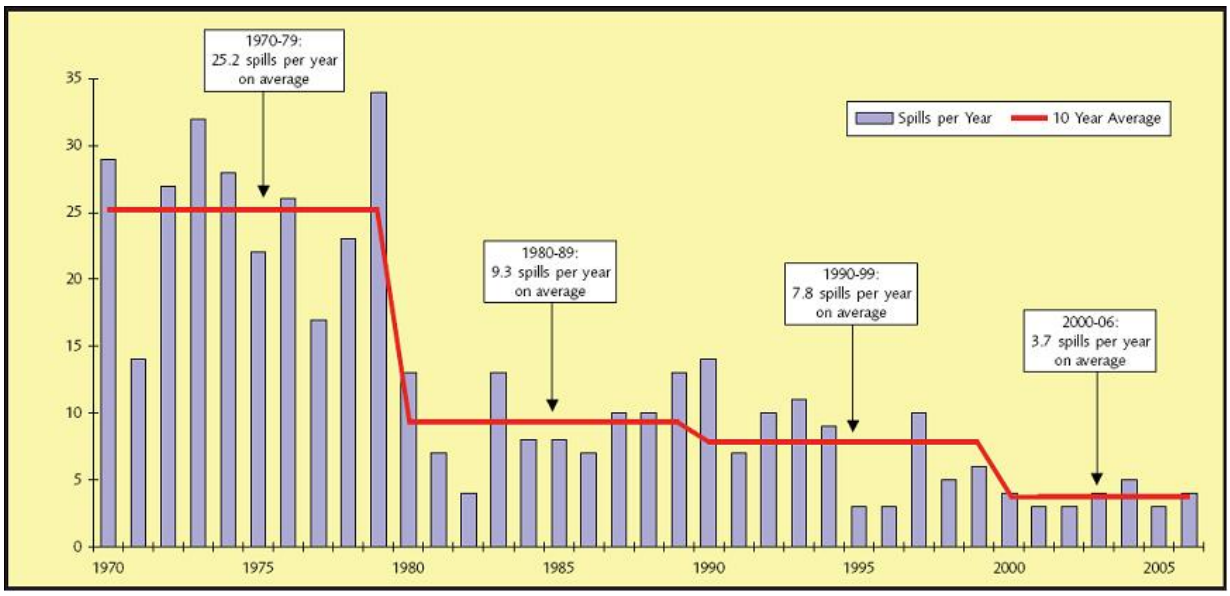


Figure 11-3 Number of large spills >700 tonnes, 1970 - 2006 (ITOPF Handbook 2007/2008)

With the increase in vessel traffic in the Project area, there is also increased risk of a marine oil spill. However, there will be an accompanying increase in response capability through designation of facilities as OHFs and the requirement for on-site response equipment. All four operations will be designated as OHFs under the *Canada Shipping Act* and, as such, will be required to have, on site, appropriate spill response equipment, trained personnel as well as prevention and preparedness plans.

The existing refinery and transshipment terminal have a mutual aid arrangement in place that would see response capability from both locations used in the event of a spill. It is anticipated that mutual aid arrangements would be expanded to include the new projects. NLRC has committed to work with the Placentia Bay Traffic Committee and with the other facilities' operators to develop an integrated approach to contingency planning that includes the communities in pre-planning, training and exercises in order to maximize response effectiveness.

OPPPs and OPEPs must be approved by Transport Canada. The TERMPOL Review Process includes consideration of risk and risk reduction, contingency planning, and the OHF requirements.

No cumulative effects on marine safety are anticipated.

11.4.5.8 Human Health and Safety

Effects

The primary concern with regard to human health is the potential effects of emissions from the operation of the various facilities. NLRC contracted the Health Research Unit of Memorial University Faculty of Medicine to prepare a health status profile for the Project area (Socio-economic Component Study, 2007). This analysis found that even with the operation of a crude oil refinery in the area for many years, the incidence of respiratory disease (an indicator of effects from emissions) is slightly lower in the area when compared to elsewhere in Newfoundland.

The air emissions from the LNG Transshipment Terminal have been indicated to be minimal (Environmental Assessment Registration and Project Description for the Grassy Point LNG Transshipment and Storage Terminal, 2006) and would not affect the Project area or communities (due to the distance, environmental conditions and dispersion criteria). Air emissions from the existing operations at NTL and the North Atlantic refinery were included in the baseline or ambient air quality information provided to NLRC by the NL Department of Environment and Conservation and have been incorporated into the air quality effects assessment completed for the Development Proposal. Hence, the cumulative effects of air emissions have already been have been considered in the assessment and discussion of the Southern Head Development Proposal in Section 10.10.

Air quality modeling for the Development Proposal was done using conservative assumptions and data, effectively providing a worst case assessment. Even with conservative assumptions, the Human Health and Ecological Effects Assessment (SENES Consultants Limited, 2007) for the Development Proposal has concluded that no measurable adverse effects would occur in the human (or ecological) community surrounding the facility.

The same report also assessed the impact of the potential for non-resident sensitive receptors (fishermen) to be present in the areas around the Marine Terminal for relatively short periods and concluded the potential for human health effects from short-term exposure is considered to be low. This is based on the conservative approach for the air emissions estimates, the low numbers of occurrences where low World Health Organization (WHO) guidelines for short term NO_2 and SO_2 standards are exceeded and a recognition that the WHO guidelines are based on the protection of sensitive individuals within the general public (asthmatics) and are thus conservative for the expected receptors. It should also be noted that the potential for fishing in this area is somewhat limited given the use of this portion of the bay as a shipping channel. There are also no aquaculture sites in this area of Placentia Bay. The modeling will be redone

when BATEA has been used in the determination of plant configuration, specific equipment selection and operational procedures.

The nearest community to the Southern Head Marine Terminal is Arnold's Cove, with the nearest house 4.7km for the jetty. NLRC's air quality effects assessment included specific consideration of predicted levels of contaminants associated with Development Proposal and Project emissions in several specific neighbouring communities – North Harbour, Come By Chance, Sunnyside, Arnold's Cove and Southern Harbour. For all communities the air quality will remain well within the NL air quality requirements during operation of the Development Proposal and Project (Air Quality Component Study, 2007).

