Summary

Project Eider Rock
Environmental Impact Assessment Report

For the proposed petroleum refinery and marine terminal
by Irving Oil Company Limited in Saint John, New Brunswick

Prepared by the
New Brunswick Department of Environment

August - 2009

New Nouveau Brunswick

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Introduction

The Environmental Impact Assessment (EIA) Report for Project Eider Rock covers more than 1,600 pages, including 3 Volumes, 25 Chapters and an Executive Summary. A list of References is contained in Chapter 25, and the Appendices provide a glossary of technical terms, as well as explaining the acronyms and units used throughout the text. In addition to the narrative, the Report includes 338 tables and 207 separate figures. It was prepared by Jacques Whitford Stantec Limited, on behalf of Irving Oil Company Ltd.

The full Report contains extensive detail on all aspects of the EIA process, its regulatory framework, as well as the technical studies and assessments conducted on behalf of the Project Proponent, Irving Oil Company Ltd., since Final Guidelines for the Environmental Impact Assessment were issued by the NB Minister of Environment in June, 2007.

New Brunswick Department of Environment (NBENV) Summary

This summary of the Project Eider Rock EIA Report has been prepared by the New Brunswick Department of Environment (NBENV), to assist the public in becoming familiar with the results of the assessments described in the full document, the key issues identified, and the conclusions reached by the Study Team.

Since the EIA Report is more than 1,600 pages in length, a primary focus of the NBENV Summary is to serve as a detailed guide to the full document, as well as summarizing its key contents.

Both this NBENV summary, which totals 208 pages, and the full EIA Report prepared by Jacques Whitford Stantec, are now available for review and/or downloading from the internet, at the following locations:

Project Eider Rock EIA Summary - www.gnb.ca/0009/0377/0002/0005-e.asp

Project Eider Rock EIA Report - www.irvingoil.com/company/erock.asp

As required by the New Brunswick EIA Regulation, both documents are also available for public review at the locations in Saint John and Fredericton listed on page 5. Given their relative size, however, it is expected that that many interested stakeholders and members of the public may prefer to access them electronically. The full EIA Report, as well as the NBENV Summary is available in PDF format.

The third component of the Project Eider Rock EIA documentation is a ‘General Review Statement’ concerning the full EIA Report, issued by the NB Technical Review Committee (TRC). The TRC is a group of diverse technical specialists from various government agencies, who were appointed by the NB Minister of Environment in 2007, specifically concerning this EIA process. The TRC General Review Statement, in response to the EIA Report, is also available for public review at the locations listed on page 5, and accessible, in PDF format, for review and/or downloading at:

Project Eider Rock General Review Statement - www.gnb.ca/0009/0377/0002/0005-e.asp

To provide an additional option in this regard, individual CD copies of the NBENV Summary and the TRC General Review Statement are available to stakeholders and members of the public on request, free of charge. To obtain such CD copies, please contact either of the Department offices listed below:

NBENV Environmental & Local Government Initiatives Branch

20 McGloin Street, E3A 5T8
P.O. Box 6000, Fredericton, NB, E3B 5H1

Tel: 506-453-3700
Fax: 506-453-3843
Email: eia-eie@gnb.ca

NBENV Region 4 Saint John

8 Castle Street, E2L 3B8
P. O. Box 5001, Saint John, NB, E2L 4Y9

Tel: 506-658-2558
Fax: 506-658-3046

Opportunity for Public Comment

Following the release of EIA documentation for review, the public is invited to comment on the report and attend the public meeting which is scheduled as follows:

November 18, 2009
7:00 p.m.
Simonds Lions Auditorium
185 Loch Lomond Road, Saint John, NB

To register to make a presentation at the public meeting, please contact the New Brunswick Department of Environment (NBENV) at (506) 453-3700 (collect). The public meeting will also provide opportunity for general comments. Simultaneous interpretation services will be provided.

To submit **written comments, which should be received on or before December 4, 2009** or 15 days following the date of the public meeting, please forward them in the official language of your choice to:

Environmental and Local Government Initiatives Branch
NB Department of Environment
P.O. Box 6000 (20 McGloin Street), Fredericton, NB E3B 5H1
Tel: (506) 453-3700, Fax: (506) 453-3676, Email: eia-eie@gnb.ca

At the end of this period, a summary of public input will be prepared and made available to the public.

Summary Focus

This NBENV Summary is focused on the 24 Chapters in the full Report, which specifically discuss the EIA study. A key objective during preparation of this Summary was to produce a document which would be relatively manageable in size for members of the public. With this in mind, only two of the 207 figures and 338 tables from the full Report have been reproduced in this NBENV Summary.

Another approach taken to reduce the Summary's length, to the maximum extent possible, was to list, by title only, some of the introductory sub-headings included in various Chapters of the Report, without presenting their content in any detail. As noted above, the full EIA Report is now posted on the Internet, and all those interested in pursuing such further detail, within the listed sub-sections, are encouraged to seek that particular information anytime by accessing:

Project Eider Rock EIA - www.irvingoil.com/company/erock.asp

The technical methods used by EIA study teams typically involve application of similar assessment procedures, consistent interpretation models, and equivalent testing criteria on a series of different Valued Environmental Components (VECs), project components, environment settings, time frames, etc. Understandably, the resulting narrative text in such EIA Reports frequently repeats the same context-setting phrases in most sub-sections of the document, although the specific focus is on different subjects.

To control the overall length of this NBENV Summary, a considerable amount of editing took place to remove some of this repetitive context-setting text material. The constant highest priority during this process was to ensure that the central content of Report narrative was captured, and highlighted, throughout the Summary.

Whenever an interested stakeholder or member of the public wishes to go further than the Summary text, and examine the relevant sections of the full Report, the availability of both documents at the above web addresses, and/or the CD copies noted above, are aimed at assisting that process.

Below are locations where print copies of the Project Eider Rock EIA Summary and General Review Statement are available and where the complete Project Eider Rock EIA Report can be viewed:

<u>Saint John</u>

- NBENV Saint John Office, 8 Castle Street, Saint John E2L 3B8
- City of Saint John: 11th Floor, 15 Market Square, City Hall, Saint John, NB E2L 4L1
- Saint John Regional Public Library, 1 Market Square, Saint John, NB E2L 4Z6
- Saint John Public Library – East Branch, 545 Westmorland Road, Saint John, NB E2J 2G5
- Service New Brunswick Centre - Saint John, 15 King Square North, 1st Floor, Saint John, NB E2L 4Y9
- Bayview Convenience, 1197 Red Head Road (near Mispec), Saint John, NB E2P 1K2

<u>Fredericton</u>

- NBENV Marysville Place, 20 McGloin Street, Fredericton, NB E3A 5T8
- NBENV Fredericton Region, 565 Priestman Street, Fredericton, NB E3B 5X8

Project Eider Rock EIA Report Summary - NBENV

Chapter 1 - Introduction

Volume 1 of the Report includes 6 Chapters and covers a total of 517 pages. In addition to the narrative text, this volume provides detailed information in 120 separate tables and 106 illustrative figures. Chapter 1 covers Pages 1-1 to 1-12 and begins by describing the proposed Project, which would involve development of a new petroleum refinery, marine terminal, and associated land-based and marine-based infrastructure, in the Red Head area, near east Saint John. The location proposed for the Project is shown in Figure 1.1 of the Report, which is reproduced in this Summary on page 210.

The Report notes that the Project is designated as an 'undertaking' under New Brunswick's Environmental Impact Assessment (EIA) Regulation. Final Guidelines for the required EIA study were issued on June, 4, 2007 by the NB Minister of Environment.

The text also points out that elements of the Project require an environmental assessment (EA) under the Canadian Environmental Assessment Act (CEAA*).* Although these elements are assessed in the EIA Report, the specific requirements of the federal EA under CEAA are addressed in a separate Comprehensive Study Report (CSR). The CSR has been developed in response to the Environmental Assessment Track Report ("EA Track Report") and Scoping Document issued on November 21, 2007 by Department of Fisheries and Oceans Canada (DFO); Transport Canada (TC); and Environment Canada (EC).

The Report states that the Proponent has taken great strides to align its planning and design with principles and practices of sustainable development. During both construction and operation, it notes that the Project would make a strong contribution to the local and provincial economies through associated direct, indirect and induced employment, and business opportunities. For environmental considerations, the Report states that planning and design of the Project has focused on the management of potential environmental effects, so that it could be constructed and operated in a manner which ensures there would be no significant adverse environmental effects.

Organization of the Report

The EIA Report is organized in three volumes and 25 chapters, as follows.

- Chapter 1 provides an introduction to the Report, identifies the Proponent and provides a brief Project overview, provides context for the Project, and outlines the structure and content of the EIA Report.

- Chapter 2 describes the planning of the Project, including the history and overview of the petroleum refining industry; outlines the principles and philosophies espoused by the Proponent for the design, construction, and operation of the Project; discusses the Project schedule, including a consideration of phasing the pace and sequence of construction, and identifies the environmental management initiatives and practices that would be implemented as part of the Project to minimize environmental effects.

- Chapter 3 provides a detailed Project Description of the proposed elements of Project Eider Rock on land, and in the marine environment, including alternative means of carrying out the Project, and describes how the Project would be constructed, operated,

ultimately decommissioned, and abandoned. Emissions and wastes, and a summary of key technical studies undertaken as part of the EIA/EA to assist in characterizing its potential environmental effects, are also provided.

- Chapter 4 provides a discussion of the applicable regulatory framework, including the regulatory requirements for the EIA/EA; the scope of the Project and the scope of the EIA/EA; a summary of public, stakeholder, Aboriginal, and regulatory consultation and engagement efforts; and other matters relevant to the scoping of the EIA/EA.

- Chapter 5 provides a description of the methodology used to conduct the EIA/EA to meet the requirements of the NB EIA Regulation and CEAA.

- Chapter 6 provides a summary of the existing environmental setting of the Saint John Region, including the historical setting, ecological context, and socio-economic context. A list of other projects and activities that are considered for the assessment of cumulative environmental effects is also provided.

- Chapters 7 to 21 provide an assessment of potential environmental effects, including cumulative environmental effects, for each Valued Environmental Component (VEC) of relevance and importance to the EIA/EA.

- Chapter 22 provides an assessment of the effects of the environment on the Project.

- Chapter 23 provides an assessment of potential accidents, malfunctions, and unplanned events.

- Chapter 24 provides closing remarks and a statement of limitations in respect to the EIA/EA.

- Chapter 25 provides the references cited in the EIA Report.

Appendix A to the Report provides a concordance table that shows where the specific requirements of the provincial Final Guidelines are addressed in the EIA. Appendices B and C provide a glossary of technical terms and a list of acronyms and units used in the Report, respectively.

Chapter 2 – Project Planning

Chapter 2 covers Pages 2-1 to 2-22. It begins with a brief history and overview of the petroleum refining industry, Irving Oil itself, and the market context for the proposed Project.

The Report states that the Proponent has developed and planned the Project with a number of commitments in mind. Specifically, a successfully designed and constructed Project Eider Rock refinery would:

- Be readily adaptable to the changing global market;
- Result in a minimal environmental footprint in air contaminant and greenhouse gas emissions, water use and wastewater release, and energy use, on a per unit basis of output delivered to the customer;
- Use the best available proven technology that is economically achievable for environmental performance and reliability;

- Incorporate human factors such as lighting, ergonomics, health, and general worker well-being into the design, to enhance the lives of Project workers and, after start-up, operational personnel; and
- Support the economic, environmental, and energy goals of New Brunswick and its people.

The Report states that the environmental technology selected for the Project would be:

- Best for the protection of the environment and society as a whole;
- Available to allow implementation, under economically and technically viable conditions, taking into consideration cost and benefits of the technology;
- Proven, by existing units in use in a similar service and of similar size to the unit proposed; for the Project; and
- Economically viable, among technologies that serve a similar purpose.

Criteria used to select technologies would include:

- Proven operation;
- Proven reliability;
- Long-term viability, taking into account existing facilities and planned development;
- Cross-media impacts including material use, energy use, emissions, and noise;
- Economic viability.

The Report also notes that the Project would be designed to balance the use of energy efficient technology to lower the potential for greenhouse gas emissions, and constructed so that it has options for future carbon capture and sequestration, or conversion ability for the emission of greenhouse gases through technology advancements or environmental innovation.

Alternative means of carrying out key portions of the Project are being considered as well, in an effort to reduce the anticipated demand on natural resources (*e.g.,* alternatives to reduce water consumption).

Chapter 2 confirms that the Proponent would continue to be proactive in its engagement of the public, neighbours, stakeholders and government agencies. Communication would be frequent, open, inclusive and transparent, and would occur directly with stakeholders through speaking opportunities, stakeholder engagement, and one-on-one discussions, as well as through media. The Project's engagement and consultation program is described in more detail in Chapter 4.

Project Purpose

The purpose of the Project being assessed under the New Brunswick EIA Regulation is to build and operate a petroleum refinery with a rated nameplate capacity of up to 250,000 barrels per day of crude oil, and associated land-based and marine-based infrastructure in Saint John, New Brunswick, for supplying refined petroleum products to the North American market and elsewhere. The Report states that the Project is intended to achieve the following outcomes:

- Increase the scale and complexity of Irving Oil's existing petroleum refining and distribution infrastructure in Saint John, thereby protecting the existing refinery from future economic risks;
- Supply incremental ultra-low sulphur gasoline, diesel fuel, and other products for the North American market and elsewhere;

- Increase the reliability of supply of refined petroleum products for the North American market;
- Support the development of an Energy Hub in New Brunswick;
- Contribute to and preserve existing economic prosperity by creating and maintaining employment and related economic spin-off activities of existing and proposed facilities;
- Support the Province of New Brunswick in its goal of achieving self-sufficiency by 2026, by providing the key components of a sustainable and fiscally stable future for New Brunswick; and
- Maintain long term viability of the existing refinery.

Alternatives to the Project

The Report notes that the Final EIA Guidelines and EA Track Report required that the "Null" or "Do Nothing" alternative be considered. It states that, given the potential adverse environmental effects of the Project are not likely to be significant, while the positive environmental effects are substantial, those positive outcomes would not be realized.

It further states that the Project is critical for the long term management of business risk for Irving Oil. Not proceeding would undermine efforts of the Province to achieve self-sufficiency and to realize and grow the Energy Hub. As such, the Report states that the Null alternative is not a reasonable or viable alternative to the Project; does not meet the Project purpose, and is not considered further in the EIA/EA.

Alternative Siting

The Project could conceivably be sited elsewhere in east Saint John; Saint John; New Brunswick; or elsewhere. The Report states that site locations outside of east Saint John were not considered viable, because the Proponent's existing refining and related infrastructure is located there. Three other locations were reviewed and evaluated by Irving Oil within east Saint John for carrying out the Project - Grandview Avenue, near the existing Saint John refinery; Black Point; and Red Head Mountain. It was determined that neither of these sites would be suitably sized and alternative locations were not considered further.

Alternative Energy Supply

Some stakeholders have suggested that a new petroleum refinery should not be built, but instead, the Proponent should explore alternative sources of energy generation. The Report states that, while alternative energy sources such as hydro, wind, solar and tidal energy play a key and growing role in satisfying a portion of the energy demands for this market, it is very unlikely that consumer demand for petroleum products will decrease in the next few decades. Further, the increasing trend toward refining of heavier crude oil requires facilities designed to be able to refine these heavier crudes. The Report states that the proposed Project is thus ideally positioned to meet this demand and provide the supply in an environmentally responsible way.

Environmental Management

A variety of environmental management policies, procedures, and systems would be developed for the Project and are generally described in Section 2.9, which covers pages 2-13 to 2-22 under the following sub-headings:

- Health, Safety, and Environmental Management System
- Building Design Codes
- Standard Operating Procedures (Commissioning, Operation, and Maintenance)
- Training Manual
- Public Awareness and Communication
- Environmental Protection Plan for Construction
- Emergency Response Plan for Operation
- Oil Pollution Emergency Plan
- Overall Response Strategies
- Spill Response Equipment Requirements
- Spill Management Simulations
- Operational Response Drills
- Marine Terminal Operation
- TERMPOL Review Process
- Marine Terminal Manual
- Greenhouse Gas (GHG) Management Plan
- Groundwater Monitoring Program
- Vegetation Management Plan
- Decommissioning and Abandonment Plan
- Follow-Up and Monitoring Initiatives

Chapter 3 – Project Description

The third chapter of the Report covers pages 3-1 to 3-391 and provides an extensive, highly detailed description of the Project. It begins by listing the facilities, assets, components, processes, and infrastructure involved, which would include:

- A petroleum refinery for refining crude oil and other feedstock into various finished products
- Linear facilities, including right-of-ways (ROWs) for pipelines, electrical power transmission, coke conveying, rail, and access roads to the facility
- Tanks for storing crude oil, intermediate products, finished products, chemicals, and water and wastewater
- Other infrastructure facilities to produce or supply the refinery complex with hydrogen, steam, electricity and water
- Environmental control systems to control atmospheric emissions, wastewater releases, and solid wastes
- A marine terminal and other marine-based infrastructure
- Facilities for the receipt and transfer of crude oil, consisting of a new crude oil berth to be constructed on a common jetty along with berths for the transfer of finished products and the use of the existing single buoy mooring (SBM)
- Facilities for the shipping and transfer of finished products and coke, consisting of two finished product transfer berths and two coke loading berths, to be constructed on a common trestle along with the crude oil berth
- A barge landing facility for unloading large modules during Construction, constructed on a temporary or permanent basis
- Other marine-based infrastructure such as a combined wastewater/seawater cooling outfall in the marine environment, and a cooling water intake structure.

The general location of the various facilities, assets, components, processes, and infrastructure associated with the Project is shown in Figure 3.1 of the Report, which is reproduced in this Summary on page 211.

Construction and Operation

Specifics on construction and operation of the Project until its decommissioning stage are provided in Sections 3.2 and 3.3, covering pages 3-2 to 3-119.

The refinery would be designed with a rated nameplate capacity of up to 250,000 barrels per day of crude oil. Over time, with efficiencies and optimization, the Report states that it could potentially process up to 300,000 barrels of crude oil on a daily basis, depending on operating conditions. In addition, the refinery would be able to process up to an additional 70,000 barrels per day of intermediate petroleum products from other sources, such as the existing Saint John refinery in east Saint John, or other sources.

The crude oil would be supplied by marine tanker ships which would deliver their cargo via a new and an existing marine terminal facility. Other raw materials (*e.g.,* water, natural gas, intermediate products, blendstock, and chemicals) would be supplied via pipelines or by ship, truck, and rail.

Refined products would be delivered to markets primarily via marine tanker ships and/or barges, with some by-products (*e.g.,* sulphur, propane, and butane) shipped by rail and/or pipeline. Some intermediate products might be transferred via pipeline, from and to, the existing Saint John refinery in east Saint John. In addition to the detailed descriptive text in Sections 3.2 and 3.3, 8 tables are provided, as well as 26 figures presenting illustrations, schematics and conceptual images.

Emissions and Wastes

Section 3.4 of the Report covers pages 3-119 to 3-154 and begins by explaining that emissions include air contaminants, greenhouse gases (GHG), sound, and light. Details on the Emissions Inventory Methodology are also provided, together with a list of Chemicals of Potential Concern (COPC). The source for each type of predicted emission or waste and a related description is presented under the following headings:

- Air Contaminant and GHG Emissions
    - Emissions Inventory Methodology and chemical of potential concern (COPC) List Development
    - Emissions from Construction of the Petroleum Refinery and Other Land-Based Infrastructure
    - Emissions from Road Vehicle Traffic to the Site
    - Emissions from Non Road Equipment
    - Emissions from Site Preparation Activities
    - Particulate Matter from Concrete Batch Plants
- Emissions from Construction of Marine Terminal and other Marine Infrastructure
- Emissions from Operation of the Refinery Complex and other Land Infrastructure
    - Emissions from Petroleum Refinery Point Sources
    - Emissions from Coke Handling and Storage
    - Emissions from Storage Tanks
    - Emissions from Valves, Fittings and Wastewater Treatment
    - Emissions from Rail Loading
- Emissions from Project-Related Vehicle Traffic

- Emissions from Operation of Marine Terminal and other Marine Infrastructure
    - Marine Vessel Traffic Emissions
    - Marine Vessel Loading Emissions
- Overall Summary – Total Emissions during Operation
- Sound Emissions
    - Construction
    - Operation
- Light Emissions
- Wastewater
    - Process Wastewater
    - Site Run-off
    - Cooling Water
- Water Use
    - Construction Water for Concrete Mixing
    - Hydrotest Water
    - Operation Water Use
- Solid Waste Construction
    - Construction
    - Sanitary Waste
- Solid Waste Operation
    - Sanitary Waste
    - Office Waste
    - Maintenance Waste
    - Hazardous Waste

Key Technical Studies

Section 3.5 provides summary information on Key Technical Studies conducted in support of the EIA/EA and covers pages 3-154 to 3-391. In addition to text material, this section presents a broad range of information in 41 tables and 48 figures.

Atmospheric Environment Technical Studies

Three Technical Studies were carried out on Air Quality, Sound Quality and Lighting respectively. The sub-headings detailed under these respective studies are:

- Air Quality Technical Study - Summary
    - Study Methodology
    - Chemicals of Potential Concern
    - Modelling Domains
    - Ambient Air Quality Monitoring
    - Emissions Inventory
    - Dispersion and Deposition Modelling Methodology
    - Model Description
    - Model Selection
    - Dispersion Modelling Approach
    - Criteria Air Contaminants
    - Non-Criteria Air Contaminants (non-CAC)
    - Secondary Particulate Formation
    - Potential Acid Input
    - Long-Range Transport
    - Odour

    - Plume Visibility
    - Ozone
    - Ambient Concentrations and Background
    - Dispersion and Deposition Modelling Results
    - Air Quality Technical Study – Summary of Main Observations
    - Greenhouse Gas Emissions and Climate Considerations
    - Climate Change Policy and Regulations
    - Projected GHG Emissions from the Project
    - GHG Emissions from the Project in Comparison to Local, Provincial, National and Global Totals
    - Weather and Climate Effects on the Project

- Sound Quality Technical Study - Summary
    - Existing Sound Quality
    - Expected Project Noise Emissions - Construction
    - Expected Project Noise Emissions – Operation

- Lighting Technical Study - Summary
    - Baseline Light Measurements – Existing Saint John Refinery and Refinery Project Development Area (PDA)
    - Prediction of Project-Related Light Quality

<u>Human Health and Ecological Risk Assessment (HHERA) Technical Study</u>

Section 3.5.2 covers pages 3-258 to 3-305. It begins by noting that that federal and provincial regulatory agencies, as well as area residents and stakeholders, have identified the need to evaluate the potential health risks to people and wildlife that could be exposed to substances that might be released by the Project to the atmosphere and other media.

The Report explains that government agencies and scientists around the world have developed a process to understand the movement of chemicals in the environment, and to assess whether or not exposure to these chemicals by people and wildlife may be linked with potential environmental effects on health. This process is called human health and ecological risk assessment (HHERA).

A detailed breakdown of the HHERA process is then provided under the following sub-headings:

- Fundamentals of Risk Assessment
- Project Alone Case HHERA
- Potential Chemical Releases from the Project to the Atmosphere
- The Assessment Area, Receptor Locations and Human and Ecological Receptors
    - Human Receptors
    - Ecological Receptors
- Exposure Assessment
    - Exposure Point Concentrations
    - Human Receptor Exposure to chemicals of potential concern (COPC)
    - Ecological Receptor Exposure to COPC
- Assessment of Chemical Hazard
- Risk
    - Non-Cancer Causing Chemicals
    - Cancer-Causing Chemicals
- Results of the Human Health and Ecological Risk Assessment (HHERA)

    - Human Health Risk Characterization
    - Criteria Air Contaminants – Inhalation Risk Assessment
    - Non-Criteria Air Contaminants (non-CAC) – Inhalation Risk Assessment
    - Multiple Pathway Assessment at Human Health Risk Assessment (HHRA) Receptor Locations
    - Ecological Risk Assessment (ERA)
- Human Health and Ecological Risk Assessment (HHERA) – Summary of Main Observations

Effluent Release Modelling Technical Study

Section 3.5.3 covers pages 3-305 to 3-326 and begins by explaining that, during operation of the Project, cooling water would be pumped to the refinery and re-circulated back to the Bay of Fundy. A detailed breakdown of this study is provided under the following sub-headings:

- Sources of Information
- Site Specific Characteristics
- Hydrodynamic Parameters
- Water Quality Parameters
- Results
    - Effluent Outfall - Seawater Cooling Option
    - Effluent Outfall – Cooling Tower Option
    - Effluent Release Modelling
- Effects of Extreme Environmental Conditions
- Effluent Release Modelling Technical Study – Summary of Main Observations

Marine Ecological Risk Assessment (MERA) Technical Study

Section 3.5.4 summarizes the MERA and covers pages 3-326 to 3-361. It begins by explaining that the purpose of this type of study:

- Characterize the quality of the process effluent wastewater treatment plant effluent and determine which constituents are chemicals of potential concern (COPC).
- Model the dispersion of the effluent discharged from the marine outfall;
- Determine the distribution and movement (fate and transport) of COPC in the marine environment, considering that substances may be deposited in both near-shore and offshore sediment.
- Provide information to assist in the assessment of the potential exposure of ecological receptors to COPC through direct exposure, food-chain pathways or both.
- Provide information to assist in the assessment of the acceptability of environmental exposures to COPC using an Ecological Hazard Quotient (EHQ) based on the ratio of exposure concentrations and Toxicity Benchmarks or Toxicity Reference Values, where an EHQ less than 1.0 will be considered acceptable.

Detailed summary information is provided on the MERA under the following headings:

- Purpose
- Framework and Setting
    - Risk Assessment Framework Spotted Sandpiper
- Problem Formulation
    - Spatial and Temporal Extent of the Study
    - Emission Sources Included in the Model

    - Screening of Ecological Receptors
    - Near Shore and Offshore Sediment Communities
    - Near Shore and Offshore Aquatic Communities
- Conceptual Exposure Model
- Exposure Assessment
- COPC Fate and Transport Modelling
- Estimating Receptor Exposure to COPC
- Toxicity Assessment
- Risk Characterization
- Conservatism in the MERA
- Marine Ecological Risk Assessment Technical Study – Summary of Main Observations

Visual Environment Technical Study Summary

Section 3.5.5 covers pages 3-361 to 3-377. It begins by explaining that this study used Geographical Information System technologies in order to best illustrate the visibility of the proposed Project infrastructure on the landscape. Multiple models were developed in order to determine the best method of illustration, including digital terrain models, viewsheds, 3-D object models, 3-D photo montages, and renderings. Summary information from the study is provided in the following sub-sections:

- Methods
- Data Sources and Limitations
- Technology Application
- Viewshed Analysis
- Preparation of 3-D Photo Montages
    - Results
    - Saint John Airport Approach Flight Path Separation

Linear Facilities Corridor Selection Technical Study – Summary

Section 3.5.6 covers pages 3.377 to 3.391 and explains that this study was aimed at identifying a Preferred Corridor and any technically and economically feasible Alternative Corridors, for linear facilities between the Project and the existing refinery. Linear corridors were also identified between individual Project components. Summary information is then provided in the following sub-sections:

- Data
- Identification of Potential Corridors
- Public and Stakeholder Consultation and Input
- Corridor Selection Methods and Criteria
- Corridor Selection Results

Chapter 4 - Regulatory Framework, Scoping, Consultation and Engagement

This chapter covers pages 4-1 to 4-32 and presents detailed information:

- Summarizing the regulatory framework applicable to the Project, including the provincial EIA and federal EA requirements as well as other applicable approvals, permits, and authorizations that will be required to enable the Project to be carried out;

- Describing the scope of the EIA/EA as determined by the provincial and federal regulatory agencies responsible for the EIA/EA of the Project under their respective scoping processes;
- Summarizing the issues and comments received from the public, stakeholders, and Aboriginal persons during public, stakeholder and Aboriginal engagement activities for the Project; and
- Identifying the valued environmental components (VECs) selected for the EIA/EA to address the requirements of the Final Guidelines, EA Track Report and public/stakeholder/Aboriginal concerns.

The regulatory framework applicable to the Project and the Scope of the EIA/EA are summarized under the following headings:

Regulatory Framework

- New Brunswick Environmental Impact Assessment Regulation
    - EIA Process for Project Eider Rock
    - Technical Review Committee (TRC)
- Canadian Environmental Assessment Act
    - EA Process for Project Eider Rock
- Other Approvals, Permits, and Authorizations

Scope of the EIA/EA

- New Brunswick Environmental Impact Assessment Regulation
    - Scope of Project
    - Factors to be Considered
- Canadian Environmental Assessment Act
    - Scope of Project
    - Factors to be Considered

Public Consultation and Engagement

The Report notes that the public consultation and engagement program conducted as part of the EIA/EA process was an important vehicle for the identification, scoping, and resolution or mitigation of potential issues of concern. It states that all issues identified in the course of consultation and engagement activities were tracked and responded to, when appropriate. Issues, questions, concerns or comments, raised through consultation and engagement initiatives, were documented as they arose, so they could be considered, as appropriate, in the EIA/EA.

The consultation and engagement program included regulatory consultation, First Nations engagement, and public and stakeholder consultation. The Report notes that some engagement activities and initiatives were designed to specifically target only one or more of these groups, while most were designed to reach all three. The program included individual briefings, discussions and Open Houses with First Nations communities, Public Open Houses in East Saint John, Technical Workshops, meetings with Key Stakeholder Groups and individual ‘door to door visits’ in the Red Head area.

A variety of information tools were used, including: Project information brochures, Project website, a Toll-free information line and direct mailings.

The Report states that a Project website was continually updated with information, and various documents made available for download. A toll-free information line was established to receive calls from the public and to respond to inquiries, while the website also contained a feedback option.

Together with the text material, the following seven tables are provided in this regard, which summarize consultation and engagement initiatives carried out by the Proponent as part of the assessment process; the key issues and concerns received from the public, stakeholders and First Nations groups, and the response or action taken as a result.

- Table 4.3 – Summary of Meetings Held with Federal and Provincial Government Departments and Agencies
- Table 4.4 - Locations, Dates, and Attendees of First Nations Open Houses
- Table 4.5 - Summary of Key Issues and Concerns Raised During First Nations Engagement activities
- Table 4.6 - Summary of Key issues and Concerns Raised by the Public During Open Houses
- Table 4.7 – Summary of Key Stakeholder Meetings
- Table 4.8 - Information Provided to Red Head Residents
- Table 4.9 - Summary of Key Comments and Issues Received and Response/Action Taken

Selection of Valued Environmental Components (VECs)

Based on the requirements of the Final Guidelines and the EA Track Report, and in response to the issues and comments received from the public, stakeholders, First Nations, and regulatory agencies, the Report states that 15 VECs were selected for conducting the environmental effects assessment of the Project. They are:

- Atmospheric Environment (found in Chapter 7)
- Water Resources (found in Chapter 8);
- Health and Safety (found in Chapter 9);
- Freshwater Aquatic Environment (found in Chapter 10);
- Terrestrial Environment (found in Chapter 11);
- Wetland Environment (found in Chapter 12);
- Marine Environment (found in Chapter 13);
- Commercial Fisheries (found in Chapter 14);
- Labour and Economy (found in Chapter 15);
- Community Services and Infrastructure (found in Chapter 16);
- Land Use (found in Chapter 17);
- Current Use of Land and Resources for Traditional Purposes by Aboriginal
- Persons (found in Chapter 18);
- Heritage and Archaeological Resources (found in Chapter 19);
- Land-Based Transportation (found in Chapter 20); and
- Marine Vessel Traffic and Navigation (found in Chapter 21).

The Effects of the Environment on the Project were also selected for assessment (Chapter 22), considering the nature and location of the Project, the changing global climate, and the potential expenditures that could result from an adverse effect of the environment on the Project.

Finally, in recognition of public concern and the importance of a defensible and comprehensive assessment of accidents, malfunctions, and unplanned events that could occur during the various phases of the Project, a separate chapter on Potential Accidents, Malfunctions, and Unplanned Events (Chapter 23) was prepared which considers the potential environmental effects of each applicable accident, malfunction or unplanned event on all VECs listed above

Chapter 5 - Environmental Assessment Methods

This chapter of the Report covers pages 5-1 to 5-13 and describes the methods used to conduct the EIA/EA. It states that the approach taken by Jacques Whitford Stantec, on behalf of the Proponent in this regard, considered all federal and provincial regulatory requirements for the assessment of environmental effects, as defined by the New Brunswick EIA Regulation and the *Canadian Environmental Assessment Act* (CEAA)

This approach also considered the issues raised by the public, Aboriginal Persons, environmental non-governmental organizations (ENGOs), and other stakeholders during consultation and engagement activities conducted; as well as integrated engineering design, and programs for mitigation and monitoring into a comprehensive environmental planning process. The study specifically focused on valued environmental components (VECs) that are of particular value or interest to regulatory agencies, the public and other stakeholders. An environmental effect is defined in CEAA and 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,
>
> (b) any effect of any change referred to in paragraph (a) on (i) health and socio-economic conditions, (ii) physical and cultural heritage (iii) 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.

The term “environmental effect”, as defined in CEAA is taken to be synonymous with the term “impact” used in the New Brunswick Environmental Impact Assessment Regulation. Chapter 5 also notes that in this EIA Report, the term “environment” includes the biophysical, human, and socio-economic components as defined in the Clean Environment Act and CEAA.

Overview of Approach

The environmental assessment methods used in conducting the EIA addressed both Project-related and cumulative environmental effects.

The Report explains that Project-related environmental effects are changes to the biophysical or human environment that would be caused by a project or activity, arising solely as a result of the proposed principal works and activities. Cumulative environmental effects are changes to the biophysical or human environment that would be caused by an action associated with the Project, in combination with other past, present and future projects and activities that have been, or might be, carried out.

Project-related environmental effects are discussed first, taking into account Project design measures and mitigation that would help to reduce or avoid Project-VEC interactions that could result in this environmental effect. The residual Project-related environmental effect is then characterized, in light of planned mitigation.

At minimum, all Project-related environmental effects are characterized using specific criteria defined for each VEC. The significance of the Project-related environmental effect is then determined and, if applicable, the likelihood of significant environmental effects is characterized. A cumulative environmental effects screening is then conducted for that residual environmental effect to determine if there is potential for a cumulative environmental effect (the environmental effects of other projects and activities that would overlap with those of the Project).

If there is potential for substantive cumulative environmental effects arising from the Project, in combination with other past and likely future projects and activities, it is assessed to determine if those cumulative environmental effects could be significant, and to consider the contribution of the Project to them. The environmental effects assessment approach used in this EIA/EA involved the following steps:

- Scoping. The scoping step of the overall assessment included selection of Valued Environmental Components, description of measurable parameters; description of temporal, spatial, and administrative/technical boundaries; definition of parameters used to characterize the Project-related environmental effects and cumulative environmental effects; identification of standards or thresholds used to determine the significance of environmental effects, and identification of existing conditions. This step relies upon the scoping undertaken by regulatory authorities, consideration of the input of the public, stakeholders, and First Nations; and the professional judgement of the Study Team.

- Assessment of Project-Related Environmental Effects. The assessment included descriptions of how an environmental effect will occur, the mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect, and the characterization of the environmental effects of the Project. The focus was on residual environmental effects, *i.e.,* the environmental effects that remain after mitigation has been applied. The evaluation also considered the effects of the environment on the Project.

- Identification of Cumulative Environmental Effects. The cumulative environmental effects of other projects and activities that overlap with those of the Project, for all phases of the Project (*i.e.,* Construction, Operation, and Decommissioning and Abandonment), as well as for Accidents, Malfunctions, and Unplanned Events, were identified. An assessment of potential interactions was completed to determine if an assessment of cumulative environmental effects was required

- Evaluation of Cumulative Environmental Effects. The residual cumulative environmental effects of the Project in combination with other past and future projects and activities that have been or will be carried out were evaluated, including the contribution of the Project to those cumulative environmental effects.

- Determination of Significance. The significance of Project-related and residual cumulative environmental effects was determined, in consideration of the significance criteria.

- Recommendations for Follow-up. The follow-up and monitoring required to verify the environmental effects predictions and assess the effectiveness of the planned mitigation was recommended, where applicable.

Chapter 5 then provides a more detailed breakdown of the steps listed above. Criteria for the screening of other projects and activities relevant to the cumulative environmental effects assessment is presented in table 5.1.

The methods used to define Temporal Cases (Base, Project and Future Cases) as part of the cumulative environmental effects assessment are also explained, as is the approach taken in Chapter 23 to assess possible future Accidents, Malfunctions and Unplanned Events.

Chapter 6 – Environmental Setting

The Environmental Setting for the proposed project is described in Chapter 6 of the Report, covering pages 6-1 to 6-60.

It begins with the Mispec area's history and goes on to cover its environmental and socio-economic background, within the broader context of Saint John and southern coastal New Brunswick. The Report notes that areas near the mouth of the Mispec River were used for fishing and hunting by the Mi'kmaq and Maliseet peoples thousands of years ago. The word Mispec itself may be derived from a Mi'kmaq term for "over-flowed", which may refer to the tidal flooding that occurs at the mouth of the Mispec River.

It points out that the dam at Robertson Lake, near Loch Lomond, was constructed by the City of Saint John in 1906. Dams were also present near the mouth of the River from roughly 1821 until the 1960s.The Report states that the dam at the mouth of the River caused political and economic problems in the late 19th and early 20th Century, because of its effect on Atlantic salmon.

Biophysical Setting

The topography in the east Saint John to Mispec areas can be described as hilly to mountainous, according to the Report. Drainage in the vicinity of the Project and between the Project and east Saint John (*i.e.,* the area within which linear facilities for the Project will ultimately be sited) is southwest towards Saint John Harbour and the Bay of Fundy.

The surficial geology in the general vicinity of the Project is mainly overlain by a relatively thin mantle of gravel, sand, and silt glacial deposits. Historically, seismic activity in New Brunswick has been clustered in three main areas: Passamaquoddy Bay, Moncton, and the Central Highlands. Since 1975, five earthquakes, ranging in magnitude from 2.7 to 3.1 on the Richter scale, have been recorded within 20 km of the Assessment Area, all with epicentres in the Bay of Fundy. The Report states that the mechanisms and forces that cause seismic events in the Bay of Fundy (including those near Mispec Point) have been studied extensively, but remain poorly understood.

Water Resources

The majority of watercourses in the area between east Saint John and Mispec are relatively small. The Mispec River is larger, and an impoundment structure and spillway at the southern outfall of Robertson Lake controls the release of water to this watercourse.

Homeowners and businesses not connected to the City's municipal water supply rely on groundwater to meet their potable needs. The Harbourview Subdivision water supply is supplied by two municipal wells in the subdivision. Private water wells are used to supply other homes and businesses in the Mispec and Red Head areas, as well as some areas of east Saint John. Figures 6.9, 6.10 and 6.11 in the Report provide detailed information on watersheds, water wells and watercourses in the area of the proposed project.

Watersheds

There are three main watersheds in the general vicinity of the Project, shown in Figure 6.9: Loch Lomond; Balls Lake, and Black River.

The Loch Lomond watershed, which includes the Mispec River watershed, is the largest of the three. Located in East Saint John, it covers an approximate surface area of 157.1 square kilometres. Some urban development, and the Saint John Airport, as well as a portion of the proposed location of the refinery facilities and other associated infrastructure, are located within the Loch Lomond watershed.

The Balls Lake watershed is east of the Project and has a surface area of approximately 35.3 km^2. It is formed by streams in the upstream section followed by Balls Lake, which drains to McKenzie Brook. The Black River watershed is east of both Loch Lomond and Balls Lake, and has a surface area of approximately 90.7 km^2. This watershed consists of a large number of tributaries and some small to medium size lakes.

Hydrogeology

Based on NBENV water well records, and the types of bedrock present, there is low potential for groundwater capacity in the general vicinity of the Project. All types of bedrock in the area tend to produce low to moderate well yields, with the exception of the two municipal wells in Harbourview Subdivision. There is no area to develop additional wells, as the subdivision is densely populated, with insufficient room for additional wells or wellhead protection areas.

Higher well yields are expected in the geological deposits located around Debly and Harbourview Subdivisions, and north of the area surrounding Red Head Marsh. However, these areas are close to Saint John Harbour and wells in these areas would be susceptible to salt water intrusion. The report also states that groundwater quality in some areas in the vicinity of the Project exceeds certain standards, based on records from NBENV.

Climate

Coastal locations, such as Saint John, experience moist Atlantic air most of the year, producing relatively mild periods in the winter and relatively cool weather for the remainder of the year. The average annual precipitation is 1,390.3 mm, of which 82.5% is in the form of rain and extreme winds are relatively uncommon. Saint John does experience a considerable amount of fog, especially during the summer months when the contrast in temperature is greatest between sea surface and the surrounding air.

Air Quality

The Report notes that Saint John has the longest history of air quality monitoring in the province, and the greatest number of monitoring stations. Sixteen monitoring stations were active in the City in 2006. The following general observations concerning Saint John are taken from "New Brunswick Air Quality Monitoring Results" – (NBENV).

- Trends at sites with long monitoring records indicate that air quality has improved since the 1970s and 1980s for all contaminants currently being measured, except ozone, for which no clear trend is apparent.

- The rate of compliance of ambient monitoring results with the ambient air quality standards at all monitoring stations in Saint John in 2006 was generally greater than 95%, and in most cases, over 99%, for most contaminants and monitoring stations in the Saint John area.

- In 2006, air quality in Saint John was considered to be “good” (as rated using the Index for the Quality of the Air, or IQUA) more than 98% of the time, in the “fair” range at all monitoring stations for less than 2% of the time. Although ambient air quality can sometimes deteriorate for short periods of time during periods of reduced dispersion, potentially resulting in “poor” or “very poor” air quality ratings, there were no hours recorded in these categories in 2006.

- The ambient air quality standards were occasionally exceeded at some of the monitoring stations, particularly with respect to sulphur dioxide and ozone, in 2006 and in previous years. For sulphur dioxide, occasional exceedances occur under infrequent meteorological conditions. For ozone, exceedances tend to occur in the summer due to long-range transport from outside New Brunswick.

Freshwater Aquatic Environment

The Freshwater Aquatic Environment in the vicinity of the Project includes several watercourses and their watersheds. Calvert Lake is within approximately 200 m of the planned location of the refinery, while the Mispec River is the only major river system within the Assessment Area.

A field investigation identified three additional fish-bearing watercourses and several ephemeral drainages, for a total of 15 fish-bearing watercourses. Balls Lake is located farther from the Project to the east beyond the Mispec River, but was considered in the EIA/EA due to stakeholder concern. In Figure 10.4, the Report provides visual detail on local watersheds in the vicinity of the Project, including fish-bearing and non-fish-bearing watercourses. Sampling data from watercourses in the general vicinity of the Project shows that water quality, in general, is adequate for supporting fish.

Fish and Fish Habitat

The Report states that, overall, fish habitat found in surveyed reaches of watercourses in the vicinity of the Project is of good quality. Surveys noted the presence of several species of freshwater fish, including brook trout and blacknose dace, which are relatively abundant in watercourses near the Project.

The reaches of most of the smaller streams surveyed also identified white sucker, American eel, and ninespine stickleback. Atlantic salmon, brown trout, common shiner, blacknose shiner, and northern redbelly were identified in the surveyed reaches of the Mispec River. Calvert Lake and Balls Lake surveys noted the presence of brook trout, finescale dace, lake chub, northern redbelly, dace, white sucker, American eel, and ninespine stickleback.

Although there are no commercial fisheries in the freshwater aquatic environment within the Assessment Area, there is a recreational fishery in the Mispec River. Local recreational fishing is for brook trout and brown trout. Local residents report incidental catches of Atlantic salmon during fall months.

Terrestrial and Wetland Environment

The Project is located within the Fundy Coastal Ecoregion, as illustrated in Figure 6.12. It offers a wide variety of habitats that support common New Brunswick wildlife species and has a diverse range of wetland types including coastal bogs, shrub, fen, and freshwater riparian wetlands. The term 'species of special status' used in the Report refers to those species that live for large parts of their life cycle in the Assessment Area, and have been identified by federal or provincial agencies as being endangered, threatened, rare, or otherwise of conservation concern.

The term 'Species at Risk' (SAR) refers to those species protected by legislation (Species at Risk Assessment, NB Environmentally Sensitive Area) and require special attention during the assessment process as their populations are, by definition, more sensitive to anthropogenic stressors. Species of Conservation Concern (SOCC) are species that, unlike SAR, are not afforded direct protection by legislation. SOCC are placed on lists as a precautionary measure that reflects an observed trend in their provincial population status. The Report notes that, for the purpose of this EIA/EA, SAR and SOCC have been combined and referred to as 'species of special status'.

Vegetation

A total of 414 terrestrial vascular plant species have been recorded in the general vicinity of the Project, between the Mispec River and Black Point, and northward to Calvert Lake and towards the existing Saint John refinery. Only one, Emmons' sedge, is a SOCC. Data from the Red Head Marsh area lists two SOCC species with provincial ranks of 'Sensitive.' In targeted surveys completed for this EIA/EA, 240 species of plants were recorded, including three listed as SOCC: arrow-leaved violet, alpine woodsia and Emmons' sedge.

Wetlands

Figure 6.13 in the Report shows 75 wetlands, totalling approximately 145 hectares (ha), within the area surveyed where the refinery facilities and other associated infrastructure would be sited. An additional 85 wetlands were identified in the 4 km-wide corridor between the proposed location of the refinery facilities and east Saint John, where the linear facilities would ultimately be sited. The Report states that wetlands found within the study area for refinery facilities are relatively poor with respect to function, and not likely to provide important habitat for wildlife species. Biological diversity within the surveyed wetlands is relatively low. No SAR or SOCC plant species were identified in the wetlands surveyed, and their hydrological value varies.

Wildlife & Birds

Wildlife is widespread throughout the area between Mispec and east Saint John, with forestry roads and power line corridors being used by wildlife as travel ways. The Report notes that 31 wildlife species (excluding birds) were observed in, or near, the general vicinity of the Project, during 2006 and 2007. It states that local game is fairly abundant and the area offers opportunities for sport hunting and fur harvesting, despite the lack of substantial mature forest habitat.

No wildlife Species at Risk were observed or are known to inhabit the areas in the general vicinity of the Project.

A total of 146 bird species have been detected in the Mispec and Red Head areas, during bird surveys and monitoring carried out during the last seven years, of which 97 species likely nest

in these areas. A total of 19 SOCC bird species have been recorded in the Mispec and Red Head areas by field studies for the Project and other projects. During breeding bird surveys in 2006 and 2007, only brown thrasher and purple finch were recorded as possible nesters.

Marine Environment

In the marine waters near Mispec Point, where the marine terminal and other marine-based facilities would be located, water depths ranging from 2 to 31 m. Field data show that the water and sediment quality at all of the surveyed stations appeared to be adequate to support aquatic life, including fish populations.

Species of fish that exist in the Outer Saint John Harbour, and in Mispec Bay, include groundfish, pelagic fish such as herring and mackerel, and migrating fish species that use the Saint John River watershed to complete part of their life cycle.

Socio-Economic Setting

Saint John is the largest city in New Brunswick and a major industrial centre in Atlantic Canada. The Saint John Census Metropolitan Area (CMA) includes the City of Saint John, the Town of Quispamsis, the Town of Rothesay, the Town of Hampton, the Town of Grand Bay-Westfield, the Village of St. Martins, and nearby rural areas. From 1991 to 2006, the Saint John CMA population declined by approximately 2.7%. According to Census 2001 data, median family income was $50,163. This was higher than the provincial median, and approximately $5,000 less than the national value.

Similarly, the Saint John CMA had a higher median individual income ($20,284) than the province ($18,257); however, it was lower than that of Canada ($22,120). Poverty remains a pressing issue within the City. The poverty rate in 2001 was 24.5%, higher than provincial and national rates, and higher than rates in other communities in the CMA.

Historically, the economy of the Saint John area was based around the industrial sector. Since 1996, the bulk of employment in the CMA has been in the service sector, which is consistent with provincial and national trends. The economic vibrancy of the Saint John area continues to improve through the increased investment and construction of large-scale developments. Including the Project, there are over $12 billion worth of investments in the oil, gas, energy, and mining sectors.

This is consistent with the region's goal of becoming the energy hub of Atlantic Canada. In 2001, the unemployment rate in the CMA was 9.2%, which was substantially lower than the provincial rate. In more recent years, unemployment in the CMA has continued to fall dramatically, reaching 4.8% in February 2008.

Land Use & Zoning

Development and building permits in Saint John are regulated under the City of Saint John Municipal Development Plan, and the relevant Zoning and Building By-laws. Across the Mispec River and beyond the City limits, planning is regulated by the Royal District Planning Commission. The Report details existing zoning in Mispec, Red Head, and east Saint John areas in Figure 6.16. The Canaport Limited and Canaport Liquefied Natural Gas (LNG) facilities are zoned for heavy industry. The Red Head Mountain area is zoned rural.

Along Black River Road and Proud Road, the land is primarily zoned residential and contains several dwellings, though much of the area is vacant. Along Red Head Road from Rocky Corner

to the Mispec River, the land is zoned residential. The existing Harbourview Subdivision is zoned residential, while other areas along Red Head Road, including the Debly Subdivision, are zoned suburban residential. An area near Mispec Bay is currently zoned for park use.

Commercial Fisheries

The commercial fishery in the general vicinity of the Project is dominated by the lobster fishery. A much lesser level of fishing effort is focused on scallop, though the area is located within a Conservation Zone that is closed to the scallop fishery for 9 months of the year. No other species support a substantive fishery in the area.

The lobster fishery has two open seasons each year. The spring season begins in April and closes in June, and the fall season begins in November and closes in January of the following year. The Mispec port is home to five commercial fishing vessels and is tidal, which limits access to and from the port to a six-hour window around each high tide. These five vessels expend up to 100% of their lobster harvesting efforts directly adjacent to the Project.

Heritage and Archaeological Resources

There are 16 documented archaeological sites in the Saint John area. All but two of these are outside the study area, within which the refinery facilities and other land-based infrastructure would be located. The site identified as Borden No. BhDl-2 was discovered during field work undertaken in 2006 for this EIA/EA. This site consists of quartz debris resulting from stone tool manufacture.

The other site identified as Borden No. BhDl-1, contains some Historic period refuse in a disturbed context, and is located along a transmission line corridor in the southwest corner of the broad 4 km-wide corridor between the proposed refinery and east Saint John.

Other Projects and Activities Re: Assessment of Cumulative Environmental Effects

The consideration of other projects and activities carried out in the Assessment Area is a necessary component of the assessment of cumulative environmental effects. In this context, the Report groups other specific projects and activities that are planned, or under construction, in Table 6.4.

Chapter 7 – Atmospheric Environment

This chapter of the Report covers pages 7-1 to 7-105. It begins by explaining the many reasons why the Atmospheric Environment is defined as a Valued Environmental Component (VEC) for this EIA process. It also notes that emissions from the Project have been identified as a key concern by regulatory agencies, the public and stakeholders.

The Report states that initiatives and technologies to mitigate the emissions have been incorporated into the design of the Project, from the outset, by the Design Team. These include the use of best available proven technology, that is economically viable, to control emissions from specific processes; cogeneration of steam and electricity, treatment of the tail gas from the sulphur plant; burning of clean gaseous fuels for heat production; use of low-nitrogen oxide (NO_x) burners and ultra low- NO_x burners for fuel combustion equipment; flare systems; vapour recovery systems to capture volatile organic compound (VOC) emissions; an energy efficiency program; enclosures to control noise, and other technology aimed at minimizing emissions from

the Project. Standard mitigation measures during Construction, such as the use of dust suppressants and implementation of an idling policy, would also be planned.

The Report emphasizes that mitigation measures are designed to ensure the Project could be carried out in an acceptable manner, without adversely affecting ambient air quality, sound quality, or climate in a significant way.

Sections 7.1, 7.2. and 7.3 cover pages 7.3 to 7.43 and provide detailed information on the Scope of the Assessment, Existing Conditions regarding the Atmospheric Environment, and Potential Project – VEC Interactions, which includes a description of the ranking system used to categorize these interactions. This ranking process is presented in Table 7.14. The Report notes that activities anticipated to have substantive emissions and the potential to cause significant environmental effects, were ranked as '2'. Overall, the three initial sections of Chapter 7 include 14 tables and 2 graphic figures illustrating data discussed in the text, which is organized under the following headings:

<u>Scope of Assessment</u>

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Change in Air Quality
- Change in GHG Emissions
- Change in Sound Quality
- Residual Environmental Effects Rating Criteria

<u>Existing Conditions</u>

- Air Quality
    - Meteorological Conditions
    - Wind Speed and Direction – Saint John.
    - Wind Speed and Direction – Canaport
    - Emissions in the Saint John Area

- Ambient Air Quality
    - Criteria Air Contaminants
    - Trace Metals
    - Volatile Organic Compounds
    - Polycyclic Aromatic Hydrocarbons, Dioxins and Furans
    - Odour
    - Summary of Ambient Air Quality

- GHG Emissions
    - Provincial GHG Emissions
    - National GHG Emissions
    - Global GHG Emissions
    - Industry Profile
- Sound Quality

Potential Project-VEC Interactions

- Potential Interactions of the Petroleum Refinery and Other Land-based Infrastructure with Atmospheric Environment
- Potential Interactions of the Marine Terminal and Other Marine-Based Infrastructure with Atmospheric Environment

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

Section 7.4 covers pages 7-44 to 7.82. This section focuses on the environmental effects of the Project-related emissions from the Petroleum Refinery and Other Land-Based Infrastructure on the Atmospheric Environment, as well as the plans for mitigating such effects.

There are 8 tables in Section 7.4 which provide detailed information on the results of assessments conducted by the study team on key issues, such as residual environmental effects, predicted ground level concentrations of criteria air contaminants (CAC), as well as non-criteria air contaminants (non-CAC), 10 minute maximum concentrations of hydrogen sulphide at different receptor locations, etc. As an example, Table 7.15 covers pages 7-46, 7-47 and 7-48. It describes Changes in Air Quality, Changes in Greenhouse Gas Emissions (GHG), Changes in Sound Quality and Combined Residual Environmental Effects during Project Construction and Operation.

These effects are presented together with the mitigation/compensation measures proposed in each case, as well as their characteristics, rated on a scale described in a reference key. They include: Direction, Magnitude, Geographic Extent, Duration and Frequency, Reversibility, Ecological/Socio-Economic Context Significance, Prediction Confidence, Likelihood, and Cumulative Environmental Effects.

Mitigation For Change in Air Quality

The Report states that the residual environmental effects associated with a Change in Air Quality are related to the predicted ground-level concentrations of CAC, Non-CAC, and odourous compounds. Mitigation would be employed to minimize emissions from the Petroleum Refinery and Other Land-Based Infrastructure during Construction and Operation.

Construction

The Report notes that the Change in Air Quality associated with Construction arises mainly from Site and Right-of-Way (ROW) Preparation, Commissioning, and Road Transportation. The following mitigation would minimize emissions of air contaminants during these activities.

- As dust suppression (e.g., water) would be used on dry windy days, the fugitive dust reaching off-site receptors is expected to be minimal.

- Emissions of combustion gases from construction equipment do not generally cause air quality objectives to be exceeded as long as new modern construction equipment is used, proper maintenance schedules are followed, and an idling policy is implemented to minimize vehicle and equipment idling at every reasonable opportunity.

- The length of the haul roads would be minimized to the extent possible. This would help reduce the quantity of fuel consumed to move materials at the site, and emissions of air contaminants.

- The short-term, intermittent nature of the emission sources would also reduce the likelihood of the emissions contributing noticeably to ambient air concentrations.

- The movement of the equipment around the site (i.e., not staying in one place) also tends to improve the dispersion of the air contaminants released at the site.

- The Report states that emissions from all Project activities during Construction, including earth moving activities, road transportation, and other activities are expected to be well within the regulatory objectives, standards and guidelines.

- Particulate matter emissions from the operation of the batch concrete plant would be short-term, intermittent and very unlikely to cause a noticeable change to ambient particulate matter concentrations at off-site receptors. The batch plant would be located in an area away from the nearest residential areas, to further reduce the potential for dust at off-site receptors.

- Emissions from Road Transportation during Construction were based on estimates of worker-related vehicle and bus traffic to and from the construction sites. Some construction materials would be trucked to the site, but most would be brought in with marine vessels, considerably reducing on-road truck traffic.

- While bussing would be provided to mitigate vehicle traffic, to and from, the construction site, and the associated emissions, for the purposes of this VEC, it has been assumed that bussing would not be used – thereby resulting in conservative vehicle emissions estimates. The additional Project-related traffic at the Bayside Drive/causeway intersection would represent a change of 23%, and vehicle emissions would be expected to increase by approximately this fraction.

  Nevertheless, such emissions would be less than 2% of those potentially emitted by the refinery during Operation, temporary during the busy times (*e.g.,* shift changes) and localized to the roadways. The quantities of emissions from Road Transportation are small and therefore would not likely cause the objectives, guidelines and standards to be exceeded.

Overall, the Report states that the potential environmental effects of Project-related construction activities on a Change in Air Quality were rated not significant.

Operation

The plume dispersion of CAC and Non-CAC emissions from the land-based sources during Operation was modeled by the study team to predict the maximum short-term and long-term (annual) average ground-level concentrations. These predictions were made at many locations defined by detailed receptor grids, for both Local Assessment Area (LAA) and Regional Assessment Area (RAA). Background values were added to the predicted values to establish the direction, magnitude, geographical extent, duration, and frequency, then compared with the regulatory objectives, guidelines and standards.

- Criteria Air Contaminants - The results of the CAC modelling are shown in Table 7.16. The Report states that the highest predicted maximum ground-level concentrations (GLC) from the normal Operation of the Petroleum Refinery and Other Land-Based Infrastructure were reported for sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) and were predicted to occur at locations near the refinery complex. For example, the

maximum predicted 1 hour NO_2 concentrations would occur slightly west of Calvert Lake (although well within the ambient objectives). The maximum predicted ground level concentration for all criteria air contaminants (CAC) modelled during normal Operation at maximum production was below the regulatory objectives, guidelines and standards. Based on these predictions, a Change in Air Quality associated with emissions of CAC during Operation of the Project would be expected to be within the objectives/guidelines/standards.

- Ozone Formation - Ground-level ozone (O_3) is formed in the atmosphere as a result of complex chemical reactions involving sunlight, NO_2 and VOC on warm humid days. Although O_3 would not be released directly from the Project, the Project-related VOC emissions might contribute to O_3 formation.

  From the modelling predictions, in the extreme worst case, the potential for ozone formation would result in levels that would not be detectable relative to background levels within 15-20 km from the PDA. Within this range, ozone levels might be discernible, but only during the specific weather conditions leading to maximum O_3 production (full sunlight, limited dispersion by low wind speeds, and restricted mixing).

  Therefore, the Project contributions to background would not be expected to frequently cause an exceedance of the 8 hour Canada-Wide Standard of 128 micrograms per cubic metre ($\mu g/m^3$).

- Non-Criteria Air Contaminant (non-CAC) - The predicted maximum ground-level concentrations of Non-CAC are summarized and presented in Table 7.17.

  Except for acrolein, the model predictions were below the applicable Ontario Ministry of the Environment (OMOE) criteria. The background values for acrolein (in absence of the Project) already exceed the OMOE criteria, and the predicted ground-level concentrations from Project would not add appreciably to the background values. It is also noted that these background concentrations are similar in magnitude to those observed elsewhere across Canada. The maximum predicted ground-level concentration of benzo(a)pyrene would approach but remain below the OMOE criteria. The predicted values for the other Non-CAC are well below the OMOE criteria. Based on these predictions, a Change in Air Quality associated with emissions of Non-CAC during Operation of the Project would not be expected to be substantive.

- Odour - Odours may be caused by emissions of sulphur-containing compounds such as Hydrogen Sulphide (H_2S), or by lighter petroleum compounds such as VOC. To assess the potential for Project-related emissions to results in off-property odours, dispersion modelling was conducted and the predicted maximum ground-level concentrations of odour-causing chemical of potential concern (COPC) were compared with odour detection thresholds. The maximum predicted 10-minute GLC are compared to published odour thresholds in Table 7.18.

  Except for H_2S, the maximum predicted odour concentrations were below the pertinent odour threshold values, including all VOC, as well as other reduced sulphur compounds. The predicted H_2S odour values might exceed its odour threshold within 400 m of the property line on the west side of the facility, during certain rare meteorological events. As shown in Table 7.20, the maximum predicted 10 minute H_2S concentrations at all residential locations near the PDA were less than 10 $\mu g/m^3$. In Table 7.21, the predicted frequency of H_2S odour threshold exceedances, at the location of the maximum predicted concentrations, was very low, and generally below the barely perceptible

range. The data in Table 7.21 also indicate that the predicted concentrations at other locations near the PDA decreased rapidly from the maximum predicted values.

Based on the frequency distribution results, it can be concluded that odours might be detected, but these occurrences would be expected to be infrequent, limited in extent, and primarily by those with a heightened sense of smell. Due to the individuality and variability of the human reaction to odourous substances, it is not possible to accurately predict the potential response to odour levels in the area.

However, it can be said with a high degree of confidence that the odour on a typical day would not significantly differ from current ambient odour levels in the area. Therefore, any Change in Air Quality due to odour emissions from Operation would not be expected to be substantive.

- Secondary Particulate Matter Formation - The dispersion modelling results for secondary particulate matter formation from the land-based sources are summarized in Table 7.21. The maximum predicted GLC of secondary particulate matter (reported as secondary $PM_{2.5}$) formed from regional sources of emissions was 5.84 $\mu g/m^3$. The contributions of the Project and other future projects cumulatively were 0.16 $\mu g/m^3$ and 0.19 $\mu g/m^3$, respectively. Since the maximums were predicted to occur at different locations, they are not additive. Nevertheless, the contribution of the Project, alone and cumulatively with other future projects, was small. Based on the conservatism in the estimates, and on the predicted magnitude, a Change in Air Quality on regional secondary particulate matter levels during Operation of the Project was not anticipated to be substantive.

- Acid Deposition - Results of the dispersion modelling used to assess acidic deposition or potential acid input due to Project emissions of NO_x and SO_2 are provided in Table 7.22. The contributions of the Project and other future projects cumulatively were 0.028 and 0.035 kilograms of hydrogen ion equivalent per hectare per year. These values are quite small compared to the baseline. It was thus concluded that a Project-related Change in Air Quality on regional potential acid input would not be expected to be substantive. Total annual wet sulphate deposition was also modelled. The maximum predicted annual wet sulphate deposition was compared to measured data at regional monitoring station locations, as shown in Table 7.23. The values in Table 7.23 show the predicted Project contributions to baseline sulphate (SO_4) deposition levels were less than 3% of average measured values. This prediction provides further evidence suggesting the environmental effects of the Project on acid deposition would not be expected to be substantive.

- Plume Visibility - Visible plume modelling was conducted to predict the potential for visible plume formation from the proposed cooling towers at the refinery complex. Based on the modelling and analysis, Project-related emissions of water vapour from the cooling towers could result in visible exhaust plumes of condensed water vapour (similar to fog) and reduced ground-level visibility at locations near the property line, including Proud Road, which runs along the western side of the refinery complex. The predicted frequency of occurrence of fogging events due to cooling towers along Proud Road was approximately 46 hours per year. Such events would be expected to be limited in duration and occur infrequently, relative to the baseline fog levels in Saint John. Therefore, a Change in Air Quality due to emissions of water vapour from the cooling towers associated with the Operation of the Project was not expected to be substantive.

- Long-Range Transport - A summary of the dispersion modelling results for long-range transport of criteria air contaminant (CAC) from the land-based infrastructure is presented in Table 7.24. Maximum predicted ground-level concentrations (GLC) were compared with regulatory criteria at selected transboundary locations, including the closest point in Nova Scotia, PEI and Maine to the Project, and at The Brothers 18 First Nations reserve.

  Based on the modelling results in Table 7.24, the predicted GLC of the CAC of interest were almost all less than 1% of the objectives, guidelines and standards. The predicted values were slightly higher at the Brothers 18 First Nation, ranging from less than 1% to about 6% of the objectives, guidelines and standards. Overall, the predicted Project contribution to transboundary environmental effects to air quality on federal lands, in other provinces, and in other countries would not be expected to be substantive.

- Summary - In summary, with planned mitigation, the Project would result in an increase in ambient concentrations of many CAC and Non-CAC within the Local Assessment Area (LAA) and the Regional Assessment Area (RAA). Those increases were considered in conjunction with the existing conditions (*i.e.,* background). From all of the analyses described above, the number of times that a predicted value, including background, would be anticipated to exceed a regulatory objective, guideline, or standard, was small. Therefore, although not necessarily negligible, the residual Change in Air Quality as a result of the Operation of the Project would not be expected to be substantive. Based on past evidence, any Change in Air Quality would likely be reversible, within a few hours, to days after the emission sources ceased operation. Overall, based on the nature and extent of expected emissions during Operation; the predicted ground-level concentrations from the dispersion modeling, and considering planned mitigation, the potential environmental effects of the Operation of the Petroleum Refinery and Other Land-Based Infrastructure on a Change in Air Quality were rated not significant.

Change in GHG Emissions

Construction and operation of the Petroleum Refinery and Other Land-Based Infrastructure would result in the release of GHG emissions to the atmosphere. Although the Report notes that the environmental effect of the GHG emissions from any specific facility on global climate change cannot be measured, it can be placed in perspective with jurisdictional (provincial, national, global) emissions, as well as with other comparable industries (industry profile).

Construction

The majority of the Change in GHG Emissions during Construction would arise from fuel consumption and energy usage during Site and Right-of-Way (ROW) Preparation. Estimates of these emissions are presented in Table 7.25. While these emissions would be low, in comparison to the emissions associated with Operation, mitigation measures would be considered. Attention to planning of the construction activities and the adoption of engine idling and proactive maintenance policies would be part of the plan to mitigate GHG emissions from Construction where possible. In addition, the original analysis of Construction-related GHG emissions was based on a five-year construction period. With the extension of this period to up to eight years, the average annual and peak GHG emissions estimates would be lower, and might be reduced even further with equipment turn-over that would bring in more efficient construction equipment influenced by the proposed federal vehicle efficiency standards.

Operation

For Operation, the GHG emission inventory was prepared for individual refinery point sources, including combustion sources, process exhaust stacks, the flare system, vessels at the marine terminal and mobile maintenance equipment operating at the site. Process unit emissions were the key focus and the estimates developed to date were based on the preliminary engineering. These are considered conservative as detailed engineering would be expected to reduce the emission levels by focusing on innovation and energy efficiency in the design. GHG emissions would be generated mainly by combustion of natural gas and refinery fuel gas at the refinery complex and are outlined in Table 7.26. Total annual GHG emissions, daily design capacities, and the resulting Greenhouse Gas Design Intensity (GDI) for a sample of refineries in Canada, the United States, Japan, and Australia are presented in Table 7.12. The GDI for these refineries ranged from a low of 4.9 to a high of 13.3. The Project emissions of GHG from Table 7.26 result in an estimated GDI for the Project of 9.73, as shown in Table 7.27.

Mitigation for Change in GHG Emissions

The Report notes that the compliance and mitigation analyses in this EIA make the assumption that the Project would ultimately be subject to federal GHG regulations now under development. It also states the Project's intention to be a world leader among petroleum refineries in energy efficiency, and in reducing and managing GHG emissions while, at the same time, providing ultra-low sulphur gasoline and diesel fuels for market. Cleaner fuels in the marketplace could lead to reduced GHG emissions at the consumer end use stage. The Report states that the Project would be designed and operated to examine and implement where possible, all potential energy efficiency measures, from waste heat recovery to high efficiency piping and pumping systems, which in the final design would help to minimize GHG emissions during Operation.

Energy Efficiency Measures

To reduce or mitigate GHG emissions from the Project, each and every potential energy efficiency measure would be examined. Some of the measures identified to be explored thus far include:

- Operation of a cogeneration unit to generate both steam and electricity
- Waste heat recovery projects where feasible;
- On-site recycling of wastewater
- Reducing overall hydraulic losses in piping
- Using variable frequency drives to reduce energy consumption
- Reducing overall hydrogen compression power demands
- Using steam turbine generators instead of let-down valves
- Reducing hydrogen requirements and the size of the hydrogen plant
- Using expanders on high pressure let down valves
- Using pinch analysis for optimizing heat recovery.

Although many of the above concepts are being considered for inclusion in the final Project design, the Report notes that those measures selected as part of the Project following detailed engineering design would be specified in the GHG Management Plan.

Cogeneration

Cogeneration, also referred to as combined heat and power, is a system capable of producing both electricity and heat (steam), usually from the same energy source. Since these systems

are more energy efficient, as they generate both heat and power for essentially the same amount of energy input, they have the potential to substantially reduce GHG emissions relative to the implementation of separate electricity and steam generation facilities, or the purchase of electricity from the grid.

For the Project, the combined-cycle cogeneration plant would produce approximately 172 megawatts of electricity using clean-burning natural gas and/or refinery gas to power a gas turbine-generator to produce electricity, and to supply supplemental energy to a heat recovery steam generator through the firing of duct heaters. Waste heat from the gas turbine would be recovered in the heat recovery steam generator to power a steam turbine-generator producing additional electricity, and generate steam for use in the refining process.

Fixed Process Emissions

Fixed process emissions are those resulting from chemical processes that produce carbon dioxide (CO_2). The primary fixed process emissions associated with the Project would be those from the hydrogen plant, and would account for approximately 32% of the GHG emissions during Operation. Consideration of fixed process emissions as suggested by federal regulatory guidance would allow for the exclusion of a substantive portion of the total GHG emissions associated with the Project.

Renewable Energy

Outside the scope of this Project being assessed, the Proponent is currently exploring the potential for alternative and renewable sources of energy in the region, such as wind and tidal energy, and will continue to play a leading role in evaluating the feasibility and potential development of such projects in the Saint John area and elsewhere in the province. The potential role of alternative low-GHG intensity energy provision to the Project would continue to be explored during development of the GHG Management Plan.

Cleaner Fuel Standards

The choice of feedstock and fuel is an important factor in determining the GHG emissions intensity associated with any large energy project. The preliminary design of the Project includes the use of a combined-cycle cogeneration plant as described above. This directly addresses the regulatory requirements relating to a cleaner fuel standard.

Carbon Capture and Storage (CCS)

CCS involves the collection and concentration of CO_2 from large point sources of GHG emissions. This is a relatively new process at this time and the technologies are not yet fully proven. While there is little CCS activity in New Brunswick at this time, the Province and Irving Oil sponsored a two day Workshop at the University of New Brunswick in March 2009 to allow those interested in the CCS science, technologies, and opportunities to become informed and to help advance local understanding. The feasibility of the capture process, transportation options, and especially, the storage aspect for a facility located in New Brunswick, has not been established. However, the Design Team is considering how to make the Project, or parts of it, 'CCS Ready' and to determine where there might be feasible opportunities for future carbon storage.

Compliance Mechanisms

The proposed federal Framework includes a number of mechanisms and options to allow

industrial emitters to meet their emission reduction obligations. These options include: Emission Reductions; Credit for Early Action Program; The Offset System; Clean Development Mechanism; Technology Fund, and Pre-certified Investments. These would be described in more detail in the GHG Management Plan.

Residual Project Environmental Effects for GHG Emissions

The Project-related GHG emissions during Construction were considered to be low in magnitude and would be short-term when compared to the emissions associated with Operation (Table 7.16). The GHG emissions estimates associated with Operation are presented in Table 7.26. Based on these estimates, the Project would result in incremental increases of GHG emissions corresponding to:

- On a provincial scale, Project-related GHG emissions would be 25% of the New Brunswick GHG total emissions (NBENV 2007b) (Environment Canada 2008i);
- On a national scale, the Project-related GHG emissions would represent 0.8% of Canadian emissions (Environment Canada 2008i);
- Globally, the Project would represent 0.02% of global GHG emissions (Environment Canada 2008i).

Emissions from large industrial GHG sources in Canada were published by Environment Canada in 2006. The Project's GHG emissions, relative to those reported within New Brunswick, were classified as 'high'. The Report explains that 'it is not possible to assess the significance related to a measured environmental effect on global climate change on a Project-specific basis (Canadian Environmental Assessment Agency 2003).' At the same time, it is recognized that global emissions of GHG, and consequent changes to global climate, are generally considered by many scientific authorities around the world to be a significant cumulative environmental effect. On this basis, while the magnitude would be high, the geographic extent global, the duration long-term, and the emissions continuous, the potential environmental effects of the anticipated Change in Project-related GHG Emissions during Construction and Operation would not be expected to be substantive, when compared to those occurring on a provincial, national or global scale.

The Report states that, based on the nature and extent of expected GHG emissions during Construction and Operation, and in consideration of planned mitigation to be developed as part of the GHG Management Plan, the potential environmental effects of the Construction and Operation of the Petroleum Refinery and Other Land-Based Infrastructure on a Change in GHG Emissions were rated not significant. Nonetheless, since the magnitude of the Change in GHG Emissions is medium to high (Construction to Operation), a GHG Management Plan would be developed and describe in detail the opportunities for energy efficient use and reductions of GHG emissions.

Change in Sound Quality

The residual environmental effects associated with a Change in Sound Quality would be related to increases in the sound pressure levels caused by noise emissions from the Project. Various mitigation measures would be used to reduce the environmental effects, including activity scheduling, mufflers and setbacks. During Construction, unwanted sound or noise might be emitted during Site and Right-of-Way Preparation, Physical Construction and Equipment Installation, and Road Transportation.

Engines used to power the heavy equipment (*e.g.,* cranes, lifts, front end loaders, dump trucks) would be sources of substantive noise emissions during the site preparation activities. Blasting

and pile driving would also be sources of noise. Diesel generators and welding sets could generate noise during construction of process units and buildings at the site. Noise might be emitted from vehicles during transport of very large modules along the heavy haul road.

During Operation, substantive emissions of noise might be generated during Operation and Maintenance of Refinery Process and Equipment, and during Road and Rail Transportation. Large combustion engines, the refinery process units (including boilers and furnaces), the flare system, coke crusher operation, conveyor system, pumps, fans, rail line and vehicle traffic all could contribute to noise emissions from the Project. Based on experience with similar construction projects and operational facilities, Changes in Sound Quality, during both Construction and Operation, could extend from the PDA out to approximately 3 km, decreasing with increasing distance from the noise source.

Mitigation for Change in Sound Quality

Mitigation measures for a Change in Sound Quality are described below for each phase. For Construction, the mitigation measures would include, but are not limited to, the following:

- Mufflers on all engines and vehicles – strict vehicle and engine maintenance policies would be enforced to minimize noise emissions from engines and vehicles on-site;
- Scheduling – where possible, noisy construction activities would be restricted to the daytime period to reduce noise environmental effects;
- Blasting and pile driving would only be conducted during the day time, Monday to Saturday, and not on statutory holidays;
- Setback distances would be considered and implemented, where possible;
- Stockpiles of overburden could be used between the construction activities on-site and off-site receptors, where the opportunity exists to provide shielding;
- Fabrication of process modules (large module and very large module) off-site. Many of the process modules would be fabricated away from the Project site, greatly reducing the machining, welding, and steam fitting tasks on-site that could generate noise;
- The provision of bussing during Construction for construction workers, where desired, to minimize Construction-related vehicle traffic, to and from, the site on a daily basis; and
- Use of the new Bayside Drive extension as an access road for Construction-related vehicle traffic to access the construction site.

Mitigation measures for Operation would include but are not limited to the following:

- Separation distances – the Project would be located in an area that maximizes separation from the City, and from the more densely populated strip along Red Head Road;
- Vegetation buffer – while vegetation is more of a psychological barrier to noise, the minimization of clearing in the Project area would leave sufficient tree cover to provide some reduction in noise;
- Topographic shielding – the location on the higher part of the hill would provide line-of-sight protection from noise to many of the residences along Red Head Road; these natural barriers can provide 5 dBA or more of protection;
- Use of mufflers on noisy process equipment - and enclosure of pump rooms, engine rooms, and compressors;
- Pump houses for pumps – many of the products of the refinery would be moved around the storage tanks and off-site by heavy industrial pumps – some of these would be enclosed in buildings to provide weather protection that would also afford attenuation of the noise levels from the pumps; and

- New road construction – by using the new Bayside Drive/Proud Road and building a new access road from Proud Road, traffic on existing residential arteries would be reduced.

These mitigation measures would be implemented, wherever technically and economically feasible, to minimize potential environmental effects of the Construction and Operation of the Project on Sound Quality.

Residual Project Environmental Effects for Change in Sound Quality

A summary of the residual environmental effects of a Change in Sound Quality is presented in Table 7.15.

Seven noise sensitive areas (NSA) were considered as noise receptors in assessing the potential Changes in Sound Quality, in and around the PDA.

These NSA represent the most noise sensitive neighbours, in and surrounding the refinery PDA, and were illustrated in Figure 3.43.

Construction

Including the activities of Site and Right-of-Way Preparation, Physical Construction Equipment Installation and Road Transportation (excluding blasting and pile driving), the predicted sound pressure levels at the identified NSAs ranged from 48-59 dBA during the day (Table 7.29). Such activities are not currently planned to occur during the night time.

The predicted noise levels were greatest along Old Black River Road, the area that is both closest to the main project site, and least shielded by topography. Red Head Road area is somewhat shielded by the rising hill, and therefore would experience less of an increase in sound pressure levels. There were no exceedances of the noise guidelines levels during the day time or night time (Tables 7.29, 7.30).

Approximately 2.3 million cubic metres of rock would need to be blasted during site preparation work, and the maximum overpressure of 128 dBA at the nearest receptor during a blasting event would be a peak. The average noise level over a period of an hour would show little influence of the short term peak. However, the associated noise would be capable of being a nuisance, because of its startling aspect. Paradoxically, infrequent blasts can be a greater nuisance because they are more startling, whereas the public could become more accustomed to more frequent blasts. Blasting for site preparation is often not a single startling blast, but is more often a rippling, or rumbling sound, not unlike distant thunder. Blasting requirements for the refinery would consist of multiple small holes, likely to occur several times per day, at distances of hundreds of metres to kilometres from residences.

The blasts would be scheduled to occur only during the day, and occur over a defined interval early in site preparation. In light of this scheduling and notifying residents of the planned blasts, the potential Change in Sound Quality would not be expected to be substantive. An estimated 1,200 to 1,600 piles could be required and would depend on the load bearing capacities of the soils. To be conservative, it is assumed that substantive pile driving would be required. Peak levels within approximately 50 m of an impulse pile driver can reach 100 dBA, and are audible above background for distances of 2 or 3 km.

Mitigation might include the use of vibratory, rather than impulse drivers, but site conditions may preclude this alternative. Confining activities to less sensitive times of the day and week can reduce the environmental effects. As currently planned, the pile drivers would not operate at

night, and would, if possible, remain inoperative on weekends. An accelerated work schedule could increase the number of pile drivers without proportionally increasing the impact, particularly if the accelerated work was carried out in the center to southern part of the site, where the greatest buffer distance would apply. Despite these precautions, some residual audibility of the pile driving work would remain.

Experience with pile driving during the construction of the Canaport Liquefied Natural Gas (LNG) terminal indicates that while the public were aware of the work, they were not substantively affected. For these reasons, and in light of the potential noise emissions from traffic activities associated with equipment operation, blasting and piling during Construction would not be expected to frequently exceed of the noise guideline levels, and were thus rated not significant.

Operation

For the noise-related activities during Operation (process units, heavy equipment, vehicle traffic), the predicted sound pressure levels at the seven NSAs ranged from 43-54 dBA for the day time (Table 7.31) and from 42-53 dBA during the night time (Table 7.32).

The predicted sound pressure levels (including background) for Operation during the day and night did not exceed the noise guideline levels. From the measured background values, and the noise model predictions described above, with planned mitigation, noise emissions from process units, heavy equipment and vehicle traffic during Operation would not be expected to exceed the noise guideline levels. Thus, the potential environmental effects of the Project during Operation on a Change in Sound Quality were rated not significant.

Determination of Significance

Pages 7-81 and 7.82 discuss the significance of the potential environmental effects on the Atmospheric Environment related to the Change in Air Quality; GHG Emissions, and Sound Quality.

Change in Air Quality

Overall, as demonstrated by the preceding analyses, the residual Change in Air Quality for the Petroleum Refinery and Other Land-Based Infrastructure would be expected to be low to medium in magnitude, local in extent, and short-term in duration.

The Project-related emissions of CAC, Non-CAC and odour would be likely to result in a Change in Air Quality on occasion during each of the phases (*e.g.,* dust during Construction; or odour during Operation).

In all cases except acrolein, the predicted values of Non-CAC did not exceed the objectives or guidelines. In some cases, the predicted 10 minute values of odourous compounds did exceed the odour thresholds; however, these would be infrequent, occur locally near the Project, and would be only marginally above the objectives. The Report notes that, although the background value for acrolein is already over the suggested guideline, the magnitude is small.

The Report emphasizes that dispersion modelling predictions are expected to be conservative, and able to capture the maximum ground level concentrations (GLC) values with a high level of confidence.

Therefore, with the proposed mitigation and environmental protection measures, the residual environmental effects of a Change in Air Quality on Atmospheric Environment during Construction and Operation of the Project were rated not significant.

The Report states there is a high level of confidence in this significance prediction.

Change in GHG Emissions

The Change in GHG Emissions as a result of the Project was ranked low for Construction and high for Operation. As explained earlier in Chapter 7, the Report confirms that the environmental effect of specific GHG emissions, from even a very large project, cannot be measured on climate change. Therefore, the Project-related residual environmental effects of a Change in GHG Emissions on Atmospheric Environment during Construction and Operation of the Project were rated not significant.

There is a moderate level of confidence in the significance prediction, due to the evolving nature of climate change science and increasing understanding of the role, and contribution, of GHG emissions to climate change. In addition, the Report points to the significant cumulative environmental effects of global anthropogenic GHG emissions (see Section 7.6) on atmospheric GHG concentrations and, subsequently, on climate change.

Change in Sound Quality

Regarding the predicted Change in Sound Quality, during Construction of the Petroleum Refinery and Other Land-Based Infrastructure, specific activities would result in a change to the baseline sound quality in the Local Assessment Area (LAA). This Change in the Sound Quality would be expected to be present throughout the life of the Project, and would result in an increase in the measurable sound pressure levels at nearby noise sensitive areas, extending up to 3 km out from the Project Development Area (PDA) in all directions.

However, the predicted increase would not be expected to exceed the noise guideline levels, either during the day time or night time periods. In light of the predictions described above, and with the planned mitigation, the residual environmental effects of a Change in Sound Quality on Atmospheric Environment during Construction and Operation of the Petroleum Refinery and Other Land-Based Infrastructure were rated not significant. There is a moderate level of confidence in the significance prediction.

Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment

Section 7.5 covers pages 7.82 to 7.93. It deals with the environmental effects of Project-related emissions from the operation of the Marine Terminal and Other Marine-Based Infrastructure on Atmospheric Environment, in light of the planned mitigation for the Project activities. This assessment is summarized in Table 7.33.

Mitigation for Change in Air Quality

The planned mitigation measures for Changes in Air Quality during Operation are:

- Implementation of an ‘idling policy’, where possible, to minimize the consumption of fuel when the marine vessels, equipment and vehicles are stationary for extended periods of time;
- Where possible, implement plans to minimize marine travel routes when moving materials and equipment to and within the construction area;

- Development of a detailed energy efficiency program for operation of all marine-based activities;
- Use of vapour recovery units to reduce fugitive emissions during loading of product to marine vessels; and
- Efficient scheduling of marine vessels, coming and going from the marine terminal, to reduce transit and docking time, reducing fuel consumption, and thus reducing combustion emissions.