Mitigation/Management

Cumulative air emissions in inner Placentia Bay are likely to decrease over the next ten years in response to provincial, national and international requirements.

As part of their operating conditions, the North Atlantic refinery has committed to decrease SO_2 emissions by another 2,000 tonnes by 2012.

Environment Canada is developing a Regulatory Framework for Air Emissions that will define caps for various sectors. NLRC is actively involved with the discussions regarding an air emissions cap for the refining sector.

The air emissions modeling included operation of the Marine Terminal. In order to be conservative, the assumptions included the use of marine diesel with 1.5% sulphur as well as two vessels loading at the same time (the equivalent of 3% sulphur).

At present, the International Maritime Organization (IMO), which governs shipping regulations in international waters, requires that ocean-going vessels use diesel with less than 4.5% sulphur. However, Canada and the United Sates are planning to apply for an exemption and have North America declared a Sulphur Emission Control Area (SECA) which would limit sulphur in marine fuel to 1.5%. The intent is that the two countries will ratify their agreement for this within 6 – 10 months. EC and other agencies are participating in preparatory work for this agreement.

A North American SECA would effectively lower the emissions from all four operations in inner Placentia Bay.

The air emissions modeling for the Development Proposal and the Project effectively modeled a worse case situation this is not likely to occur. The model will be re-run once BATEA has been applied to engineering design and equipment specifications. While air

emissions are already within provincial limits, it is anticipated that air emissions will be greatly reduced through BATEA.

NLRC has committed to the installation of air quality monitors and an ongoing air quality monitoring program that will meet the needs of the communities as well as regulators.

There is no expectation of cumulative effects on human health and safety.

11.4.5.9 Conclusion on Significance of Adverse Environmental Effects after Consideration of Mitigation

After consideration of the potential cumulative effects and corresponding mitigation and/or management measures, the RAs conclude that cumulative effects of construction and operation of the Project are not likely to cause significant adverse environmental effects.

12 Summary of Mitigation Measures and Significance of Residual Effects

12.1 Summary of Mitigation Measures

Potential effects, including potentially significant ones, can be mitigated by additions to or changes in equipment, operational procedures, timing of activities, or other measures. The CEA Act, Section 16d states that: " Every screening or comprehensive study of a project … shall include a consideration of … measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project." Table 12-1 provides a summary of mitigation measures for each VEC as proposed by the proponent.

In accordance with Section s.37(2.2) of the CEA Act TC and DFO will ensure the implementation of all mitigation measures listed in Table 12-1, when assistance is provided by the appropriate FA(s) as per CEA Act Section s.37(2.3). DFO will work together with NLRC to develop an acceptable fish habitat compensation plan to address the HADD of marine and freshwater fish and fish habitat.

NLRC will develop EPPs for the construction, operations and decommissioning phases of the Project and provide them to the appropriate regulatory agency for review.

NLRC will also comply with all applicable regulatory requirements, permits and authorization conditions, and will implement follow up program listed in Section 13.

Table 12-1 Mitigation Measures

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
VEC: Marine Water Quality			
Phase: Construction			
Potential sedimentation in the immediate offshore area (potentially affecting health and habitat of marine species in the area)	Permits, authorizations, and the development of the EPP.	With permit and authorization conditions as well as other appropriate mitigation measures by the proponent in place, it is concluded that there will not be any significant residual effects on marine water quality in the project area	Not Likely to cause significant adverse environmental effects.
	Designs will incorporate proper dust suppression enclosures and filtering as required to minimize fugitive emissions from the sulphur and coke storage and transportation areas.		
	Areas that have gravel surfaces during construction will be wetted to minimize dust generation.		
	Use DFO guidelines and publications on controlling sedimentation, run-off, and erosion from construction sites.		
	Silt curtains and sedimentation ponds.		
	Only 'clean' rock will be used for infilling.		
	Armour stone will be placed progressively to minimize shoreline and prevent loss of infill materials.		
PHASE: Operations			
Potential for surface run-off during storms which could carry contaminants into the marine environment	Permits, authorizations, and the development of the EPP.	With effective permits, authorizations, site EPP and monitoring programs in place, it is concluded that there will not be any significant residual effects on water quality as a result of Marine	Not Likely to cause significant adverse environmental effects.
	NLRC will build a ballast water and bilge water treatment plant		
	Stormwater will be treated prior to discharge		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
	No-splash loading for petroleum liquids and covered conveyor systems for dry products (coke and sulphur)	Terminal operations.	
	Effluents will meet federal Petroleum Refinery Liquid Effluent Regulations, and provincial Water and Sewage Regulations		
	Areas that have gravel surfaces during operations will be wetted to minimize dust generation.		
	Holding ponds for uncontaminated stormwater will be used to prevent discharge of sediment from the Development Proposal.		
PHASE: Decommissioning			
Similar to effects during construction	Comparable to those mitigation measures used in construction	With effective permits, authorizations, site EPP and monitoring programs in place, it is concluded that there will not be any significant residual effects on water quality as a result of decommissioning the Marine Terminal.	Not Likely to cause significant adverse environmental effects.
VEC: Marine Sediment Quality and Transport			
PHASE: Construction			
Loss of hydraulic fluid, lubricant, or other petroleum products into water (contaminating sediments directly or via materials entering the marine environment through erosion or sedimentation) as well as a concrete spill.	The EPP will specify prevention measures to avoid sediment contamination.	With the necessary permits, approvals, authorizations and EPP in place, it is concluded that there will not be any significant residual effects on sediment quality and transport associated with construction of the Marine Terminal.	Not Likely to cause significant adverse environmental effects.
	Heavy equipment will be properly maintained to avoid leakages, as well as only used on stable terrain on dry land or construction barges.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
	Storage and Handling of Gasoline and Related Products Regulations will be followed.		
	No major repairs or refueling will take place within 30 m of water.		
	Spill kits will be situated on barges, boats, and at the Marine Terminal and trained personnel will be on-site at all times.		
	Sedimentation ponds will be used to prevent suspended solids from entering the marine environment.		
	Equipment and procedures will ensures that concrete will not spill into the sea during pouring operations		
	All wood used near the marine environment will adhere to DFO's Guidelines to Protect Fish and Fish Habitat from Treated Wood Used in Aquatic Environment		
PHASE: Operations			
Run-off from wharf and/or jetty areas	The EPP will specify prevention and operating procedures for all types of activities at the Marine Terminal.	With the necessary permits, approvals, authorizations and EPP in place, it is concluded that there will not be any significant residual effects on sediment quality and transport. It is concluded that monitoring will detect measurable changes in sediment quality and allow for corrective measures to be put in place with negligible residual effects.	Not Likely to cause significant adverse environmental effects.
Accidental events	The terminal will be a designated oil Handling Facility with the required plans, equipment and trained personnel in place.	There are no residual effects expected from accidental events on sediment quality and transport based on the	