These mitigation measures would be implemented wherever technically and economically feasible to minimize potential environmental effects of the Operation of the Project on Air Quality. The Report also notes that the sulphur content of fuels being burned by marine vessels that transfer crude oil and finished products, to and from the marine terminal, was conservatively set at 1.5% sulphur by weight. Planned MARPOL regulations relating to the sulphur content of marine fuels at international ports are set to come into effect in the year 2020.

These requirements, if adopted in Canada, would see fuel sulphur being limited to 0.5% sulphur by weight, thus representing a potential three-fold reduction in SO_2 emissions associated with the Operation of the Marine Terminal and Other Marine-Based Infrastructure. Although this assumption was not carried forward quantitatively in the EIA/EA, once these new requirements are in place, they would further mitigate the potential Change in Air Quality associated with the Operation of the Marine Terminal and Other Marine-Based Infrastructure.

Residual Project Environmental Effects for Change in Air Quality

The dispersion of CAC emissions from the operation of the Marine Terminal and Other Marine-Based Infrastructure was modelled, to predict the maximum short-term and long-term (annual) average ground-level concentrations. As emissions from the marine vessels would be expected to be intermittent in nature, a conservative yet probable emissions scenario was developed for modelling purposes. Table 7.34 summarizes the results.

The highest values were reported for SO_2 and these occurred over water, south-east of the marine terminal. Although the modelled 1 hour, 24 hour, and annual average SO_2 ground-level concentrations were predicted to be above the ambient air quality objectives (for Saint John County), the locations of these maximum predicted values would occur overwater to the south-east of the marine terminal, far enough from land that prolonged human exposure would be not likely to occur.

Since the modelled emissions scenario is conservative (*i.e.,* the ship emissions were modeled as three ships at the marine terminal for every hour of the year whereas in reality, less than three vessels would be at the marine terminal for the majority of the time), the actual ground-level concentrations over water would be expected to be below the Saint John County SO_2 objectives.

The maximum predicted ground-level concentrations of CAC at all receptors on land are below the relevant objectives, guidelines and standards.

In summary, the residual Change in Air Quality would be expected to be medium in magnitude, local in extent, short-term in duration, and not substantive. Based on the nature and extent of expected emissions during Operation, and the predicted ground-level concentrations from the dispersion modelling conducted, and in consideration of planned mitigation, the potential environmental effects of the Operation of the Marine Terminal and Other Marine-Based Infrastructure on a Change in Air Quality were rated not significant.

Project Environmental Effects Mechanisms for Change in Sound Quality

Changes in Sound Quality during Operation could arise from activities associated with the Crude Oil and Finished Product Transfer. Potential environmental effects mechanisms would include diesel engines, electrical motors, and pumps, all of which could be sources of substantive noise emissions, during crude and product transfer activities.

Mitigation for Change in Sound Quality

Mitigation measures for a Project-related Change in Sound Quality for crude oil and finished product transfer would include the following: well maintained mufflers on all marine engines and marine equipment; use of enclosures for all motors and pumps used in marine loading and unloading activities, and distances from sources to noise sensitive areas would be large.

Residual Project Environmental Effects for Change in Sound Quality

While at dock, ships would emit noise emissions from hotelling marine vessel engines, if auxiliary power was required. Typically, the sound of ships in port is dominated by the cargo-handling activities, and the ship propulsion noises themselves are barely audible.

The largest sources of noise at the loading/unloading terminal are pumps, which, for the purposes of the sound modeling, were assumed to operate both in unloading and loading mode. The emissions from pumps for marine loading/unloading and seawater cooling intake structure were also modelled, and included with the land-based sources of noise. The contribution of the marine activities to the acoustic environment, however, would be expected to be small, especially at the NSA locations on land.

This is primarily because the source-receptor distances would be large, and because there would likely be some masking by noise associated with the land-based infrastructure. Based on this brief analysis, experience, and professional judgment, the Change in Sound Quality during Operation of the Marine Terminal and Other Marine-Based Infrastructure would not be expected to be substantive. Thus, the potential environmental effects of the Operation of the Marine Terminal and Other Marine-Based Infrastructure on a Change in Sound Quality were rated not significant.

Determination of Significance

- Change in Air Quality The residual Change in Air Quality for the Marine Terminal and Other Marine-Based Infrastructure would be expected to be medium in magnitude, local in extent, and short-term in duration.

  Dispersion modelling predictions for CAC emitted from the marine-based infrastructure were below the regulatory objectives, guidelines and standards at all receptors overland. Some predicted values exceeded the objectives, guidelines and standards over water. The Report emphasizes, however, that the predicted concentrations of SO_2 over water did not exceed the federal maximums for all averaging periods. In light of the planned mitigation measures, the residual environmental effects of a Change in Air Quality on Atmospheric Environment during Operation of the Marine Terminal and Other Marine-Based Infrastructure were rated not significant, with a moderate level of confidence.

- Change in Sound Quality The contribution of noise emissions from the marine-based activities would not be expected to cause the noise guideline levels for a Change in Sound Quality to be exceeded, primarily because of the large distances from the

navigational areas and marine terminal to noise sensitive areas. In light of the planned mitigation measures, the residual environmental effects of a Change in Sound Quality on Atmospheric Environment during Operation of the Marine Terminal and Other Marine-Based Infrastructure were rated not significant, with a moderate level of confidence.

Assessment of Cumulative Environmental Effects

Section 7.6 begins at the bottom of page 7-89 and continues to the end of Chapter 7 on page 7-105. It focuses on the cumulative environmental effects of other projects and activities in the Saint John area on the Atmospheric Environment, when considered in combination with those from the Project. Table 7.35 identifies these other projects and activities, and ranks them in terms of significance, while table 7.36 presents a summary of the residual cumulative environmental effects on Atmospheric Environment.

Project Cumulative Environmental Effects Mechanisms for Change in Air Quality

The main projects or activities in the Regional Assessment Area (RAA) with the potential to act cumulatively with the Project to bring about a Change in Air Quality would be:

- Industrial Land Use (e.g., the Gypsum Wallboard Manufacturing Plant and the Canaport LNG Marine Terminal and Multi-Purpose Pier); and

- Planned Marine Use (including marine vessels for LNG, natural gypsum, and petroleum coke shipping in the Port of Saint John).

In addition, smaller emission sources such as marine vessels, automobiles, and residential wood burning might also contribute to cumulative environmental effects. Also, long-range transport of air contaminants from other jurisdictions may contribute to cumulative environmental effects.

- Base Case For the Base Case (Existing Environment), the primary mechanisms for a Change in Air Quality arise from emissions of air contaminants from existing and regional sources in the Saint John airshed, and emissions from other regions into the RAA. Emission sources include existing projects and activities. For the Saint John airshed, an extensive ambient monitoring network exists and baseline conditions are well-characterized (Section 7.2).

- Project Case The primary mechanisms for a Change in Air Quality for the Project Case arise from emissions of air contaminants from the Petroleum Refinery and Other Land-Based Infrastructure, the Marine Terminal and Other Marine-Based Infrastructure (Sections 7.4 and 7.5), as well as existing emission sources (Base Case). For this case, the emissions of air contaminants from the Project would interact cumulatively with the emissions from other existing sources in the RAA. The Change in Air Quality would depend on several factors including: the relative proximity of emission sources, differences in air contaminant emission rates, and variance in local meteorology.

- Future Case For the Future (Cumulative Environmental Effects) Case, the primary mechanisms for a Change in Air Quality would arise from the cumulative emissions of air contaminants from substantive existing sources, Project sources, and other future sources in the Saint John airshed (e.g., Canaport LNG, Gypsum Wallboard plant), as well as emissions from other regions into the RAA.

Cumulatively, the sources of emissions include existing power plants, pulp and paper mills, the existing Saint John refinery, the Project sources and other future projects that have been defined at this time. Other future projects and activities in the RAA which have the potential for cumulative environmental effects on a Change in Air Quality would include the Gypsum Wallboard Manufacturing Plant and the Canaport LNG Marine Terminal and Pier in Canaport. In this Future Case, the environmental effects from the future projects would interact with the environmental effects of the Base Case and the Project Case. The Change in Air Quality would depend on the relative proximity of emission sources, differences in air contaminant emission rates, and variance in local meteorology.

Mitigation of Cumulative Environmental Effects for Change in Air Quality

Mitigation of cumulative environmental effects for a Change in Air Quality would require participation and cooperation from those facilities that are substantive sources of emissions. Beyond the mitigation measures described earlier which are specific to the Project itself, other measures that could be explored in cooperation with other project proponents, and provincial/federal governments, with input from the public and other stakeholders, would include development and implementation of an air quality response plan for the Saint John airshed to reduce emissions during episodes of poor air quality.

Although not in the control or influence of the Proponent, governments and other stakeholders could also develop and implement policies or programs to improve air quality (e.g., improved public transit, international agreements, and emission reductions programs) that could cumulatively result in positive environmental effects.

Residual Cumulative Environmental Effects for Change in Air Quality

The residual cumulative environmental effects are assessed by considering a Change in Air Quality from the Base Case, the Project Case, and the Future Case.

- Base Case To characterize the Base Case in the RAA, ambient air quality monitoring data from provincial and federal programs, as well as supplementary ambient monitoring data were analyzed. Data on the existing air quality conditions (Section 7.2, Section 3.5.1) were used to estimate background air quality concentrations (Base Case) to be used for the dispersion modelling in the Project and Future cases. In addition to background ambient air quality data, major industrial emission sources in the RAA were modelled to characterize the Base Case for secondary particulate matter formation and potential acid input.

- Project Case The residual Change in Air Quality for the Project Case was assessed for each of the land-based and marine-based infrastructure components in Section 7.4 and 7.5 respectively. The potential environmental effects of both land-based and marine-based infrastructure were assessed individually, in conjunction with the Base Case. In both instances, the Change in Air Quality would be expected to be medium in magnitude, local in extent, and short-term in duration. The residual cumulative environmental effects of the Base Case plus both the land-based and marine-based infrastructure would be less than that of the Future Case, which is discussed below.

- Future Case For the Future (Cumulative Environmental Effects) Case, emissions inventories were developed for CAC from proposed future Industrial Land Use projects as described above. To be conservative, only projects which would result in a net increase of air contaminant emissions into the Saint John airshed were included in the

assessment of cumulative environmental effects. The other future projects meeting this criterion, which were included in the cumulative environmental effects assessment, were:

- Industrial Land Use (*e.g.,* the Gypsum Wallboard Manufacturing Plant and the Canaport LNG Marine Terminal and Multi-Purpose Pier); and

- Planned Marine Use (including marine vessels for LNG, gypsum, and petroleum coke shipping in the Port of Saint John).

Emissions of Non-CAC from other future projects were not estimated, due to limited availability of data for these sources.

However, as CAC emissions from proposed future sources are relatively low, compared to emissions estimated for the Base Case and Project Case, the related Non-CAC emissions from other future sources would not be expected to be substantive.

The dispersion of CAC emissions from the selected future industrial sources was modelled to predict the maximum short–term (hourly) and long-term (annual) average GLC, due to these sources alone. These results were then combined with predictions from dispersion modelling results, for both land-based and marine-based infrastructure, where applicable (Sections 7.4.1 and 7.5.1). Finally, background concentrations based on ambient monitoring data were added to the combined modelling results, to assess the cumulative environmental effects of the Future Case.

For CAC, the predicted values for the Future Case were compared with regulatory objectives, guidelines and standards to establish the direction, magnitude, geographical extent, duration, frequency, reversibility, and ecological/socio-economic context. A summary is provided to indicate the nature of the predictions in Table 7.37.

From this table, and from the contour plots provided in Section 3.5.1, the highest values were reported for SO_2 and occurred over water, south-east of the marine terminal. These maximum GLC were primarily due to emissions from the Project marine-based infrastructure (Section 7.5.1). Although the maximum predictions for 1 hour, 24 hour, and annual SO_2 were above the ambient air quality objectives set by the New Brunswick Department of Environment (for Saint John County), the locations of these exceedances were far enough from land that prolonged human exposure would not likely occur.

The maximum predicted SO_2 concentrations were below the federal maximums for SO_2 (which are equivalent to the SO_2 criteria for most counties in New Brunswick, and most likely applicable in the marine waters of the Bay of Fundy.) Further, as the emissions scenario modelled for the marine-based infrastructure was conservative (Section 7.5.1), the potential frequency of exceedances was diminished. All predictions of SO_2 ground-level concentrations on land were below the regulatory objectives. All of the other model predictions of CAC for the Future (Cumulative Environmental Effects Case) were below the regulatory objectives, guidelines, and standards.

On an overall basis, the residual cumulative environmental effect on a Change in Air Quality would be expected to be medium in magnitude, local in extent, and short-term in duration. The Project contribution to the cumulative environmental effect would also be expected to be medium in magnitude, local in extent, and short-term in duration.

In both cases, the frequency of events where objectives, guidelines, standards, or odour thresholds would be exceeded was expected to be, at worst, occasional. The cumulative environmental effects of the Project, during all phases, in combination with other projects and activities were rated not significant.

Project Cumulative Environmental Effects Mechanisms for Change in GHG Emissions

Similar to a Change in Air Quality, the cumulative environmental effects of a Change in GHG Emissions from the Project were assessed in combination with GHG emissions from other future projects. These included the GHG emissions from Industrial Land Use (e.g., the Gypsum Wallboard Manufacturing Plant and the Canaport LNG Marine Terminal and Multi-Purpose Pier) and the Planned Marine Use (including marine vessels for LNG, natural gypsum, and petroleum coke shipping in the Port of Saint John). The GHG emissions from the Other Future Projects, based on available information, are summarized in table 7.38.

Mitigation for Change in GHG Emissions

The mitigation measures for Project-related GHG emissions are presented in Section 7.4. GHG emissions are a global issue. As a result, mitigation, to be effective in reducing the rate of increase of GHG concentrations in the atmosphere, must be undertaken globally.
Such an undertaking requires the introduction of transformative technologies that, over time, would result in the displacement of older, inefficient technologies—those which would provide the goods and services of similar quality with lower GHG design intensity.

For other future projects, there is opportunity for mitigation measures to be implemented to reduce GHG Emissions. These measures are not fully known for each specific project but are expected to be similar to those presented in this EIA/EA for the Project.

Residual Cumulative Environmental Effects for GHG Emissions

As with the cumulative environmental effects assessment for the Change in Air Quality, the cumulative environmental effects for the Change in GHG Emissions were assessed for the Base Case, Project Case and Future Case.

- Base Case New Brunswick's GHG emissions were approximately 18 Mt CO_2eq/a in 2006 (Environment Canada 2008i). Emissions were about 21 Mt prior to the announcement of federal initiatives to reduce emissions from large sources. It is anticipated that the province will stabilize GHG emissions at 1990 levels by 2012 (15.9 Mt; Table 7.10), and that full implementation of the provincial plan will see GHG emissions decline by 10% (to approximately 14.3 Mt) by 2020 (NBENV 2007b).

  The Canadian emissions, country-wide, are approximately 721 Mt CO_2eq/a (Table 7.11). Global emissions are approximately 49,000 Mt CO_2eq/a as discussed in Section 7.2.2.3.

- Project Case As described in Section 7.4, the Project-related GHG emissions during Operation were estimated at 5.77 Mt CO_2eq/a, and are considered 'high' in the context of CEA Agency guidance. The Project (Operation) was predicted to result in a Change in GHG Emissions (Section 7.4.1.2) as follows: 25% of the total New Brunswick emissions projected for 2015; 0.8% of Canadian total emissions; and 0.02% of total global emissions (based on fossil fuels).

  The potential mitigation for these emissions would include: The continued pursuit of innovation, by looking at every potential aspect of the Project during the design process

to improve energy efficiency; a design approach that allows the refinery to take advantage of options for future carbon capture or sequestration opportunities, should they become available; continuous improvement and adaptive management; and being best-in-class in energy efficiency with as small an environmental footprint as possible.

- Future Case The GHG emissions from other future projects would be expected to add approximately 3% to the anticipated 2015 GHG emissions total for New Brunswick. The Project would be scrutinized through the design and the permitting process to ensure that it would operate with the highest energy efficiency, and lowest GHG emissions, that are technically and economically feasible.

  This would be done while balancing the public demand for refined fuel products, in the context of increasing energy intensity resulting from the refining of heavy crudes, which will become more prevalent as supplies of lighter crudes decrease.

  The GHG emissions from other future projects would add cumulatively to those of the Base Case and the Project. According to CEA Agency guidance (CEA Agency 2003), the magnitude of the Change in GHG Emissions for the Project alone would be high (> 1 million tonnes CO_2eq per year). As a result, the magnitude for the Project, in combination with other future projects, would also be high. Nevertheless, the Project contribution, relative to the global emissions of GHG, is small, as a percentage of national or global emissions (Table 7.36).

  The cumulative environmental effects of a Change in GHG Emissions on Atmospheric Environment are thought by many scientific authorities as being significant, even in absence of the Project. The Project in combination with these cumulative environmental effects is thus significant. However, the Project contribution to the residual Change in GHG Emissions would be very small, relative to global emissions. Because the environmental effect on climate change would not be measurable, this contribution would be considered to be not substantive.

Change in Sound Quality

As discussed in Section 7.6.3, a Change in Sound Quality from the Project would not be expected to act cumulatively with other future projects, and therefore the cumulative environmental effects were rated not significant.

Determination of Significance - Change in Air Quality

Overall, the residual cumulative environmental effects of a Change in Air Quality would be expected to be medium in magnitude, local in extent, and short-term in duration. The Project contribution to the cumulative environmental effect would also be expected to be medium in magnitude, local in extent, and short-term in duration. Dispersion modelling predictions for CAC, emitted from the Petroleum Refinery and Other Land-Based Infrastructure, the Marine Terminal and Other Marine-Based Infrastructure, and proposed regional industrial sources (including background) occasionally exceeded the regulatory objectives for SO_2 only, at receptors over water, and also exceeded odour thresholds, for hydrogen sulphide (H_2S) only, at locations near the refinery complex.

Planned improvements to industrial sources in the airshed and continuous air quality improvement achieved through regulation and policy would continue to result in continuously reduced ambient concentrations of contaminants and odours in the region, even with the Project. Therefore, the cumulative environmental effects would not vary substantially from the

predicted Change in Air Quality, due to emissions from the Petroleum Refinery and Other Land-Based Infrastructure (Section 7.4).

The cumulative environmental effects of a Change in Air Quality were therefore rated not significant.

Similarly, the Project contribution to the cumulative environmental effects of a Change in Air Quality was rated not significant. Both significance predictions are made at a moderate level of confidence.

Determination of Significance - Change in greenhouse gas (GHG) Emissions

While emissions from the Project would add to existing GHG emissions occurring globally, and potentially contribute to those increasing concentrations, a potential cause and effect between Project emissions and global climate change cannot be characterized.

Emissions from the Project might add approximately 0.02% to annual total global GHG emissions. This is not an unimportant value, but still a very small fraction of the global total emissions of GHG. However, despite anticipated growth in the demand for clean transportation fuels, the Project could be assumed to be offsetting emissions from other refineries in North America in the future, as lighter crude supplies decrease, and heavy crudes become more prevalent.

Because the Project's contribution to a net change in global GHG emissions would be small, and because the environmental effect of the Project on global climate would not be measurable, the Change in GHG Emissions as a result of the Project (i.e., the Project contribution to the cumulative environmental effects) was rated not significant. There is a high level of confidence in this significance prediction.

However, increasing GHG emissions and the resulting increase in GHG concentrations in the atmosphere, and the consequent changes to the global climate are believed to be a significant, cumulative, environmental effect.

Therefore, even with the planned mitigation, and the analysis presented in this EIA/EA, the potential environmental effects, including cumulative environmental effects, of a Change in GHG Emissions from the Project and from other planned future projects, was rated significant.

This rating is a result of the fact that the existing environmental effects of GHG emissions on global climate are significant, even in the absence of the Project. This would occur with or without the Project; although substantive policy and regulatory instruments have been proposed by governments around the World to address these cumulative environmental effects, including Canada. This significance prediction is made at a moderate level of confidence.

The Project would be built in response to a continuing growth in demand for high quality refined products that will, in the future, be produced from increasingly prevalent heavy crude oils. With its advanced technologies and efficiencies, it would be expected, over time, to replace older, less efficient refineries.

The GHG Management Plan to be developed for the Project would incorporate several initiatives to reduce the amount of energy needed to produce high quality products for market from crude oils, and other feedstocks of declining quality.

Follow-up and Monitoring

For a Change in Air Quality, follow-up and monitoring programs would be established to measure the release of Project-related air contaminants to the atmosphere, and to monitor ambient air quality in the vicinity of the Project property boundaries. Several primary sources of emissions would be anticipated to have continuous emissions monitors. These would be installed on the stacks to monitor and quantify key air contaminant emissions, as indicators of the efficiency of the operation of the respective units, and for comparison against regulatory values. Further, it would be anticipated that source emissions testing would be conducted for key sources and select air contaminants as prescribed by the regulatory agencies.

In addition to the extensive ambient air quality monitoring network already operated by provincial and federal programs in the Saint John region, it is anticipated that additional ambient monitoring would be required, on a continuous basis, within the vicinity of the Project, to monitor the ambient air quality in the nearby communities.

Emissions of GHG would be monitored and/or calculated to quantify annual emissions for reporting to federal requirements, as a follow-up measure to a Change in GHG Emissions. Follow-up monitoring for a Change in Sound Quality would be conducted by measuring sound pressure levels in specific noise-sensitive areas and/or along the site perimeter as the Project proceeds, particularly during Construction but also on occasion during Operation. The monitoring plan would be developed in consultation with regulatory authorities, prior to the start of Construction as part of the Environmental Protection Plan (EPP) for the construction activities. A noise complaint follow-up and response procedure would also be developed as part of the EPP.

Summary

In summary, given the planned mitigation, and the analyses presented in this EIA/EA, the potential Change in Air Quality and Change in Sound Quality on Atmospheric Environment as a result of the Project during all phases, including cumulative environmental effects, was rated not significant.

The potential environmental effects of the Change in GHG Emissions, on Atmospheric Environment, from the Project alone during all phases, were rated not significant. The potential environmental effects of the Change in GHG Emissions, on Atmospheric Environment from the Project and other future projects, including cumulative environmental effects, were rated significant.

The significant rating is solely the result of the environmental effects of existing GHG emissions (even in absence of the Project) on global climate.

Chapter 8 – Water Resources

This chapter of the report covers pages 8-1 to 8-35. It begins by explaining that Water Resources were identified as a Valued Environmental Component (VEC), due to their importance in providing potable water to residents or businesses in the area surrounding the Project.

The Report notes that at least 3,800 US gallons per minute of freshwater would be required to supply the process water needs of the Project. This estimate is based on the use of seawater cooling to meet all the cooling demands of the Project.

As an alternative to this approach, the Report explains that the Proponent is also considering the use of cooling towers to meet these requirements. If such towers were ultimately incorporated into the Project design, overall freshwater requirements could rise to as much a s 7,570 US gallons per minute. In this scenario, however, the Proponent would aggressively implement water conservation, recycling and reuse initiatives, so the total requirements of the Project would not exceed 5,600 US gal/min.

A Project freshwater demand of up to 5,600 US gal/min has been carried through the assessment of Water Resources. Other water recycling or conservation initiatives could further reduce this demand and would be explored during detailed design. Among the possible water supply options, it has been determined that the use of raw (untreated) freshwater, sourced from the City of Saint John municipal water supply, is the most technically and economically feasible means of reliably supplying the freshwater needs of the Project. A small amount of treated water could also be supplied as potable water.

Freshwater for the Project would be supplied via a new water main connected to the municipal water supply. The Report notes that currently available studies indicate the excess available water supply from the City's Loch Lomond water system would not be sufficient to meet the demands of the Project on its own.

However, when combined with the available capacity of the Spruce Lake water supply system, there appears to be sufficient excess capacity in the City's water supply system, as a whole, to sustainably supply the Project. This finding is subject to confirmation by the City through updated studies now being completed. The City has indicated that its preferred option would be to supply the Project from the Loch Lomond system alone. The freshwater supply requirements for the Project are the subject of detailed commercial discussions and negotiations between the Proponent and the City to determine the best means of supplying the required freshwater for the Project, under what conditions, from which source, using which infrastructure, at whose cost, and under what acceptable commercial terms.

The use of groundwater is not currently planned to supply the Project. It has been concluded through this assessment, and previous studies, that, should the City determine it can acceptably and sustainably supply sufficient freshwater to the Project, the adverse environmental effects of the Project on surface water and groundwater resources, including cumulative environmental effects, would not be significant.

Sections 8.1 and 8.2 covers pages 8-2 to 8-17 and provide detailed information on the Scope of Assessment and Existing Conditions under the following sub-headings

<u>Scope of Assessment</u>

- Regulatory setting.
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

- Surface Water Resources
    - Surface Water Supplies
    - Water Availability
    - Other Surface water Sources
- Groundwater Resources
    - Overburden Geology
    - Bedrock Geology
    - Groundwater Flow Directions
    - Groundwater Quality
    - Receptors in the Local Assessment Area (LAA) - (Well Users)
    - Well Yield and Characteristics

Potential Project-VEC Interactions

Section 8.3 covers Pages 8-17 to 8.28 and begins with table 8. 2, which lists each proposed activity or physical work, in connection with Potential Project Environmental Effects to Water Resources. The level of interaction each activity or physical work would have with Water Resources was rated as either 0, 1 or 2. Only one Project activity (water supply use) was identified as potentially interacting with surface water resources, while five activities that could interact with groundwater resources were identified. The Report also points out at this juncture that Accidents, Malfunctions, and Unplanned Events were addressed separately in Chapter 23.

All project activities or physical works associated with the Marine Terminal and Other Marine-Based Infrastructure were ranked as 0, as these Project components would not interact with Water Resources, in any substantive way, during any phase of the Project. Several activities and physical works undertaken during Construction and Operation were ranked as 0, as there is no anticipated interaction between these activities and Water Resources under normal conditions.

For surface water resources, the majority of the potential environmental effects were ranked as 0, because the surface water resource itself is located a considerable distance from the Project Development Area (PDA), and is outside the Local Assessment Area (LAA). Only one potential surface water environmental interaction, Water Supply and Use, was carried forward for further assessment.

Potential environmental effects on groundwater by the Project were assigned either 1 or 0. Potential environmental effects assigned 0 are generally associated with Operation, (*i.e.*, road transportation, existing pipelines, and employment factors) which would not be expected to cause any interaction or environmental effects on groundwater.

Several activities under Construction and Operation were assigned a ranking of 1, as these could potentially affect groundwater resources. The report states, however, that most potential Project-related effects are anticipated to be temporary. It also notes that the proposed best management practices have been demonstrated to effectively mitigate these concerns. These best management practices, which include mitigation, monitoring, and contingency planning, are detailed in Section 8.3.1.

The potential environmental effects of all Project-related activities and physical works were ranked as either 0 or 1 in Table 8.2 on Water Resources, during all phases of the Project, and, including cumulative environmental effects, were rated not significant. The Report states there is a high level of confidence in this prediction.

Section 8.3.1 then describes the rationale for selection of activities that were ranked as 2 in Table 8.2. Although they were rated not significant, activities ranked as 1 for interaction with Change in Groundwater Availability are discussed as well.

Change in Surface Water Availability

Because of the physical nature and location of the surface water resources that would be used by the Project, potential environmental effects could only occur during Operation. The interaction between Water Resources and Water Supply and Use during Operation was ranked as 2 in Table 8.2. This activity has the potential to affect surface water resources, as it might reduce the amount of water available for the City of Saint John municipal users, or their industrial customers. The Report notes that a relatively high freshwater demand would be required by the Project during Operation.

Change in Groundwater Availability

Potential environmental effects from the Project on groundwater resources were identified for Construction, Operation, and Decommissioning and Abandonment, and ranked as 1, for all Project phases.

Interactions with Well Users

The Report states that domestic wells located within close proximity to, or hydraulically down-gradient of the PDA, or any associated linear infrastructure within the LAA, could be affected by Project activities during Construction, Operation, or Decommissioning and Abandonment. Figure 8.4 shows the location of domestic water wells in the LAA.

Calvert Lake: Residential wells located at Calvert Lake have been acquired by the Proponent, and would be properly decommissioned and abandoned according to NBENV guidelines. Wells located north and west of Calvert Lake and Bean Brook are separated from the PDA by a hydraulic boundary (Bean Brook), and considered less likely to be influenced by the Project.

Mispec Beach: Based on topography and expected shallow groundwater flow directions, Mispec Beach wells are located hydraulically down-gradient of potential Project facilities, and could be indirectly affected by activities in the PDA.

A small topographic high, immediately northwest of the residents, might protect the wells from drainage and groundwater flow originating on the PDA. A 150 m wide protection zone is provided between the Mispec Beach wells and the Project facilities.

Lower Red Head Road: Based on topography and expected shallow groundwater flow directions, the Lower Red Head Road wells could potentially be affected by Project activities. However, an existing buffer between the PDA and these estimated 18-20 wells, extending northwest and up-gradient of the wells, and encompassing the small unnamed tributaries, would be expected to mitigate any potential environmental effects such that they would not be significant.

Rocky Corner: The estimated 30 Rocky Corner residential wells could be affected by Project activities. Shallow groundwater originating from the PDA could be captured by these wells. The wells in the northerly portion of Rocky Corner are less likely to be affected by Project activities, due to the steep topography of Red Head Mountain, to the immediate north and west of these wells. No Project construction is proposed on steep slopes, therefore topography should divert local groundwater flow to the southeast. Wells situated along the southeast portion of Rocky

Corner are directly down-gradient of the PDA, and could receive some recharge from the vicinity of the PDA. A 150 m wide protection zone would be provided between the Rocky Corner wells and Project activities.

Anthonys Cove: There is a potential for groundwater environmental effects from Project activities (tank farm) located immediately southeast of Anthonys Cove. The proposed mitigation would be exclusion of activities or drainage control within an inferred drainage channel that drains the peninsula between Anthonys Cove and Deep Cove, northwest through Anthonys Cove. A 150 m wide protection zone would be provided between the Rocky Corner wells and Project activities. No groundwater or run-off effects from the main portion of the PDA located farther to the northeast would be anticipated, due to distance, proven effective mitigation, and the presence of the intervening Anthonys Brook and Red Head Mountain.

Red Head Mountain: Since no PDA facilities are planned for construction on the southern and western sides of Red Head Mountain, the community of Red Head would not be expected to be directly affected by Project activities, as a strong hydraulic gradient is expected between Red Head Mountain and Anthonys Brook. Drainage in this area of the Project would be expected to be controlled by steep gradients from Red Head Mountain towards Bean Brook and Anthonys Brook.

Old Black River Road C: Project activities within the PDA, or the LAA situated to the north, south, and east of these wells, could theoretically affect the groundwater. Potential environmental effects from the Project would be expected to be minor, west of Area C, since the topography indicates groundwater in the area of the PDA would not flow in this direction.

Contingency Plan for Mitigation of Residential Well Environmental Effects

The planned mitigation would be expected to effectively mitigate environmental effects to residential wells.

However, a contingency plan would be developed, and implemented to provide an interim water supply, in the unlikely event that groundwater resource users experience unacceptable adverse environmental effects, as per Canadian Council of Ministers of Environment (CCME) Guidelines, in groundwater quality, or quantity, during any stage of the Project.

The specifics of the contingency plan would be decided on a case-by-case basis, pending the nature of the adverse environmental effect, and its relation to the Project. The contingency plan would include the tasks below, as they might be determined applicable and appropriate, for each individual circumstance encountered as a result of Project activities:

- Establish an arbitration process for the reporting, investigation, mitigation and remediation of residential well damage claims;
- Remedial Action Plan to restore damaged wells;
- Provide temporary potable (bottled water), or whole house (water tank) water to residences until the activity is over and conditions return to normal;
- Repair damaged wells by driving the casing back into place with a drill rig, installation of a grouted casing liner (to seal off in-flow), well reconstruction or replacement;
- Provide water treatment or new well to affected well user;
- Wells would be drilled or repaired by a licensed water well contractor;
- Well repair and/or replacement, including deepening of existing wells and replacement of permanently damaged wells; and
- Reduce demands on local groundwater aquifer through use of approved water source

(municipal or bulk trucking) for needs of Project (*i.e.*, watering for dust suppression, concrete production).

Construction

Interactions between Water Resources and Site and Right-of-Way Preparation, Physical Construction, Equipment Installation, Construction of Linear Facilities, and Watercourse Crossings during Construction were ranked as 1 in Table 8.2. These activities have the potential to affect groundwater availability due to clearing and grubbing, excavation, blasting, and pile driving.

Most potential environmental effects, on groundwater quantity or quality, at receptor wells would be related to groundwater vibrations associated with excavations, and changes in the groundwater levels or flow directions in areas located hydraulically up-gradient of water wells.

In most cases, these environmental effects would be temporary and effectively mitigated by best management practices and industry standards for major construction works.

Blasting and Ground Vibration Due to the potential for bedrock to be encountered near surface throughout the PDA and LAA, blasting might be required to facilitate excavation for some Project components. The level of interaction of blasting activities on groundwater resources would depend on the type of rock, the depth of the excavation, and the distance to the well. Blasting activities are commonly the cause of complaint from well owners living near large development projects.

The most commonly received complaints relate to changes in water quality such as increased turbidity, discolouration of water, and coliform bacteria contamination due to damage of well casing seals. Vibration from construction equipment has been reported to adversely affect water wells and springs in close proximity, generally resulting in temporary increases in colour and turbidity.

In rare cases, continuing residual environmental effects of poor water quality may occur, due to loosening of well casing that permits shallow groundwater or surface water to enter directly into the well. Mitigation of residual water quality environmental effects caused by blasting could include driving the casing back into place with a drill rig, installation of a grouted casing liner (to seal off inflow), or well reconstruction, or replacement. In the case of temporary water discoloration, the most common mitigative measure would be to provide temporary potable (bottled water), or whole house (water tank) water, to residences, until the activity is over and conditions return to normal.

The magnitude of any blasting-related environmental effects on a well is proportional to several factors, including: the distance between the blast and a receptor well; the structural integrity of the well; size of the individual blast; and the seismic properties of the intervening bedrock. Older, poorly constructed wells are also more likely to suffer physical damage or ongoing water quality issues, than newer properly constructed wells.

In very rare cases, the yield of a previously low yield well may be slightly reduced, to the point where the well becomes insufficient for domestic use. In the unlikely event of loss of well yield, the most common mitigative measure is to provide temporary water until the well can be remediated by deepening, hydro-fracturing or re-construction. Monitoring would be completed prior to, and during, blasting and ground vibration activities, and could include the following:

- Pre-blast surveys (*i.e.,* completion of a questionnaire to document well construction,

water quantity and quality issues, and well location based on the homeowner's knowledge), as well as sampling of potable water wells at owner-occupied residences within 500 m of proposed blasting location, or a reasonable subset of domestic wells in larger subdivisions, with analysis for bacteria, general chemistry, and trace elements.
- Vibration monitoring during blasting
- Direct monitoring of any wells within 30 m of blasting excavations (none expected)
- Mitigation during blasting and ground vibration producing activities might include, but is not limited to, the following:
- Use best management practices for blasting and excavation; and
- When possible, ripping would be used preferentially, over blasting within 150 m of wells or springs.

Excavation and Dewatering If an excavation intercepts the water table, the excavated area could result in a local lowering of the water table, and alter local hydrogeological conditions, including groundwater flow patterns. With respect to groundwater resources, major excavations that extend substantially below the water table for long periods of time have the potential to lower local water levels.

Excavation and dewatering are more likely to affect the shallow overburden aquifer and the upper fractured bedrock, with little measurable environmental effect on deeper fractured bedrock groundwater flow systems.

Dug or screened wells completed in overburden, or very shallow (less than 30 m deep) drilled wells in bedrock within an effective distance of 30 m to 100 m from the excavation, typically have less water in storage. They are thus more likely to be affected by small declines in water level caused by major excavations into the water table. Deeper drilled wells with a greater volume of in-well storage are less likely to be effected by excavation dewatering. The domestic water supply wells located within the LAA are predominately drilled wells ranging in depth from 19.8 to 161.5 m (65 to 530 feet) with an average of 57.3 m (188 feet). Based on distance from the PDA and indicated depths, the majority of these wells would not be expected to be adversely affected by minor water level declines caused by Project activities.

A 150 m buffer zone would be present around identified domestic water supply wells. This should effectively mitigate any potential environmental effects from excavation dewatering on wells. Mitigation during excavation and dewatering activities might include, but is not limited to the following;

- Preventing buried corridors from becoming drainage pathways through use of flow barriers or plugs;
- Construction sequencing to minimize excavation duration of local groundwater dewatering;
- Maintaining existing topography and vegetation cover to minimize changes in recharge;
- Minimizing the duration of an excavation below the water table.

Acid Rock Drainage Based on the expected nature of the underlying bedrock, no acid rock drainage would be anticipated within the PDA. The report notes that this will be discussed further in Chapter 22. Due to the variable nature of the bedrock throughout the LAA, there is a low potential for encountering sulphide mineralization, based on previous studies for other industrial activities. In the event that acidic rock was encountered, there are industry standards regulating the excavation and disposal of such rock, and for the mitigation and prevention of chronic acid rock drainage. Mitigation for acid rock drainage could include, but is not limited to, the following:

- Minimizing exposure of mineralized bedrock (if discovered to be present) to prevent persistent acid rock drainage; and
- Covering exposed mineralized bedrock (if necessary) using clay till, concrete or other approved methods.

Changes to Groundwater Recharge Area Such a large development would, by necessity, change the groundwater infiltration potential in the local watershed. Normal rainfall infiltration into the overburden and bedrock aquifers could be reduced, or eliminated, by the presence of large structures, paved areas and areas compacted by heavy equipment. This could affect groundwater levels and flow patterns on a local scale, resulting in slight changes in base flow to local streams due to diversion of both run-off and groundwater flow beneath major buildings, paved areas and lined lagoons.

The magnitude and duration of water level environmental effects beneath the PDA would be dependent on the hydrogeologic properties of the overburden or bedrock aquifer. Environmental effects on down-gradient deep bedrock wells would be expected to be negligible, because recharge encompasses an area much larger than the PDA. Less than 20 percent of the PDA would be rendered effectively impermeable. Theoretical lowering of the water table could affect very shallow wells located immediately down-gradient of the PDA. While these environmental effects would be expected to be small, to minimal, for seasonal recharge throughout the area, several mitigation actions to reduce loss of potential aquifer recharge could be applied. There are opportunities to modify the perimeter storm water management strategy to offset the environmental effects of infiltration loss to the subsurface. Mitigation for changes to groundwater recharge areas could include, but is not limited to, the following:

- Maximizing green areas within, or near, the PDA, including the establishment of green buffer zones;
- Integration of infiltration basins within the storm water management strategy;
- Provision of infiltration trenches (French drains) under paved parking lots;
- Storm water run-off diversion to adjacent green areas for infiltration; and
- Construction of pressure focused infiltration ponds, as part of storm water management ponds.

Operation

The main potential adverse environmental effect of the Project on groundwater resources during Operation would include accidental and chronic releases of process and maintenance chemicals and products to the surface environment that could infiltrate into the underlying groundwater aquifers. Such accidental releases are addressed in Chapter 23. The interaction between Water Resources and Right-of-Way and Infrastructure Maintenance during Operation was ranked as 1 in Table 8.2. The report states that, pending the implementation of the mitigation strategies described above, the environmental effects of the Project on groundwater quantity were rated not significant. The main operational issues with respect to groundwater quality would be de-icing chemicals and vegetation control chemicals that might be used throughout the PDA and LAA.

De-icing Chemicals As with all roadways in Atlantic Canada, de-icing maintenance is required during the winter months for safety reasons. By reason of its high solubility and mobility in the subsurface, road salt applied to highways, access roads, parking areas and wastewater management facilities (to mitigate freezing conditions), can enter the bedrock aquifer and move down-gradient towards receptor wells. This additional salt loading from the Project would add to existing salt loading from local highways and roads. The residential well inventory did identify a

few minor incidences that could be attributed to road salting. The significance of this type of interaction would be dependent on several factors including:

- Distance to a receptor well;
- Groundwater flow directions; and
- Intervening hydrogeology (*i.e.*, hydraulic conductivity).

Potential mitigation could include provision of improved drainage to direct salt laden run-off away from groundwater recharge areas and groundwater wells. Use of alternative de-icing measures such as sand salt mixtures and saline brine mixtures could also reduce environmental effects, if they were determined to be technically and economically feasible for the Project.

Vegetation Control Intensive use of herbicides along pipeline corridors, and other linear features such as power line corridors and valve stations throughout the LAA, could pose a small risk to groundwater users located hydraulically down-gradient of application points. Most modern herbicide chemicals are typically less hazardous and persistent than those used in the past. Notwithstanding the low probability of adverse environmental effects on water supply wells, the use of chemical herbicides to control vegetation along linear features would be minimized, and conducted in compliance with applicable pesticides control legislation, using best management practices including:

- Use of mechanical vegetation control methods up-gradient of water supply wells;
- Use most environmentally “friendly” herbicides;
- Close management control of pesticide chemical storage and application; and
- Seasonal optimization of herbicide applications (*i.e.,* spray at correct time) to reduce volume used.

The Report also notes at this point that the environmental effects of accidental releases of petroleum process chemicals or products are addressed in Chapter 23.

Decommissioning and Abandonment

The interaction between Water Resources and Removal of Facilities and Site Reclamation was ranked as 1 in Table 8.2. Potential interactions involved in Decommissioning and Abandonment would be very similar to those occurring during Construction, with less or no blasting and deep excavation anticipated. Mitigation measures would be similar to those discussed for Construction. The objective would be to restore the site in a manner which minimizes any ongoing adverse environmental effects on groundwater such as reduced groundwater recharge potential, uncontrolled subsurface drainage pathways, and acid rock drainage.

Best management procedures, applicable or regulated at the time of Decommissioning and Abandonment, would be applied in the decommissioning and restoration of this industrial site. Decommissioning, depending on the ultimate use of the decommissioned site, could be considered a net positive environmental effect on groundwater resources.

Summary

To summarize, the Report states that all Project activities ranked as 1 in Table 8.2 would not result in significant environmental effects on Water Resources during any phase of the Project, due to the application of well established and proven mitigation measures, and were rated not significant.