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
	All vessels using the terminal will have the required insurance, Oil Pollution Emergency Plan and contract with a recognized Responses Organization in place.	extremely low likelihood of such an occurrence.	
	Equipment located at the Marine Terminal during operations will contain only small quantities of hydrocarbons will be stored at least 30 m from water.		
	There will be continuous observation and monitoring at the Marine Terminal. During active loading and/or unloading operations, both terminal and vessel personnel will monitor operations.		
	A sediment quality monitoring program will be in place during operations.		
PHASE: Decommissioning			
Loss of hydraulic fluid, lubricant, or other petroleum products into water (contaminating sediments directly or via materials entering the marine environment through erosion or sedimentation).	The EPP will specify prevention measures and operating procedures to avoid sediment contamination.	A specific EPP and approved procedures for the various steps in decommissioning will ensure that there will not be any residual effects on sediment quality.	Not Likely to cause significant adverse environmental effects.
	Activities and environmental protection measures will be comparable to those identified under Construction.		
VEC: Marine Fish and Fish Habitat			
PHASE: Construction			
Potential for sedimentation, erosion, run-off and dust to enter the marine environment	Any activities within the marine environment will be conducted in strict compliance with all federal and provincials permits, approvals and authorizations, as well as the EPP and the agreed fish habitat compensation strategy.	Good construction practice and implementation of the EPP will lead to low potential for sedimentation, erosion, run-off, excessive dust, effects from blasting will not cause negative residual effects on marine fish and fish habitat.	Not Likely to cause significant adverse environmental effects.