The environmental effects on groundwater from Decommissioning and Abandonment would be anticipated to be not significant.

It would be anticipated that the potential measurable changes in groundwater quantity and quality could be mitigated through well established groundwater protection procedures. Therefore, the environmental effects of the Project on Groundwater Resources were rated not significant.

The surface water resources that supply the City of Saint John are physically located well outside of the Project Development Area (PDA) and the Local Assessment Area (LAA), and, with the exception of an approximate 30% demand on the estimated excess capacity, these surface water resources would not be directly affected by Project activities. For this reason, only potential residual environmental effects on surface water resources during Operation were carried forward for further assessment.

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

Table 8.3 provides a summary of the residual environmental effects of the Project on Water Resources that were ranked as 2 in Table 8.2. Presuming a successful and mutually agreeable arrangement is made between the City of Saint John and the Proponent (following the EIA/EA process), the freshwater for the Project would be obtained from the City of Saint John municipal system. Subject to confirmation by the City through updated studies that are currently being completed, Project demand would be well within the currently estimated total excess water supply capacity of 19,300 US gallons per minute, available from the City of Saint John municipal water supply system as a whole.

The City has indicated a preference to supply the Project from the eastern (Loch Lomond) system alone; however, the water supply from this system alone is currently insufficient to meet the Project demands without infrastructure upgrades or other management initiatives (*e.g.*, possibly switching the existing Reversing Falls pulp and paper mill from the eastern system to the western system).

The City also advises that there is ample excess capacity in the western system, but there exist limited infrastructure connecting the eastern and western systems currently, and a full connection between the two systems would be costly. While the projected Project water demands are well within the estimated total excess capacity of the municipal system as a whole, it is recognized that several technical challenges may exist in terms of delivery of this water to the Project.

The potential residual environmental effect of large scale withdrawals of freshwater from the City of Saint John municipal system is the only surface water residual environmental effect discussed further in this assessment and relates to Operation. The main issue is a decreased availability of water for future municipal users.

The requirements for freshwater supply to the Project would be the subject of detailed commercial discussions and negotiations between the Proponent and the City to determine the best means of supplying the required freshwater for the Project, under what conditions, from which source, using which infrastructure, at whose cost, and under what acceptable commercial terms.

Efforts would be made through design, optimization and recycling to further reduce the volumes of water potentially taken from the Saint John municipal system to supply the Project. The

added taxation revenue associated with an increased tax base to the City, as a direct result of the Project, could assist in financing any required infrastructure upgrades to the municipal water distribution system, although commercial discussions between the City and the Proponent would determine the most appropriate means of providing for any upgrades that might be required.

The environmental effects of the Project on surface water resource availability would be considered to be well within the total system capacity during Operation, provided appropriate monitoring and control of water flows were maintained. The magnitude was considered moderate, because there is excess capacity available. The duration was considered long-term as surface water would be required throughout Operation. The frequency of an adverse environmental effect during a period of extended drought would be considered to be rare or sporadic over the life of the Project.

Determination of Significance

In summary, the required water demand of the Project would be well within the available the surface water in the municipal system (based on the most recent information that is available publicly). The location of the surface water resource is remote from the PDA.

The Report states that if the City determines that it can acceptably and sustainably supply sufficient freshwater to the Project, its environmental effects on Water Resources during all phases of the Project would be rated not significant. Based on experience with the existing Saint John refinery, and modern water management and distribution technology, confidence such a rating is considered to be high.

Assessment of Cumulative Environmental Effects

In association with the conclusions above, an assessment of the potential cumulative environmental effects was conducted for other projects and activities that have potential to interact with the Project. Table 8.4 presents the potential cumulative environmental effects to Water Resources, and ranks each interaction with other projects as 0, 1 or 2, with respect to the nature and degree to which important Project-related environmental effects would overlap with those of other existing or proposed projects and activities.

Surface Water Resources

Projects and activities potentially interacting with surface water resources, and the Petroleum Refinery and other Land-Based Infrastructure for cumulative environmental effects ranked as 1, would include Industrial Land Use, and Planned Residential Development supplied by the City of Saint John municipal system. Interactions between these projects and activities and surface water resources have potential to result in a cumulative environmental effect (*i.e.*, further demand on the municipal system). Considerable excess capacity exists to supply additional subdivisions and land-based developments. The total cumulative demands must not exceed the firm yields of the municipal water resource. As discussed above, and subject to confirmation following the completion of the currently ongoing water availability review, the City of Saint John municipal system has sufficient water for the Project and the existing municipal users.

The primary mechanism for mitigation for cumulative environmental effects on surface water resources is to assure that total cumulative water demands do not exceed the established safe yield of the City Saint John surface water system. New additional facilities would need to be assessed with respect to their water demand, before approval by the City for the supply of municipal water from its supply and distribution system. A program of monitoring and reporting

of reservoir levels by the City should prevent future water over-abstraction of the system. Cumulative environmental effects on surface water resources would include gradual depletion of the estimated excess capacity of the Loch Lomond and Spruce Lake reservoirs, as each new development came on stream.

In consideration of the estimated reserve capacity of the two primary municipal water supply watersheds, no adverse cumulative environmental effect would be anticipated, as long as the total cumulative demand of the existing, proposed and future projects did not exceed the sustainable capacity of the City of Saint John water supply system during any foreseeable drought period. The magnitude of water abstraction from the municipal system could be measured and monitored with installed metering to each existing and future development.

Groundwater Resources

Projects and activities potentially interacting with groundwater resources, and the Petroleum Refinery and other Land-based Infrastructure for cumulative environmental effects ranked as 1, would include Industrial Land Use, Infrastructure Land Use, Planned Future Industrial Developments and Planned Residential Development supplied by groundwater wells.

Interactions between these projects and activities and groundwater resources have potential to result in a cumulative environmental effect (*i.e.*, additional infrastructure and groundwater users could affect the subsurface flow around the facility). The Project and any new industrial users would have the potential to affect groundwater quality of the area. Future subdivisions requiring groundwater supply would be limited to the theoretical yield of the aquifers in the area.

Any future industrial or commercial developments using groundwater would potentially limit finite water resources. Each new development within the LAA would need to be assessed with respect to potential environmental effects on groundwater. Cumulative environmental effects on groundwater quantity would be limited to residential wells only, as there is not sufficient hydrogeological capacity for the development of large scale industrial or commercial water supply wells.

The primary mechanism for mitigation for cumulative environmental effects on groundwater resources is the same as those discussed for the Project. Cumulative environmental effects on groundwater resources would include gradual lowering of the water table throughout the PDA, progressive loss of yield to shallow and low yield water supply wells, and gradual deterioration in well water quality at receptors located hydraulically down-gradient of the facilities. The environmental effects could be effectively mitigated during Construction and Operation of each new facility.

Determination of Significance

The Report concludes that, with a successful commercial agreement between the Proponent and the City of Saint John for supplying the Project in a sustainable manner and under mutually agreeable commercial terms, there would be no residual cumulative environmental effects on surface water resources or groundwater resources likely to occur from the Project, existing users, or potential future users. There is considerable excess capacity in the City of Saint John municipal water supply system. Any future developments would be limited to the remaining available resources from the City of Saint John. Residual cumulative environmental effects during all phases of the Project were therefore rated not significant, with a high level of confidence.

Follow-up and Monitoring

The Proponent would work closely with the City of Saint John to further identify means of mitigating environmental effects to the extent that they are not significant, and to identify the requirement for, and implementation of, any improvements that might be needed.

As part of the groundwater and surface water protection strategy, a program of surface water and groundwater monitoring would be implemented to provide surveillance of ambient reservoir and groundwater levels, and groundwater chemistry on, and down-gradient, of the PDA. Monitoring would focus on groundwater flow pathways between the PDA and down-gradient receptor wells.

Surface water resource use would be monitored throughout Operation as follows:

- Continued reservoir monitoring;
- Monitor water consumption by the Project; and
- Monitor in plant water streams and water use conservation (sustainability).

Monitoring of potential groundwater environmental effects associated with the Project would be an integral component of the environmental management strategy. Groundwater monitoring would include a combination of the tasks presented below.

- Installation of groundwater monitoring wells within, and hydraulically down-gradient of, the refinery site and tank farm areas, after completion of Construction activities. These would be used to establish baseline conditions, detect chronic releases of product and process chemicals, and to monitor groundwater level conditions within the PDA.

- Installation of perimeter groundwater monitoring wells between selected facilities and sensitive down-gradient groundwater users (*i.e.*, clusters of residential wells and subdivision areas as identified in Section 8.2.2).

These wells would resemble typical water supply wells, and would be equipped with automated water level monitoring devices and sampling pumps. The monitor wells would be used to differentiate seasonal and Project-related changes in groundwater levels and groundwater quality leaving the site.

- As part of the groundwater protection strategy, selected domestic wells could be routinely monitored throughout Operation.

- A well damage claims arbitration process would be established to rapidly investigate, and, if warranted, remediate any adverse environmental effects on residential wells caused by Project activities. This process could include: contact and reporting mechanisms; investigation procedures; remedial alternatives; and post remediation effectiveness monitoring. For example, after the remediation of an affected well, follow-up groundwater monitoring would be carried out for a sufficient period of time to confirm the effectiveness of the remediation.

- A program of groundwater monitoring would be warranted if any Project facilities were to be implemented up-gradient of the above identified concentrations of residential water supply wells. In addition, wells within the LAA that are located down-gradient of or immediately adjacent to linear infrastructure associated with the PDA would also require

consideration to identify potential environmental effects on groundwater resources and, if identified, any required subsequent mitigation.

Chapter 9 – Health and Safety

Chapter 9 covers pages 9-1 to 9-63. In addition to the narrative text, it provides extensive and highly detailed information in 23 separate tables and 4 figures. Chapter 9 begins by defining Health, in this context, as a condition of the environment that relates to the physical health and well-being of the people living in the vicinity of a project, or using the lands in the area of a project.

It points out that Health and Safety are important to local stakeholders and the general public, as they want to understand and minimize the potential environmental effects on their health that could arise from exposure to chemicals released to the environment from the Project.

The Report explains that a Human Health Risk Assessment (HHRA) is the most appropriate mechanism to assist in the assessment of potential environmental effects on public health. It further notes that any chemical, from the most benign to the most toxic of chemicals to which humans can be exposed, has the potential to cause environmental effects in people. It is the concentration, duration of exposure, and route by which people come into contact with a particular chemical, that determines if it might cause harm to their health.

A Baseline Public Health Assessment was initially conducted to characterize the existing health status of the communities surrounding the Project. Overall, the findings revealed that the existing health status of Saint John area residents is similar to that in the rest of the province. However, there are some exceptions, where residents of the former Health Region 2 had differences in their reported disease rate, compared to the remainder of the province. This information was used to understand and assess how Project-related emissions could result in a change in this health status.

Additionally, an extensive baseline soil and biota sampling program was carried out to characterize the existing (baseline) conditions of the environment in the vicinity of the Project, with respect to current average concentrations of a variety of chemical of potential concern (COPC) in soil, water, forage, produce, as well as terrestrial and marine biota.

The Report also notes that the Human Health and Ecological Risk Assessment conducted by the Study Team consisted of a human health risk assessment (HHRA), and an ecological risk assessment (ERA).

The HHRA focused on quantitatively evaluating potential changes in health, due to short-term exposures (*e.g.,* changes in asthma rates, changes in the occurrence of eye/throat irritations), and potential changes in health due to long-term chemical exposures to chemicals primarily during Operation (*e.g.,* changes in cancer incidence rates, changes in rates of neurological disorders).

The Report notes that health risks associated with existing (baseline) concentrations of a number of COPC in the Saint John area (*i.e.,* acrolein, arsenic, manganese, and vanadium) were determined to be high, in relation to accepted benchmarks (even in the absence of the Project), thus potentially contributing to risks to human receptors in the Saint John area. However, further examination of these data determined that concentrations of these COPC were similar to other communities in New Brunswick or the rest of urban Canada.

The results of the HHRA indicated that the potential environmental effects of Project-related releases of COPC on a Change in Public Health, when they were evaluated in isolation of existing concentrations of chemicals in the environment in the Saint John area, were not significant.

However, given that existing baseline concentrations of certain contaminants are present in the environment at levels that may be associated with health risks already in excess of regulatory benchmarks, the cumulative environmental effects of the Project, in combination with existing conditions and other future planned projects and activities that could be carried out, were rated significant.

This would only be the case for four of the over 90 COPC evaluated through the HHRA, which are present in the environment at levels that exceed regulatory benchmarks, even in absence of the Project.

As a precautionary measure, even though the health risks associated with the existing concentrations of most COPC in the environment are within acceptable benchmark levels, the cumulative environmental effects of the Project, and other future projects and activities that could be carried out, were rated significant.

The Report further states that, regardless, the contribution of the Project to these cumulative environmental effects would not be significant. It notes that the Project's environmental effects would be minimized by the application of best available, economically viable, proven technology, as well as other mitigation and environmental management practices and procedures. Project-related emissions and wastes would be controlled to an extent that they would be in compliance with air quality or health-based standards.

As such, the Project would not be anticipated to significantly affect the existing health status of residents of the Saint John and surrounding areas, as described in the Baseline Public Health Assessment.

With respect to public safety, The Report states that all phases of the Project, as currently planned, would be carried out in compliance with the applicable occupational health and safety, as well as public safety legislation of the Province of New Brunswick and the Government of Canada.

Extensive mitigation, planning, and environmental management measures developed in support of the Project would assist in minimizing the risks of accidents, malfunctions or unplanned events that might otherwise be a cause for concern with regard to Health and Safety.

The report further states that Construction, Operation, and Decommissioning and Abandonment of the Project would not cause significant environmental effects to a Change in Public Safety, as the activities during these phases would be carried out in full compliance with the laws that exist to protect the safety of workers and the public, and because considerable care has been taken by the Proponent to plan, prepare for, and respond to unplanned events that could lead to public safety concerns.

Section 9.1 covers pages 9-3 to 9-17, and provides detailed information on the Scope of Assessment under the following sub-headings

<u>Scope of Assessment</u>

- Regulatory Setting

- Issues Raised During Public and Stakeholder Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria
    - Change in Public Health
    - Considerations for Non-Carcinogenic Chemicals
    - Considerations for Carcinogenic Chemicals
    - Change in Public Safety

Existing Conditions

The Report explains at this point that existing conditions with respect to Health and Safety were established using two scientific approaches:

- An epidemiological assessment of the current health status of residents in the Regional Assessment Area (RAA); and

- A predictive quantitative risk assessment of the potential health risks associated with human exposure to existing concentrations of COPC in the environment.

Current Health Status – Baseline Public Health Assessment

A Baseline Public Health Assessment was initially carried out to describe the current health status of Saint John area residents prior to the construction or operation of the Project. This study summarized various health indicators that are commonly used to measure the health status of a population, including:

- Demographic characteristics;
- Birth characteristics;
- Mortality;
- Morbidity;
- Cancer incidence;
- Reproductive experiences;
- Hospital use; and
- Determinants of health.

The New Brunswick Department of Health and Statistics Canada provided access to several population data bases and surveys that formed the basis of the supporting data used in the Baseline Public Health Assessment. The smallest geographic area for which health records and population counts were made available is the Census subdivision.

Since the health of residents living closest to the Project is of most interest, residents of the City of Saint John and residents of Simonds Parish (the two closest Census subdivisions) were evaluated in the Baseline Public Health Assessment. The key observations of the Baseline Public Health Assessment are provided below.

Self Reported Health

Most self-reported characteristics of health in the former Health Region 2 were found to be similar to those of New Brunswick as a whole. These include:

- Asthma
- Diabetes
- Use of insulin and pills to control diabetes;
- Obesity;
- Current and lifetime smoking habits;
- Alcohol consumption habits;
- Chronic fatigue syndrome;
- Multiple chemical sensitivities;
- Anxiety and mood disorders;
- Self-perceived health;
- Improvements in self-perceived health over one year;
- Satisfaction with life in general;
- Self-perceived stress; and
- Use of illicit drugs in the past year.

However, the former Health Region 2 had higher levels of self-reported mental health issues, exposure to second hand smoke, and learning disabilities, than the rest of New Brunswick.

They also had a lower screening rate for colorectal cancer by colonoscopy, and fecal occult blood count, than the rest of New Brunswick. In addition, women in the former Health Region 2 reported a higher rate of exercise, and were more likely to take folic acid supplementation for their pregnancy. Men over the age of 35 in the former Health Region 2 were just as likely as men over the age of 35 in the rest of New Brunswick to have had screenings for prostate cancer.

Births

Overall, the rate of low birth weight for all live births was similar for the residents of Saint John and Simonds Parish, compared to the rest of New Brunswick. However, it was noted that mothers 25 years of age and older in Saint John and Simonds Parish are more likely to have low birth weight babies, than other mothers of the same age in the rest of New Brunswick

Mortality

Infant mortality rate and mortality rates for each individual major cause of death in Saint John and Simonds Parish were similar to the rest of New Brunswick from 2000 to 2004. However, residents of Saint John and Simonds Parish experienced a higher all-cause mortality rate than the rest of New Brunswick.

The higher mortality rates of residents of Saint John and Simonds Parish translate into a reduction in life expectancy of 1.6 years of life for women, and 2.3 years of life for men. The causes of death for which mortality rates are elevated in residents of Saint John and Simonds Parish, as compared to all other residents of New Brunswick, are:

- Cancer in men and women (*e.g.*, lung cancer for men, kidney cancer);
- Diseases of the nervous system in men and women (primarily Alzheimer's disease);
- Diseases of the circulatory system in men and women (*e.g.*, heart disease);

- Diseases of the skin and subcutaneous tissue (just beneath the skin) in men; and
- Endocrine (*e.g.*, diabetes), nutritional (*e.g.,* obesity) and metabolic disorders (*e.g.*, thyroid disease) in men.

Cancer Incidence

Death due to all cancers represents the leading cause of potential years of life lost in Canada and the Atlantic Provinces.

For both men and women, in Saint John and Simonds Parish and the rest of New Brunswick, three sites account for most cancers:

- Women: breast, colorectal, and lung cancer; and
- Men: prostate, lung, and colorectal cancer.

The age standardized cancer incidence rate for men and women together, in Saint John and Simonds Parish, was determined to be higher than the rest of New Brunswick, although this finding was more pronounced in men than in women, and included cancers of the:

- Lung, in men and women;
- Bladder, in men;
- Breast cancer, in women;
- Skin (melanoma), in men; and
- All other cancers in men.

There was no difference in cancer incidence for either men or women between Saint John and Simonds Parish, and the rest of New Brunswick, for cancer of the kidney, colon and rectum, prostate, leukemia, lymphoma, non-Hodgkin's Lymphoma, and brain. It was also determined that stomach cancer rates in women from Saint John and Simonds Parish are lower than the rest of New Brunswick.

Hospitalization Rates

For the reporting period, it was found that residents of Saint John and Simonds Parish were admitted less often to health care facilities than other residents of New Brunswick. However, there are some differences in that residents of Saint John and Simonds Parish are admitted to hospital more often for diseases of arteries, arterioles and capillaries (mainly atherosclerosis), diseases of the nervous system (mainly carpal tunnel syndrome and Alzheimer's disease), and diseases of the eye and adnexa (mainly day surgeries for cataracts).

Furthermore, men of Saint John and Simonds Parish are admitted more often to health care facilities for chronic lower respiratory diseases (bronchitis and emphysema), other diseases of the upper respiratory tract (mainly day surgery for chronic tonsillitis and day surgery for deviated nasal septum), flu and pneumonia, benign tumours, and endocrine disorders (mainly diabetes); while women in Saint John and Simonds Parish are admitted more often to health care facilities for lung cancer. Rates of hospital admission for asthma in residents of Saint John and Simonds Parish are no different than those for residents of the rest of New Brunswick.

Psychosocial and Other Health Risks

The Report notes that several studies have found evidence of self-reported measures of stress in communities surrounding refineries and other large industrial facilities. Such studies explain

that more people in heavily industrialized communities generally suffer stress, and may have stress-related complaints (such as perception of poorer physical and mental health), than other communities which do not host such industries.

Responses to environmental stress have been reported to be affected by uncertainty about the risk and lack of control of these risks, as well as a perception that industry does not respond to these concerns. The Report points out that stress and stress-related complaints may occur in the presence of an industry, regardless of toxicologically significant exposure.

The Community Health Survey carried out by Statistics Canada has explored the prevalence of some of these factors in the general population (*e.g.*, self-perceived stress, mental health, and satisfaction with life in general) in the former Health Region 2, which includes the City of Saint John and Simonds Parish.

It determined that residents of the former Health Region 2 had a higher incidence of self-reported mental health issues than the rest of New Brunswick. However, a relationship between these issues, and potential psychosocial effects of living in a community with an existing large industrial base, could not be determined.

The Report notes that a mental and physical health assessment in a community around an accident (explosion) in a petrochemical complex was published recently, and indicated that post-accident mental and physical health scores declined following the accident.

The identified risk factors for lower scores following an accident were having a high school degree, distance from the accident, and lower pre-accident health scores.

Media coverage, especially television, had some influence on post-accident decline of these scores, but was not associated with the absolute fall in health scores.

The Report states that the relationship of health status declines, and toxicologically relevant exposures 'per se', have not been clearly demonstrated. Overall, this is a new area of study that is receiving wider attention in the scientific community. It is also known commonly as chemophobia—or a fear of exposure to chemicals. The Report notes that it is not possible to quantitatively assess this issue, but it should nonetheless be acknowledged that these effects may manifest themselves in some individuals.

<u>Predicted Baseline Human Health Risks – Existing Environmental Chemical Concentrations</u>

Section 9.2.2 covers pages 9-21 to 9 -34 and provides detailed information on predicted human health risks associated with the exposure of people to existing (background) concentrations of chemicals in the environment within the Local Assessment Area (LAA), under the following sub-headings:

- Predicted Baseline Health Risks via Inhalation
    - Predicted Baseline Health Risks from Exposure to Criteria Air Contaminants (CAC)
    - Predicted Baseline Health Risks from Exposure to Non-CAC

- Predicted Baseline Health Risks from Chemicals via Multiple Exposure Pathways
    - Health Risks from Non-Carcinogens
    - Health Risks from Carcinogens

- Summary of Baseline Health Risks

- Discussion of Baseline Acrolein in Air
- Discussion of Baseline Vanadium in Multiple Media
- Discussion of Baseline Arsenic in Multiple Media.
- Discussion of Baseline Manganese in Multiple Media

Potential Project-VEC Interactions

Interactions between changes in Public Health, or changes in Public Safety, and each Project activity and physical are presented in Table 9.12. They are also ranked as 0, 1, or 2, depending on the nature and extent of the anticipated interaction.

Project activities where the interaction between Project-related emissions and human receptors was considered probable, and requiring further assessment, were ranked as 2. Project activities that would not result in emissions of chemicals, or where emissions would be present, but the potential for exposure was deemed negligible or unlikely, were ranked as 1.

Project activities where there would be no emissions, or where human exposure was not likely, were ranked as 0.

Potential Interactions With a Change in Public Safety

The report states that the Project would not interact with a Change in Public Safety in any substantive way during Construction, Operation, or Decommissioning and Abandonment. It notes there might be some limited interactions between a Change in Public Safety and several Project activities during Construction, Operation, or the Decommissioning and Abandonment phases. But all interactions with a Change in Public Safety were ranked as 0 or 1, and could not possibly be significant.

These interactions would be mitigated by compliance with health and safety legislation, safety by design, and implementation of environmental management measures aimed at protecting human health. Safety and control systems were described in Section 3.2 of the Project Description, and include process control systems, fire prevention measures, fencing and security.

The entire perimeter of the refinery site would be fenced, and access to the refinery area, marine terminal, and tank areas would be provided via security gates manned by trained security personnel.

Safety risks to workers would be reduced by complying with the requirements of various governing standards, public safety codes, regulations and other industry standards, to help ensure that the Project would be carried out in a safe manner to protect workers and the public.

With the application of, and compliance with, these Acts, regulations, and standards, including the application of safety and security measures that are known to effectively mitigate the predicted environmental effects, the potential interactions of all Project activities and physical works associated with the Project with a Change in Public Safety were ranked as either 0 or 1, and would not be substantive.

The potential environmental effects of all Project works and physical activities that were ranked as 0 or 1 in Table 9.12 on a Change in Public Safety, during all phases of the Project, including cumulative environmental effects, were rated not significant, with a high level of confidence.

Potential Interactions With a Change in Public Health

Public health could be affected from direct (*e.g*., inhalation) and indirect (*e.g*., ingestion of fish) exposure to chemicals emitted from Project activities and physical works. Activities not expected to generate any (or nominal) amounts of emissions, from any component, during any phase of the Project, would not be expected to interact with a Change in Public Health.

The interactions between these activities and a Change in Public Health were ranked as 0 in Table 9.12, and include Employment and Expenditure, Emissions Control, Management of Effluents and Wastes, Water Supply and Use.

The potential environmental effects of these Project activities and physical works ranked as 0 in Table 9.12, including cumulative environmental effects, on a Change in Public Health during all phases of the Project, were rated not significant and are not considered further in the EIA/EA. The Report states a high level of confidence in this prediction.

Activities associated with Physical Construction and Equipment Installation, as well as from Construction of Linear Facilities and Watercourse Crossings, would be expected to generate contaminant air emissions, mainly from the use of energy to assemble the equipment at the site. While these emissions are likely measurable, they would not be substantive and would not likely result in a Change in Public Health. These activities were therefore ranked as 1.

Emissions of air contaminants would result from combustion gases emitted from the heavy equipment required for Construction and Installation of the Jetty and Other Marine-Based Infrastructure. However, the scope and extent of the activities required indicates that these emissions would not be noticeable in the Local Assessment Area (LAA). Interactions between these activities and potential environmental effects were ranked as 1.

Marine Vessel Transportation activity during Construction of the Marine Terminal and Other Marine-Based Infrastructure would be expected to generate measurable emissions of air contaminants. However, the marine vessel movements would be expected to be limited, of short duration, and local to the barge landing area. Because of this, the emissions were not considered to be substantive and the potential of Marine Vessel Transportation to interact in a significant way with a Change in Public Health was ranked as 1.

Linear Facilities Presence and Operation would involve operation of the electrical transmission line, the pipelines, and rail line potentially for 24 hours per day, year round. Right-of-Way (ROW) and Infrastructure Maintenance involves monitoring and inspection of Project infrastructure. These activities would be expected to use small quantities of fuel and emissions would be expected to be measurable, but not substantive. Emissions from locomotives on the rail line would not be substantive. Therefore, during Operation, emissions to the atmosphere from Linear Facilities Presence and Operation, as well as ROW and Infrastructure Maintenance, would be expected to be nominal, and the potential for a substantive interaction to occur was ranked as 1.

Wastewater, Cooling Water, and Storm Water Release would result in a release of effluent containing residual quantities of chemical of potential concern (COPC) in the wastewater, at levels in compliance with legislation to the marine environment, through a diffuser pipe into the Bay of Fundy.

Results of marine water modelling and uptake modelling into marine biota determined that chemical concentrations in these environments would not be measurable in the long-term, compared to existing conditions. Therefore, human interaction with these low level

concentrations of chemicals in water would not be measurable and the interaction was ranked as 1.

The Removal of Facilities and Site Reclamation for both Project components on land, and in the marine environment, would be likely to occur decades into the future. Some energy and fuel would be used to decommission the facilities, remove equipment, and restore the sites.

These activities would be likely to generate measurable emissions of air contaminants, but would likely be short-term and localized to the land and marine sites. The emissions and associated health risks would not be considered substantive, and therefore, the interaction between Removal of Facilities and Site Reclamation on a Change in Public Health was ranked as 1. Further assessment would be done prior to the Project being decommissioned.

Thus, the Report states, for those Project activities and physical works for which the interactions with a Change in Public Health were ranked as 1 in Table 9.12, the potential environmental effects of the Project activities and physical works, including cumulative environmental effects, on a Change in Public Health, during any phase of the Project were rated not significant and are not considered further in the EIA/EA. There is a high level of confidence in this prediction.

The activities, for which the interaction between the Project and a Change in Public Health were ranked as 2, are also indicated in Table 9.12. They include the following:

- Site and Right-of-Way Preparation, Commissioning, and Road Transportation associated with Construction of the Petroleum Refinery and Other Land-Based Infrastructure;

- Operation and Maintenance of Refinery Processes and Equipment associated with Operation of the Petroleum Refinery and Other Land-Based Infrastructure; and

- Marine Vessel Transportation, Berthing and Deberthing, and Crude Oil and Finished Product Transfer activities, associated with Operation of the Marine Terminal and Other Marine-Based Infrastructure.

The interactions associated with the above activities were ranked as 2, because of the potential for substantive emissions of chemicals to the atmosphere, and the potential for people in the area being exposed to these chemicals, either directly (via inhalation) or indirectly (via ingestion and dermal contact from multiple pathways).

<u>Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment</u>

The Report explains at this juncture that the following Project activities and physical works were carried forward in the environmental effects assessment:

> **Construction:** Site and Right-of-Way Preparation, Commissioning, and Road Transportation Physical Construction and Equipment Installation (Change in Sound Quality only); and
>
> **Operation:** Operation and Maintenance of Refinery Processes and Equipment.

It further notes that a summary of the residual environmental effects of the Petroleum Refinery and Other Land-Based Infrastructure on Atmospheric Environment is presented in Table 9.13.

The assessment which follows is also supplemented by data contained in the summary of the Human Health and Ecological Risk Assessment Technical Study, which was presented earlier in Section 3.5.2.

Existing Conditions for a Change in Public Health

As noted earlier, an assessment of the existing or baseline health status of local residents of the City of Saint John and Simonds Parish was carried out, and is detailed in Section 9.2.1.

Existing health status, whether different, in some cases, from the rest of the population of New Brunswick, was used as the benchmark to ensure that exposure of humans to Project-related emissions would not alter the 'status quo.'

Project Environmental Effects Mechanisms for a Change in Public Health

During Construction and Operation, environmental effect mechanisms that could result in a Change in Public Health, as determined by comparison of predicted health risks to accepted regulatory benchmarks primarily include those activities that might result in a change in the air quality.

The Report states that some of the chemicals would deposit onto the ground and might move through the environment, potentially increasing concentrations in the soil, water, garden produce, fish, and wild game, as described in Section 3.5.2. People might inhale the contaminants directly, or they might ingest or come into contact with the contaminated media.

The Report notes that the potential for a significant environmental effect on a Change in Public Health would be dependent on the toxicity of the chemical contaminant, the amount (or dose) of the chemical to which the person is exposed, and the duration of the exposure. A Change in Public Health could result from short-term exposure or long-term exposure to the chemical. The report also notes that the type of Change in Public Health associated with exposure to a chemical would be dependent on the specific toxicological properties of that chemical.

Environmental Effects Mechanisms During Construction The Report states that the emissions people would be exposed to during Construction would be limited to combustion gas emissions from heavy equipment (including earth movers, excavation equipment, and grading equipment) as well as from fugitive dust (particulate matter) generated during the earth-moving activities associated with the Site and Right-of-Way Preparation. On-road vehicle traffic associated with the site activities would also generate emissions.

Commissioning activities might result in relatively high emission rates during initial start-up of the systems. However, this phase of the Project would be very brief in duration, when compared to other activities associated with Construction and Operation. The Report notes that the potential environmental effects to public health during Commissioning would be expected to be similar to those that could occur as part of Accidents, Malfunctions and Unplanned Events (Section 23.1).

Environmental Effects Mechanisms During Operation During Operation, emissions from the Project would arise from emissions of air contaminants from the Petroleum Refinery and Other Land-Based Infrastructure. Although pollution control technology would be used, residual air contaminants would be released to the atmosphere and disperse, with the potential to cause residual adverse environmental effects to a Change in Public Health.

Mitigation for a Change in Public Health

A number of mitigation measures would be employed to reduce air emissions during Construction and Operation, including use of dust suppressants, a Commissioning Plan for Construction, the use of cogeneration to efficiently generate steam and electricity, Tail Gas Treatment Units on the Sulphur Recovery Plants, and Vapour Recovery Units on the storage tanks and relevant loading operations. These mitigation measures and others, described in more detail in Section 7.4.1, would reduce the release, and hence people's exposure, to the chemicals.

Characterization of Residual Project Environmental Effects for a Change in Public Health

As described in Section 3.5.2, health risk estimates inherently incorporate the normal EIA descriptors such as direction, magnitude, geographic extent, duration/frequency and the ecological/socio-economic context of the environmental effect. Duration, frequency, and geographic extent are included in the calculations of exposure, and thus are inherently included in the health risk estimates.

Concentration Ratio (CR) and Hazard Quotient (HQ) indicate the magnitude of the risk, as a proportion of a tolerable concentration or exposure dose, while the Incremental Lifetime Cancer Risk (ILCR) indicates the magnitude of the incidental increase in the cancer rate.

The geographic extent of the environmental effect is incorporated into the health risk estimates, through the dispersion modelling of air contaminant concentration results, thereby providing health risk estimates specific to known locations of sensitive populations (*e.g.*, hospitals, schools).

The duration and frequency of exposure are incorporated into the exposure assessment portion of the Human Health Risk Assessment (HHRA) and the use of 1 hour maximum, 24 hour maximum, or annual average modelled concentrations, and their corresponding tolerable concentrations.

The Report notes that environmental effects on public health from short-term exposures are generally considered to be reversible. For short-term exposures, people may experience a Change in Public Health (*e.g.*, eye irritation) for the duration of the exposure; however, but once the exposure has ended, the environment effect would be reversed (*e.g.*, eyes no longer irritated). The potential health risks from short-term exposure can be decreased by reducing the air contaminant concentrations, or by limiting the potential exposure of people to contaminant air concentrations that are higher than the tolerable concentrations provided by regulatory agencies. The environmental effects of health risks associated with long-term exposures, including cancer health risks, are considered to be generally irreversible.

Construction As previously noted, the potential for a Change in Public Health from Construction would arise mainly from Site and Right-of-Way Preparation, particularly from fugitive dust emissions and combustion gas emissions generated during earth-moving activities. Mitigation measures to reduce emissions from these activities would also decrease the potential for a Change in Public Health. These measures would include use of dust suppressants (*i.e.*, water), use of modern equipment that is well maintained, establishing an idling policy, and minimizing the length of haul roads as described in detail in Section 7.4.1. The Report states that the emission of air contaminants during Construction would not be expected to result in ambient air concentrations that exceed the ambient air quality objectives, guidelines and standards at off-site locations.

Based on a review of the current toxicological research, these same objectives, guidelines, and standards were considered suitable inhalation exposure limits (toxicity reference values) for use in the HHRA. Since CR is calculated as the ratio of the ambient air concentration to these exposure limits, the CR is expected to be less than 1.0. The Report states that, since emissions from Construction would be localized and of short duration, an evaluation of long-term exposures and associated potential health risks during Construction is not warranted. These health risks would be encompassed in the evaluation of long-term health risks associated with Operation (over an assumed average 70 year lifetime of an individual).

Operation The dispersion and deposition of chemicals of potential concern released from the Petroleum Refinery and Other Land-Based Infrastructure during Operation were modeled, and the results used as inputs to the HHRA. These inputs were used to estimate potential health risks associated with short-term and long-term inhalation exposures to chemical of potential concern (COPC) released from the Project, as well as long-term exposures through ingestion and dermal contact of emitted COPC with environmental media through multiple pathways.

A summary of the air dispersion and deposition modelling and HHRA is provided in Sections 3.5.1 and 3.5.2 respectively. The health risk estimates (*i.e*., CR, HQ, and ILCR) were used to establish the significance of the residual environmental effects associated with the Operation of the Project Alone.

- **Health Risks Via Inhalation – Concentration Ration (CR) Values for Criteria Air Contaminants (CAC) – Project Alone,** The CR values associated with the maximum CAC concentrations from the Petroleum Refinery and Other Land-Based Infrastructure (Project Alone) were provided in Table 3.84 for short-term exposures (*i.e*., 1 hour and 24 hour) and long-term exposures (*i.e*., annual average). None of the CR values for any individual COPC for the Project Alone was greater than the benchmark criteria of 1.0.

- **Health Risks Via Inhalation – Concentration Ratio (CR) Values for Non-Criteria Air Contaminants (non-CAC) – Project Alone,** For Non-CAC, the CR values associated with the 1 hour and 24 hour maximum ground-level concentrations of Non-CAC from the Petroleum Refinery and Other Land-Based Infrastructure (Project Alone) were presented in Table 3.86, and were less than 1.0 for each of the chemicals. Similarly, the CR values for long-term exposures at each of the human health receptor locations were less than 1.0 for each Non-CAC, as indicated in Table 3.85.

- **Health Risks Via Inhalation – Incremental Lifetime Cancer Risk (ILCR) Values for Carcinogens – Project Alone,** The maximum predicted ILCR values for the carcinogenic COPC from the Petroleum Refinery and Other Land-Based Infrastructure (Project Alone) for the residential receptor locations were provided in Table 3.87. The maximum ILCR values were all predicted to occur at the Old Black River Road C human receptor location. However, the results indicated that none of the ILCR values predicted for the carcinogenic COPC exceeded the recommend regulatory acceptable cancer risk level of 1-in-100,000.

- **Health Risks via Multiple Pathway Exposure – Hazard Quotient (HQ) Values for Non-Carcinogens – Project Alone,** The HQ values for long-term exposure to chemicals via multiple exposure pathways from the Petroleum Refinery and Other Land-Based Infrastructure (Project Alone) were summarized in Table 3.88. This table provides the maximum HQ value of all the human health receptor locations assessed, and includes HQ values for typical residents (Residential), as well as residents who hunt and fish (Hunter/Angler), and residents who practice subsistence farming (Farmer). The HQ value for each non-carcinogenic chemical was less than the benchmark of 0.2.

- **Health Risks via Multiple Pathway Exposure – Incremental Lifetime Cancer Risk (ILCR) Values for Carcinogens – Project Alone** The ILCR values for long-term exposure to chemicals via multiple exposure pathways from the Petroleum Refinery and Other Land-Based Infrastructure (Project Alone) were summarized in Table 3.89. This table provides the maximum ILCR value of all the human health receptor locations assessed, and includes ILCR values for typical residents (Residential), as well as residents who hunt and fish (Hunter/Angler), and residents who practice subsistence farming (Farmer). The ILCR value for each non-carcinogenic chemical was less than the benchmark of 1-in-100,000 (10^{-5}).

Determination of Significance

The Report states that, with mitigation, the Project Alone would not result in a CR greater than 1.0, a HQ greater than 0.2, or an ILCR greater than 1-in-100,000 for Project-related emissions to air, for any of the human receptor scenarios evaluated. It notes these results indicate that the risk of a Change in Public Health through either short-term or long-term exposures, including the risk of cancer incidence, would be negligible.

Therefore, the Report states that the environmental effects of the Petroleum Refinery and Other Land-Based Infrastructure, alone, on Health and Safety, during all phases of the Project, were rated not significant. It states that there is a high level of confidence in these predictions.

Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment

Residual environmental effects of the Marine Terminal and Other Marine-Based Infrastructure, on Health and Safety, for those Project activities and physical works ranked as 2 in Table 9.12 are summarized below. The environmental effects are presented and assessed, in light of planned mitigation for the Project activities. The following Project activities and physical works were carried forward in the environmental effects assessment, with all other interactions in all phases having been rated not significant:

- Marine Vessel Transportation, Berthing and Deberthing; and
- Crude Oil and Finished Product Transfer.

Assessment of Project-Related Environmental Effects

The Report states that activities associated with the Marine Terminal and Other Marine-Based Infrastructure would have the potential to directly or indirectly expose people in the Regional Assessment Area (RAA) to air contaminant emissions, thereby interacting with a Change in Public Health.

The environmental effects of the Marine Terminal and Other Marine-Based Infrastructure during Construction and Decommissioning and Abandonment on a Change in Public Health were previously rated not significant. As a result, only environmental effects of selected Project activities and physical works during Operation are assessed below.

Existing Conditions for a Change in Public Health

The Report points out that existing conditions or baseline health status of local residents of Saint John and Simonds Parish were discussed in Section 9.2.1.

As noted earlier, existing health status, whether different in some cases than the rest of the population of New Brunswick, was used as the benchmark to ensure that exposure of humans to Project-related emissions would not alter the 'status quo'.

Project Environmental Effects Mechanisms for a Change in Public Health

During Operation, the Project-related marine vessel activity would not be continuous, but intermittent, with visits to the marine terminal typically lasting a day or two. However, during this time, the emissions of air contaminants might be substantive from activities including Marine Vessel Transportation, Berthing and Deberthing and Crude Oil and Finished Product Transfer, and therefore have the potential to result in a Change in Public Health. Fugitive emissions of volatile organic compounds (VOC) from product loading to marine vessels could also occur during Operation.

Mitigation for a Change in Public Health

A number of mitigation measures would be employed to reduce air emissions during Construction and Operation, including use of dust suppressants, implementation of an idling policy, vapour recovery units on the storage tanks and relevant loading operations. These mitigation measures and others, described in more detail in Section 7.5.1, would reduce people's exposure to the Project-related emissions.

Characterization of Residual Project Environmental Effects for a Change in Public Health

The HHRA derived health risk estimates (*i.e.*, CR) associated with air contaminant emissions from the Marine Terminal and Other Marine-Based Infrastructure were described in Sections 3.5.2 and 9.4.1.

These health risk estimates inherently incorporate the normal EIA descriptors such as direction, magnitude, geographic extent, duration/frequency and the ecological/socio-economic context of the environmental effect. As noted in Section 9.4.1, the environmental effects on public health from short-term exposures are generally considered to be reversible, while the environmental effects of health risks associated with long-term exposures are generally considered to be irreversible.

The dispersion and deposition of chemicals of potential concern released from the Marine Terminal and Other Marine-Based Infrastructure during Operation were modelled, and the results used as inputs to the HHRA to estimate potential health risks associated with short-term and long-term inhalation exposures to COPC released from the Project

As emissions from the marine vessels associated with the marine-based infrastructure are intermittent in nature, a conservative yet probable emissions scenario was also developed for modelling purposes. In this scenario, it was assumed that three ships would be at the marine terminal concurrently throughout Operation, which is a very conservative assumption.