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Blasting can also cause harm to marine organisms.	No blasting will take place in the marine environment.		
	On land blasting will be done in accordance with accepted practice and guidelines such as DFO's 1998 Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters.		
Noise and disturbance will cause some animals to leave the immediate area.	The EPP will specify noise control measures.		
Potential for chemical contamination through hydraulic fluid or oil leaks.	The EPP will specify prevention measures and operating procedures to avoid chemical contamination.		
Infilling along the shoreline to create the wharf and tug basin, which will remove the existing habitat.	Infilling practices have been outlined in Section 10.1.2 and 10.2.2. There are numerous guidance documents for good construction practice that prevent erosion, sedimentation, dust and run-off that will be followed during construction of the Marine Terminal.	These practices will be followed during construction of the Marine Terminal, making any effects minor to negligible.	
The loss of fish habitat associated with this physical footprint.	A detailed Fish Habitat Compensation Plan acceptable to DFO will be developed. The proposed compensation strategy will be to build lobster habitat suitable for a range of ages and sizes of lobster. The new habitat will be incorporated into the overall wharf structure.		
PHASE: Operations			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Potential contamination from operations, such as dust from coke or sulphur loading.	The management and operational procedures that will be in place for the Marine Terminal (Marine Terminal Regulations and Information manual) will ensure effects on fish and fish habitat area are avoided or minimized.	With adherence to the fish habitat compensation strategy (and compensation plan to be developed in consultation with DFO) there will be no residual effects due to operations.	Not Likely to cause significant adverse environmental effects.
	Covered conveyor for coke and sulphur loading to prevent fugitive emissions.		
There may be some attraction to the marine intake and outfall pipes as structures on the seabed offering shelter.	The seawater intake and outfall pipes will be designed to minimize effects on marine organisms. The pipes will be buried in the inter-tidal zone and anchored with concrete blocks over the entire length to prevent floating. Specially designed screening will be used at the end of the pipe to reduce the intake velocity and protect marine organisms from being taken in.		
	The outfall pipe diffuser will ensure that the zone of influence of the effluent is minimized and reaches allowable limits within a radius of 100 m.		
	Compliance monitoring will detect abnormalities that must be addressed.		
	The effectiveness of the fish habitat compensation plan will also be monitored and reported.		
PHASE: Decommissioning			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
By the time decommissioning is considered, marine communities will be well established on the wharf, jetty supports and marine pipes. The decision may be to leave some of these structures in place. Other infrastructure will be removed.	As marine communities will be well established on the marine structures, the preferred course of action determined by regulatory agencies at the time maybe to leave some infrastructure in place, removing the rest if it is not to be used for other purposes.	There will be no residual effects from decommissioning.	Not Likely to cause significant adverse environmental effects.
	Removal of marine structures would follow comparable practices as outlined under construction.		
VEC: Freshwater Fish and Fish Habitat			
PHASE: Construction			
The project will affect four watersheds.	Prior to de-watering, water bodies will be electro-fished to remove and relocate any fish present.	Permits, approvals and authorizations; use of the EPP; and implementation of the Fish Habitat Compensation strategy are able to address the potential harmful effects of construction of the refinery on freshwater fish and fish habitat, making them negligible or minor in effect.	Not Likely to cause significant adverse environmental effects.
Water bodies (ponds and streams) in the immediate footprint of the refinery will be effectively removed from site and will not exist upon completion of refinery construction.	Permits approvals, authorizations and implementation of the EPP will avoid or minimize effects on water bodies, both those in the footprint before de-watering and those outside the footprint throughout construction.		
Potential for sedimentation of streams and ponds outside the refinery footprint.	A 50 m buffer zone of undisturbed natural vegetation will be maintained between construction areas and all fish habitat water bodies outside the Project Area.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Site preparation (earthworks, clearing, grubbing, leveling) and construction within the physical footprint of the plant will negatively affect fish and fish habitat.	Sedimentation control structures (i.e. silt curtains, and/or sediment fences and sedimentation ponds) will be constructed prior to beginning any activities involving disturbance of the soil, work along the shoreline or near areas of high runoff potential.	Good construction practice and implementation of the EPP will lead to low potential for sedimentation, erosion, run-off, excessive dust, effects from blasting will avoid negative effects on marine fish and fish habitat.	
	Silt screening, perimeter ditching, velocity controls, settling ponds and compliance monitoring.		
	Dewatering of the site will be undertaken in accordance with approved practices.		
	All stream crossings on the access roads will be constructed in accordance with the procedures outlined in the EPP and will meet or exceed the requirements of DFO.		
	Where streams are deemed to be fish habitat, culvert installations will be designed to allow the passage of fish and to preserve habitat.		
	NLRC has developed an acceptable fish habitat compensation strategy that will address both stream and pond habitat.		
PHASE: Operations			
During operations there is potential for air emissions from vessels berthed at the jetties to affect water bodies, e.g. through the production of acid rain.	The use of BATEA; permits, approvals and authorizations; use of the EPP; and continued environmental monitoring will ensure that air emissions from vessels docked at the jetties will not cause significant adverse effects on freshwater quality.	With the describe mitigations in place, the effects on freshwater fish and fish habitat will be negligible to minor.	Not Likely to cause significant adverse environmental effects.
PHASE: Decommissioning			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
There is the potential for sedimentation, erosion and run-off to affect water bodies within the Watson's Brook watershed during decommissioning work.	Decommissioning activities, such as cleaning and dismantling of site tanks and pipelines, will be done under the necessary permits and EPP in order to prevent effects on water bodies off-site. Specific measures to control runoff and sedimentation have been previously discussed above.	A site environmental audit and an approved decommissioning plan developed in consultation with regulatory agencies will ensure that residual effects of decommissioning activities on the freshwater environment are negligible.	Not Likely to cause significant adverse environmental effects.
VEC: Aquaculture and Commercial Fisheries			
PHASE: Construction			
Sedimentation from run-off or erosion affecting marine water quality could also affect aquaculture operations if it was severe or long term and affected the health of the farmed animals or the farm's nets and moorings.	Construction activities at the Marine Terminal will be incompliance with the EPP such as the use of silt curtains and sedimentation ponds as previously discussed.	With the intended mitigation measures in place and effective monitoring and communication between the Project and the fish harvesters by the Fisheries Liaison Manager, the residual effects on the commercial fisheries will be minor to negligible.	Not Likely to cause significant adverse environmental effects.
Excessive sedimentation could affect moored fishing gear as well and could cause fish to leave the area, as could underwater noise.	Construction activities at the Marine Terminal will be incompliance with the EPP such as the use of silt curtains and sedimentation ponds as previously discussed.		
There may be increased risk of gear damage with construction related traffic entering and leaving the construction zone.	NLRC has committed to gear and interference compensation and implementing specific vessel traffic management practices in the Project area during construction.		
Vessel activity and the necessary CSZs associated with construction of the Marine Terminal will temporarily affect fishing operations in the immediate Project area.	A Fisheries Liaison Manager will provide a dedicated link between the project and the area fishers, as well as the aquaculture industry in Placentia Bay.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Floating debris from Project activities could also affect fishing or aquaculture gear.	There will be ongoing efforts to ensure that Project associated debris does not escape the site.	There will be no effects on aquaculture due to mitigation measures (e.g. debris management) and to the distance of aquaculture facilities from the Marine Terminal site.	
PHASE: Operations			
Increased vessel traffic in the Project area as vessels arrive and depart the terminal jetties and wharf could affect fishing activity in the immediate Project area through loss of access to specific fishing grounds, gear damage or interference.	NLRC has indicated that they will work with FFAW to establish a compensation program for economic loss by fishers (in addition to the gear damage compensation program) for loss of access caused by the presence of permanent facilities on established fishing grounds within the Marine Terminal area.	NLRC's planned mitigation measures, including compensation programs for gear damage and loss of access as well as the dedicated on-site Fisheries Liaison Manager and Marine Manager will serve to make the potential effects of the Marine Terminal minor to negligible.	Not Likely to cause significant adverse environmental effects.
	NLRC's Fisheries Liaison Manager and Marine Manager will work with the Fisheries Liaison Committee.		
	Vessel berthing infrastructure and procedures will be reviewed in the TERMPOL review for the Marine Terminal.		
PHASE: Decommissioning			
The potential affects on aquaculture and the commercial fisheries from decommissioning are comparable to those during construction.	Mitigation measures comparable to those in place for construction and operations would be used during decommissioning.	Effects of decommissioning will be of short duration and limited to the immediate project area and, as such, are negligible for commercial fishing activity. There are no residual effects on aquaculture.	Not Likely to cause significant adverse environmental effects.
VEC: Migratory Birds			
PHASE: Construction			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Clearing, noise and lighting will affect birds and bird habitat in the immediate area of the terminal. Possible run-off and sedimentation, air emissions and liquid effluent, possible collisions with structures (e.g. marine barge cranes) and accidental release of harmful products into the environment such as fuel oil and other machinery products that may be in use. Construction activities are expected to affect primarily land-based birds as seabirds do not typically come as far as the head of Placentia Bay, the location of the Marine Terminal.	Conditions associated with permits, approvals and authorizations and implementation of the EPP will address the requirements of the *Migratory Birds Convention Act* (MBCA) and associated regulations, in particular Section 6 of the Migratory Birds Regulations and Section 5.1 of the MBCA.	Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will enable that construction of the Marine Terminal to have negligible effects on migratory birds. No residual effects on migratory bird populations are predicted during this phase, given that appropriate mitigation measures are in place.	Not Likely to cause significant adverse environmental effects.
	Minimization of dust, run-off and associated sedimentations, noise and lighting (when safe).		
	Heavy equipment maintenance.		
	Fuel oil specifications; use of best available technology.		
	Avoiding Bald Eagle and Osprey nest trees by 300m.		
PHASE: Operations			
Disturbance from noise and activity during operations is predicted to affect areas within 200 m.	Mitigation measures to be used to protect migratory birds during operations will ensure that the requirements of the MBCA and associated regulations are met.	Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will enable the Marine Terminal to operate within the requirements of the MBCA and its regulations and have negligible effects on migratory birds. No residual effects on migratory bird populations are predicted during this phase, given that appropriate mitigation measures are in place. On-site observation and	Not Likely to cause significant adverse environmental effects.
	Minimization of noise and lighting (when safe).		
	Monitoring for and reporting of bird mortality rates.		
	Use of best available technology.		
	Implementation of the EPP.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Lighting of the area during construction and operations may serve to attract some bird species with the risk of resultant mortality. Leach's Storm Petrels in particular can be attracted to light, especially in fog or during storms. While Leach's Storm Petrels are numerous in outer Placentia Bay with over 200,000 breeding pairs, they are infrequent in the Marine Terminal area.	Mitigation measures associated with lighting include strobe lights being used only on tall structures at the minimum intensity and minimum number of flashes per minute allowable by TC, minimizing the number of lights as possible, avoiding use of exterior decorative lights, and shielding of task lighting to shine only where needed. NLRC has indicated that, in the event of Storm Petrel strandings at the Marine Terminal, they will use the handling techniques outlined for Storm Petrels in Williams and Chardine (n.d.) in a protocol established for use with offshore oil production operations.	monitoring plans will be in place to confirm this assessment.	
PHASE: Decommissioning			
Expected to be similar to those experienced during the construction phase.	Mitigation measures to be implemented here are similar to those outlined for the construction phase.	Implementation of the mitigation measures outlined in permits, approvals and authorizations and the EPP will ensure that decommissioning of the Marine Terminal will have negligible effects on migratory birds. No residual effects on coastal bird populations are predicted during this phase, given that appropriate mitigation measures are in place.	Not Likely to cause significant adverse environmental effects.
Issues to consider will be runoff, sedimentation and the disturbance from noise and lighting.	Similar mitigation measures to control run off, sedimentation and will be used here as described above under construction mitigations measures.		
VEC: Species at Risk			
PHASE: Construction			
Marine fish species at risk may be affected through run-off and sedimentation, blasting (on land) and pile driving (marine). Negative effects could also result from noise, activity	Minimization of dust, run-off, sedimentation, noise and lighting (when safe), and adherence to the EPP for construction, as previously discussed.	With mitigation measures in place, construction activities are predicted to have no residual effect on marine-associated bird species, marine mammals, sea turtles or lichen species	Not Likely to cause significant adverse environmental effects.
	Use of best available technology.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
and lighting, as well as air emissions and the release of effluents.	Adherence to DFO guidelines for blasting (setback distances to ensure sound pressure does not exceed 100 kPa in the water column).	considered at risk. Construction activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)) for these species.	
	Acoustic monitoring to ensure sound levels do not exceed 100 kPa from blasting and for establishing 180 and 190 dB safety zones.		
	Will be specified in the EPP.		
In the case of marine mammals and sea turtles at risk, run-off and sedimentation may have an effect by increasing the turbidity of their surroundings, affecting visibility and possibly making it more difficult to find food. Potential effects from noise (on- land blasting, marine pile driving) and the risk of collisions with vessels.	Delaying of pile driving or blasting operations if any marine mammal or sea turtle is sighted within a designated safety zone		
	Cessation of pile driving if a marine mammal or sea turtle enters a designated safety zone.		
The Boreal Felt Lichen has not been found within the Marine Terminal footprint (it was found in one area in the vicinity of an access road for the Development Project). Surveys will continue in the Development Project footprint, including the Marine Terminal site.	NLRC intends to continue surveys for the lichen in the Project area. In the event boreal felt lichen occur, consideration will be given to leaving in place any trees that possess lichen or the proponent will make efforts to transplant trees that are providing habitat for this species.		
PHASE: Operations			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Potential effects may include collision with vessels; noise from vessels; harmful effects resulting from effluent or an oil spill into the marine environment; attraction of birds to structures and lighting.	Implementing proven measures for avoiding harm to marine mammals or sea turtles (such as altering course to avoid any marine mammals or sea turtles; vessels maintaining consistent and/or reduced speed and travel direction; delaying start or shut down on land blasting if marine mammals or sea turtles are in 180/190 dB zone).	With mitigation measures in place, routine operation activities are predicted to have no residual effect on marine-associated bird species considered at risk, nor will they have a significant effect (physical or behavioural) on blue whales, right whales, fin whales, harbour porpoises, or leatherback sea turtles, thus operation activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)).	Not Likely to cause significant adverse environmental effects.
Air emissions from tankers berthed at the jetty may affect boreal felt lichen if it occurs in the general area.	Using best available technology; following all pertinent regulations to reduce contaminants in air emissions.	There will be no residual effects on Species at Risk from air emissions.	
	Monitoring for occurrence of lichen and protection of lichen found.		
	Air quality monitoring and monitoring of contaminant uptake by lichens.		
PHASE: Decommissioning			
Similar to construction activities and have comparable potential effects.	Mitigation measures to be implemented here are similar to those outlined for the construction phase.	Decommissioning activities for the proposed Marine Terminal are not expected to interact with species of marine-associated birds, marine mammals or sea turtles considered at risk, thus there are no residual effects.	Not Likely to cause significant adverse environmental effects.