A summary of the air dispersion modelling and results of the HHRA were provided in Section 3.5.1 and 3.5.2 respectively.

The health risk estimates (*i.e.*, CR) were used to establish the significance of the residual environmental effects associated with the operation of the Project alone.

- **Health Risks Via Inhalation –Concentration Ratio (CR) Values for Criteria Air Contaminants – Project Alone,** The CR values associated with the maximum

concentrations CAC from the Marine Terminal and Other Marine-Based Infrastructure (Project Alone) were provided in Table 3.84. CR values are provided for short-term exposures (*i.e.*, 1 hour and 24 hour) and long-term exposures (*i.e.*, annual average).

With the exception of SO_2, none of the CR values were greater than the benchmark criteria of CR=1.0. All CR values at locations on land, where people might be exposed to emissions for any appreciable amount of time, were well below the benchmark criteria. The CR value for SO_2 at the point of maximum 1 hour exposure was 1.3, while the CR value for SO_2 at the point of maximum 24 hour exposure was 1.6. As noted in Section 7.5 and illustrated in Figure 3.32, the highest concentrations of SO_2 occurred in the Bay of Fundy, approximately 1 km offshore. Human receptors would not likely be found at this location for any appreciable length of time.

To put these short-term exposure risks into context, it is important to evaluate the toxicological basis of the risk predictions, the likelihood of exposure, and the frequency of exposure. Studies have shown that SO_2 in air acts primarily as a respiratory tract irritant in humans following short-term exposures. The maximum modelled 1 hour concentration of SO_2 was 571 $\mu g/m^3$, which was compared to the NBENV guideline for Saint John County of 450 $\mu g/m^3$. Although the basis for the selection of 450 $\mu g/m^3$ is unknown, an exposure limit of 660 $\mu g/m^3$ has been used in other jurisdictions. This exposure limit is based on a 1 hour no observed adverse effect level, from multiple studies of healthy, asthmatic, and atopic volunteers.

The maximum ground-level concentration of SO_2 was less than this 660 $\mu g/m^3$ exposure limit. The Report also notes that control of emissions from marine vessels is being considered by regulatory agencies and would involved reducing the sulphur content in fuel, from 1.5% to as low as 0.5%, in the coming years. Since the modelled emissions scenario is conservative, in that less than three vessels would be at the marine terminal for the majority of the time, the actual offshore concentrations would be expected to be below the Saint John County SO_2 exposure limit of 450 $\mu g/m^3$.

Although it is possible that people could be exposed to these maximum concentrations of SO_2, for example on fishing boats or pleasure craft, it is important to note that these would be very infrequent exposures on the ocean. Given that concentrations of SO_2 are below health-based guidelines, it would be unlikely that this would pose an actual risk to individuals' health.

As noted in Section 7.5 and illustrated in Figure 3.32, the highest values of SO_2 would occur at least 1 km offshore. Although the maximum predictions for 1 hour and 24 hour SO_2 would exceed the ambient air quality objectives, the locations of these exceedances would be far enough from land that prolonged human exposure would not likely occur.

The CR values for the human health receptor locations (Table 3.81), where people live, were less than 1.0, indicating that there would be no undue risk from exposure to marine emissions at these locations.

- **Health Risks – Non-Criteria Air Contaminants (non-CAC) – Project Alone**, The emissions from the Marine Terminal and Other Marine-Based Infrastructure (Project Alone) would be negligible, compared to those from the Petroleum Refinery and Other Land-Based Infrastructure, and would be intermittent. Further, the Change in Air Quality for the marine terminal and associated activities would be expected to be low in magnitude, local in extent, and short-term in duration. Since the emissions from the land-

based infrastructure resulted in CR, HQ, and ILCR values that were less than the benchmark criteria of 1.0, 0.2, and 1-in-100,000 respectively, it would be expected that health risks associated with the lower overall emissions of Non-CAC from the Operation of the Marine Terminal and Marine-Based Infrastructure would also meet the benchmark criteria.

Determination of Significance

Although the 1 hour and 24 hour maximum concentrations of SO_2 would result in CR values that exceed the benchmark criteria of 1.0, the maximum concentrations would be over 1 km offshore and away from the general public.

The emissions scenario modelled was also conservative, in that less than three vessels would be at the marine terminal for the majority of the time. With mitigation, the Project Alone would result in health risk values that meet the benchmark criteria at each of the human health receptor locations, indicating no unacceptable environmental effects on Change in Public Health from short-term and long-term exposures to releases from the Marine Terminal and Other Marine-Based Infrastructure.

Therefore, the environmental effects of the Marine Terminal and Other Marine-Based Infrastructure alone on Health and Safety during all phases of the Project were rated not significant. There is a high level of confidence in these predictions.

Assessment of Cumulative Environmental Effects

The Report explains at this juncture that two scenarios were evaluated for their potential to result in cumulative environmental effects on Health and Safety. The first scenario was the addition of the potential health risk posed by Project-related emissions (Project alone) to the existing concentrations of chemicals in the RAA (Baseline). The second scenario was the potential for the Project to overlap with other projects and activities that could be carried out in the Saint John region (Future Case).

A listing of the other projects and activities with potential for cumulative environmental effects, with the combined land-based and marine-based components of the Project, is provided in Table 9.15. Each interaction with the other projects was ranked as 0, 1, or 2, with respect to the nature and degree to which important Project-related environmental effects could overlap with those of the other projects and activities

Several other projects and activities that are not expected to generate any (or not measurable) amounts of air contaminant emissions would not be expected to act cumulatively with the Project-related environmental effects. These projects and activities were ranked as 0 in Table 9.15, and included Forestry and Agricultural Land Use, Recreational Land Use, and Planned Residential Development. The residual cumulative environmental effects of the Project, in combination with these projects and activities that were ranked as 0 in Table 9.15 on a Change in Public Health, were thus rated not significant, and are not considered further in this EIA.

Several projects and activities were identified as having some potential for cumulative environmental effects, and were ranked as 1 in Table 9.15. However, based on the description of these other projects and activities, as provided in Section 6.4, the potential air contaminant emissions associated with them were not considered to be substantive, and therefore, would not appreciably change the air quality or, by extension, result in a Change in Public Health. These activities include:

- Infrastructure Land Use;

- Planned Infrastructure Projects; and
- Planned Marine Use.

While these activities might overlap with those associated with the Project, their emissions (*i.e.,* the primary pathway for which a Change in Public Health might occur) would not be substantive, and even despite the overlap, they could not possibly result in a significant cumulative environmental effect on Health and Safety. As such, residual cumulative environmental effects of the Project, in combination with the other projects and activities that were ranked as 1 in Table 9.15 on a Change in Public Health, were rated not significant, and are not considered further in this EIA.

There could be a potential for the residual environmental effects of the Project to overlap with air emissions from Industrial Land Use and Planned or Future Industrial/Energy Projects. Therefore, they have been carried forward for further assessment. The main projects or activities in the RAA with the potential to act cumulatively with the Project to cause a Change in Public Health would be:

- Gypsum Wallboard Manufacturing Plant;
- Canaport LNG Marine Terminal and Pier, including marine vessels;
- Projects at the existing Irving Oil refinery; and
- Irving Pulp & Paper Lime Kiln Replacement.

Of these projects or activities, the only common contaminants of concern (COPC) known to overlap with the Project are the criteria air contaminant (CAC) emissions.

Therefore, only CAC emissions were modelled and evaluated with respect to their ability to result in a cumulative environmental effect on a Change in Public Health. Smaller sources such as marine vessels, vehicles, and residential wood burning might also contribute to cumulative environmental effects, as could the long-range transport of air contaminants from other jurisdictions.

For the assessment of the potential cumulative environmental effects that the Project would have over baseline conditions, only non-carcinogenic (*i.e.*, CR and HQ) health endpoints were evaluated against their respective health benchmarks. The benchmark for exposure to carcinogenic compounds of 1-in-100,000 is only applicable to individual carcinogens, from individual facilities or sources.

Therefore, the Report states it is not appropriate to evaluate the potential cancer risk of combining Project-related emissions and adding them to existing or baseline conditions. Thus, carcinogenic exposures were not evaluated for their potential to result in cumulative environmental effects.

The potential for the Project overlap with other projects is the same for both the land-based and marine-based components of the Project. Therefore, the residual cumulative environmental effects of the combined land and marine-based Project components were assessed together. Residual cumulative environmental effects of current and planned projects on Health and Safety are summarized in Table 9.16.

Project Cumulative Environmental Effect Mechanisms for a Change in Public Health

As previously noted, there is a potential for the residual environmental effects of the Project to overlap with air emissions from Industrial Land Use projects and activities within the Regional

Assessment Area (RAA). For the purposes of cumulative environmental effects assessment on Health and Safety, industrial land uses within the RAA were considered, with emphasis placed on those activities closest to the Project, or with the largest potential for air contaminant emissions.

Potential cumulative health risks resulting from air contaminant emissions include those associated with short-term exposures and non-carcinogenic long-term exposures. The potential cumulative environmental effects on Health and Safety resulting from accidents or malfunctions are addressed in Chapter 23.

Base Case A number of industrial projects and activities currently operating within the RAA may release air contaminants that were also identified as COPC for the Project (Table 3.79). The existing concentrations of these chemicals in the environment incorporate both the natural background concentrations of chemicals, and the accumulation of COPC from anthropogenic sources in the RAA. Baseline information used to assess the Base Case includes concentrations of COPC in the ambient air (Section 7.2.1) and COPC concentrations in soil, water, and biota (Section 3.5.2).

Project Alone Case The Project Alone Case for a Change in Public Health would include Project-related air contaminant emissions from the Petroleum Refinery and Other Land-Based Infrastructure in combination from the land-based marine infrastructure. The Project Alone Case also incorporates, separately, combustion emissions from marine vessels, and fugitive emissions from Crude Oil and Finished Product Transfer activities associated with the Marine Terminal and Other Marine-Based Infrastructure.

The results of the Project Alone Case for the petroleum refinery and the marine terminal on their own are discussed in Sections 9.4 and 9.5, respectively. Project-related upset conditions were also modelled, and are assessed in Chapter 23.

Project Case (Base Case + Project Alone Case) The environmental effects of the Project on public health would be expected to act cumulatively with other existing industrial projects and activities. The Project Case assesses the Project air contaminant emissions (Project Alone Case) in combination with existing chemical concentrations in the environment, which incorporate the environmental effects of the existing industrial projects and activities (Base Case).

Future Case For the Future Case, the primary mechanisms for Change in Public Health would arise from the cumulative emissions of air contaminants from existing and proposed substantive sources in the Saint John air shed, and emissions from other regions into the RAA. Sources of emissions would include existing power plants, pulp and paper mills, the existing oil refinery and others, the Project sources, and other future projects. The future projects and activities in the RAA, which could have potential for cumulative environmental effects for a Change in Air Quality, include changes in industrial land use such as the Gypsum Wallboard Plant and the Irving Pulp and Paper Lime Kiln replacement.

For this case, environmental effects from future proposed projects could interact with the environmental effects of the Base Case and the Project Case, and would depend on the relative proximity of emission sources, differences in air contaminant emission rates, and variability of local meteorology. The potential for the Project overlap with other projects would be the same for both the land-based and marine-based components of the Project. Therefore, the residual cumulative environmental effects of the combined land and marine-based Project components were assessed together.

Mitigation of Cumulative Environmental Effect for a Change in Public Health

Mitigation measures for the Project that reduce air emissions would be effective mitigation for a Change in Public Health. These measures have been highlighted in Sections 9.4.1 and 9.5.1 and described in further detail in Sections 7.4.1 and 7.5.1. However, mitigation of cumulative environmental effects for Change in Public Health would require participation from government and other stakeholders, as discussed in Section 7.6.1. These mitigation measures would help improve air quality in Saint John, thereby reducing the potential for a cumulative Change in Public Health.

Characterization of Residual Cumulative Environmental Effects for Change in Public Health

The residual cumulative environmental effects to public health were assessed by considering changes in health risks from the Base Case through the Project Case and into the Future Case.

Base Case To characterize the Base Case in the RAA, health risk estimates (*i.e.*, concentration ratio (CR), hazard quotient (HQ), and lifetime cancer risk were calculated using baseline concentrations of COPC in the environmental media with the Local Assessment Area (LAA).

The health risk estimates associated with these baseline conditions are summarized in Section 9.2.2. As previously described, the results indicated that the existing concentrations of the following chemicals in the environment could result in exposures to residents that exceed the benchmark criteria.

- Measured 1 hour and 24 hour baseline concentrations of acrolein exceeded their regulatory exposure limits (CR = 1.5 in both cases).
- Measured annual average baseline concentrations of acrolein exceeded the regulatory exposure limit (CR = 2.5).
- Baseline exposures to vanadium exceeded the benchmark of 0.2 for all three human receptor scenarios (resident, hunter/angler, and farmer), with HQ values ranging from 0.29 to 0.38.
- Baseline exposures to arsenic (HQ=0.92) exceeded the benchmark for residents who are hunter/anglers.
- Baseline exposures to manganese (HQ=0.38) exceeded the benchmark for residents who are hunter/anglers.

Project Alone Case The residual Change to Public Health for the Project Alone Case was assessed, for each of the land-based and marine-based infrastructure components, in Sections 9.4 and 9.5 respectively. As indicated in Section 9.4, the results for the Petroleum Refinery and Other Land-Based Infrastructure indicated that the risk of a Change in Public Health through either short-term or long-term exposures, including the risk of cancer incidence, from the Project Alone, was rated not significant.

The health risks associated with the Marine Terminal and Other Marine-Based Infrastructure are provided in Section 9.5. Although the 1 hour and 24 hour maximum concentrations of SO_2 could result in concentration ratio (CR) values that exceed the benchmark criteria of 1.0, the maximum concentrations would be at least 1 km offshore, away from the general public, and the emissions scenario modelled was conservative, in that less than three vessels would be at the marine terminal for the majority of the time. With the mitigation proposed, the Project would result in health risk values meeting the benchmark criteria at each of the human health receptor locations, indicating no significant environmental effects on public health from short-term and long-term exposures.

Project Case (Base Case + Project Alone Case) The Project Case assessed cumulative

environmental effects of the Project air contaminant emissions, in combination with the environmental effects of existing industrial projects and activities).

- **Health Risks via Inhalation – Concentration Ratio (CR) Values for Criteria Air Contaminants (CAC)**

  The CR values associated with the maximum concentrations of CAC from the Petroleum Refinery and Other Land-Based Infrastructure, and the maximum concentrations of CAC from the Marine Terminal and Other Marine-Based Infrastructure, in combination with existing ambient air concentrations, are provided in Table 9.17. The CR values are provided for short-term exposures (*i.e.*, 1 hour and 24 hour) and long-term exposures (*i.e.*, annual average). As noted above, the maximum ground level concentration of SO_2 for 1 hour and 24 hour (marine-based) exceeded their benchmark CR of 1.0, based on Project-related emissions.

  However, these ground-level concentrations would be expected to occur infrequently, and not occur over inhabited areas. Maximum model-predicted concentrations are intended to be conservative and represent worst-case emissions during rare worst-case meteorological conditions. As indicated in the cumulative frequency distribution plot of maximum 1 hour SO_2 concentrations (Figure 3.32), the model-predicted values decrease rapidly from the maximum predicted concentrations.

  For example, at the location of the maximum predicted 1 hour SO_2 concentration, the concentration of SO_2 at the 99.9_{th} percentile would be 280 $\mu g/m^3$ (*i.e.*, 99.9 percent of the time, the concentration would be less than 280 $\mu g/m^3$ and therefore less than the ambient air quality criteria of 450 $\mu g/m^3$), while the concentration at the 90_{th} percentile would be 68 $\mu g/m^3$ (*i.e.*, similar to background).

  Although the maximum annual average concentration of SO_2 could also result in a CR value that exceeds the benchmark of 1.0, the location of this exceedance would be offshore. Since there is no one living in this area, there is no one that would be exposed to this concentration on an annual basis.

  For both short-term and long-term exposures, it is important to evaluate health risks at locations where people would most likely be exposed for extended periods of time. The CR values for SO_2 for 1 hour, 24 hour, and annual average time periods at the maximum human receptor location (where people live) are shown in Table 9.18. In inhabited areas, the concentration of SO_2, from Project-related sources and in combination with baseline concentrations, would result in health risks that are below the regulatory benchmark.

  Therefore, although the predicted health risks associated with levels at the location of the maximum ground-level concentration would be higher than the benchmark, people would be unlikely to be exposed, as these locations are at least 1 km offshore. Since the predicted health risks from exposure to these COPC in inhabited areas would meet the benchmarks, there would not be a significant residual cumulative environmental effect for a Change in Public Health.

- **Health Risks Via Inhalation – Concentration Ratio (CR) Values for Non-Criteria Air Contaminants (non-CAC)**

  For Non-CAC, the CR values associated with the maximum ground-level 1 hour and 24 hour concentrations, and the maximum average concentration at human receptor locations, are presented in Table 9.19. The CR values represent the combined

environmental effects of the Project emissions and baseline concentrations. With the exception of acrolein, the CR values for short-term and long-term exposures were less than 1.0 for each of the Non-CAC. The baseline measured concentrations of acrolein present in Saint John already exceed the government acceptable benchmark for air quality for all three time periods (1 hour, 24 hour, annual). However, as described in Section 9.2.2, the levels are comparable to other Canadian cities, and well below actual concentrations that have elicited human response of mild eye irritation.

Although Project-related emissions of acrolein would be themselves below the regulatory CR benchmark, they would add to the existing baseline conditions. As shown in Table 9.20, the Project contribution to the cumulative long-term (average annual) level of acrolein in air would be less than 2% of the total.

As previously stated, maximum model-predicted concentrations are intended to be conservative and represent worst-case emissions during rare worst-case meteorological conditions. To investigate model predictions during other (more common) meteorological conditions, frequency distributions of the 1 hour dispersion model predictions were considered. In Table 9.21, percentile values are presented for the 1 hour model-predicted values (including background) at the location of the maximum ground level concentration.

The model-predicted values decrease rapidly from the maximum predicted concentrations. For example, the data in Table 9.21 indicate that at the 98th percentile of the 1 hour predicted values (including baseline concentrations), the Project contributions to acrolein concentrations would be less than 2% of the total. Therefore, on an average basis, the predicted ground-level concentrations for the Project case would be similar to existing conditions.

- **Health Risks via Multiple Pathway Exposure – Hazard Quotient (HQ) Values for Non-Carcinogens**

  The hazard quotient (HQ) values for long-term exposure to chemicals via multiple exposure pathways are summarized in Table 9.22. The table provides the maximum HQ value of all the human health receptor locations assessed, and includes HQ values for typical residents, residents who hunt and fish (Hunter/Angler), as well as residents who practice subsistence farming (Farmer). The resulting HQ values were compared to a benchmark level of 0.2. The majority of COPC had HQ values less than 1.0, with the exception of vanadium, arsenic, and manganese.

  In all three cases where chemicals exceeded the HQ benchmark of 0.2 (vanadium, arsenic, and manganese), less than 1% of the risk was posed from Project-related emissions, while greater than 99% of the risk was attributable to baseline or existing concentrations of these chemicals in the Regional Assessment Area (RAA) (Table 9.23).

Future Case For the Future Case, emissions inventories were developed for CAC from proposed future industrial land use projects described in Section 6.4 – Other Future Projects for Consideration of Cumulative Environmental Effects. Only projects which would result in a net increase of air contaminant emissions into the Saint John air shed were included in the assessment of cumulative environmental effects.

Emissions of Non-CAC from other future projects were not estimated due to limited availability of data for these sources. However, as CAC emissions from proposed future sources would be relatively low compared to emissions estimated for the Base and Project cases, the Non-CAC

emissions from other future sources would not be expected to be substantive.

The dispersion of CAC emissions from the selected future industrial sources was modelled and the results are provided in Section 3.5.1. The health risk values (*i.e*., CR) associated with the short-term and long-term exposure to CAC were calculated, based on the combined environmental effects to air quality from the baseline, both components of the Project (*i.e*., Land and Marine), and selected other future projects. The results are summarized in Table 9.24.

Although there were benchmark exceedances of SO_2, these are attributable to the same issues as discussed for the Project Case, and are not increased by the addition of the other proposed industrial activities in the RAA. Thus, the conclusions drawn above would be similarly applicable in the Future Case.

Determination of Significance

The cumulative environmental effects of a Change in Public Health on Health and Safety of all past, present and reasonably foreseeable projects/actions, in combination with the residual environmental effects of the Project, were predicted to be significant, in relation to potential health risk from chemical exposure.

However, this is based primarily on existing concentrations of only four chemicals in the RAA (out of over 90 chemicals evaluated quantitatively as part of the HHRA). In all cases, the Project contribution to potential health risks and associated cumulative environmental effects was predicted to be negligible, and thus rated not significant.

Given that existing baseline concentrations of four of the over 90 COPC are present in the environment at levels associated with health risks, that are already in excess of regulatory benchmarks, the cumulative environmental effects of the Project on Change in Public Health, in combination with existing conditions and other future planned projects and activities that would be carried out, was rated significant.

As a precautionary measure, even though the health risks associated with the existing concentrations of most COPC in the environment are within acceptable benchmark levels, the cumulative environmental effects of the Project and other future projects and activities that would be carried out were rated significant. However, the contribution of the Project to these cumulative environmental effects was rated not significant. There is a high level of confidence in these predictions.

Follow-up and Monitoring

The follow-up and monitoring recommended in Chapter 7, Atmospheric Environment is appropriate for the protection of Health and Safety. No specific Health and Safety follow-up and monitoring recommendations would be required.

Summary

Environmental effects of the Project on Health and Safety were assessed by calculating the potential risk of human exposure to Project-related emissions to air, and their subsequent deposition in the environment. A Human Health Risk Assessment (HHRA) was conducted to provide a quantitative assessment of the potential risk to Residents, Hunters and Anglers and Subsistence Farmers in the RAA. Baseline conditions of a number of COPC were determined to pose a potential risk to receptors in the RAA, with CR and HQ values calculated above their respective benchmarks. However, further examination of these exceedances determined that

concentrations of these COPC were similar to other communities in New Brunswick, and the rest of urban Canada.

A Baseline Public Health Assessment evaluated a number of health indicators that are commonly used to measure the health status of a population. Overall, findings reveal that health status is similar in Saint John (former Health Region 2) and the rest of the province.

However, there are some exceptions where the former Health Region 2 had differences in their reported disease rate than the remainder of the province. Mitigation measures for adverse environmental effects on human health include those listed in Chapter 7 (Atmospheric Environment) to reduce contaminant air emissions from the Project.

Where necessary, the Proponent would attempt to purchase neighbouring residential properties to lessen the potential for people to be exposed to undue human health risks at selected receptor locations. No additional Health and Safety-specific mitigation would be proposed.

Based on the results of the Human Health Risk Assessment (HHRA), the Project Alone would not be anticipated to result in Concentration Ratio (CR), Hazard Quotient (HQ) or Incremental Lifetime Cancer Risk (ILCR) greater than their respective benchmarks of 1.0, 0.2, and 1-in-100,000, for any contaminant of potential concern (COPC) at any human receptor location. Therefore, with the proposed mitigation and environmental protection measures, the environmental effects of the Project on Health and Safety were rated not significant.

The HHRA results for Project Case and Future Case, which reflect the cumulative environmental effects for a Change in Public Health, indicated that there would be potential human health risks, based on exposure of human receptors to long-term and short-term concentrations of COPC, in air and in other environmental media.

These results indicated that, with the proposed mitigation and protection measures, the cumulative environmental effects of the Project, in combination with other projects and activities that have been or would be carried out on Health and Safety, were rated significant.

However, the contribution of the Project to the cumulative environmental effects was rated not significant, given that the majority of the environmental effect would be based on existing or baseline concentrations of chemicals in the Regional Assessment Area (RAA).

Overall, the Project would not be anticipated to affect the existing health status of residents of the RAA, as provided in the Baseline Public Health Assessment. The follow-up and monitoring recommended in Chapter 7, Atmospheric Environment would be appropriate for the protection of Health and Safety, and no specific Health and Safety follow-up and monitoring would be required.

Chapter 10 – Freshwater Aquatic Environment

Chapter 10 covers pages 10-1 to 10-43, and illustrates key subject areas with 8 tables as well as 4 figures. It begins by explaining that the Freshwater Aquatic Environment includes watercourses (rivers, lakes, and streams) that provide habitat for fish and other freshwater aquatic species. As such, it was identified as a Valued Environmental Component (VEC), due to its importance in supporting freshwater aquatic life.

Although there is no known Aboriginal fishery or commercial fishery in the Freshwater Aquatic

Environment in the Regional Assessment Area (RAA), the Report notes that local residents value the ability to angle recreationally mainly for brook trout and brown trout. During public and stakeholder engagement activities, some local residents expressed concerns about the Project and how it might affect this activity. There is currently no recreational fishing season for Atlantic salmon on the Mispec River, but local residents have identified that conserving the salmon population in this river is important to them.

The Report notes that the Project has the potential to affect the Freshwater Aquatic Environment, due to the unplanned or accidental release of deleterious substances or sediments into watercourses; direct mortality of fish; changes in drainage area, and the deposition of air contaminant emissions. The Report states, however, that with effective Project planning, design, avoidance, and application of known and proven mitigation measures, it has been concluded that the environmental effects of the Project on the Freshwater Aquatic Environment would not be significant.

Section 10.1 and 10.2 cover pages 10-2 to 10-18 and provide detailed information on the Scope of Assessment and Existing Conditions under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Aboriginal, Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

Table 10.4 lists each Project activity and physical work, and ranks each interaction as 0, 1 or 2. These rankings are also defined and indicate the level of interaction each would have with the Freshwater Aquatic Environment.

All Project activities or physical works associated with the Marine Terminal and Other Marine-Based Infrastructure were ranked as 0, since these would not interact with the Freshwater Aquatic Environment in any substantive way.

As such, the potential environmental effects of the Construction, Operation, and Decommissioning and Abandonment of the Marine Terminal and Other Marine-Based Infrastructure on the Freshwater Aquatic Environment were rated not significant, with a high level of confidence.

Overall, the potential environmental effects of all Project activities and physical works that were ranked as 0, including cumulative environmental effects, on the Freshwater Aquatic Environment, during any phase of the Project, were rated not significant, and were not considered further in the assessment. The Report notes, however, that the Environmental Risk

Assessment (ERA) does include an assessment of the environmental effects of emissions from

ships in the Marine Environment on the Freshwater Aquatic Environment.

Potential Interactions of the Petroleum Refinery and Other Land-Based Infrastructure

This section describes the rationale for the ranking of activities as 1 or 2, which are summarized in Table 10.4.

Construction The interaction between the Freshwater Aquatic Environment and Road Transportation during Construction was ranked as 1, as this activity has the potential to affect fish populations primarily through erosion and sedimentation of watercourses.

Activities related to Construction of Linear Facilities and Watercourse Crossings were also ranked as 1. The potential crossing locations included Hazen Creek, a tributary to Hazen Creek and Brandy Brook, as well as field-identified watercourses. Hazen Creek and the Tributary to Hazen Creek each have one potential crossing, while Brandy Brook might be crossed up to four times by the preferred linear facilities corridor.

Two unmapped watercourses also lie within the preferred linear facilities corridor, each having one potential crossing. Despite this, there would be no anticipated direct interaction between these construction activities and the Freshwater Aquatic Environment, due to the avoidance of all work activity in fish-bearing portions of watercourses, through application of technologies such as horizontal directional drilling (HDD) and bridging for linear facility watercourse crossings.

Work activity within 30 m of watercourses (particularly those that are fish-bearing) would also be minimized. Further, preliminary geotechnical investigations indicated that bedrock in the Project Development Area (PDA) is not net acid producing. As such, there is very little risk for acid rock drainage during construction. A Project specific environmental protection plan (EPP) for Construction would also be developed, including the following:

- Implementation of well established and proven erosion and sedimentation control measures for protection of watercourses during near-stream work, as per the standard protocols from the NB Departments of Transportation and Environment, as well as other procedures designed specifically for the control of run-off.
- Proper storage, use, and containment of potentially deleterious substances, as per the standard NBDOT protocols and provincial hazardous material storage and containment regulations.
- Monitoring of water quality parameters (*e.g.,* total suspended solids) during work.
- Compliance with all provincial and federal legislation, permits, approvals and guidelines.

Due to the implementation of effective erosion and sedimentation control measures and the avoidance of all work activity in fish-bearing portions of watercourses, the environmental effects of the interactions ranked as 1, with the Freshwater Aquatic Environment during Construction, were rated not significant.

The interactions between the Freshwater Aquatic Environment and the following Construction activities and physical works were ranked as 2 in Table 10.4:

- Site and Right-of-Way Preparation; and
- Physical Construction and Equipment Installation.

The Report notes that construction activities have potential to affect fish populations through

changes in surface water available for stream flows, due to an increase in impermeable surfaces and diversion of surface water run-off. Change in fish populations are a particular concern in the Mispec River watershed, and sub-watersheds supplying tributaries to the Mispec River, due to the presence of Atlantic salmon in the system. The potential interaction between the Freshwater Aquatic Environment and these construction activities is complex and required further analysis.

This potential environmental effect would continue through Operation. The potential for changes in surface water availability was also raised by stakeholders, members of the public, and regulators, during consultation, further emphasizing the importance of this interaction, and its ranking as 2.

Operation The following interactions between the Freshwater Aquatic Environment and the following Operation activities were ranked as 1:

- Emissions Control and Management of Effluents and Wastes
- Water Supply and Use
- Linear Facilities Presence and Operation
- Right-of-Way and Infrastructure Maintenance
- Road and Rail Transportation.

Emissions Control and Management of Effluents and Wastes was ranked as 1, due to the interaction of air emissions, wastes and effluents with the Freshwater Aquatic Environment. The ranking of 1 reflected the existence of well established and proven mitigation measures, including air pollution control technologies, for this anticipated interaction. It is also supported by the Ecological Risk Assessment (ERA), which showed that predicted environmental concentrations of contaminant of potential concern (COPC) resulting from atmospheric Project emissions did not result in any unacceptable risk to any aquatic ecological receptor.

As noted earlier, no wastewater discharge to the Freshwater Aquatic Environment would be planned as part of the Project. Additionally, all provincial and federal legislation, permits, approvals and guidelines would be followed.

Water Supply and Use was ranked as 1 because, although surface water is proposed as a potential source of process water for the Project, it would be obtained through the licensed City of Saint John municipal water supply system, and not from watercourses within the Regional Assessment Area (RAA).

The Mispec River watershed has been separated from the Loch Lomond watershed by a dam at the south end of Robertson Lake. While water use from the municipal watersheds by a variety of users, including the Project, could result in lower than normal water levels, it would be expected that the City of Saint John, as the owner and operator of the municipal system, would manage the water supply in a manner that did not adversely affect the Freshwater Aquatic Environment.

The Report notes that Interactions between the Linear Facilities Presence and Operation, Right-of-Way and Infrastructure Maintenance, and Road and Rail Transportation and the Freshwater Aquatic Environment have potential to cause a Change in Fish Populations through the potential release of deleterious substances and contaminated surface run-off from roads and rail beds.

A ranking of 1 was assigned, due to the existence of well established and proven mitigation methods and techniques, including the standard erosion and sedimentation measures described above for these anticipated interactions. For those activities ranked as 1 in Table 10.4, in consideration of the planned implementation of known and proven mitigation, the environmental

effects of the Project on the Freshwater Aquatic Environment during Operation were rated not significant. Operation and Maintenance of Refinery Processes and equipment were ranked as 2, due to their interaction with the Freshwater Aquatic Environment. The presence, operation and maintenance of Project processes and equipment would sustain the loss of drainage area which would take place during Construction and, thus, was carried through the assessment.

Decommissioning and Abandonment The interaction between the Freshwater Aquatic Environment and the Removal of Facilities and Site Reclamation was ranked as 2. Potential interactions involved in Decommissioning and Abandonment would be anticipated to be very similar to those occurring during Construction.

Such interactions would also have potential to cause a Change in Fish Populations due to erosion and sedimentation of watercourses, and the release of deleterious substances. Well established and proven mitigation methods and techniques, including standard erosion and sedimentation measures, as described above, would be employed during this phase of the Project. These interactions are nonetheless carried forward in the EIA.

To summarize, all Project activities ranked as 0 or 1 in Table 10.4 would result in no residual environmental effects on fish populations, due to the application of well established and proven mitigation measures, and were considered to be not significant.

The post refinery ecological hazard quotient (EHQ) was less than 1, and no freshwater fish mortality would be expected to result from any of the Project phases. It is anticipated that the measurable parameters presented in Table 10.1 would be maintained to support existing fish populations in the RAA during these Project activities. Therefore, no residual environmental effects on fish populations would be anticipated from these activities, and they were rated not significant.

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on the Freshwater Aquatic Environment, is provided in Table 10.5. They include the following interactions, which were ranked as 2, due to the potential change in drainage area of watersheds containing fish-bearing watercourses.

Construction

- Site and Right-of-Way Preparation
- Physical Construction and Equipment Installation.

Operation

- Operation of Refinery Processes and Equipment.

Decommissioning and Abandonment

- Removal of Facilities and Site Reclamation.

Assessment of Project-Related Environmental Effects

As discussed earlier, a Change in Fish Populations through interactions ranked as 1 in Table 10.4 were rated not significant, and would be effectively mitigated through well established and proven mitigation measures.

Harmful alteration, disruption or destruction (HADD) of freshwater fish habitat would also be avoided, through the use of horizontal directional drilling (HDD) technology at underground

pipeline crossings, and bridging of watercourses for road, and above ground, pipeline crossings. The potential change in drainage area ranked as 2 in Table 10.4 required further investigation.

The measurable parameters used to assess the potential Change in Fish Populations from a change in drainage area were the drainage area itself, dissolved oxygen (DO) and water temperature. Drainage area for fish-bearing watersheds in the Regional Assessment Area (RAA) was considerably reduced with the construction of the Robertson Lake dam in 1906. Since then, drainage area loss has occurred on a much smaller scale for other watersheds in the Local Assessment Area (LAA), primarily due to residential and industrial development and road construction.

DO levels were observed in the surveyed watercourses at levels sufficient to support populations of fish. Several instances of low DO levels were observed in Calvert and Balls Lake, and in watercourses where barriers such as beaver dams had reduced flow.

Water temperatures in the majority of watercourses showed cool clear water, also supportive of brook trout and Atlantic salmon populations, with the exception of areas impounded by beaver dams or tree falls.

Potential Project-Valued Environmental Components (VEC) Interactions

During Construction, environmental effect mechanisms resulting in a loss of drainage area would primarily include near-stream and watershed-level works for linear facility and land-based Project component construction. A loss in drainage area has the potential to affect fish populations through lower stream flow, particularly during base/low flow conditions (summer months).

Lower stream flows can also affect DO levels and water temperatures. Of particular interest are the watersheds supplying the Mispec River, and its tributaries, Brandy Brook (Unnamed Tributary 1 to Mispec River), Anthonys Brook, and Bean Brook, due to their proximity to the PDA (Figure 10.4). Watershed area within each of the watersheds supplying these watercourses would be reduced due to Construction and Operation of the refinery and associated land-based facilities (*e.g.,* tank facilities).

Components of Construction contributing to these mechanisms would include Site and Right-of-Way Preparation, Physical Construction and Equipment Installation.

These components would contribute to drainage loss through the creation of interception ditches and the subsequent diversion of flows. Operation components to this mechanism could have similar effects. During Decommissioning and Abandonment, environmental effects mechanisms could also be very similar, with the exception that the potential Removal of Facilities and Site Reclamation might result in restoration of drainage area.

Mitigation of Environmental Effects for Change in Fish Populations

The following mitigation measures, through careful design and planning, would be employed to avoid or reduce the environmental effects of the Project on the Freshwater Aquatic Environment, potentially resulting from the loss of drainage area described above:

- Avoidance of work activity in fish-bearing portions of watercourses;
- Minimization of work activity within 30 m of watercourses (particularly those that are fish-bearing);
- Minimization of disturbance of drainage area for fish-bearing watercourse watersheds;

- Hydrological analysis of fish-bearing watersheds in the LAA to support design and confirm environmental effects predictions;
- If required, development of an effective storm water management system with the capability to return surface water to select drainage areas to maintain stream flows for fish-bearing watercourses;
- Compliance with all provincial and federal legislation, permits, approvals and guidelines.

Characterization of Residual Project Environmental Effects for Change in Fish Populations

The Project activities ranked as 2 in Table 10.4 required further assessment, in addition to the mitigation measures presented above, due to the complexity of their potential to affect fish populations.

As described earlier, the mechanism for this environmental effect would entail a change in surface water hydrology, where run-off would be captured from Project facilities and directed outside of the drainage area. This is particularly important at the refinery site, where site run-off would be collected, directed to wastewater treatment, and discharged to the marine environment. This environmental effect would be restricted to watercourses downstream of the area, within which run-off water would be diverted. The duration of the Project-related Change in Fish Populations would be expected to slightly exceed the expected lifespan of the Project.

Drainage Area Assessment An assessment was carried out for permanent fish-bearing watercourses that might be affected by a reduction in drainage area, to determine the potential drainage area affected. This assessment used existing information, combined with ground verification in select areas, to define the watershed boundaries. Additional field hydrological survey data was collected during the spring and summer of 2008, including water level and stream flow information from select watercourses in the LAA. Table 10.6 shows that, while drainage area would be lost, the amount would be relatively small, in comparison to the total drainage area present for each watershed. The Report states that this would not be anticipated to affect the fish populations presently inhabiting each stream.

Fish Habitat Requirements The Report also points out that any observed or measurable reduction in stream flows, due to loss of drainage area, would likely occur during periods of the year when low flow conditions were present (*e.g.,* summer/winter). The report notes that critical lifecycle stages (*e.g.,* spawning) for species such as Atlantic salmon, or other fish species, most commonly occur during periods of high flow. As a result, it is not anticipated that the small potential reduction in stream flows, due to small losses in drainage area, would affect the ability of fish populations to survive in watercourses near the PDA and in the LAA.

The Report notes that Atlantic salmon are clearly the most sensitive species in the Mispec River system. Atlantic salmon carry out the critical stages of their lifecycle (migration, spawning, hatching) under higher flow conditions, but are tolerant under a broad range of habitat conditions. Supporting information contained in the Surface and Groundwater Resources Technical Study indicated that groundwater discharge sustains most small stream flows in the PDA during the dry portions of the year. Brook trout are found in watercourses in the LAA, and also spawn in the fall months during higher flow conditions. Other non-salmonid fish species present in surveyed watercourses are also resilient and hardy under low flow conditions.

Further to the description of habitat requirements above, the Report states that a loss in drainage from the Project would only be experienced in the lower reaches of the Mispec River. These lower reaches are fed by the entire drainage area upstream of the PDA, which would not be affected by the Project. Flows in the middle and upper reaches of the Mispec River, where salmonid spawning is more likely to occur (particularly Atlantic salmon), would therefore not be

anticipated to be reduced to any measurable degree by the Project.

During field surveys of the lower reaches of the Mispec River near the PDA, there was little potential salmonid spawning habitat observed, likely due to the steep gradient in this area. Potential spawning habitat was observed further upstream near the crossing of Old Black River Road in the Mispec River and Brandy Brook. Juvenile salmon were also observed in this upstream area, well above the PDA, which would not be affected by the Project.

Atlantic salmon were not observed in any of the unnamed tributaries draining to the Mispec River during field surveys. Brandy Brook, as with Mispec River, would experience a small loss in drainage area (approximately 9.5%) at its lower reaches. Juvenile salmon were observed in this watercourse as well, although at much lower numbers than the upstream reaches of the Mispec River.

Areas of spawning and rearing habitat were observed in Brandy Brook during stream surveys. In-stream flows in these areas would not likely be affected by the Project, due to the vast majority of upstream drainage area that would remain intact to provide adequate stream flows. Atlantic salmon were not observed in any of the other smaller watercourses (*e.g.,* Bean Brook, Anthonys Brook) near the PDA and in the LAA, nor would they be expected to be observed, given the small nature and habitat characteristics of these watercourses. The predominant species observed in these smaller watercourses were brook trout and blacknose dace.

The Bean Brook watershed would experience the highest predicted drainage area loss on a percent basis (approximately 18.3%). Although this could potentially represent a substantial loss in drainage area, it is anticipated that Calvert Lake would serve to provide Bean Brook with adequate stream flows during low flow conditions.

Further, it is highly likely that populations of other fish species in these smaller streams and the Mispec River are naturally adapted to low flow conditions and able to seek areas of deeper water refuge during dry months of the year. It is not anticipated that the small drainage area lost due to Project development would affect fish populations, when these natural conditions occur.

History of Mispec River and Atlantic Salmon As discussed in Section 10.2, the lower Mispec River system was historically the site of multiple industrial operations and infrastructure (*i.e.,* sawmill, cotton mill, barrier dam) that would likely have had a significant environmental effect on the ability of the system to support populations of migratory fish species such as Atlantic salmon. This system has since recovered considerably and now contains freshwater habitat conducive to supporting Atlantic salmon populations.

The following primary factors have been identified as relating to the collapse of the inner Bay of Fundy Atlantic salmon stock:

- Alteration of habitat by forestry and agriculture practices;
- Damming of rivers and estuaries;
- By-catch in shad and herring fisheries;
- Potential salmon farm threats such as disease or competition; and
- Illegal fishing of wild salmon.

As the Project would not involve any of the activities listed above, the Project would also not contribute to any further decline of inner Bay of Fundy Atlantic salmon populations in the Mispec River system. Although the inner Bay of Fundy native salmon of the Mispec River would appear

to be extirpated. The Report notes that the Project would not affect the River's capacity to

support Atlantic salmon populations, at present or in the future.

Potential Mitigation At this juncture, the Report states that, if further field hydrological data collection and analysis, currently being undertaken, suggests that the loss of drainage area has potential to result in a change in sensitive fish populations due to decreased stream flows, or if follow-up identifies any issues, additional mitigation measures would be available and could be implemented.