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
The removal of marine infrastructure may have the potential to disturb habitat and increase the turbidity of underwater surroundings, potentially affecting the health, habitat and behaviour of fish, marine mammals and sea turtles.	AT this time, it may be practical to le the marine infrastructure remain in place, since it will have already have been established as marine habitat for many years.	If boreal felt lichen is at the Marine Terminal site, mitigation measures will have been in place and will be maintained during decommissioning. Decommissioning activities are not expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1)) and the residual effect is insignificant.	
Possibility of introducing oily wastes or residues into the marine environment.	Mitigation measures to be implemented here are similar to those outlined for the construction phase.	With implementation of the proposed mitigation measures, residual effects will be negligible.	
VEC: Marine Mammals			
PHASE : Construction			
Noise, the possibility of collisions with vessels, as well as run-off and sedimentation.	Noise Reduction Measures, collision avoidance and settlement ponds and silt curtains. Will be specified in the EPP.	Given the mitigation measures to be implemented, it is predicted that there will be no significant negative effect on marine mammals during construction. It is predicted that there will be no residual effect on marine mammals.	Not Likely to cause significant adverse environmental effects.
Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to sound outside a certain range.	Blasting assessments will ensure that 100 kPa is not exceeded and that blasting is not permitted if a marine mammal is sighted within a designated safety zone (180 dB re 1 µPa rms).		
Some marine mammals will exhibit avoidance of the area where vessels are involved in construction activities	Measures will include adherence to DFO Guidelines for blasting (setback distances, acoustic monitoring, visual monitoring, delay/resumption criteria etc.)		
PHASE: Operations			

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Noise, presence of structures, run-off, sedimentation, air emissions, effluent characteristics and lights.	Noise Reduction Measures, collision avoidance, settlement ponds and silt curtains, air quality monitoring and improvements, Waste water collection and treatment. Lighting illumination levels determined to minimize effects.	No significant negative effect on marine mammals during operational activities, including those effects from noise, possible vessel collisions with marine mammals, the presence of structures, lighting, air emissions, liquid effluent, as well as run-off and sedimentation.	Not Likely to cause significant adverse environmental effects.
Increased risk for a collision between marine mammals and tankers	Marine mammal protocols will be established for vessel traffic associated with the terminal in both the EPP and the Marine Terminal Regulations and Information handbook		
	A focus on avoidance of interaction		
Some marine mammals will probably exhibit a larger zone of avoidance around the terminal, given that sound levels will be higher	Vessels in the Marine Terminal area will be moving slowly as they approach and depart the wharf or jetty, thereby minimizing the risk of collision.		
	Vessels altering course to avoid any marine mammals; vessels maintaining consistent and/or reduced speed and travel direction; reducing speed when possible.		
	A program of marine mammal observations in the immediate terminal area will be implemented and any collisions or mortalities will be reported to DFO and investigated.		
PHASE: Decommissioning			
Similar to those experienced during construction of the Marine Terminal.	Similar to those experienced during construction of the Marine Terminal.	With the outlined mitigation measures in place, decommissioning activities at the Marine Terminal are predicted to have	Not Likely to cause significant adverse environmental effects.

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
	Mitigation measures will include permits, approvals, authorizations and implementation of the EPP and the Marine Terminal Regulations and Information handbook.	no significant residual effect on marine mammals.	
VEC: Marine Safety			
PHASE: Construction			
There is the potential for interference and/or gear and vessel damage with other vessels in the area around the Marine Terminal throughout the construction period.	Establishment of a Construction Safety Zone around the Marine Terminal and, during their actual construction, around the intake and outfall pipe routes.	With implementation of the proposed mitigation measures, in particular the Construction Safety Zone and effective communication with other marine users, residual effects on marine safety will be negligible.	Not Likely to cause significant adverse environmental effects.
	NLRC intends to investigate development of a vessel traffic management process for Come By Chance Bay with other users of the area		
	All vessels associated with construction will meet TC regulations and standards under the *Canada Shipping Act* as well as international regulations established by IMO.		
PHASE: Operations			
Potential effects are as outlined during construction – interference and/or gear or vessel damage with other vessels in the area.	Marine Terminal operations will be carried out in accordance with established national and international regulations, standards and codes of practice.	With implementation of the proposed mitigation measures, including the use of ISM and ISGOTT and the onsite Marine Manager, residual effects during operations will be minor to negligible.	Not Likely to cause significant adverse environmental effects.
	NLRC will follow the International Safety Management Code (ISM) developed by IMO		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
	All tankers calling at the Terminal will be required comply with all applicable IMO Conventions and recognized industry standards		
	The terminal will have the appropriate equipment and support facilities to handle all anticipated vessel traffic at the berth		
	During cargo transfer: there will be continual observations by both tanker and terminal personnel of the tanker and Marine Terminal, the Marine Terminal will be equipped with flood lights and operational cameras and monitoring equipment to detect leakage, spills or a change in position of the tanker while at the berth, weather, wind and wave conditions will be continuously monitored, loading/discharge operations shall be stopped in the event of electrical storms in the vicinity or when wind speeds reach a sustained 35 knots, and tankers shall leave the berth if wind speeds reach a sustained 40 knots with a deteriorating forecast.		
PHASE: Decommissioning			
In the event that the marine faculties are dismantled, marine equipment comparable to that used for construction will be used. The potential effects are comparable to those during construction – interference with other marine users.	Well-established communication and liaison procedures and mechanisms will be in place in the Project area that will avoid or minimize the potential negative effects of decommissioning activities	With implementation of the proposed mitigation measures, residual effects will be negligible.	Not Likely to cause significant adverse environmental effects.
	At the time of decommissioning, it may be decided to leave some of the seafloor structure in place: in this case the site would be marked and charted.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
VEC: Human Health and Safety			
PHASE: Construction			
There is the potential for interference and/or gear and vessel damage with other vessels in the area throughout the construction period.	Establishment of a Construction Safety Zone around the Marine Terminal and, during their actual construction, around the intake and outfall pipe routes.	Implementation of the proposed mitigation measures including effective communication with other marine users will be able to reduce the residual effects on human health and safety to minor during construction.	Not Likely to cause significant adverse environmental effects.
	Operational concerns will be discussed with other marine users of the area through the Placentia Bay Traffic Committee, the Project Fisheries Liaison Committee and other appropriate mechanisms.		
	NLRC also intends to investigate development of a vessel traffic management process for Come By Chance Bay with other users of the area		
PHASE: Operations			
Potential effects are as outlined during construction and include interference with other vessels in the area and/or gear or vessel damage.	The Project will work with other marine users of the area around the Marine Terminal to develop the approach/departure routes for vessels using the Marine Terminal.	Implementation of the proposed mitigation measures including effective communication with other marine users and ongoing liaison through key personnel such as the Fisheries Liaison Manager and Marine Manager will be able to reduce the residual effects to minor or negligible throughout terminal operations.	Not Likely to cause significant adverse environmental effects.
	The terminal will have a full time Marine Manager and dedicated fisheries liaison process in place.		
	NLRC will continue to use their community communication initiatives to inform other users of this area of the bay about the terminal's traffic, manoeuvring areas and procedures.		