The diversion of surface water flow from the land based facilities back to select watersheds through a modified storm water management system would be one example. To summarize, for the majority of watersheds within the LAA, the loss of drainage area would be low in magnitude. While it would occur during Construction and remain for the life of the Project, it would not be anticipated to affect fish populations.

Assessment of Cumulative Environmental Effects

An assessment of the potential cumulative environmental effects was conducted for other projects and activities that could have potential to interact with the Project.

Table 10.7 identifies potential cumulative environmental effects and ranks each interaction with other projects as 0, 1 or 2 with respect to the nature and degree to which important Project-related environmental effects might overlap with those of other projects and activities. Projects and activities potentially interacting with the Petroleum Refinery, and other Land-Based Infrastructure, with potential for cumulative environmental effects ranked as 1, include Infrastructure Land Use and Planned Infrastructure Projects. Well established and proven mitigation measures and techniques would exist for these potential interactions.

Projects and activities that would potentially overlap with the environmental effects of the Petroleum Refinery, and other Land-based Infrastructure ranked as 2, include Industrial Land Use, Forestry and Agricultural Land Use, Recreational Land Use, Planned Future Industrial/Energy Projects, Planned Residential Development and Planned Marine Use (including aquaculture).

To address these potential interactions, an environmental effects assessment was conducted, and the resulting cumulative environmental effect mechanisms, mitigation measures and characterization of residual cumulative environmental effects are presented in Table 10.8.

Project Cumulative Environmental Effect Mechanisms for Change in Fish Populations

The Project cumulative environmental effect mechanisms for a Change in Fish Populations are described below for the Base Case, Project Case and Future Case scenarios:

Base Case The Base Case includes past projects, as well as current projects that have received some level of environmental approval and/or are in some form of planning, construction and/or commissioning. Past projects, activities and actions contributing to this Base Case are the:

- Mispec River barrier dams (1821 to 1894 and 1898 to the 1960s)
- Mispec River sawmill
- Mispec River pulp mill
- Mispec River cotton and wool mills
- Past forestry and agriculture activities

- Past recreational and commercial fishing activities.

Freshwater Aquatic Environment habitat conditions on the Mispec River have improved considerably in more recent decades. This is evidenced by the good habitat quality and the presence of healthy fish stocks of native and non-indigenous species (*e.g.,* brown trout). Commercial fishing for Atlantic salmon in the Bay of Fundy has been prohibited for some time, and it is unknown if Atlantic salmon were ever fished commercially on the Mispec River itself. Recreational fishing for Atlantic salmon is currently prohibited, but was formerly allowed on the Mispec River, prior to the collapse of the inner Bay of Fundy Atlantic salmon stock. Recreational fishing still takes place for resident and sea-run trout species. Current projects, activities and actions contributing substantively to the Base Case are:

- Municipal water supply dam at Robertson Lake
- Canaport LNG emergency access road
- Brunswick Pipeline
- Aquaculture
- Operation of existing road network
- Fishing activities
- ATV and snowmobile use.

The dam at the south end of Robertson Lake has likely changed fish populations, in particular by reducing the habitat available for migratory species such as Atlantic salmon, that tend to require the habitat provided by larger streams.

The Canaport LNG emergency access road and the Brunswick Pipeline projects are both linear projects that cross fish-bearing watercourses. The Report notes that these projects were required to comply with legislation requiring the proponent to conduct a project specific EIA and provide appropriate mitigation measures. No substantive environmental effects are known to have resulted from these projects.

Aquaculture operations, specifically those for Atlantic salmon, exist currently in the Bay of Fundy, although there are no sites proximal to the Mispec River estuary. Department of Fisheries and Oceans Canada (DFO) has identified the spread of disease and competition from escapees from aquaculture operations as contributing to the collapse of the inner Bay of Fundy Atlantic salmon stock. This may contribute to cumulative environmental effects on remaining salmon stocks, and the ability of the Mispec River to recover from previous cumulative environmental effects related to dams and past habitat degradation.

The operation of the existing road network has the potential to affect the Freshwater Aquatic Environment, primarily through the potential release of deleterious substances into fish-bearing watercourses via contaminated surface water run-off.

Fishing, ATV, and snowmobile use are all recreational activities. Fishing has the potential to affect the Freshwater Aquatic Environment through the direct mortality of recreational fish species (*i.e.,* brook trout). ATV and snowmobile use have the potential to affect the Freshwater Aquatic Environment through the use of inappropriate crossing points over fish-bearing watercourses, which has potential to cause harmful alteration, disruption or destruction (HADD) of fish habitat and direct mortality of fish.

Project Case The Project would involve construction and operation of facilities which have the potential to interact with the Freshwater Aquatic Environment through erosion and sedimentation of watercourses and loss of drainage area. Other projects occurring in the same

watersheds, such as the Brunswick Pipeline Project, also have the potential for interaction. Well established and proven erosion and sedimentation mitigation measures would be available to address these interactions. The potential environmental effects from loss of drainage area have been demonstrated to be not significant, when the habitat requirements for fish species present in the area are considered, in combination with proposed mitigation measures.

Existing conditions currently supportive of fish populations would be maintained throughout Project development. The habitat important to Atlantic salmon and other species would continue to remain viable and unaffected.

Future Case Environmental effects from reasonable foreseeable projects (Future Case) include those future projects, activities or actions that will occur with certainty, including projects that are in some form of regulatory approval process or have made a public announcement to seek regulatory approvals. For the purpose of this assessment, the Future Case includes the following projects and activities:

- Irving Oil Projects in the Saint John/Mispec Area
- Potential Wind Energy Projects
- Residential Subdivisions.

Though no projects are currently being considered/planned in the Mispec area, potential future Irving Oil projects in the Mispec Area could interact with the Project's environmental effects on the Freshwater Aquatic Environment, through construction and operation of additional linear facilities across fish-bearing watercourses and, potentially, an additional loss of drainage area in fish-bearing watercourse watersheds.

Potential wind energy projects would also require the construction of linear facilities (*e.g.,* roads, transmission lines). Residential subdivision developments, depending on their location, might also result in removal of drainage area from fish-bearing watercourse watersheds and would also require the construction of linear facilities (*e.g.,* roads, water mains).

The environmental effects mechanisms for the Future Case are similar to those for the Base Case and Project Case for linear facility construction and operation. The removal of drainage area as a result of Future Case projects would also have potential to contribute to a cumulative environmental effect on fish populations.

However, such future projects would be undertaken under appropriate regulatory and planning processes, and unauthorized fish and fish habitat environmental effects would not be permitted. Thus, the cumulative environmental effects in the Future Case were rated not significant.

<u>Mitigation of Cumulative Environmental Effect for Change in Fish Populations</u>

The Report notes that Mitigation measures for the Project Case are provided in Sections 10.3.1, and 10.4.1. It states that the mitigation measures proposed for the Project-related environmental effects would also be anticipated to be effective in mitigating any cumulative environmental effects.

No projects are currently being considered/planned within the LAA and, thus, no further loss of drainage area, would be expected. The mitigation measures proposed in Section 10.4.1, if required, would be anticipated to be effective in mitigating any cumulative environmental effects from a loss in drainage area.

No additional mitigation measures would be required to address potential cumulative environmental effects on the Freshwater Aquatic Environment beyond those proposed for the Project.

Future projects will be required by the EIA Regulation and/or CEAA, if triggers are present, to conduct a project specific environmental assessment that will address future potential environmental effects at that time. Existing conditions currently supportive of fish populations would be maintained throughout Project development and the development of future projects.

Characterization of Residual Cumulative Environmental Effects for Change in Fish Populations

Potential residual cumulative environmental effects, resulting from the combination of the Base Case and Project Case on fish populations in the LAA and RAA, would primarily consist of those related to operation of the existing road network, construction and operation of additional linear facilities (*e.g.,* roads, pipelines) and refinery components for the Project, which could result in erosion and sedimentation, as well as loss of drainage area in fish-bearing watercourse watersheds. The interactions of these activities with the Freshwater Aquatic Environment would have potential, if unmitigated, to affect fish populations.

However, given the existence of well established and proven mitigation measures and techniques already presented to address the activities listed above, no residual cumulative environmental effects on fish populations would be anticipated. In particular, the ability of the Mispec River system to support Atlantic salmon would not be affected.

Determination of Significance

The sections below discuss the significance of the residual Project environmental effects, residual cumulative environmental effects, and proposed follow-up and monitoring for these environmental effects.

Residual Project Environmental Effects

The important potential residual environmental effect from the Project on the Freshwater Aquatic Environment would be a Change in Fish Populations, as a result of the loss of drainage area. Well established and proven mitigation measures are available for other activities and interactions described previously. Therefore, no residual environmental effect would be anticipated from these other activities (*e.g.,* linear facility construction, road operation).

Loss of drainage area was also determined to be not significant and would not be expected to change fish populations in the LAA or RAA. With the proposed mitigation and environmental protection measures, the residual environmental effect of a Change in Fish Populations on the Freshwater Aquatic Environment, during all phases of the Project, was rated not significant. This conclusion was determined with a high level of confidence.

Residual Cumulative Environmental Effects

The characterization of the potential cumulative environmental effects and associated mechanisms, combined with the proposed mitigation measures proposed earlier, demonstrated that the residual cumulative environmental effect of a Change in Fish Populations as a result of past, present and reasonably foreseeable projects and activities, in combination with the environmental effect of the Project during all phases, was rated not significant. This determination was made with a high level of confidence.

Additionally, the proposed mitigation measures demonstrate that the Project contribution to a cumulative environmental effect on fish populations in the Freshwater Aquatic Environment would be rated not significant. This determination was made with a high level of confidence.

Follow-up and Monitoring

Follow-up and monitoring programs would be implemented for the Freshwater Aquatic Environment as presented in Table 10.5. Follow-up and monitoring programs would consist of the following, in response to loss of drainage area being identified as the most important environmental effect mechanism.

- Monitoring of stream flow, dissolved oxygen (DO), total suspended solids (TSS) and water temperature in the Mispec River and tributaries where drainage area had been changed, with a focus on wetted perimeters and minimum flows. Bean Brook and Calvert Lake would also be included in this monitoring program. Additional baseline data for these parameters would be collected prior to Construction and sampling sites determined, based on fish-bearing watersheds that would experience Project-related drainage area loss.

Summary

The environmental effect of the Project on the Freshwater Aquatic Environment has been shown to be not significant, as a result of careful Project design and planning, in combination with the existence and application of well established and proven mitigation measures and techniques. The Freshwater Aquatic Environment in the LAA and RAA would continue to support fish populations throughout Project development, including Atlantic salmon in the Mispec River.

The cumulative environmental effect of the Project, in combination with past and future projects and activities in the LAA and RAA, has also been shown to be not significant. Mitigation measures implemented during Project development would be effective at mitigating cumulative environmental effects from the Project.

Future projects would be required to implement similar mitigation measures and perform project specific environmental assessments to investigate potential environmental effects, including cumulative environmental effects, on the Freshwater Aquatic Environment.

Follow-up and monitoring would focus on in-stream flows in watersheds in the LAA that would experience a loss of drainage area from Project development. Stream flow, dissolved oxygen (DO), Total Suspended Solids (TSS), and water temperature would be monitored at select sites prior to Construction, as part of the program.

Chapter 11 – Terrestrial Environment

Chapter 11 covers pages 11-1 to 11-40, and illustrates key subject areas with 8 tables as well as 5 figures. It begins by explaining that the Terrestrial Environment was identified as a Valued Environmental Component (VEC), and is important to the public for a number of reasons. Many valued components of the landscape (*i.e.,* wildlife, vegetation, and natural resources) are linked to biodiversity. Forests and other vegetation perform important water and air purifying functions; carbon and nutrient cycling, as well as providing habitat for wildlife.

The Report states that the Project has the potential to interact with the Terrestrial Environment by changing terrestrial habitats and/or populations of plants and/or animals that are important in a socio-economic or environmental context, including Species at Risk (SAR) or Species of Conservation Concern (SOCC). For the purpose of this EIA, SAR and SOCC were combined and referred to as species of special status.

The Report notes that the landscape surrounding the Project has been substantially fragmented by roads and forest resource harvesting for more than a century.

The Project would not interact with the Red Head Marsh, which is a provincially significant wetland. Few species of special status have been reported during field investigations for the Project, or other recent projects within the Local Assessment Area (LAA). The potential environmental effects on terrestrial populations present in the Project Development Area (PDA) would be mitigated using standard construction practices and scheduling of Project components and activities (*e.g.*, clearing during winter to avoid interaction with the bird nesting season).

Known locations of rare plants would be avoided, and interactions with other species of special status minimized to the fullest extent possible, in consideration of technical and economic feasibility. Mature forest habitat and interior forest would be avoided, where necessary, to prevent disturbance of important terrestrial habitat for SAR or SOCC. The Report states that residual environmental effects on the Terrestrial Environment were rated not significant for all Project phases, due to the nature of interactions and planned mitigation. The potential cumulative environmental effects were also rated not significant.

Section 11.1 and 11.2 cover pages 11-2 to 11-22 and provide detailed information on the Scope of Assessment and Existing Conditions under the following sub-headings:

Scope of Assessment

- Issues and Concerns Identified During Aboriginal, Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

Table 11.4 lists each Project activity and physical works for the Petroleum Refinery and Other Land-Based Infrastructure and ranks each interaction as 0, 1, or 2. These rankings indicate the level of interaction each activity or physical work would have with the Terrestrial Environment. All Project activities and physical works associated with the Marine Terminal and Other Marine-Based Infrastructure were ranked as 0, as these Project components would not interact with terrestrial wildlife populations in any substantive way. Marine birds, such as the harlequin duck, are assessed in Chapter 13.

Some of the project activities listed in Table 11.4 would not be expected to have any interaction with the VEC, (Employment and Expenditure, Water Supply and Use) and, as such, were ranked as 0. Project activities and physical works associated with Construction, Operation, and

Decommissioning and Abandonment of the Petroleum Refinery and Other Land-Based Infrastructure were included in the assessment.

Only those interactions ranked as 2, however, were carried forward to the detailed environmental effects assessment analyses in Section 11.4. Interactions that could occur, but would not be considered likely to result in any significant adverse environmental effects, even without the use of mitigation, were ranked as 1, and thus rated as not significant. The following describes the rationale for the selection of activities as 1 or 2, summarized in Table 11.4:

Construction The following Project activities and physical works during Construction were ranked as 1 and would interact with the Terrestrial Environment, but would not likely result in any significant adverse residual environmental effects:

- Physical Construction and Equipment Installation;
- Commissioning;
- Road Transportation.

Interactions between the Terrestrial Environment and these activities would be mitigated by the use of standard construction and best management practices, or would be low enough in magnitude, to not result in a significant adverse residual environmental effect on terrestrial populations.

Physical Construction and Equipment Installation would occur in habitat that would have already been removed and accounted for elsewhere. As a result, potential environmental effects would be limited to accidental events, or indirect environmental effects such as human presence and noise. This construction activity might disturb some terrestrial populations by increasing sound levels, but the duration would be restricted to the construction window.

Increased traffic during construction might have similar interactions. However, the main roadways to the site already exist, with few additional access roads required. Mitigation for initial flaring during commissioning would include timing the activity outside migratory periods for birds. Road Transportation could result in vehicle collisions with wildlife and, as accidental events, are addressed in Chapter 23.

The potential interaction between construction-related noise and terrestrial populations could be further reduced by minimizing the extent of clearing and grubbing, maintaining natural vegetation as much as possible and using appropriate noise suppression for all equipment. In addition, the Project might affect habitat quality adjacent to its installations and activities, due to human presence and associated sound and visibility. However, these land-based construction activities would not contribute to the loss of habitat, and would not directly threaten the sustainability of terrestrial populations. Therefore, the resulting environmental effects were rated not significant.

The interactions between the Terrestrial Environment and the following construction activities and physical works were ranked as 2, and were thus considered in more detail.

- Site and Right-of-Way Preparation; and
- Construction of Linear Facilities and Watercourse Crossings (including Wetlands).

Construction of the land-based infrastructure for the Project would have the greatest potential to affect terrestrial populations, through the loss or alteration of habitat for wildlife species, and/or the direct loss of individual plants and animals, potentially including species of special status. The loss of freedom of movement between patches of habitat, called fragmentation, would also

be an issue for some species that regularly move around in a landscape, exploiting resources that are seasonally available and other species that require large home ranges.

Key mitigation to reduce potential adverse environmental effects would include avoiding known locations of species of special status and their habitat(s) to the extent possible, and clearing vegetation for the Project outside the migratory bird breeding season. To further reduce interactions, the Project would minimize equipment and vehicle traffic in non-right of way habitat and only clear the minimal area necessary.

Secure species potentially affected by avoidance of habitat, or degradation of the quality of habitat, would not be affected to a degree that would cause a reduction in populations. Thus, the environmental effects of Construction have been rated not significant. Indirect environmental effects, such as noise, would be similar as those described above for Physical Construction and Equipment Installation activities, and, therefore, were not considered further.

Operation The interaction between the Terrestrial Environment and the following operational activities and physical works were ranked as 1:

- Operation and Maintenance of Refinery Processes and Equipment Operation;
- Emissions Control and Management of Effluents and Wastes;
- Linear Facilities Presence and Operation;
- Right-of-Way and Infrastructure Maintenance; and
- Road and Rail Transportation.

The above operational activities could potentially interact with the Terrestrial Environment by lowering the quality of adjacent habitat for terrestrial populations through disturbances such as light and/or sound, or emissions, by displacing or otherwise affecting species that are sensitive to these activities.

Mitigation including noise suppression systems on all machinery, and using existing vegetation (forest) to attenuate noise emissions during all stages of the Project, would decrease interactions with neighbouring terrestrial populations. Increased sound levels might cause wildlife to temporarily relocate to a less disturbed location. Sound level attenuation would be influenced by topography and vegetation cover surrounding the Project. The Report notes that wildlife currently use habitat that is available on the existing Saint John refinery property.

For example, waterfowl raise young in wetland habitat and fire ponds within view and hearing distance of the refinery, a distance ranging between 150 and 300 m. Red fox, white-tailed deer, and occasionally moose are also observed on the existing refinery property.

Interactions between Operation and direct mortality on terrestrial populations would include potential wildlife strikes with towers, stacks or gas flares, and/or transmission lines, and potential air contaminant emissions. Light sources, especially at night and/or during inclement weather, have been shown to be an attractant to migrating birds. While birds can fly into any non-illuminated structure, it is the additional attraction of lights that is of concern.

The Project would have obstruction lighting for human safety, as the Saint John Airport is approximately 9 km to the northeast. However, studies suggest that bird mortalities might be decreased by using strobe lights and/or less intense lights. Additional mitigation in the form of lighting standards was presented in Section 3.5.1.4, which would reduce the amount of light pollution and sky glow.

There is no evidence to suggest that a high incidence of avian collisions with flares/lighting would occur at the Project site, located within 5 km of the existing Saint John refinery, and the City of Saint John.

The Project's electric power transmission line would be built and operated by NB Power and would be expected to be subject (separately) to the NB EIA Regulation. The Project would not include factors or features that would have the potential to result in increased risk of bird collisions or electrocutions, as compared to any other of the thousands of kilometres of transmission line in New Brunswick.

Potential environmental effects to birds from lighting would be monitored during Construction and Operation, and if it became apparent that there was an elevated risk or incidence of these collisions, a plan would be developed and implemented in consultation with the appropriate regulatory authorities, as part of permitting activities.

The Report also states that the Proponent would abide by the Migratory Birds Convention Act to prevent exposure of birds to contaminants which may be harmful to them, and would consider safeguards in the design of treatment ponds. Background concentrations of contaminants of potential concern (COPC) during the operational phase of the Project would not result in any Hazard Quotient (HQ) exceedance.

The Human Health and Ecological Risk Assessment (HHERA) study indicated no unacceptable risk to terrestrial receptors from Project emissions. As the above activities would not involve the loss of habitat, or directly threaten the sustainability of terrestrial populations, The Report notes they have limited potential to adversely affect terrestrial populations, and states that such populations near the Project would acclimatize to its presence over time. Overall, in consideration of the above, the planned design, and mitigation, the potential environmental effects of the Project during Operation were rated not significant.

Decommissioning and Abandonment The interaction between the Terrestrial Environment and the Removal of Facilities and Site Reclamation was ranked as 1. The activity associated with removing infrastructure and site reclamation might have a short term negative interaction with local terrestrial populations, but in the longer term, a positive interaction would be anticipated due to the re-establishment of natural vegetation cover. The environmental effects of the Project during Decommissioning and Abandonment were thus rated not significant.

<u>Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment</u>

This section evaluates the potential for Project-related activities to result in environmental effects on the Terrestrial Environment. A summary of the environmental effects assessment and prediction of residual environmental effects, resulting from interactions ranked as 2 on the Terrestrial Environment, has been provided in Table 11.5. Only the interactions ranked as 2 were considered and include the following:

- Site and Right-of-Way Preparation; and
- Construction of Linear Facilities and Watercourse Crossings.

<u>Assessment of Project-Related Environmental Effects</u>

The residual environmental effects (although not significant) would be a Change in Terrestrial Populations in the immediate vicinity of the PDA, due to a reduction or change in habitat, and the incidental loss of small, common wildlife (and plants) unable to avoid disturbance, especially

during site preparation. A number of mitigation measures would be implemented to minimize environmental effects. They would include minimizing of the Project footprint, minimizing the disturbance to interior forest habitat, avoiding known locations of species of special status, and clearing vegetation during the winter.

Potential Project-VEC Interactions

During Construction, environmental effect mechanisms resulting in a loss of habitat area would primarily include clearing and grubbing works for construction of the linear facilities and land-based Project components. Local terrestrial populations require, and/or are required by other species as a food item. Of particular interest are individuals of species of special status recorded in the LAA. Overall, few species have been recorded and only four (including common nighthawk and Canada warbler) are known to be from locations that might interact with the PDA.

Specific habitat necessary for some species is also of interest. Interior forest, as a representative of specific wildlife habitat, is present in the PDA and the avoidance, to the extent possible, of this habitat would reduce interactions with terrestrial populations that are reliant on this type of habitat.

Mitigation of Environmental Effects for Change in Terrestrial Populations

Mitigation measures that would be implemented during the Project are listed in Table 11.5, in addition to those measures introduced in Section 11.3. They would be implemented, wherever technically and economically feasible, to minimize potential environmental effects of the Construction of the Project on the Terrestrial Environment.

- Avoid known locations of plant species of special status, and established nest sites of bald eagle and peregrine falcon.
- Minimize the loss or fragmentation of mature forest habitat and interior forest.
- Conduct clearing activities in fall and/or winter, outside the breeding season of migratory birds.
- Establish buffers and protect active migratory bird nests until fledging, upon their discovery in work areas.
- Design lighting so as to reduce potential attraction by birds, such as strobe lights on towers and use of down-lighting.

Characterization of Residual Project Environmental Effects for Change in Terrestrial Populations

Table 11.6 is a qualitative summary of the magnitude of residual environmental effects for measurable parameters carried forward, while Table 11.7 presents the quantifiable residual environmental effects for measurable parameters, where they can be quantified.
For example, a loss in area of forest (ha), within the combined refinery and other land-based infrastructure in the PDA, is presented for each age class of forest. This loss of habitat would be localized to the specific footprint of the land-based Project facilities.

To summarize, with mitigation, the Project would result in a loss of approximately 244 ha of forest habitat of varying age within the Refinery PDA, and 73 ha of interior forest within the Refinery PDA, over a period of 6-8 years (*i.e.,* during Construction). Approximately 92 ha of land would be required in the preferred linear facilities corridor, as a result of the construction of linear facilities (*e.g.*, pipeline and transmission line), pending final routing, including approximately 56 ha of forest of varying age.

Thus, the total loss of forest habitat associated with the Project would be approximately 300 ha. The vegetation removal would occur in the initial phases of construction when the ground is cleared and grubbed in preparation for the construction of land-based infrastructure.

These potential environmental effects would very likely be reversible as the forest/habitat that was removed returns to pre-Project conditions. It is anticipated that known locations of vascular plant species of special status would be avoided during the construction of this Project based on detailed surveys.

Suitable habitat for a low number or proportion of bird species of special status would also be lost to Construction. The application of the same standard mitigation, to avoid or reduce potential environmental effects on migratory birds, would be implemented. This includes clearing prior to breeding season when nests and/or nestlings are not present. Clearing in the winter would avoid direct mortality of nesting birds, including bird species of special status. Overall, it was therefore concluded that the residual environmental effects of the Project, in consideration of planned mitigation, were not significant.

Assessment of Cumulative Environmental Effects

Residual cumulative environmental effects of current and planned land use on the Terrestrial Environment are summarized in Table 11.8. Groups of Interactions were ranked 0, if their Project-related environmental effects would not act cumulatively with those of other Projects and Activities.

The groups of interactions ranked as 1 were Project-related environmental effects that would act cumulatively with those of other Projects and Activities, but were unlikely to result in significant cumulative environmental effects, or would not measurably change the state of the Terrestrial Environment.

There were no interactions ranked as 2 and, as shown in Table 11.8, no potentially significant cumulative environmental effects of the Project, in combination with other projects and activities, were considered likely.

The Project would potentially remove up to 300 ha of forested habitat in an otherwise forested, but industrially developed landscape, inside the City of Saint John. The Report concludes that there would be no loss of regional biodiversity in the Fundy Coastal Ecoregion. With respect to the activities of other future projects with potential for cumulative environmental effects, the cumulative environmental effects on Terrestrial Populations would not be significant, as habitat loss and degradation would be localized and small in area.

The Report further states that sustainability of populations, both secure and species of special status, would not be affected in the Fundy Coastal Ecosystem.

Determination of Significance

The Project would result in a decrease of forested wildlife habitat. This would be in addition to the habitat already removed for construction of the Red Head Secondary Access Road (Bayside Drive), the Canaport LNG terminal, and the Brunswick Pipeline. The Project might potentially disturb wildlife by increasing sound levels in the LAA during the Operation of the Project. However, this was rated not significant.

The loss of terrestrial habitat due to the Project would be localized to the footprint of the Petroleum Refinery and Other Land-Based Infrastructure. Currently, there are few species of

special status in the PDA that could be affected by the Project and little interior forest, largely due to the current level of forestry and industrial activity in the local area.

The greatest portion of the habitat loss would occur in the initial phases of Construction (*i.e.,* Site and Right-of-Way Preparation, and Construction of Linear Facilities and Watercourse Crossings (Including Wetlands) when the ground is cleared and grubbed in preparation for the construction of land-based infrastructure. Mortality associated with Operation, would be expected to affect a small percentage of terrestrial populations (if at all), and the potential environmental effect could be greatly reduced by using the mitigation outlined in Table 11.5.

Based on past evidence and the mitigation outlined for this Project, the potential environmental effects on the Terrestrial Environment were rated not significant. The report states there is a high level of confidence in the assessment of environmental effects and significance prediction, because of the nature of mitigation outlined in this assessment, and the collective professional judgment of the Study Team, which has local knowledge based on involvement with other projects within the ecoregion.

Summary

The potential environmental effect, Change in Terrestrial Populations, represents a wide range of species groups that include birds, mammals, herpetiles, invertebrates and flora. However, the environmental effects of the Project on the Terrestrial Environment would not be anticipated to be significant, as a result of careful Project design and planning, in combination with the existence and application of well established proven mitigation and environmental protection measures.

It is not anticipated that the Project would result in the direct mortality of large numbers of terrestrial species, with the exception of vegetation that would be cleared. The Terrestrial Environment in the LAA and RAA would continue to support terrestrial populations throughout Project development and operation. Other projects and activities are ongoing within the RAA, but the potential cumulative environmental effects would be considered not significant.

Mitigation measures implemented during Project development would be effective in reducing cumulative environmental effects from the Project. Future projects would also be required to implement similar mitigation measures and perform project specific environmental assessments that would investigate potential environmental effects, including cumulative environmental effects, on the Terrestrial Environment.

The Project would avoid any known locations of species of special status that might be present in the PDA, wherever technically and economically feasible. Follow-up programs, with respect to potential environmental effects of lighting on birds, would be developed during the permitting phase of the Project, in the event monitoring during Construction and Operation indicates an elevated risk or evidence of avian collisions with lights and/or flares. Such monitoring and follow-up plans would be developed in consultation with the appropriate regulatory authorities, during the permitting phase of the Project.

Chapter 12 – Wetland Environment

Chapter 12 covers pages 12-1 to 12-34, including 7 tables and 3 figures. It begins by explaining that the Wetland Environment was selected as a valued environmental component (VEC) in recognition of the NB Department of Environment (NBENV) goal for no net loss of wetland

function. In addition, it points to the value placed on wetland preservation by regulatory agencies, the public, and stakeholders.

The Report states that Project activities would not be anticipated to have significant environmental effects on wetlands potentially affected by such activities, because of planned mitigation for unavoidable loss of wetland function.

It explains that the amount and quality of wetland loss is not anticipated to be problematic in the Fundy Coastal Ecoregion, or locally, because of the large amount of wetland of these types which presently exist, in particular locally to the northeast, and their relatively low function, even within small local watersheds.

The Report states that compensation for loss of wetland function would be negotiated with regulatory authorities, and further compensation might be required, if it was determined as such through monitoring of potential, indirectly affected, wetlands. The Report notes that the Project would not contribute substantively to cumulative environmental effects, because of the planned compensation, and mitigation for loss of some functions (*e.g.*, storm water management).

Section 12.1 and 12.2 cover pages 12-1 to 12-12 and provide detailed information on Scope of Assessment and Existing Conditions under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

Table 12.3 lists each Project activity and physical work, and ranks each interaction as 0, 1, or 2. These rankings indicate the level of interaction each activity or physical work would have with the Wetland Environment. All those associated with the Marine Terminal and Other Marine-Based Infrastructure were ranked as 0, since they would not interact with the Wetland Environment, including coastal wetlands, in any substantive way, and therefore, could not be significant.

Red Head Marsh, which is not within the Project Development Area (PDA) or near the preferred linear facilities corridor, would be the nearest coastal wetland. Potential for interaction with coastal wetlands would be limited to accidents, malfunctions, and unplanned events, which are addressed in Chapter 23.

Several activities and physical works undertaken during Construction, (Physical Construction and Equipment Installation, Commissioning, Road Transportation and Employment and Expenditure) were also ranked as 0, as there would be no anticipated interaction between these activities and the Wetland Environment under normal conditions.

Once site preparations activities were complete, the Physical Construction and Equipment Installation, and routine use of the road transportation network, would be anticipated to have no interaction with the Wetland Environment. Any potential indirect environmental effects from these activities would be associated with accidents, malfunctions, and unplanned events. For Operation, no interaction would be anticipated with Water Supply and Use.

For all of the above Project activities ranked as 0 in Table 12.3, the potential environmental effects of the Project during all phases, including cumulative environmental effects, were rated not significant. The Report notes there is a high degree of confidence in these environmental effects and significance predictions.

The rationale for selection of activities as 1 or 2, as summarized in Table 12.3, is outlined below:

Construction There were no Project-related activities during Construction of the Petroleum Refinery and Other Land-Based Infrastructure ranked as 1. Interactions between the Wetland Environment and the following Construction activities were ranked as 2:

- Site and Right-of-Way Preparation.
- Construction of Linear Facilities and Watercourse Crossings (including wetlands).

These activities would result in the loss of wetland area and function during Construction. They would have the greatest potential to alter natural drainage patterns, wetland hydrology, and the water balance of fish-bearing and non-fish bearing streams. Changes to hydrological function would include a reduction in discharge to down-gradient wetlands (and watercourses), due to the loss of drainage area, surface water storage and release, and resultant flow moderation. The hydrological changes could result in a change in downstream wetland communities, including the introduction of undesirable or invasive species and, over the long term, conversion to upland habitat.

Site and Right-of-Way Preparation would involve forest clearing, excavation of wetland soils and subsequent grubbing of overburden material such as tree stumps and large rocks. Because of the prevalence of exposed bedrock and shallow soil at the refinery complex site, site levelling would require controlled blasting. The potential for erosion and sedimentation during site preparation would be greatest, compared to other Project activities.

Construction of Linear Facilities and Watercourse Crossings (including wetlands) would have a similar interaction with the Wetland Environment. However, the amount of habitat permanently lost and the potential for indirect environmental effects would be less, because of the narrow ROW, and not all of the linear facilities would have permanent environmental effects. For example, transmission lines can span wetlands. Above-ground sleeperways would minimize interactions with wetlands, and wetlands disturbed by the laying of underground pipelines (where used) can typically be restored.

For narrow riparian wetlands, in-stream work would be avoided through the application of horizontal directional drilling (HDD) technologies and bridging. Wetland crossings could involve the installation of culverts or other means to maintain hydrology across roads and railroads. Because of the potential for significant environmental effects of these Project activities during Construction, they were carried forward for further assessment.

Operation The interaction between the Wetland Environment and the following Operation activities were ranked as 1:

- Emissions Control and Management of Effluents and Wastes;
- Linear Facilities Presence and Operation;
- Right-of-Way and Infrastructure Maintenance; and
- Road and Rail Transportation.

Emissions Control and Management of Effluents and Wastes ranked as 1, due to the potential interaction of air emissions, wastes and effluents with the Wetland Environment. A ranking of 1 was assigned, given the existence of well established and proven mitigation measures, including air pollution control technologies, for this potential interaction. The ranking was also supported by the Ecological Risk Assessment (ERA), which showed that predicted environmental concentrations of contaminants of potential concern (COPC) resulting from atmospheric Project emissions would not result in any unacceptable risk to any terrestrial receptor, including wetlands.

Any wastewater discharge to the Wetland Environment would be required to meet regulatory requirements prior to discharge. Technologies such as conventional wastewater treatment systems described in Chapter 3, as well as emerging technologies such as engineered wetlands for tertiary treatment, would be explored in this regard.

Interactions between the Linear Facilities Presence and Operation, Right-of-Way (ROW) and Infrastructure Maintenance, Road and Rail Transportation, and the Wetland Environment would have potential to cause a Change in Wetland Quality and Quantity through the alteration of drainage patterns, erosion, introduction of invasive species and siltation. The creation of corridors could facilitate the propagation and movement of invasive species and allow for increased traffic of all-terrain vehicles (ATVs). However, these activities would be anticipated to have little environmental effect on the Wetland Environment, due to standard mitigation measures concerning erosion and sediment control, invasive species management, and storm water management.

Wetland which was restored, following the laying of above-ground and underground pipelines, as well as wetland located within 30 m of other linear facilities, would be monitored to confirm the return or maintenance of wetland conditions and function during Operation. As a last resort, if additional loss of wetland functions occurred during Operation, additional compensation would be implemented. Given the implementation of effective mitigation measures, the environmental effect of the potential interactions during Operation, which were ranked as 1, including cumulative environmental effects, were rated not significant.

The interaction of Operation and Maintenance of Refinery Processes and Equipment with the Wetland Environment was ranked as 2. Because of the potential for significant environmental effects of these Project activities during Operation, they were carried forward for further assessment.

Decommissioning and Abandonment At the end of the Project life, Decommissioning and Abandonment would involve the rehabilitation of the site to acceptable standards. It would be expected that all disturbed areas would be rehabilitated and re-vegetated with native plants and trees. It is also assumed that wetland lost through the Construction phase, and possibly during Operation, would have been compensated, resulting in no net loss of wetland or wetland function.

The Report notes in this context that improvements in wetland function, as a result of Decommissioning and Abandonment, would be an environmental benefit. The positive environmental effect would be greatest for the large Project components (refinery complex and

tank farm). The potential environmental effects of Decommissioning and Abandonment activities, including cumulative environmental effects, were rated not significant.

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

A summary of the environmental effects assessment and prediction of residual environmental effects, which would result from interactions ranked as 2 on the Wetland Environment, is provided in Table 12.4. This table also includes an evaluation of the significance of environmental effects overall, from all phases. Only the interactions ranked as 2 were considered in this table. They include:

Construction

- Site and Right-of-Way Preparation; and
- Construction of Linear Facilities and Watercourse Crossings (including wetlands).

Operation

- Operation of Refinery Processes and Equipment.

Assessment of the Project-Related Environmental Effects

The measurable parameters used to assess the potential change in wetland quality and quantity, as presented in Table 12.1, were wetland area, wetland function, and hydrology (proportion of wetland lost within drainage area).

The area and proportion of wetlands in the Local Assessment Area (LAA) is relatively high, and avoidance of wetland altogether would not be possible, given the size and scope of the Project. Few wetland functions were identified for the wetlands within the Refinery PDA, and avoidance would be practiced wherever possible.

None of these wetlands suggested an obvious important wetland function; botanical and wildlife surveys did not identify rare species or important habitat for wildlife, and none were identified as “coastal bogs” that are unique to the Fundy Coastal Ecoregion.

Hydrological function was the main function of note, and would most easily be measured by evaluating the proportion of wetlands which would be lost within drainage areas, in particular for fish-bearing watersheds in the LAA.

The following describes the potential Project-VEC interactions, environmental effect mechanisms, mitigation measures and residual environmental effects of the Project on the Wetland Environment, with a focus on the measurable parameters discussed above.

The three principles of avoidance, mitigation and compensation were considered in the assessment of the Wetland Environment.

Potential Project-VEC Interactions

During Construction, environmental effect mechanisms resulting in a loss of wetland area, and the resultant loss of wetland function, including hydrological function, would primarily include land-based Project component construction, with less concern for linear facilities. The assessment of potential loss of hydrological function, through the loss of wetland area and diversion of surface water flows, was linked to the key potential environmental effect on fish

populations, as discussed and assessed in Chapter 10. Another potential indirect environmental effect on wetlands would include the draining of wetlands located up-gradient of the Refinery PDA, where excavation/blasting would be required.

These activities would contribute to the direct loss of wetlands, and potential indirect loss through creation of interception ditches and diversion of flows. These activities could contribute to the ongoing potential indirect environmental effects on wetlands, primarily due to hydrological changes related to storm water management.

Mitigation of Environmental Effects for Change in Wetland Quality and Quantity

The mitigation sequence of avoidance, minimization, and compensation, as outlined in the Draft Proposed Wetland Mitigation Guidelines for New Brunswick, and as applied to the Project, are presented here in the form of mitigation to avoid wetlands where possible; minimize the loss and potential environmental effects, and ultimately compensate for residual losses.

Avoidance Before the consideration of mitigation to reduce potential environmental effects on wetland quality, avoidance of wetlands was first considered to reduce the loss of wetlands. During the siting process for the Project, a constraints analysis was performed considering several alternatives. The result was the selection of the current site, which contains few options for avoidance of wetlands, except for the potential for some minor adjustments of on-site linear facilities (*e.g.*, heavy haul road, and piping and conveyors), and siting of the linear facilities corridor between the proposed refinery complex and east Saint John.

Minimization of Loss of Wetland Quality and Quantity The following mitigation measures, grouped by category, would be implemented through careful design and planning, wherever technically and economically feasible.

General

- All work to follow Terms and Conditions of NBENV Wetland Alteration Approvals.
- Activities would be timed to coincide with low water or frozen conditions.
- Construction activities would be restricted to the PDA.

Working in Wetlands:

- Excavation in wetlands would be carried out by an excavator operating from a dry stable surface to minimize sediment generation.
- Only what is necessary to meet engineering requirements would be excavated.
- Excavated wetland material would be retained for placement in restoration areas to improve seeding success and restoration of organic soil.
- Excavated materials not derived from wetlands would not be placed in a wetland.

Minimizing environmental effects on wetland quality and function:

- The Project would be designed and engineered to avoid the draining of wetlands up-gradient from the construction activities.
- As an alternative to excavating wetland soils and infilling with impermeable fill, the permeability of permanent wetland crossings (*i.e.*, roads and railway tracks) would be considered to allow for the passage of subsurface water.

Storm water management:

- Effective storm water management system would be developed that preserves drainage patterns and has the capacity to return surface water to wetlands that form headwaters of fish-bearing watercourses.
- Oil/water separators could remove contaminants from storm water.
- Engineered wetlands for wastewater treatment would also be considered as an alternative to, or to complement, conventional wastewater treatment systems.

Erosion and sediment control mitigation:

- Erosion control fencing, check dams, silt fencing, use of mulch (possibly from shrubs and trees removed during clearing), and sedimentation control ponds would be the basis of standard erosion and sediment control mitigation.
- Slope of embankments would not exceed a 2:1 ratio and would be re-vegetated as soon as possible.
- Sedimentation would be reduced by routing drainage diversion channels away from wetlands.
- Erosion control structures would be monitored regularly and maintained as necessary.
- Water control would be maintained at all times. Water removed from excavations would be pumped or directed to an approved sediment control measure (*e.g.*, settlement pond, adjacent vegetated area or filter bag).
- Ditches would not drain directly to wetlands, where it could be avoided. Flows would be directed away from wetlands by take-off ditches for dissipation through settling ponds and/or adjacent vegetated areas.

Mitigation specific to underground pipelines:

- Permanent trench breakers would be installed at the edge of watercourses/ wetlands, and at steep sections of the pipeline alignment, to prevent potential uncontrolled drainage and erosion along the backfilled trench. Trench breakers consist of material with low permeability that block water flowing through the pipeline trench and could be constructed of suitable soil, sand bags or polyurethane foam.

Restoration (Underground Pipelines):

- The hydrology of each wetland affected by pipeline construction would be restored to the extent practical.
- Wood rip-rap (log corduroy) and gravel fill material used for temporary access through wetlands would be removed to the original wetland water elevation, and water flow or drainage across the pipeline right of way maintained in wetland areas.
- Seeding in, or within 30 m of, wetlands would be avoided, except in special circumstances, and fertilizer or lime would not be applied to wetlands, or within 30 m, as part of any revegetation plan. In special circumstances, seeding of a wetland might prove warranted. For example, watercourses that flow through wetlands might require the banks be re-seeded, if there was a substantial stability issue that could not be mitigated by other means. Consultation with the appropriate regulatory authorities would be completed before making this decision.
- At sites where off-road vehicle use could not be controlled, crossings would be stabilized, in consultation with regulatory agencies and the landowner. This could involve maintaining a single travel lane over log corduroy in an effort to prevent future recreational traffic effects on wetlands.