POTENTIAL EFFECTS	MITIGATIONS	RESIDUAL EFFECTS	SIGNIFICANCE
Air emissions from vessels could also have effects on human health.	Air emissions from the tankers while at the terminal will be minimized through the use of best available technology and terminal procedures, such as vessels shutting down unnecessary engines while at the jetty. Emissions will meet air quality control guidelines. Covered conveyor systems for the loading of both coke and sulphur will minimize dust from these operations. Air emissions monitoring will be in place with results reported and available to the public.	With implementation of the proposed mitigation measures, residual effects will be negligible.	Not Likely to cause significant adverse environmental effects.
PHASE: Decommissioning			
The potential affects on human health and safety during decommissioning are comparable to those during construction.	Mitigative measures would be comparable to those in place for construction. By this time, the vessel traffic routes associated with the Marine Terminal would be well established and other marine users in the area would be familiar with them.	With implementation of the proposed mitigation measures, residual effects will be negligible.	Not Likely to cause significant adverse environmental effects.

12.2 Significance of Residual Effects

Based on the detailed analysis of environmental effects and mitigation measures considered to reduce or minimize or eliminate adverse environmental effects, the conclusion on the significance of adverse environmental effects of the undertaking after consideration of mitigation measures is presented in Table 12.2 below, which provides synthesis of the significance of residual effects.

Table 12-2 Conclusions of Significance of Adverse Environmental Effects After Mitigation

Impact Rating	Project										
Significance Rating: S = Significant I = Insignificant - = No Impact Level of Confidence: 1 = Low 2 = Medium 3 = High Likelihood/Certainty (probability of occurring): 1 = Low 2 = Medium 3 = High	Construction					Operations			Decommissioning & Rehabilitation		
	Site Preparation	Roads & Utilities	Marine Terminal Construction	Intake & Outfall	Accidents & Malfunctions	Marine Terminal Operation	Intake & Outfall	Accidents & Malfunctions	Land Activities	Marine Activities	Reclamation & Rehabilitation
Marine Water Quality											
Significance Rating	I	I	I	I	I	I	I	I	I	I	-
Level of Confidence	3	3	2	3	3	3	3	3	3	2	-
Likelihood	1	1	1	1	1	1	1	1	1	1	-
Sediment Quality &Transport											
Significance Rating	I	I	I	I	I	I	I	I	-	I	-
Level of Confidence	3	3	3	3	3	3	2	2	-	3	-
Likelihood	1	1	1	1	1	1	1	1	-	1	-

Impact Rating	Project										
Significance Rating: S = Significant I = Insignificant - = No Impact Level of Confidence: 1 = Low 2 = Medium 3 = High Likelihood/Certainty (probability of occurring): 1 = Low 2 = Medium 3 = High	Construction					Operations			Decommissioning & Rehabilitation		
	Site Preparation	Roads & Utilities	Marine Terminal Construction	Intake & Outfall	Accidents & Malfunctions	Marine Terminal Operation	Intake & Outfall	Accidents & Malfunctions	Land Activities	Marine Activities	Reclamation & Rehabilitation
Marine Fish and Fish Habitat											
Significance Rating	I	I	I	I	I	I	I	I	-	I	-
Level of Confidence	3	3	3	3	3	3	3	3	-	3	-
Likelihood	1	1	1	1	1	1	1	1	-	1	-
Freshwater Fish & Fish Habitat											
Significance Rating	I	I	-	-	I	-	-	-	I	-	I
Level of Confidence	3	3	-	-	3	-	-	-	3	-	3
Likelihood	1	1	-	-	1	-	-	-	1	-	1
Aquaculture/Commercial Fisheries											
Significance Rating	I	-	I	I	I	I	I	I	-	I	-
Level of Confidence	3	-	3	3	3	3	3	3	-	3	-

Impact Rating	Project										
Significance Rating: S = Significant I = Insignificant - = No Impact Level of Confidence: 1 = Low 2 = Medium 3 = High Likelihood/Certainty (probability of occurring): 1 = Low 2 = Medium 3 = High	Construction					Operations			Decommissioning & Rehabilitation		
	Site Preparation	Roads & Utilities	Marine Terminal Construction	Intake & Outfall	Accidents & Malfunctions	Marine Terminal Operation	Intake & Outfall	Accidents & Malfunctions	Land Activities	Marine Activities	Reclamation & Rehabilitation
Likelihood	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**
Migratory Birds											
Significance Rating	**I**	**I**	**I**	**-**	**I**	**I**	**-**	**S**	**I**	**I**	**I**
Level of Confidence	**3**	**3**	**3**	**-**	**2**	**3**	**-**	**2**	**3**	**3**	**3**
Likelihood	**1**	**1**	**1**	**-**	**1**	**1**	**-**	**1**	**1**	**1**	1
Species at Risk											
Significance Rating	**I**	**I**	**I**	**I**	**I**	**I**	**-**	**I**	**I**	**I**	**I**
Level of Confidence	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**3**	**3**	**3**
Likelihood	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	1
Marine Mammals											
Significance Rating	**I**	**I**	**I**	**-**	**I**	**I**	**-**	**I**	**-**	**I**	**-**