- Openings would be created in log corduroy left in place in wetlands, to facilitate restoration of pre-construction hydrological conditions.

Further discussion of the selected mitigation is provided below:

Maintenance of Hydrology across Linear Facilities The design of linear facilities would consider permeability of permanent wetland crossings (*i.e.*, roads and railway tracks) to allow for the passage of sub-surface water, as an alternative to excavating wetland soils and infilling with materials which may reduce permeability.

This could be achieved with the use of Geo-grid, which could be rolled out over the surface of a wetland and then covered with road building aggregate. This method of wetland crossing would still require the installation of culverts to ensure the passage of excess water during intense precipitation events, and spring freshet conditions.

Compensation A compensation plan would be developed for the loss of wetland in consultation with NBENV, Canadian Wildlife Service (CWS), and NB Department of Natural Resources (NBDNR), and with participation of selected stakeholders (*e.g.,* Ducks Unlimited, ACAP Saint John). The objective would be to ensure no net loss of wetland function. Compensation would likely be based on the NBDNR Draft Proposed Wetland Mitigation Guidelines for New Brunswick, or more recent guidelines, if available at the time of development.

Compensation for lost wetlands would consider the restoration of previously disturbed wetlands on the property, creation of wetlands outside the Refinery PDA, and compensation sites in adjacent Proponent-owned properties, if any are available.

Studies were conducted for the Wetland Environment during 2008 and would continue prior to Construction to further refine predictions of wetland loss, including:

- Assessment of stream flow during spring and summer to provide improved data on the water storage capacity of the wetlands;
- Detailed wetland delineations within, and adjacent to, the Refinery PDA, as well as along the preferred linear facilities corridor;
- Functional assessment within, and adjacent to, the Refinery PDA.

<u>Characterization of Residual Project Environmental Effects for Change in Wetland Quality and Quantity</u>

The mechanism for this environmental effect entails a change in surface water hydrology, where run-off would be captured from Project facilities and directed outside the watersheds. This would be particularly important at the refinery complex site, where site run-off would be collected, possibly used within the refinery process, directed to wastewater treatment, and discharged to the marine environment. This environmental effect would be restricted to wetlands and watercourses downstream of the area where run-off water would be diverted. The likelihood for and magnitude of residual environmental effects on wetland hydrology as a result of Construction of Linear Facilities and Watercourse Crossings (including Wetlands) would be much lower, as crossings would be designed to span watercourses without disturbance. Wetland crossings would also be designed to maintain hydrology across roads and rail lines (*e.g.,* using culverts under the ROW). Pipeline crossings that cannot avoid wetlands would be restored following pipeline installation.

Wetland Area A summary of the area of wetland potentially directly affected by the Refinery PDA is presented in Table 12.5, by Project component, and illustrated in Figure 12.3. An

estimate of the directly affected wetlands within the PDA for the preferred linear facilities corridor, (100 m wide, 9.2 km long) is approximately 20 ha. However, it is anticipated that environmental effects on wetlands could be minimized, as pipeline sleeperways and conveyors would be above grade.

An unpaved road would be required along the pipeline for maintenance and leak detection purposes, and the rail line might be included along the linear corridor. Such facilities would be designed to minimize their environmental effects on wetlands by minimizing footprint and ensuring drainage across the right-of-way at appropriate locations. With mitigation and restoration, the area of directly affected wetlands would be reduced to approximately 10 ha, which accounts for access roads and railway lines. Subsequent monitoring would determine if wetland conditions have been restored in these ROWs. Detailed design would determine the final area to be affected, and addressed through the permitting process and compensation negotiations with NBENV. All wetland area loss occurring as a result of Project activities would be compensated. Consequently, no residual environmental effect on the Wetland Environment would be anticipated from these activities.

Wetland Function Few wetland functions, other than hydrological function, were identified as important for wetlands within the Refinery PDA. Wetlands within the PDA for the preferred linear facilities corridor would be expected to be similar in function. Compensation would provide any habitat functions elsewhere, and more extensive wetlands to the northeast would provide this function for the common wildlife in the region.

With compensation, no residual environmental effects would be expected for wetland function, as the application of mitigation measures would allow for the maintenance of wetland function within the LAA.

The wetlands potentially indirectly affected by the Refinery PDA are illustrated in Figure 12.3. The amount of wetland area with the potential for indirect environmental effects from the Refinery PDA was estimated, worst case, at 140.2 ha. The Report states there is a high degree of confidence that hydrology could be maintained across the linear facilities PDA (especially where above grade), thereby limiting potential indirect environmental effects on both up-gradient and down-gradient wetlands.

Although mitigation measures would be implemented to avoid or minimize indirect environmental effects, indirect loss of wetland area or function would be determined through monitoring and, if loss was confirmed, compensation would be required.

The percent loss of wetlands and drainage area for each watershed likely to have wetland loss, as a result of the Refinery PDA, is provided in Table 12.6. The highest proportion of drainage loss in a watershed with a fish-bearing stream (18.3%), which also has a high percentage of wetlands lost (54.3%), has been predicted to occur in the Bean Brook watershed.

Although this may potentially represent a substantial loss in wetland and drainage area, it is anticipated that Calvert Lake would serve to provide Bean Brook with adequate stream flows during low flow conditions. Anthonys Brook watershed, although it would also experience a high proportion of wetland loss from the product storage tanks, would be predicted to lose only 13.2% of the total drainage area. This loss would not be anticipated to be substantial enough to affect the fish populations inhabiting the associated watercourse.

The Refinery PDA would have a much smaller proportion of wetland loss on the remaining fish-bearing streams, ranging between 4.0% and 16.3%, with a range of drainage area loss between 0% and 10.5%. The loss of wetland and drainage area from the Brandy Brook watershed would

occur at the lower extent of the watershed, and would therefore be unlikely to substantively affect the hydrology of Brandy Brook.

The Report states that, with mitigation, the Project would result in a loss of wetland per watershed ranging from 4% to 67% for wetlands affected by the Refinery PDA. This environmental effect would be ongoing from Construction through Operation. If loss of hydrological function (*i.e.*, water balance) was found to have ecological consequences as determined by follow-up monitoring, mitigation could be provided through the diversion of storm water back to affected watersheds as described in Section 10.4.1.

Loss of this hydrological function would therefore be reversible should it be identified in follow-up, though it is not anticipated. The Report states that, notwithstanding the potential local loss in function, wetland compensation would be implemented to result in no net loss of wetland function.

Assessment of Cumulative Environmental Effects

The Report confirms again at this juncture that many of the Project-related environmental effects on the Wetland Environment would be mitigated with well established and proven mitigation measures. Where wetlands could not be avoided or the environmental effects mitigated, any losses would be compensated, as required under provincial legislation and policy.

As shown in Table 12.7, no potentially significant cumulative environmental effects overlapping with those of the Project were considered likely. The Report states that the Project would not contribute to cumulative environmental effects, because of the planned compensation, and the mitigation for loss of function (*e.g.*, storm water management). It notes that there is little spatial overlap with cumulative environmental effects of past and current projects, and most of those projects would be assessed federally and/or provincially, requiring compensation for loss of wetland function.

Large current projects such as the Canaport LNG project, Canaport LNG Emergency Access Road, Brunswick Pipeline, International Power Line, Highway Improvement Projects, as well as most future large projects, have been, or would be required to conduct an EIA pursuant to EIA Regulation.

In many cases, a federal EA under CEAA has been, or would also be, required. Several other activities such as residential developments, and forest harvesting (*e.g.*, associated road building), that might affect wetlands, would be regulated under the Wetland and Watercourse Alteration (WAWA) Regulation. Many of the same mitigation measures outlined in this EIA Report regarding wetlands would be applicable, and none of these activities could result in non-compensated loss of wetland function.

Forestry activities such as road building and harvesting would also have the potential to affect wetland quality and quantity. Forestry activities would be carefully planned and monitored by NBDNR to avoid wetlands on Crown land, whereas it is unlikely this would be the case on privately owned forest land. Other projects that have been, or would be assessed through the provincial EIA Regulation, would be required to adhere to the three principles of wetland management (avoidance, mitigation, and compensation).

Determination of Significance

The Report states that well established and proven mitigation measures would be available for

most Operation activities, as described previously. Therefore, no residual environmental effect would be anticipated from these activities. Loss of wetland drainage area and the resultant environmental effect on hydrological function has been predicted to be low in magnitude, and would be expected to result in environmental effects that were not significant. Should the results of confirmatory field studies, in support of permitting of the Project, show that the reduction in hydrological function in selected watersheds would affect fish populations, the Report states that the mitigation measures described previously, involving diversion of storm water back to select watersheds, would be applied to mitigate any potential environmental effects.

With the proposed mitigation, and wetland compensation, the residual environmental effects of Construction, Operation, and Decommissioning and Abandonment on the Wetland Environment were rated not significant. This conclusion was made with a moderate level of confidence.

Similarly, with the proposed mitigation, including avoidance and minimization of wetland loss to the extent feasible, given the scope of the Project, the cumulative environmental effects of Construction, Operation, and Decommissioning and Abandonment of the Project, in combination with other projects and activities that would be carried out, were rated not significant. The Report states there is a moderate level of confidence in the assessment of environmental effects and significance prediction, because of the nature of mitigation outlined in this assessment and the collective professional judgment of the Study Team, which has local knowledge based on involvement with other projects within the ecoregion.

Follow-up and Monitoring

Compliance monitoring, to be identified in the Environmental Protection Plan (EPP) for the Project, would be carried out to confirm that wetland mitigation measures were implemented correctly during Construction. Environmental effects monitoring would be carried out following the completion of Construction, to monitor the success of wetland restoration within the linear facilities ROWs, and to monitor the function of potentially indirectly affected wetlands upstream and downstream.

The details of the monitoring would be provided within the application for WAWA permits, and would be subject to review at that time. The long-term wetland monitoring would be expected to detect potential changes in wetland quality and quantity (*e.g.,* changes in drainage patterns, effects of ATV use, and presence of invasive species). During the WAWA permitting process, the Proponent, in consultation with NBENV, would develop a wetland compensation plan ensure that there would be no net loss of wetland function.

Summary

The environmental effects of the Project on the Wetland Environment have been shown to be not significant, given careful Project design and planning, in combination with the existence and application of well established and proven mitigation measures, and the required compensation for loss of wetland function. The Wetland Environment in the LAA and RAA would continue to provide necessary wetland functions throughout Project development. The cumulative environmental effects of the Project, in combination with past and future projects and activities in the LAA and RAA, were also shown to be not significant.

The wetland mitigation sequence principles of avoidance, minimization and compensation would be followed, when considering Project design and engineering. Mitigation measures implemented during Project development would be effective at mitigating cumulative environmental effects.

Future projects would be required to implement similar mitigation measures and perform project specific EAs to investigate potential environmental effects, including cumulative environmental effects, on the Wetland Environment. Follow-up and monitoring would focus on the success of wetland restoration within the linear facilities ROWs; the potential indirect environmental effects of wetlands adjacent to the Refinery PDA, and the hydrological function of wetlands in watersheds of fish-bearing watercourses in the LAA, that would experience a loss of drainage area from Project development.

Chapter 13 – Marine Environment

Chapter 13 covers pages 13-1 to 13-141. In addition to the narrative, it provides extensive detailed information in 25 separate tables and 37 figures. The Chapter begins by providing definitions for fish and fish habitat under the federal Fisheries Act, and explains that marine birds are considered a component of the Marine Environment as well. It notes that the Bay of Fundy is home to a diverse array of flora and fauna, including over 100 fish species, 2,371 invertebrate taxa, and at least 40 species of marine mammal and birds. The Report also points out that a number of invertebrate species, such as lobster, rock crab, and sea scallop, are important commercially, and marine mammals have high ecological and socio-economic importance in the Bay.

The large baleen whales which frequent the lower Bay are the focal point of whale watching activities, promoting tourism and drawing revenue. Upwards of 17 species of marine mammals occur in varying densities throughout the Bay of Fundy. Twenty-three species of marine birds have been regularly detected during winter coastal surveys in the local Bay area. The Report explains that the Marine Environment was selected as a Valued Environmental Component (VEC) because of the:

- Specific regulatory requirements of the Fisheries Act;
- Specific regulatory requirements of the Migratory Birds Convention Act
- Potential presence of some species of special status; and
- Intrinsic importance of fish populations and fisheries resources to the socio-economic component of the human environment.

Chapter 13 focuses on key Project activities that might interact with the Marine Environment. These activities include construction and operation of the jetty, barge landing facility, Project-related vessel traffic, seawater cooling intake and release, and any potential anchorage and exclusion zones for Project-related tankers. Cumulative environmental effects are also assessed at the end of the Chapter.

The Report notes that potential environmental effects of accidents, malfunctions and unplanned events on the Marine Environment are discussed separately in Chapter 23. It states at the outset that the Project has the potential to affect the Marine Environment, primarily during Construction of the marine terminal, including the jetty and other marine-based infrastructure. These environmental effects would be largely localized; essentially limited to the physical footprint of these structures in the Marine Project Development Area (PDA) during the short-term (one to two years), and likely to result in harmful alteration, disruption or destruction (HADD) of fish habitat on the sea bed.

However, the Report also states that, due to effective Project planning, design, avoidance, and the application of known and proven mitigation measures during Construction, it has been concluded that the environmental effects of the Project on the Marine Environment would not be

significant. It also notes that positive environmental effects would be likely to occur, after Construction and during Operation of the Project, as a result of “reef” effect attraction of marine species to the jetty, and other marine-based infrastructure, colonizing hard surfaces and creating new fish habitat.

Mitigation measures to limit HADD during Construction would include avoidance of biologically sensitive periods, when feasible; disposal of dredged material in the nearby ocean disposal site managed by Environment Canada; implementation of Fisheries and Oceans Canada (DFO) guidelines for the use of underwater explosives where appropriate, and fish habitat HADD compensation measures developed in consultation with DFO.

During Operation, potential adverse environmental effects would include direct mortality of fish eggs and larval fish drawn into the seawater cooling intake, and the release of effluent, containing mainly heated seawater, through a marine outfall located a distance from Mispec Point.

Other potential adverse environmental effects on the Marine Environment would include potential for increased sound in the acoustic marine environment during Construction and Operation, as a result of dredging and blasting in the Marine PDA, as well as vessel traffic in Bay shipping lanes and the Marine PDA. The Report states, however, that these environmental effects would not be significant, due to effective Project design, avoidance, and application of known and proven mitigation measures.

Such measures would include barriers and fish screens to minimize impingement and entrainment of fish. Thus, any direct mortality of fish eggs and larval fish would be unlikely to adversely affect a change in marine populations, or biodiversity of fish species in the Bay.

The Report also states that strong tidal currents in the area of Mispec Point, and the use of a diffuser, or similar technology, to facilitate effluent dispersion at the outfall location, would be effective mitigation for mixing and dispersing the heated seawater and effluent from the wastewater treatment plant. The predicted result would be no significant chronic exposure to water, sediment and marine biota in the long-term. In the case of sound emissions to the marine environment, fish, marine mammals and birds would likely avoid the footprint of the jetty, and other marine-based infrastructure within the Marine PDA, during Construction.

The Report states that the cumulative environmental effect of the Project on the acoustic environment during Operation was rated not significant on the North Atlantic right whale, a Species at Risk. It notes that these whales exhibit very limited avoidance behaviour, and would not be likely to avoid their feeding habitat in the Grand Manan area, because of incremental vessel traffic in Bay of Fundy shipping lanes.

Few species of special status were reported during field investigations for the Project, or other recent projects, that are known to use the Marine PDA as foraging habitat during a portion of the year. These are limited to the harbour porpoise and harlequin duck.

The potential environmental effects on those marine populations were rated not significant, because the Marine PDA does not represent important populations or foraging habitat, in comparison to other populations and areas within the entire Bay. Sections 13.1 and 13.2 cover pages 13-1 to 13-97 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Aboriginal, Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

- Existing Knowledge
    - Identified Data Gaps
- Methods
- Physical Environment
    - Bathymetry and Sea Bed Features
    - Geomorphology
        - Coastline
        - Sediments on the Sea Floor Surface
        - Stratigraphy and Depth to Bedrock
    - Physical Oceanography
        - Tides
    - Waves
        - Currents
        - Storm Surges
        - Ice
        - Water Mass Characteristics
        - Temperature
        - Salinity
        - Turbidity
        - Dissolved Oxygen (DO)
        - pH
        - Variation of Water Characteristics over a Tidal Cycle
        - Underwater Acoustic Environment in the Bay of Fundy
        - Ambient Underwater Sound Levels in the Bay of Fundy
- Fish Habitat
    - Water Quality
    - Sediment Quality
    - Plankton
        - Phytoplankton
        - Ichthyoplankton
    - Benthic Habitat
        - Intertidal Zone
        - Subtidal Zone
    - Fish
    - Marine Mammals
    - Marine Birds

Summary of Existing Conditions

Section 13.2 concludes with a summary of Existing Conditions, which notes the information presented indicates that marine environment in the Marine Project Development Area (PDA) supports populations of various species of fish, as defined in the federal Fisheries Act, and marine birds. It adds that, overall, there is a healthy level of biodiversity in the Local Assessment Area (LAA) and Regional Assessment Area (RAA).

The substrate in the marine environment of the Marine PDA is comprised of a relatively narrow band of a few hundred metres of bedrock and boulders, adjacent to a predominantly bedrock shoreline and small intertidal zone. This substrate type supports a diverse epifaunal benthic habitat and seaweed community, including marine resources such as lobster in the deeper subtidal zone. The substrate transitions in the nearshore area to that of a silty sand sea bottom and extends seaward. The benthic habitat offshore is less diverse and supports more infaunal invertebrates.

Currents in the Marine PDA are influenced by the tide and these swift tidal currents keep waters vertically mixed and highly turbid, creating a light-limited environment that impedes plankton production. Consequently, the low levels of ichthyoplankton (fish larvae and eggs) and mesozooplankton found are directly correlated with the low levels of primary production observed.

Water and sediment quality in the Marine PDA is generally good and adequate for fish to survive, if reproduction takes place. It was not unexpected that sediment quality in the immediate vicinity of the Black Point ocean disposal site exceeded CCME guideline values for some chemicals, based on the historical use of this site.

Water quality is influenced by the Saint John River primarily during the spring freshet, with the change in water quality being most noticeable in the upper 2-3 m of the water column. Species of fish that exist in the Outer Saint John Harbour, and in the LAA, would also likely exist and be supported in the Marine PDA. They include groundfish, pelagic fish such as herring and mackerel, as well as migrating fish species that use the Saint John River watershed to complete part of their life cycle.

The Report states that Marine mammals noted to frequent the Bay of Fundy were also investigated to characterize baseline conditions, including species at risk (*e.g.,* the Endangered North Atlantic right whale and blue whale), and species of conservation concern (*e.g.,* fin whale and harbour porpoise). Other species of special status include the leatherback sea turtle, inner Bay of Fundy Atlantic salmon (possibly), Atlantic wolffish, shortnose sturgeon that is found only in New Brunswick, striped bass, and American eel.

Harlequin duck is the only likely marine bird species of special status with suitable feeding habitat area in the Marine PDA, and a regular wintering location. The rocky shoreline feeding habitat of harlequin duck found in the Marine PDA is relatively common throughout the Bay of Fundy, and has not been designated as Critical Habitat.

Potential Project-VEC Interactions

Section 13.4 covers pages 13-98 to 13-130 and provides detailed information on Potential Project-VEC Interactions, as well as Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment, under the following sub-headings:

Marine Terminal and other Marine-Based Infrastructure Environmental Effects Assessment

- Assessment of Project-Related Environmental Effects
    - Fish
        - Project Environmental Effects Mechanisms for Change in Marine Populations (Fish)
        - Characterization of Residual Project Environmental Effects of a Change in Marine Populations (Fish)
    - Fish Habitat
        - Project Environmental Effects Mechanisms for Change in Marine Populations (Fish Habitat)
        - Characterization of Residual Project Environmental Effects on a Change in Marine Populations (Fish Habitat)
    - Marine Mammals
        - Project Environmental Effects Mechanisms for Change in Marine Populations (Marine Mammals)
        - Characterization of Residual Project Environmental Effects on a Change in Marine Populations (Marine Mammals)
    - Marine Birds
        - Project Environmental Effects Mechanisms for Change in Marine Populations (Marine Birds)
        - Characterization of Residual Project Environmental Effects on a Change in Marine Populations (Marine Birds)

Section 13.4 concludes on page 13-130 with the following summarizing statement:

- Overall, in consideration of the existing conditions, Project activities and planned mitigation, the residual environmental effects of all Project activities during all phases on the Marine Environment are rated not significant. There is a high level of confidence in the predictions.

Assessment of Cumulative Environmental Effects

Residual cumulative environmental effects of current and planned marine use on a Change in Marine Populations are then summarized in Table 13.23. The Report notes that Interactions ranked as 2 were those situations where Project environmental effects could potentially act cumulatively with those of other projects and activities, resulting in significant cumulative environmental effects, or at least a measurable change in the state of the Marine Environment. The projects and activities ranked as 2 in this context were Planned Marine Use (including aquaculture).

The Report further explains that interactions between these projects and activities could have the potential to result in cumulative environmental effects through increased acoustic emissions to the marine environment; increased Total Suspended Solids (TSS); artificial light, and habitat alteration, disruption and/or destruction. Cumulative environmental effect mechanisms, mitigation measures and characterization of residual cumulative environmental effects in this context are then presented in Table 13.24.

Base Case The Base Case included past projects, and current projects that have received some level of environmental approval and/or are in some form of planning, construction and/or commissioning. Past projects, activities and actions contributing to this Base Case were: Past commercial fishing and whaling activities. The Report notes that fishing is a key environmental effect generating activity, which permanently removes fish from populations, thus decreasing

spawning biomass and potentially disrupting food-web structure.

In addition, some fishing methods (*i.e.,* bottom trawling) adversely affect benthic habitat. The Report further notes that 'bycatch' contributed significantly to the decline of several large demersal fish groups in the RAA, including the Atlantic wolffish. Similarly, commercial whaling for large baleen whales severely affected populations in the late 19th and early 20th Centuries. Cumulative environmental effects of fishing and other activities on inner Bay of Fundy Atlantic salmon were previously described in Section 10.5.

Current projects, activities and actions contributing substantively to the Base Case are:

- The Existing Canaport single buoy mooring (SBM);
- Canaport LNG;
- Black Point ocean disposal site managed by Environment Canada;
- City of Saint John Eastern Wastewater Treatment Facility;
- Aquaculture;
- Commercial fishing activities.

The largest marine construction project currently underway in the RAA is the Canaport LNG facility at Mispec Point. The footprint of its marine components resulted in the alteration of a limited amount of benthic habitat, which was compensated through the HADD authorization process.

Conversely, marine infrastructure associated with the Canaport LNG terminal could have a positive cumulative environmental effect in the Marine PDA, due to the additive presence of hard bottom habitat. Hard bottom benthic habitats create more surface area to be colonized by sessile marine plants and invertebrates, as compared to flat, sandy or silty bottoms, and may attract mobile macrofauna, such as fish and lobster.

The Report notes that a temporary, localized reduction in water quality would be likely, due to construction of the LNG Terminal marine facilities and resulting increases in TSS and potential contaminants (*e.g.,* metals) in disturbed sediment. Sound produced during the construction of the LNG Terminal marine facilities would be expected to be similar in intensity and duration to those associated with Construction of the Project.

The majority of sound originates from pile driving, dredging, and the activity of support vessels. Vessels using the existing Canaport SBM also contribute sound to the LAA. The Report states that these sounds are likely to affect marine mammals that could visit the Mispec Point area, namely harbour seal and harbour porpoise, but would not be significant.

Environment Canada manages the use of the Black Point ocean disposal site where dredged material from the Saint John Harbour is disposed. The typical volume of material disposed of each year at the Black Point ocean disposal site is 50,000 cubic metres (m^3), although approximately 375,000 m^3 of materials were dredged in 2006.

The historical disposal of dredged material at this location has led to the presence of contaminated sediments at the site. The environmental effects of this activity are increased TSS levels and potential exposure of marine populations to contaminated sediments within the disposal area.

The Report further notes that the City of Saint John maintains the Eastern Wastewater Treatment Facility, which discharges treated sewage to Saint John Harbour. Discharge of treated sewage sludge could affect the health of marine organisms through acute and chronic toxic effects, and high nutrient levels may cause localized eutrophication of the marine environment.

Aquaculture operations, specifically those for Atlantic salmon, currently exist in the Bay of Fundy, although there are no sites near the Marine PDA. Commercial fishing activity in the RAA continues to remove biomass from the Marine Environment. Small numbers of harlequin duck (a species at risk), greater scaup and Barrow's goldeneye (both species of conservation concern), spend the winter feeding in the Marine PDA and LAA. A small loss of feeding habitat would be expected due to the Canaport LNG terminal.

Project Case The Project would result in a cumulative disturbance/loss of benthic habitat in combination with construction and operation of the Canaport LNG marine facilities. A permanent loss of benthic habitat for both Projects would be addressed separately through a habitat compensation program, associated with the required Fisheries Act authorization to ensure no net loss of fish habitat. The Project and the Canaport LNG terminal would also add to existing safety and fishing exclusion zones. The Report points out at this juncture that mitigation measures for both projects would reduce the potential for adverse cumulative environmental effects.

It also notes that, since the LNG facility and the Project would be located very near one another, the combined spatial extent of perceived sound levels in the marine environment would not be substantially greater than for either project on its own. The combined environmental effect on marine mammals in the upper Bay of Fundy was predicted to be minimal and rated not significant.

Acoustic emissions from the construction of both Canaport LNG and the Project would be expected to attenuate quickly in the shallow waters of the upper Bay of Fundy. Based on a study which measured acoustic propagation in the Bay, it's expected that construction sounds would attenuate to intensities below ambient sound levels within 20 to 30 km. It is therefore unlikely that combined construction sounds would be perceived by the baleen whales that concentrate in the lower Bay of Fundy. The Grand Manan right whale conservation area is located approximately 80 km from the Marine PDA.

The cumulative loss of habitat or degradation of habitat, due to noise caused by the Project and the LNG terminal, would be small, when considered within the context of total available wintering habitat in the Bay of Fundy for harlequin duck, greater scaup and Barrow's goldeneye. The occasional harlequin duck, greater scaup or Barrow's goldeneye displaced from the Marine PDA due to the Project and the Canaport LNG terminal would find adjacent, suitable feeding habitat, and no health effects on displaced birds would be expected.

The Project and the Black Point ocean disposal site could cumulatively affect the marine environment by way of increased TSS and smothering of benthic habitat in the Marine PDA. The increase in TSS due to Project Construction would be localized and of short duration.

The Report also notes that, if dredge spoils from the Project (which are known to have contaminant levels below CCME Guidelines) would be disposed of at the Black Point disposal site, they would likely cap existing contaminated sediments at the Black Point ocean disposal site that were historically deposited there. Recent evidence also suggests that the risk of environmental effects from sediment loads to organisms close to the Black Point ocean disposal site is low.

Discharges from the proposed City of Saint John Eastern Wastewater Treatment Facility, given the relatively close spatial proximity, would have the potential to interact with discharges from the Project. However, discharges from the Project would abide by CCME Guidelines. In addition, the strong flushing action of the Bay of Fundy tidal currents would rapidly dilute discharges of both projects, reducing the risk of substantive cumulative environmental effects on the Marine Environment.

The Report notes that no important marine salmon habitat would be destroyed, and no salmon mortality would be expected due to impingement and entrainment. Relatively few fish in general would be affected by impingement and entrainment, and rates of loss would likely be within natural variation of these populations. Therefore, the residual cumulative environmental effects of impingement and entrainment with commercial fishing activity were rated not significant.

Future Case Future projects and activities could take place in the region that might interact with the cumulative environmental effects as documented above in the Base Case and the Project Case. Such projects and activities could include:

- Expansion of the City of Saint John Eastern Wastewater Treatment Facility;
- Point Lepreau II;
- Potential Tidal Power Projects; and
- Increased Aquaculture in Bay of Fundy.

The City of Saint John is proposing to expand the Eastern Wastewater Treatment Facility to treat an average daily flow of 35,000 m^3 of activated sewage sludge. The outfall pipe would extend 1,100 m into Saint John Harbour. Point Lepreau II could contribute to the cumulative environmental effects on marine birds, due to the importance of Point Lepreau as a migratory landmark for thousands of migrating sea ducks and wintering habitat for harlequin duck.

The cumulative loss of habitat or degradation of habitat, due to noise caused by the Project, and a future Point Lepreau II, would be small when considered within the context of total available wintering habitat for harlequin ducks and other marine birds available in the RAA. Tidal power projects might also be developed in the upper Bay of Fundy in the future.

Although the details of such projects are unknown, they would likely have environmental effects similar to the Project, such as increased sound, destruction of benthic habitat, and limited mortality of fish due to intakes or moving underwater parts. Therefore, marine populations that travel through the Bay, such as marine fish, harbour porpoise and harbour seal, might be affected.

Various projects planned for future operation in the Bay of Fundy would require the use of marine vessels. All such vessels, associated with the projects listed in Table 13.25, might produce acoustic emissions with the potential to act cumulatively with acoustic emissions from tankers serving the Project. Acoustic emissions from existing vessel traffic in, and around, Saint John Harbour, as well as throughout the Bay of Fundy, might also act cumulatively with acoustic emissions from vessels serving the Project.

The Report notes that over 1,680 vessels transited the Bay of Fundy shipping lanes in 2007. All such vessels contribute anthropogenic sound to the marine environment, which act cumulatively to produce high background ambient sound levels. The cumulative environmental effect of acoustic emissions from vessels associated with the Project, and other imminent and future projects in the Bay of Fundy, would be an overall increase in ambient underwater sound levels.

This could potentially have negative consequences to the health of a marine mammal, if it displaces the animal from important foraging habitat. Such behavioural avoidance would likely reduce the incidence of vessel strikes to marine mammals (Chapter 23), but would be unlikely to displace marine mammals from important foraging habitat. Reduced foraging efficiency and increased energy expenditure would be expected to be minimal.

Masking of sounds produced by marine mammals, particularly baleen whales, could occur, although this is not expected to have adverse environmental effects on marine mammal populations. For the North Atlantic right whale, the Grand Manan Basin constitutes one of two important summer foraging habitats and high abundance of copepods in the deep waters of this area is critical to the survival of the right whale.

Displacement of right whales from the Grand Manan Basin by elevated ambient sound levels would have significant energetic consequences to this species.

The Report explains at this juncture that, although the right whale can perceive the sounds produced by marine vessels, existing research suggests that they are not highly reactive to these anthropogenic emissions. It has been speculated that right whales may be habituated to the sounds of vessels, given that their important habitat is adjacent to the Bay of Fundy shipping lanes, an area of heavy vessel traffic.

Based on the existing literature, it is not expected that acoustic emissions from vessels serving the Project would act cumulatively with acoustic emissions from other vessel traffic to adversely affect the habitat quality or health of North Atlantic right whales. Shipping lanes have been moved in the Bay to avoid the important feeding habitat of right whales, thus lessening the risk of cumulative effects on this species due to increased vessel traffic.

The Report states that, overall, acoustic emissions from Project activities would be unlikely to have adverse cumulative environmental effects on the habitat quality, or health, of marine mammals in the Bay of Fundy. The cumulative environmental effect of changes in marine mammal populations would be low in probability and magnitude, reversible, regional, and long-term. Mitigation measures which could be implemented by the Project proponent to reduce potential cumulative environmental effects would be the same as those described for Project construction in the marine environment (Table 13.15). Mitigation measures for the Project Case were provided in Section 13.4.1.

In light of the above, and the proposed mitigation, the Report states that cumulative environmental effects of the Project in combination with past, present and future Projects, during all phases, were rated not significant.

Summary Future development in the Regional Assessment Area (RAA) would be required by the EIA Regulation and/or CEAA, if triggers were present, to conduct a project-specific environmental assessment that would address future potential cumulative environmental effects at that time. Existing conditions, currently supportive of marine populations, would be maintained throughout Project and the development of future projects. Characterization of the potential cumulative environmental effects and associated mechanisms, combined with the proposed mitigation measures, demonstrate that the residual cumulative environmental effects of a change in marine populations, as a result of past, present and reasonably foreseeable projects and activities, in combination with the environmental effects of the Project during all phases, can be rated not significant.

This determination was made with a high level of confidence. Additionally, the proposed mitigation measures demonstrate that the Project contribution to a cumulative environmental

effect on Marine Populations in the Marine Environment can be rated not significant. This determination has been made with a high level of confidence.

Follow-up and Monitoring

Follow-up and monitoring programs would be implemented for the Marine Environment as presented in Table 13.15. The following monitoring programs would be suggested:

- Land-based effluent from the Project would be monitored to check that contaminant levels are within acceptable ranges. Water discharged from the outfall would be monitored to check that contaminant levels are within acceptable ranges.
- Sediments in the Marine Project Development Area (PDA) would be monitored during the initial stage of Operation.
- Abundance and re-colonization of benthic habitat in the Marine PDA would be monitored early in Operation.
- Fish screens performance would be monitored to verify effectiveness of mitigation and confirm environmental effects predictions.

Chapter 14 – Commercial Fisheries

Chapter 14 covers pages 14-1 to 14-30, including 6 separate tables and 4 figures. It begins by noting that Commercial Fisheries are important to the local and regional economy, and a valued way of life for some residents of southeastern New Brunswick.

The Bay of Fundy, including the near shore areas close to the Project, supports commercial fisheries that provide an important source of income for local fishermen. As Project-related activities would occur within this near shore environment, and an area where commercial fishing is known to occur, the Report explains there is potential for interactions between the Project and Commercial Fisheries.

With proposed mitigation, and recognizing that the majority of Project activities would occur within the Proponent's water lot and Saint John Harbour, as administered by the Saint John Port Authority, the Report predicts the residual environmental effects of the Project on Commercial Fisheries would be not significant.

Recommended mitigation would include compensation to established commercial fishermen who operate out of the Mispec wharf, where Project infrastructure and associated safety exclusion zones might, at times, interfere with commercial fisheries, due to a confirmed disruption of traditional travel routes.

Establishment of clear practices and procedures for marine terminal operations in a Marine Terminal Manual; the delineation of Project vessel zones of operation during Construction, and encouragement of the use of established approaches by Project-related vessels, would further mitigate potentially adverse environmental effects on commercial fishermen operating out of Mispec wharf.

The Report notes that the Proponent would continue to work through the Port of Saint John Traffic Committee, as a formal line of communication between fishermen and operators of the Project. Sections 14.1 and 14.2 cover pages 14-1 to 14-17 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Public, Stakeholder, and Aboriginal Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

The potential interactions between Project-related activities during each phase of the Project and Commercial Fisheries are shown in Table 14.3, and would involve the following marine-based activities and physical works:

- Construction and Installation of the Jetty and Other Marine-Based Infrastructure;
- Marine Vessel Transportation, Berthing and Deberthing; and
- Crude Oil and Finished Product Transfer.

The assessment of environmental effects on Commercial Fisheries included potential interactions with the lobster and scallop fisheries. Through consultation and a review of available information from DFO, it was determined that, within the Local Assessment Area (LAA), groundfish, rockweed, sea urchins, shad, gaspereau, eel, dogfish, herring, mackerel, and sturgeon do not support important harvests.

Though some fishing activity of these species may occur in limited quantities within the LAA, these fisheries were not expected to result in interactions with the Project. Thus, the groundfish, rockweed, sea urchins, shad, gaspereau, eel, dogfish, herring, mackerel and sturgeon fisheries were not considered further in the assessment of environmental effects on Commercial Fisheries. The potential environmental effects of the Project, including all phases and activities, on the commercial fishing of these species, were rated not significant.

The Report notes, as well, that fishing licences have been issued for rock crab in the Saint John area. In recent years, however, this species has not been fished because current market conditions do not make the fishery viable. Licensed lobster fishermen are permitted to retain rock crab and Jonah crab as a by-catch, which they use primarily for personal use. Therefore, crab species were also not considered further in this assessment. In all cases, the potential environmental effects of the Project to Commercial Fisheries, including cumulative environmental effects, on these components of the commercial fisheries, during all phases of the Project, were rated not significant.

The Report states at this juncture that dredging activities have the potential to interact with Commercial Fisheries. It notes that Project-related dredging would occur under authorization, in a manner considered acceptable by regulatory authorities through post-EIA permitting activities, and dredge spoils would be disposed at approved disposal sites. Habitat compensation would be provided. Consequently, the Report states that the potential for interactions between dredging activities and Commercial Fisheries would be very low, given that such dredging

activity would only occur as authorized on the Proponent's water lot, and/or at approved existing dredge disposal locations. Project-related dredging activities were thus rated not significant.

During Construction, Project activities could interact with Commercial Fisheries and result in an environmental effect. Construction and installation of the jetty and other marine infrastructure would lead to an increase in vessel traffic in the LAA to carry units and construction materials.

Such construction-related traffic and marine vessel transportation would mostly consist of tugs and barges. These types of vessels, along with the placement of infrastructure within the marine environment, would occupy space within the LAA. As a result, these areas of Project activity would not be accessible for fishing. Construction activities, as well as the location of the new jetty and other marine-based infrastructure, including the barge landing facility and seawater cooling intake structure, might require that fishing vessels travel around these areas to reach areas currently fished within the LAA. This would have potential to interrupt and lengthen travel routes for commercial fishermen based at the Mispec wharf, which could increase their operational costs.

During Operation, activities within the LAA would include berthing and deberthing from the jetty, crude oil unloading and finished petroleum product loading at the jetty. Safety exclusion zones around the new jetty, the barge landing facility and the seawater cooling intake structure, would reduce access to these areas, potentially resulting in a loss in available areas currently fished by Mispec-based fishermen.

The safety exclusion zones around the jetty and the seawater cooling intake structure might also cause Mispec-based fishermen to alter their travel routes (if they exceed current exclusion zones) and take a longer path, skirting the exclusion zones, to reach their areas currently fished. A demonstrated increase in steaming time could result in an increase in operational costs.

During Decommissioning and Abandonment, the Project would adhere to all applicable environmental regulations and laws in place at that time. Accordingly, environmental effects to Commercial Fisheries were not foreseen during Decommissioning and Abandonment. Thus, the environmental effects of the Project during Decommissioning and Abandonment were rated not significant.

Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment

Residual environmental effects of the marine terminal and other marine-based infrastructure on Commercial Fisheries are summarized in Table 14.4.

Assessment of Project-Related Environmental Effects

Without mitigation, the Report states that potential interactions of the Project with Commercial Fisheries would result in a decrease in net income to local commercial fishermen. The main concern would be increased steaming distance and, therefore, increased operating expenses, and lost fishing time, for established Mispec-based fishermen. The principal mitigation for this environmental effect would be to compensate those fishermen for confirmed increased steaming time, the specifics of which would be negotiated, once the final engineering design of the Project was complete.

As a result of the placement of the new jetty, barge landing facility and seawater cooling intake structure, as well as the addition of safety exclusion zones around this infrastructure, some additional area, which could be fished, would be effectively unavailable. This area would be

within Saint John Harbour, and the existing water lot owned by the Proponent. The Report notes at this juncture that fishing is already restricted by existing Canaport operations and construction of the Canaport LNG project. Within this area, fishing activity could be restricted to support the development and operation of marine terminals and ensure safe facility operations.

Existing Conditions for Change to Net Income of Local Commercial Fishermen

Commercial lobster fishermen based at the Mispec wharf currently fish for lobster to the south, east and west of Mispec Bay. To reach areas currently fished to the west, they travel close to the shore, skirting out to avoid infrastructure and/or safety exclusion zones. Commercial fishing activity and vessel movement occurs within the water lot, where it does not interfere with the safe operation of Canaport.

The Report notes that the Mispec wharf is a tidal port and vessels can only enter or leave port during a six hour window surrounding each high tide. As discussed earlier, the marine PDA is not located within any established steaming routes for scallop fishermen. The marine PDA is also not known to contain scallop areas currently fished. Some scallop fishing activity occurs within the southern-most portion of the LAA, during the period which starts the second Tuesday in January, and ends the last day of March.

Project Environmental Effects Mechanisms for Change to Net Income of Local Commercial Fishermen

The barge landing facility, seawater cooling intake structure, as well as the marine terminal and jetty, would be located close to, or within, travel routes commonly taken by Mispec fishermen between their wharf and lobster areas currently fished to the west of the PDA. Such fishing vessels would be required to deviate from these routes to avoid Project components, including any safety exclusion zones around the marine terminal and seawater cooling intake structure.

Because the Mispec wharf is tidal, with a limited window within which a vessel can be away from port each tidal cycle, a confirmed increase to steaming time might also result in a decrease in fishing effort, and potentially, lower catch amounts.

The placement of marine infrastructure and safety exclusion zones could also change the area of bottom available for fishing in the LAA. The potential loss of areas currently fished would be within the Proponent's water lot. Fishing activity presently occurs there, provided it doesn't interfere with safe operation of the facilities. Additional vessel traffic associated with the Project might also restrict fishing vessel activity within the LAA.

Mitigation for Change to Net Income of Local Commercial Fishermen

Mitigation for adverse environmental effects on the net income of local commercial fishermen has been proposed and would include the following:

- Compensation for established Mispec-based fishermen for demonstrated loss of net income as a result of confirmed increased steaming distance and, therefore, increased operating expenses and lost fishing time. Discussions regarding compensation would begin, once the final Project engineering design was complete.

- Encouragement of the use of established approaches by Project-related vessels, and delineation of Project vessel zones of operation during the Construction phase. The Report notes in this context that final decisions regarding approaches would be at the

discretion of vessel captains and pilots, and could be affected by environmental conditions, including weather and currents.

- Establishment of practices and procedures for marine terminal operations, as defined in a Marine Terminal Manual, to ensure all commitments, applicable rules and regulations would be met, to help minimize interactions with fishing vessels.

- Work would continue through the Saint John Traffic Committee as a formal line of communication between fishermen and operators of the Project during Construction and Operation.