Impact Rating	Project										
Significance Rating: S = Significant I = Insignificant - = No Impact Level of Confidence: 1 = Low 2 = Medium 3 = High Likelihood/Certainty (probability of occurring): 1 = Low 2 = Medium 3 = High	Construction					Operations			Decommissioning & Rehabilitation		
	Site Preparation	Roads & Utilities	Marine Terminal Construction	Intake & Outfall	Accidents & Malfunctions	Marine Terminal Operation	Intake & Outfall	Accidents & Malfunctions	Land Activities	Marine Activities	Reclamation & Rehabilitation
Level of Confidence	3	3	3	-	3	3	-	3	-	3	-
Likelihood	1	1	1	-	1	1	-	1	-	1	-
Marine Safety											
Significance Rating	I	I	I	I	I	I	I	I	-	I	-
Level of Confidence	3	3	3	3	3	3	3	3	-	3	-
Likelihood	1	1	1	1	1	1	1	1	-	1	-
Human Health & Safety											
Significance Rating	I	I	I	I	I	I	-	I	-	I	-
Level of Confidence	3	3	3	3	3	3	-	3	-	3	-
Likelihood	1	1	1	1	1	1	-	1	-	1	-

13 Follow-Up Programs

Follow-up programs that address the federal scope for the Project are outlined below. The follow-up programs address a number of aspects of CEAA's Operational Policy Statement (OPS) for Follow-up Programs, including:

- The need to verify the accuracy of the environmental assessment predictions potential influence on ecosystem components valued by society;
- The need to address public concerns;
- A need to verify that mitigation measures were effective;
- Cumulative effects are a part of this assessment; and
- The nature of this Project warrants careful follow-up programs.

NLRC is committed to ensuring that any environmental effects that could result from the construction, operation, and decommissioning of the proposed Project are identified, avoided or minimized and managed effectively.

Follow-up compliance monitoring will be associated with permits, approvals and authorizations. The follow-up program will be used to measure the effectiveness of mitigation and/or avoidance measures taken to protect the environment; to compare the actual effects of the Project with those predicted within this CSR; and to identify problem areas and set priorities for stricter environmental controls or enforcement action. NLRC will also have follow-up programs to monitor the effectiveness of certain commitments, such as those related to working with the area fish harvesters.

Follow-up programs will be developed according to regulatory conditions and in consultation with regulators and the Community Liaison Committee (NLRC Project Registration, 2006). Details for all Follow-up programs will be submitted to regulatory agencies for approval. The results of Follow-up programs will be summarized and made available to the public on a regular basis.

Follow-up programs for the Project proposed by NLRC include:

13.1 Fish and Fish Habitat

NLRC will work with DFO to develop a Fish Habitat Compensation Plan for both the freshwater and marine areas affected by the Project. Each area of compensatory habitat under the Fish and Fish Habitat Compensation Strategy and subsequent Plan will be monitored to ensure that the physical attributes of the habitat are being maintained (e.g., substrate placement, habitat stability) as well as the anticipated net production increases are achieved.

NLRC proposes to develop and carry out a freshwater monitoring program in the general area of the proposed development in collaboration with ongoing community stewardship initiatives such the Salmon Stewardship group.

NLRC intends to install a fully automated hydrometric (flow and quality) station on Watson's Brook as soon as practical and, in the interim, is taking measurements manually. NLRC has added a water quality sensor to the hydrometric station on the Come By Chance River.

13.2 Marine Water and Sediment Quality

NLRC will design and implement a marine sampling station network in the Project area in consultation with the appropriate regulatory agencies.

13.3 Oceanographic Data Collection

NLRC is continuing field programs in order to enhance the data set available for the design of monitoring programs and confirmation of the discharge outfall design and oil spill modeling. These programs include the collection of additional oceanographic data. NLRC will continue to support the SmartBay project.

13.3.1 NWPA Conditions of Approval

Monitoring necessary to ensure adherence to NWPA conditions.

13.4 Marine Safety

Monitoring to ensure compliance with all applicable regulations of the *Canada Shipping Act* and relevant International Maritime Organization (IMO) Conventions including the International Convention for the Safety Of Life At Sea (SOLAS), International Convention for the Prevention of Pollution from Ships (MARPOL), and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).

NLRC will continue with the TERMPOL Review Process and address the requirements of an OHF.

13.5 Human Health and Safety

Air emissions modeling for the Marine Terminal will be repeated as engineering design advances. The results will be discussed with the community advisory group and presented in a public meeting. NLRC has also committed to establishing a network of air

quality monitor stations and regular reviews of the health status profile for nearby communities.

13.6 Environmental Effects Monitoring

NLRC will include monitoring of effects on marine organisms meant for human consumption, using blue mussels from aquaculture facilities in Placentia Bay. Mussels would be transported to the monitoring site(s) and placed in cages suspended in the water column at strategic locations. Samples will undergo tainting evaluation and analysis for oil content and other deleterious substances. The potential for a monitoring program that includes the newly established scallop 'reef' in North Harbour will be considered. The Follow-up program will be developed in collaboration with pertinent government agencies.

13.7 Fisheries Liaison

NLRC will employ a full time Fisheries Liaison Manager to ensure commitments made in the EIS and CSR are met and are effective.

13.8 Species At Risk

NLRC will do additional surveys prior to construction to determine presence of *Erioderma pedicellatum* in the Marine Terminal area and, if it is, take effective mitigation measures.

13.9 Site Environmental Monitors

NLRC will have on-site environmental monitors to ensure implementation of the EPP and the effectiveness of environmental protection measures.

14 Conclusions

TC and DFO have consulted with expert FAs, the public and other relevant stakeholders during the comprehensive study process.

Based on information contained in the CSR and taking into account the implementation of mitigation measures, the RAs conclude that the Project is not likely to cause significant adverse environmental effects.

15 References and Supporting Documents

The documents entitled: Newfoundland and Labrador Refinery Project: Environmental Impact Statement, "Volume 1 - Summary and Conclusions, Volume 2 - Project Description and Planning, Volume 3 - Biophysical Assessment, Volume 4 – Socio-Economic Assessment, Volume 5 – Public Consultations, and the Map and Drawings Folio" and the supporting component studies, have been used as supporting documentation for the development of the CSR and in ascertaining the extent and significance of impacts on VECs in the area of the proposed Southern Head Marine Terminal. These supporting documents were developed in response to the Guidelines for the preparation of the EIS provided by a joint Federal/Provincial EA Committee following its consultations with other federal/provincial authorities and the public.

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