Characterization of Residual Project Environmental Effects for Change to Net Income of Local Commercial Fishermen

The fishing areas to the west of the marine Project Development Area (PDA), for which travel routes and steaming distances might be affected, are estimated to be fished no more than half of the time. The additional time required to travel from Mispec wharf to the western fishing areas is also small, relative to the total available fishing time in a given high tide of approximately 6 hours, or the approximately 18 hours available when fishing between high tides.

The change in available fishing area due to the footprint of the marine terminal jetty, barge landing facility and seawater cooling intake structure, as well as the associated safety exclusion zones, would be less than 1% of the total area within the Local Assessment Area (LAA). The Report states that any potential change in steaming time from Mispec wharf would also be very small, relative to the available fishing time in a tidal cycle. The confirmed environmental effects of this, on fishing time and costs, would be compensated if they were demonstrated to result directly and solely from the Project.

Given that any potential change in steaming time from Mispec wharf would be very small, and there would be compensation for confirmed increased steaming time by Mispec-based fishermen, the potential Change to Net Income of Local Commercial Fishermen during Construction and Operation was rated not significant.

There is a high level of confidence in these environmental effects and significance predictions, because of the extent of the available information, confirmed through stakeholder engagement, and understanding of the key effects mechanisms.

Assessment of Cumulative Environmental Effects

The potential for the Project to overlap with other projects and activities is the key consideration for the assessment of cumulative environmental effects.

The potential residual cumulative environmental effects of current and planned projects and activities on Commercial Fisheries are summarized in Table 14.5. Residual cumulative environmental effects of current and planned marine use on Commercial Fisheries are presented in Table 14.6.

For the purposes of this cumulative environmental effects assessment, all projects or activities, within both the Lobster Regional Assessment Area (RAA) and the Scallop RAA were considered, with emphasis placed on those activities closest to the Project. Projects and activities included in this assessment were those with potential to, in combination with the Project, substantively interfere with usual traveling routes of fishing vessels, and/or result in a loss of available fishing area for areas currently fished.

Each year on average, 70-75 crude oil carrying vessels of various sizes and capacities moor at the existing single buoy mooring (SBM) to unload their product. The average mooring time for a vessel at the SBM is approximately 37 hours, resulting in the SBM being occupied approximately 32% of the time over the course of an average year. When a ship is attached to the SBM, a navigational exclusion zone is in place for safety and all vessels, including fishing vessels, remain outside this zone. Construction of the LNG marine terminal has been completed and operations will begin soon. During its construction, all vessels, including fishing vessels, travelled around this location to avoid the possibility of colliding with components and vessels actively working at the site.

The existing Canaport marine terminal currently interacts cumulatively with Commercial Fisheries within the LAA, due to the potential increased steaming time around the installations when exclusion zones are in effect. Currently, all crude oil for the existing refinery is unloaded at the existing SBM, regardless the size of the crude oil carrier.

Once the Project would be operational, it would be expected that only very large crude carriers would moor at the SBM for unloading. Smaller vessels would berth at the Project's marine terminal. When operational, it would be expected that approximately 30 to 35 very large crude carrier crude tankers would arrive annually to deliver crude oil to the Project. On average, approximately 280 product tankers and 22 to 30 coke vessels would be anticipated as well each year, to transport finished products to markets.

An exclusion zone around the Canaport LNG jetty for safety purposes would also have potential to act cumulatively with the Project, and cause potential loss of access to additional lobster fishing areas. Such an exclusion zone would be likely to include area that is a part of the Proponent's water lot only. The Report notes at this juncture that the SBM and LNG terminal exclusion zones would border one another in such a way that, when both were in effect, fishing vessels could not pass between them and would have to travel around the southern edge of the SBM safety exclusion zone.

In this situation, there would be no cumulative environmental effect of the Project on fishing vessel steaming time, because the Project's components would not represent additional obstacles along the path the fishing vessels would have to travel. With the Project, however, and assuming possible vessel berthing overlap for the SBM and the Canaport LNG terminal, there would be potential for a cumulative environmental effect on fishing vessels' steaming distance and travel time.

Lobster fishermen from other ports do not routinely travel through the PDA to reach their fishing areas. As a result, such travel would not be expected to be substantially affected due to Project-related marine infrastructure and safety exclusion zones. As noted earlier, Commercial scallop fishing occurs very infrequently through the majority of the LAA, and is a highly mobile fishery, with most fishing vessels covering a large area within the RAA each fishing season.

Elsewhere, there are other planned marine uses that have the potential to act cumulatively on Commercial Fisheries, but these involve salmon aquaculture in Charlotte County, and are well outside the LAA. There are also planned increases in ship traffic to the Port of Saint John, as a result of additional cruise ship activity, the importation of petroleum coke to the Coleson Cove Generating Station, and gypsum and potash shipping. In addition, a safety exclusion zone would be expected in the future around LNG tankers, when navigating waters of the Bay of Fundy. This additional vessel traffic, particularly in and near the Port of Saint John, could further interfere with commercial fishing activities.

The Report points out at this juncture that its focus is on the local lobster fishery, as the LAA is home to an important local commercial lobster fishery, during both spring and fall lobster seasons each year. Cumulative environmental effects to the scallop fishery as a result of the Project would not be foreseen, as scallop fishing is not known to currently occur in the marine PDA, or the areas adjacent to it, including the Canaport LNG terminal.

With compensation for the Project for confirmed increased steaming time, the Report predicts there would be no residual cumulative environmental effects on Commercial Fisheries, with respect to Change to Net Income of Local Commercial Fishermen, due to confirmed increased steaming time for Mispec-based fishermen.

It is estimated that there would be residual cumulative environmental effects on net income, associated with effects on timing fishing activities to maintain access to Mispec wharf. But the time required to travel the additional distance for each round trip from Mispec wharf to the western areas currently fished would be small, relative to the total available fishing time in a given high tide of approximately 6 h, or the approximately 18 h available when fishing between high tides. This residual cumulative environmental effect attributable to the Project was predicted, however, to occur only a small percentage of the time.

Any confirmed change in steaming time, relative to available fishing time in a tidal cycle would represent an additional inconvenience to local lobster fishermen, and could be expected to have an effect on their fishing patterns. But, overall, the Report states that the magnitude of the environmental effect is predicted to be low; would occur relatively infrequently, and would be localized to the Mispec-based fishermen operating within the LAA.

Cumulatively, the total area available for fishing that would be effectively lost to local lobster fishermen due to existing Canaport terminal activities, the Project, and the Canaport LNG terminal operation, would be estimated to be small, relative to the total area of the LAA. The Project's primary contribution to this cumulative environmental effect would be estimated to be very small (less than 1% of the area of the LAA), particularly with respect to the larger RAA (Figure 14.2). With the proposed mitigation, including compensation for established Mispec-based fishermen that can confirm increased steaming time, the residual cumulative environmental effects of Change to Net Income of Local Commercial Fishermen on Commercial Fisheries, of all past, present and reasonably foreseeable projects, in combination with the environmental effects of the Project, during Construction, Operation, and Decommissioning and Abandonment, were rated not significant.

Similarly, the Project's contribution to cumulative environmental effects of Change to Net Income of Local Commercial Fishermen on Commercial Fisheries during Construction, Operation, and Decommissioning and Abandonment were rated not significant.

The Report states there is a high level of confidence in these cumulative environmental effects and significance predictions, because of the extent of the available information, confirmed through stakeholder engagement activities, and understanding of the key environmental effect mechanisms.

Follow-up and Monitoring

No follow-up or monitoring for the environmental effects of Change to Net Income of Local Commercial Fishermen would be recommended.

Chapter 15 – Labour and Economy

Chapter 15 covers pages 15-1 to 15-34. It includes 1 figure, 11 tables, and begins by explaining that Labour and Economy was selected as a Valued Environmental Component (VEC), because of its role as a determinant of socio-economic well-being. It further notes that the assessment of potential environmental effects on Labour and Economy is important within the Saint John Census Metropolitan Area (CMA), and more broadly, within the Province.

The Report states that income generated and expenditures by the Project would be expected to create substantial opportunities for business and industry in a number of sectors. It notes, as well, that a residual adverse environmental effect on supply and cost of labour would be expected, particularly during Construction. This would require other projects to be increasingly proactive and innovative in attracting and retaining workers.

The Report explains that phasing the pace and sequence of Construction over a longer duration (approximately six to eight years) would lessen the potential for residual adverse environmental effects on labour due to the Project, and extend the economic benefits and spin-offs to the region over a longer period than previously envisioned.

It points out that the Project would result in further positive development of labour force capabilities and incomes within the Saint John CMA, and the Province. It could attract and retain new workers to the region, who would contribute to the overall health of the local economy. The Proponent would also participate, associated with the Project, and in partnership with the 'Benefits Blueprint Initiative,' in developing strategies to engage women, visible minorities and those living in poverty, in the Project's economic benefits.

A Procurement and Supply Strategy would be implemented to maximize benefits to the Saint John CMA and provincial economies. A Labour Relations Strategy would help avoid or minimize adverse environmental effects on labour, by focusing on the development and implementation of initiatives to enhance the available workforce, and increase retention rates in an increasingly competitive market. This would be particularly important during Construction. Specific elements of the Labour Relations Strategy would include:

- Promotion of construction trades and apprenticeship development;
- Productivity enhancement;
- Attraction and retention strategy for local and mobile construction workers; and
- Workforce expansion and diversification, including repatriation of workers to Atlantic Canada, a Temporary Foreign Workers Strategy, an Immigration Strategy, and a Workers in Transition Strategy.

Sections 15.1 and 15.2 cover pages 15-2 to 15-11 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries

- Residual Environmental Effects Rating Criteria

Existing Conditions

- Population
  - Saint John Census Metropolitan Area (CMA)
  - City of Saint John
- The Economy
  - The New Brunswick Economy
  - The Economy of the Saint John CMA
- The Labour Force
- Employment and Income
  - Saint John CMA
  - Poverty

Potential Project-VEC Interactions

The potential environmental effects on Labour and Economy are identified in Table 15.5 and were evaluated jointly for all Project activities and physical works. They would be expected to be greatest during Construction, but would also occur throughout Operation, Decommissioning and Abandonment.

Change in Economy

Because of direct and indirect expenditures associated with the Project during all phases, changes in economic production would be felt within the Saint John CMA, as well as across the Province, and Canada. This would be reflected in the gross domestic product (GDP), employment, income and government tax revenues. Examples of areas where business opportunities could be created due to the Project would include communications, community accommodation and related services, construction, logistics, medical and safety, office and administration, and remote site services.

The Report notes at this juncture that the residual visual or aesthetic environmental effects of the Project on business and industry, during all phases of the Project, including cumulative environmental effects, were rated not significant. Potential environmental effects on local businesses and industries due to Project-related traffic, noise and air quality were also not considered further, given the types and locations of businesses involved, and the predicted areas of influence of Project-related noise and air emissions.

The residual environmental effects of the Project on Atmospheric Environment (Chapter 7) and Land-Based Transportation (Chapter 20), during all phases of the Project, were rated not significant as well. Thus, the associated residual environmental effects on local business and industry during all phases of the Project, including cumulative environmental effects, were also rated not significant. There is a high level of confidence in these predictions.

Change in Labour

Employment and income (direct, indirect and induced) would be generated, as a result of the activities and physical works of the Project, for both the Saint John CMA and the Province. The Report states, in this context, that Project-related demand for labour might place strains on, or exceed the available supply of labour within the Saint John CMA, and the Province as a whole. Competition for labour could potentially result in wage inflation, and local or provincial shortages

of skilled labour, thereby potentially inhibiting other economic development, and affecting the competitiveness of other businesses.

Although potentially tempered by more challenging economic conditions recently observed globally, this could become evident during Construction, when the Project's demand for labour would be greatest, although supply-demand constraints might also occur during Operation, and Decommissioning and Abandonment. The report notes there would be a loss of Project-related employment with Decommissioning and Abandonment, but this would not occur for several decades or more.

The degree to which labour competition could occur, particularly during Construction, would depend on a number of factors, including: the specific skill-set required by the Project, and the skill-set available within the Saint John CMA and the Province; the availability of skilled labour from other areas; and supplier development, procurement, employment and training initiatives which support the Project.

Deleterious competition for labour could be further exacerbated by high numbers of retiring workers.

The existing age profile for the construction workforce in Atlantic Canada is older than in other regions. A key challenge for the region, given the expected increase in regional investment, could be availability of skilled workers. The potential for workforce expansion initiatives, such as training and apprenticeship programs; the engagement of individuals currently under-represented in the industry, including women and visible minorities; as well as those living in poverty, would also be important to the region. With approximately 25% of the City's population living in near poverty conditions, many believe that income disparities could continue to stress its social fabric.

Environmental Effects Assessment

The residual environmental effects of the Project on Labour and Economy are summarized in Table 15.6.

Existing Conditions for Change in Economy

For the Province of New Brunswick, total GDP is approximately $26.4 billion at present and GDP per capita is approximately $35,200. Recent statistics on employment by industry for the Saint John CMA, the Province and Canada, are shown in Table 15.7. The principal source of revenue for the City of Saint John is property tax, which accounts for approximately 75% of total revenue. Total expenditures under the 2008 City of Saint John operating budget have been projected at approximately $119 million, representing a 6.4% increase over the 2007 operating budget.

Project Environmental Effects Mechanisms for Change in Economy

The Report states that total direct construction costs of the Project were initially estimated at $4.9 billion (2007 dollars). This included approximately $1.5 billion to be spent on labour, $2.8 billion on materials, and $0.6 billion on operated equipment. More recent estimates have placed these costs at approximately $6.3 billion (in 2007 dollars), and such estimates could further evolve as engineering design unfolds. To introduce conservatism in the environmental effects assessment, the initial estimates were used in this EIA/EA. Any further refinements to the estimates would likely be greater than these amounts, thereby further enhancing the economic benefits of the Project.

During Operation, direct annual expenditures of the refinery have not yet been determined and would be proprietary. They would substantive, however, and could be expected to be similar to those associated with the operation of the existing Saint John refinery. During Decommissioning and Abandonment, similar types of expenditures to those occurring during Construction would be expected (although likely at a lesser scale). With Decommissioning and Abandonment, there would also be a loss of Project-related employment and expenditures, requiring adjustments by the local economy.

Project expenditures would generate new economic production directly, due to supplies and services purchased by the Project, as well as indirectly, as a result of the additional purchases of suppliers required to meet the demands of the Project. An additional induced economic environmental effect would occur, as those directly and indirectly employed by the Project spend their incomes.

Mitigation for Change in Economy

A Procurement and Supply Strategy would be implemented to maximize benefits to the Saint John CMA and provincial economies. Elements of this strategy could include:

- A contracting and compensation plan to help ensure alignment of suppliers with the Project's objectives;
- Labour management initiatives, including the management of labour availability and productivity, and the sharing of risks among the Proponent and suppliers;
- A plan for the further development of a safe, productive and competitive supply of local contractors, as long-term suppliers to the Project;
- Development of the Approved Contractors List to help ensure that suppliers meet Irving Oil safety and quality standards, including initiatives to assist local contractors to become pre-qualified as suppliers.

In order to help leverage the expected economic expansion throughout southwestern New Brunswick, a number of programs have been identified by the Benefits Blueprint Initiative. These Initiatives include: a Supply Chain Development Program; a Business Productivity Enhancement Program, and an Industrial Land Development Strategy, among others. If implemented, these programs would further optimize the economic benefits of the Project.

With respect to mitigation of potential adverse environmental effects associated with the loss of Project-related employment and expenditures during Abandonment, broad-based economic development of the region would be expected over the long-term. It is important to realize that the Saint John CMA economy would not expected to be critically dependent on the Project for its economic health, particularly in the long-term, as regional development advances.

Characterization of Residual Project Environmental Effects for Change in Economy

To support the environmental effects assessment of the Project, a separate economic input-output model was developed to estimate direct, indirect and induced environmental effects of the Project on the economy, during Construction and Operation. The results provided a more detailed estimation of the Project's environmental effects on the economy. The total direct, indirect and induced economic environmental effect on GDP to the Saint John CMA economy was estimated to be approximately $2.4 billion.

To New Brunswick's economy, the estimated total was approximately $2.7 billion, and to the Canadian economy, approximately $4.1 billion. During the Construction period, the Project would directly provide approximately 11,700 person-years of full-time equivalent employment

(10,100 trade person-years and 1,600 person-years for professional employees). This would be supplemented by employment in firms that supply goods and services to the Project, and the associated employment generated in the services sector.

Within New Brunswick, total direct, indirect and induced employment has been estimated to be approximately 26,600 person-years, and within Canada, approximately 45,900 person-years.

During Operation, total annual Project expenditures would be extensive, and similar to those associated with the operation of the existing Saint John refinery. The direct addition to the New Brunswick economy was estimated to be approximately $172 million per year in GDP. The total direct, indirect and induced economic environmental effect to the Saint John CMA economy was estimated to be approximately $224 million annually. For the NB economy, the total economic environmental effect during Operation was estimated at approximately $234 million, and to the Canadian economy, approximately $342 million annually.

The Project would directly provide approximately 1,000 full-time equivalent permanent positions during Operation, consisting of operations staff, engineers, as well as commercial supply chain and project execution professionals. These would be supplemented by employment in firms that supply goods and services to the Project, and associated employment generated in the services sector. Within New Brunswick, total direct, indirect and induced employment was estimated at approximately 1,780, and within Canada, approximately 3,180.

The Government of Canada and the Province of New Brunswick would also increase its revenue from business tax, personal income tax, sales tax and property taxes, paid as a result of the direct, indirect and induced economic activity. Similarly, the City of Saint John would realize an increase in revenues, principally from property taxes.

With the investment expenditure and the employment during Construction, the federal, provincial and municipal governments in Canada could expect to receive approximately an additional $922 million in total revenues. This would include approximately $610 million in revenue to all levels of government, due to Project-related economic activity within New Brunswick alone, over half of which (about $340 million) would be directly due to the Project itself. Total direct, indirect and induced tax revenues to the Government of New Brunswick were estimated to be approximately $220 million over Construction, and total tax revenues to all municipalities within the Province of New Brunswick were estimated to be approximately $17 million.

During Operation, the federal, provincial and municipal governments in Canada could expect to receive approximately an additional $71 million annually in revenues. This would include approximately $46 million in revenue to all levels of government, due to Project-related economic activity within New Brunswick alone, with about $30 million annually directly due to the Project itself. Total direct, indirect and induced tax revenues to the Government of New Brunswick would be estimated at approximately $17 million annually. Total tax revenues to all municipalities within the Province of New Brunswick would be estimated to be approximately $1.6 million annually, not including the property taxes paid directly by the Project.

As an indicator, the existing Irving Oil refinery pays approximately $4.5 million per year in property taxes, which is split between the City of Saint John and the Province.

Thus, a reasonable estimate of property taxes paid by the Project after Construction is complete would be approximately $4 to 5 million per year, which would represent about 3 to 4% of the operating budget of the City.

While the environmental effects of the Project on the economy were predicted to be strongly positive, it should be noted that, during the change from phase to phase, particularly moving from Construction to Operation, it could take local economies time to adjust after a busy Construction period, and reduce economic activity to match routine Operation conditions. The magnitude of the adjustment required, however, could be offset by broader increases in regional economic activity associated with other projects realized due to a favourable investment climate and economic synergies.

Given the long time period involved until Decommissioning and Abandonment, it is not possible to reasonably estimate the environmental effects of that phase of the Project on the economy. Nonetheless, substantial expenditure would undoubtedly be involved during Decommissioning and Abandonment.

With the proposed Procurement and Supply Strategy to enhance positive environmental effects, and with phasing the pace and sequence of Construction to prolong the economic benefits to the Saint John region over a longer period of time, the effect of Change in the Economy on Labour and Economy, during all phases of the Project, has been rated as highly positive, with no significant adverse residual environmental effects. This prediction has a high level of confidence and would be highly likely to occur.

Change in Labour

During Construction, Operation and Decommissioning and Abandonment, the Project would require a substantial number of temporary and permanent workers. Based on the existing labour market conditions within the Saint John CMA, and more broadly within the Province, the demand for labour by the Project would be expected to be greater than what would be available locally. Without mitigation, strong competition for trade labour would be expected to create local and provincial shortages and wage inflation. This environmental effect might potentially occur in other sectors, due to labour moving to the trades as more lucrative employment.

To mitigate the potential adverse environmental effects of a change in labour, and enhance the positive environmental effects of the Project, a Labour Relations Strategy would be implemented. The various components would include Workforce Expansion and Diversification, Productivity Enhancement and Attraction and Retention strategies. In addition, Construction would be phased over a longer duration (approximately six to eight years), thereby reducing the potential for competition for labour, and reducing the potential for shortages of skilled workers to occur.

The residual environmental effect of Change in Labour would be anticipated to be both positive and adverse, though mitigation would be planned to minimize any adverse environmental effects. A residual adverse environmental effect of a Change in Labour, would be expected, particularly during Construction, because of remaining restrictions on the availability of labour within certain trades. This would require other projects to be increasingly proactive and innovative in recruiting and retaining workers.

Effective implementation of the proposed Labour Relations Strategy would be predicted to result in the further positive development of labour force capabilities and incomes within the Saint John CMA and the Province.

The Project would attract and retain new workers to the region, which would contribute to the overall health of the local economy. Development of an Alternative Labour Force Strategy would engage women, visible minorities, and those living in poverty, to share in the economic benefits of the Project, where feasible. The Proponent would be an active participant in the Benefits

Blueprint Initiative and continue to work with its partners to optimize social benefits as a result of major projects in New Brunswick, including Project Eider Rock.

Existing Conditions for Change in Labour

The Construction Sector Council has reported that major building projects in New Brunswick would drive up construction employment by 35% to meet the construction peak in 2013. Labour needs, coupled with New Brunswick's older-than-average age profile, have produced tight labour markets.

At a provincial level, the labour force in January 2008 was reported to be 397,900, a nine percent increase from 365,040 in 2001. The unemployment rate in New Brunswick increased from January 2007 by 0.3 percent to 8.2 percent in January 2008. This, however, represents a 4.3 percent decrease from the 2001 unemployment rate of 12.5 percent. Difficulties in finding and retaining workers, due to a local labour shortage, have resulted in an hourly wage growth in New Brunswick.

The growth of the oil and gas industry in Western Canada has resulted in many Atlantic Canadian workers leaving to find prosperity out west. In response to the shortage of available workers, wage rates in Atlantic Canada are increasing. In the construction industry, weekly wages are up 10% in New Brunswick in 2008. Furthermore, while project developers are forced to absorb higher labour costs, they are also facing the added expense stemming from delayed construction timetables due to understaffing.

The total experienced labour force in the Saint John CMA increased from approximately 60,300 in 2001 (Table 15.9) to 69,800 in January 2008. The construction industry trades experienced a 25 percent increase in employment between 2001 and 2006.

From the present until 2010, it is expected that, not including the labour requirements of the Project, unemployment levels will be reduced to record lows, to the point where the individuals required in the labour force will not be available for many trades.

Project Environmental Effects Mechanisms for Change in Labour

During Construction, the trades that would be required include: boilermakers, carpenters, electricians, labourers, millwrights, pipefitters, instrumentation technicians, iron metal fabricators, steel workers, welders, and others. The additional skilled workers that would be required include truck drivers, loggers, heavy equipment operators, crane operators, marine captains, tug operators, barge operators, industrial drivers, industrial drillers, concrete pourers and spreaders, and excavator operators.

During Operation, the workers required would include engineers, technologists, environmental specialists, maintenance workers, welders, boilermakers, operators, drivers, security personnel, safety specialists, and others.

Based on existing labour market conditions within the Saint John CMA, and the Province, the demand for labour by the Project would likely be greater than what was available locally. Without mitigation, the resulting strong competition for trade labour would be expected to create local and provincial shortages, as well as wage inflation.

This environmental effect could potentially occur in other sectors, such as the service sector, due to labour moving to the trades as more lucrative employment.

The Report notes that, nationally, there are current shortages of particular concern, including project managers and supervisors, boilermakers, crane operators, heavy equipment operators, insulators, ironworkers, millwrights, and pipefitters and welders.

The existing challenge in New Brunswick is thus compounded by projections of labour shortages in most other provinces in Canada. Once the Project was operational, the demand for labour would decrease to much more stable levels in the long-term. The main challenge would be the aging workforce and number of people in these occupations entering retirement. Upon Abandonment, there would be a loss of employment associated with the Project, and the challenge would be transition of these workers into new jobs or occupations.

Mitigation for Change in Labour

The proposed mitigation of adverse environmental effects on labour would be focused on development and implementation of a number of initiatives to enhance the available workforce, and increase retention rates in an increasingly competitive market.

As previously noted, the Proponent would phase the pace and sequence of Construction activities over a longer duration than originally planned (approximately six to eight years), to extend the time over which labour would be required, and reduce the annual demand. Irving Oil has also developed a Labour Relations Strategy through dialogue with regulatory authorities, trade unions, education institutions, and local business leaders. Specific elements of this Strategy include the following:

- Labour force expansion, involving an immediate investment in young workers, by working with the trades to develop apprentice training and recruitment, apprentice mentoring, and minimum apprentice ratio standards;
- Productivity enhancement, with programs focused on reducing the environmental effects of issues that inhibit productivity, such as supervisory skills enhancement and training, supervisor mentoring and evaluation, craft pre-employment skills assessment, site and working conditions standards, drug and alcohol testing, among others;
- Attraction and retention, with programs aimed at achieving a reputation as a project of choice, including site facility standards, Workplace Respect Policy, an incentive program, performance management program, worker engagement program, repatriation of workers to Atlantic Canada, and a Mobile Construction Workforce Strategy;
- Labour force diversification, with programs designed to increase representation of women and visible minorities in the construction workforce, a Temporary Foreign Workers Strategy, an Immigration Strategy, and a Workers in Transition Strategy.

Workers in Transition would target workers from industrial sectors in economic downturn, such as the forestry industry, who might have skills similar to the requirements of the building trades. The workforce diversification strategy would focus on development of the labour force in segments of society currently under-represented in the construction trades, such as women and visible minorities. The Proponent would liaise with key stakeholders, including Aboriginal groups, immigrant communities, government organizations, community groups and non-government organizations (NGOs), building trades unions, and contractors, to identify opportunities for partnerships in developing the strategy.

A key to the successful development of an alternative labour force would be the workplace respect policy that would focus on cultural awareness, conflict identification, de-escalation and resolution, and investigation practices designed to eliminate harassment, bullying and violence in the workplace.

In order to further enhance the Project's positive environmental effects, and, as part of developing a diversified labour force, engagement of those living in poverty would be considered through existing social networks in Saint John. The goal would be to facilitate the potential for any marginalized segment of society to participate in the likely opportunities created by the Project.

The Benefits Blueprint Initiative has identified a number of programs that could help leverage the expected economic expansion throughout south western New Brunswick.

Irving Oil is an active participant in this initiative led by the business community in Saint John. Identified strategies include a Workforce Expansion Initiative, an Energy Skills Centre of Excellence, and a Construction Skills Training Program, among others.

If implemented, these programs would further optimize the economic benefits of the Project.

In December 2008, the Government of New Brunswick announced the commitment of $44 million for New Brunswick Community College (NBCC) Saint John and $35 million for a new college in Edmundston, to expand current post-secondary education programs. The intent is to have the expanded programs operating in two years time. For NBCC Saint John, it is estimated that there would be approximately 600 new seats available. This investment would also help address the current limits to training capacity, and further mitigate any adverse environmental effects on labour.

Characterization of Residual Project Environmental Effects for Change in Labour

Of the estimated 11,700 person-years of direct employment required during Construction, 1,000 to 1,500 positions would be expected to be filled by residents of the Saint John CMA and nearby communities. The shortfall of an average of 1,000 to 1,500 construction workers would be anticipated to be filled by workers coming from outside the region. During Operation, it is estimated that approximately 250 or 25% of the required workers would likely come from the existing Saint John CMA population. This would leave a requirement for approximately 750 new workers, increasing by about an additional 1,500 to 2,000 on a temporary basis during refurbishment periods.

Effective implementation of the proposed Labour Relations Strategy would result in the further positive development of labour force capabilities and incomes within the Saint John CMA, and the Province. The Project would attract and retain new workers to the region, contributing to the overall health of the local economy.

Development of a Labour Force Diversification Strategy would be expected to engage women, visible minorities and those living in poverty to share in the economic benefits of the Project.

However, as previously noted, a residual adverse environmental effect of a Change in Labour would also be likely, particularly during Construction. Despite mitigation, there could be remaining restrictions on the availability of labour within certain trades. Operation would see a better balance of the labour supply and demand. However, demographics (*i.e.,* an aging and retiring workforce) would continue to create challenges to meeting labour demands in specific occupations.

Overall, the residual environmental effects of the Project on labour have been predicted to be moderate in magnitude, and occur most prominently within the Saint John CMA, but also throughout New Brunswick. The adverse residual environmental effect of Change in Labour on Labour and Economy during all phases of the Project was rated not significant. The prediction

has a moderate level of confidence, and was assessed as having a medium probability of occurrence.

Assessment of Cumulative Environmental Effects

The residual cumulative environmental effects of the Project on the Labour and Economy VEC are summarized in Table 15.10. The Report notes that current infrastructure, recreation, forestry and agricultural land use projects and activities, as well as planned residential development, are predicted to not act cumulatively with the Project, because they would not involve substantial employment and expenditures.

Other projects that could interact cumulatively with the Project include other existing and planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, Potash Corporation expansion of mining operations, development of the Coast Guard site in Saint John), as well as projected increases in industrial activity associated with the Port of Saint John. All proposed large-scale investment projects would result in a combined total of approximately $12.8 to $18.5 billion in construction over the next ten years.

Project Cumulative Environmental Effect Mechanisms for Change in Economy

Such projects would involve substantial construction or operation expenditures, which could potentially overlap with the Project and, thus, potentially result in a cumulative change to the economy. Such projects would also generate increased employment and income; revenue from business income; personal income and property tax, as well as creating opportunities for businesses, similar to those for the Project.

Base Case Cumulative environmental effects would occur as a result of the employment and income created by other projects, as well as the expenditures for materials and potential increases in property taxes and business and personal income taxes.

Depending on the scale, these other projects would create cumulative environmental effects in the Saint John CMA, as well as more broadly to the Province of New Brunswick. In particular, this includes expansion of Potash Corporation mining operations.

Existing marine uses that also represent substantial employment expenditures within the Saint John CMA would include the shipping activities of the Port of Saint John.

Project Case Employment and expenditure activities associated with Construction and Operation have the potential to act cumulatively on the economy within the Saint John CMA and, more broadly, the Province of New Brunswick. The additional economic activity would result in additional revenues to governments through an increase in property taxes and business and personal income taxes.

Future Case Foreseeable future projects, which might act cumulatively on the economy, include other planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, development of the Coast Guard site in Saint John).

Overall, a cumulative increase in economic production, income and employment generated with future projects, would enhance the economic environmental effects that would already be evident as a result of the Project. Such projects would also have the potential to further increase economic growth for the region, as a more broad-based economic development for the Saint John CMA and the Province is realized.

Mitigation of Cumulative Environmental Effect for Change in Economy

Mitigation of cumulative environmental effects for changes in the economy would be as previously identified for mitigation of environmental effects (Section 15.4.1). In brief, a Procurement and Supply Strategy would be implemented with the following elements:

- Phasing of the pace and sequence of Construction over approximately 6-8 years, thereby extending economic benefits to the region over a longer period of time;
- A contracting and compensation plan to help ensure alignment of suppliers with the Project's objectives;
- Labour management initiatives, including the management of labour availability and productivity, and the sharing of risks among the Proponent and suppliers;
- A plan for the further development of a safe, productive and competitive supply of local contractors as long-term suppliers to the Project; and
- Development of the Approved Contractors List to help ensure that suppliers meet Irving Oil safety and quality standards, including initiatives to assist local contractors to become pre-qualified as suppliers.

Characterization of Residual Cumulative Environmental Effects for Change in Economy

Overall, the predicted residual cumulative environmental effects on economy would be strongly positive. This would be reflected in an increase in economic production, as well as an increase in revenues to municipal and provincial governments through business and personal income taxes and property taxes. Cumulatively, broad-based economic growth could be expected within the Saint John CMA and the Province.

With the proposed mitigation, the environmental effect of Change in Economy on Labour and Economy, of all past, present and reasonably foreseeable projects/actions, in combination with the environmental effect of the Project, was rated highly positive, with no significant adverse residual cumulative environmental effects.

With the proposed mitigation, Project contribution to cumulative environmental effects of Change in Labour on Labour and Economy was also rated highly positive, with no significant adverse residual cumulative environmental effects. This prediction has a high level of confidence.

Project Cumulative Environmental Effect Mechanisms for Change in Labour

Projects which could begin construction or operation that correspond to the phases of the Project would have the potential to result in a cumulative Change in Labour. This could have a cumulative environmental effect, resulting in an increase in the competition for labour, particularly for skilled trades positions. Potential positive cumulative environmental effects would include a robust, broad-based development of employment and income throughout the Saint John CMA, and the Province.

Base Case Any past and present projects under construction, operation or refurbishment would have the potential to result in cumulative environmental effects with a Change in Labour. In particular, this would include expansion of Potash Corporation mining operations. Existing marine uses, which also represent substantial employment expenditures within the Saint John

CMA, include the shipping activities of the Port of Saint John.

Project Case The phasing of the pace and sequence of Construction over a 6-8 year period (rather than 4-5 years as previously planned), although not accounted for directly in this EIA, would provide further mitigation for the Project to cause adverse environmental effects from a Change in Labour. The Report notes, however, that demand for labour by the Project would likely be greater than what would be available locally.

Strong competition for trade labour would be expected to create local and provincial shortages and wage inflation. This would have potential for an adverse cumulative environmental effect on existing businesses, as it could become more difficult to attract and retain employees.

Future Case Foreseeable future projects that might act cumulatively on labour would include other planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, development of the Coast Guard site in Saint John). Given current unknowns in the design and implementation schedule of these projects, the specific nature and timing of the additional change in labour is somewhat uncertain, and could occur during Construction and/or Operation.

Overall, a cumulative increase in employment generated with future projects would enhance the environmental effects that would already be evident as a result of the Project.

Mitigation of Cumulative Environmental Effect for Change in Labour

Mitigation of cumulative environmental effects for Change in Labour would be as previously identified for mitigation of environmental effects. Mitigation would also be focused on development of a Labour Relations Strategy, as discussed earlier.

Characterization of Residual Cumulative Environmental Effects for Change in Labour

Considering all major current and foreseeable future projects throughout the Province of New Brunswick, it has been estimated that new direct, indirect and induced provincial employment will peak at approximately 33,200 in 2012.

Within the Saint John CMA, it has been further estimated that direct construction-related employment will peak at approximately 8,300 in the year 2014. The specific demand for labour by other future projects is not yet known. However, it is evident that these projects would act cumulatively in increasing employment and income.

It also becomes evident that the Project would be a large contributor to labour demand, likely greater than any other planned project in the region. Point Lepreau II would be close, at an estimated 4,000 during peak of construction, should it proceed. Thus, the Project would play a large and important role in the cumulative Change in Labour.

Overall, the predicted cumulative Change in Labour would be anticipated to be both positive and adverse.

The effective implementation of the proposed Labour Relations Strategy by the Project would be predicted to result in the further positive development of labour force capabilities, and incomes within the Saint John CMA and the Province. Cumulatively, all projects would contribute to the attraction and retention of new workers to the region, which would contribute to the overall health of the local economy.

However, it is also expected that, cumulatively, other businesses could find it more difficult to obtain required skilled labour in a timely and cost-effective manner. This would require more expensive and complex labour sourcing strategies. In addition, the realities of an aging and retiring workforce would continue to create challenges in regard to meeting labour demands.

Mitigation has been proposed to minimize such adverse environmental effects, including promoting and supporting training programs, apprenticeship for trades people, and a workforce expansion and diversification strategy.

With the proposed mitigation, the Project contribution to adverse cumulative environmental effects of Change in Labour on Labour and Economy has been rated not significant.

This prediction has a moderate level of confidence, with uncertainties primarily due to the unknown extent to which the schedule of other projects might change, and/or other projects might implement mitigation to reduce adverse environmental effects on labour.

Follow-up and Monitoring

As part of the assessment of potential environmental effects on Labour and Economy, Project employment and procurement would be monitored to confirm predictions and inform adaptive management. This would include documentation of the realized number of workers by trade/occupation and location of permanent residence, as well as expenditures on suppliers by type and location of supplier.

Chapter 16 – Community Services and Infrastructure

Chapter 16 covers pages 16-1 to 16-42 and includes 15 tables. It begins by listing potential interactions between the Project and Community Services and Infrastructure:

- The level of service offered by local emergency response services (*e.g.,* fire, medical and police);
- The level of service available from on-going support services (*e.g.,* health services, social services and public education);
- The need for social services and demand on local government and Non Government Organizations (NGOs) to provide to vulnerable groups in the community (*e.g.,* addictions treatment, crisis intervention, food banks, and other social concerns);
- Availability of short-term and long-term accommodations;
- Affordability of housing and displacement of low income families;
- Availability of space and programs offered by entertainment and recreational facilities.

The Report explains that, while some of the Project workforce would be local, or from other parts of New Brunswick, many would be expected to enter the Greater Saint John area, on both a temporary and permanent basis.

This influx of workers and their families could place certain strains and challenges on levels of service provided by Community Services and Infrastructure. It notes that Project would place additional demand on local emergency response services and on-going support services, which could be affected by the routine presence of workers associated with either Construction or Operation.

Of particular concern would be the potential environmental effects on public health and social services, including the adequacy of existing ongoing health services, and the potential need for an increase in community health and social support services. There might also be Project related environmental effects on the availability of both short-term and long-term accommodations. Demand on accommodations could lead to the displacement of low income individuals and families, due to increases in housing costs.

The Report also notes that existing programs and space offered by entertainment and recreation facilities, particularly where inadequate to meet current supply, would be insufficient to meet the needs of the projected increase in the regional population. After careful consideration of the above interactions and planned mitigation, however, the report predicts the environmental effects on Community Services and Infrastructure would not be significant. With mitigation, overall levels of services would be expected to be maintained.

During Construction, phasing of the pace and sequence of construction activities over a longer duration than initially planned (approximately 6-8 years) would lessen demands placed by workers on Community Services and Infrastructure. With respect to increased demands on the public health care system due to direct Project employment, it would be expected that some non-emergency health care would be provided to individuals employed for the Project (*e.g.,* a nurse on-site); an Employee Assistance Program would be offered by the Proponent to its employees, and Project health and safety policies would be enforced.

The Proponent would also work with its contractors to encourage attention to these mitigation strategies for their employees. Other mitigation could include Project accommodations built specifically to house non-local workers during Construction, particularly for foreign workers that might experience social and cultural adaptation issues, and/or would lack support of local family.

With an influx of a temporary non-local workforce during Construction, the demands on local community services provided by the public sector and NGOs (*i.e.,* health and social services) would have the potential to be high. However, with the recommended design guidelines for Project accommodations, it would be predicted that these potential environmental effects could be mitigated.

A key component of mitigation would be the continuation of a participatory process among stakeholders to further develop specific measures to address environmental effects on social services, including a focus on vulnerable groups within the community. This would include dialogue between the community, government, developers, and social service NGOs to identify viable ideas to address affordable housing needs.

For example, such strategies could include plans for adaptive reuse of any Project facilities that might be developed to meet accommodation demand during Construction. The Proponent would work closely with the City of Saint John and other stakeholders to further identify means of mitigating environmental effects, to the extent that they would not be significant, and to identify the requirement for, and implementation of, any improvements that would be needed.

Sections 16.1 and 16.2 cover pages 16-2 to 16-12 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

<u>Scope of Assessment</u>

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effects

- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-Valued Environmental Component (VEC) Interactions

The Report identifies potential environmental effects on Community Services and Infrastructure in Table 16.3. No distinction was made between activities and physical works associated with the Petroleum Refinery and Other Land-Based Infrastructure, and those associated with the Marine Terminal and Other Marine-Based Infrastructure.

Potential Interactions with a Change in the Accommodation Market

After accounting for approximately 1,000 to 1,500 Project construction jobs, initial estimates have identified a potential need to accommodate an average of 1,000 to 1,500 construction workers, peaking at approximately 3,500, from outside of the Greater Saint John area. The Report notes again that phasing the pace and sequence of Construction over a longer period than previously forecast would provide further mitigation for potential environmental effects of a Change in the Accommodation Market.

It also points out that permanent direct employment during Operation has been estimated at approximately 1,000. An additional 1,500 to 2,000 would be potentially required during refinery maintenance/upgrade periods. Approximately 25% of workers for Operation would likely come from within the existing Greater Saint John population.

The above factors would have potential to affect a Change in the local Accommodation Market, both for short-term and long term accommodations. Specific effects would include increased demand on accommodations, leading to changes in the local market; shortages in supply; a lack of diversity in available supply, and price inflation. This could also lead to the displacement of low income individuals and families, due to Project-related increases in rental rates, and costs of housing. This potential effect would be of particular concern, given the current high level of poverty and affordable housing needs within the City of Saint John.

The Change in the Accommodation Market would be expected to be greatest during Construction and Operation, although direct employment and expenditure activities would diminish during Operation. It would be anticipated that the number of workers required for Decommissioning and Abandonment would be less than during Construction or Operation, and the market would make the necessary adjustments in supply to meet the anticipated demand. As such, it was predicted that Decommissioning and Abandonment would not result in substantive residual environmental effects on the accommodation market.

Potential Interactions with a Change in the Level of Service from Community Services and Public Infrastructure

Employment and expenditure activities associated with Construction and Operation have also been forecasted to place additional demands on community services and public infrastructure. Potentially affected services and infrastructure would include: local emergency response; on-going support services; food services, entertainment and recreation facilities.

Policing services in the Regional Assessment Area (RAA) are provided primarily by the Saint John Policy Department and the RCMP, in addition to other small forces in the area. During Construction, there would be potential for an increase in criminal activity, including drug use, alcohol abuse, sex trade offences, theft, and break and enter. Other environmental effects of concern on policing, specifically associated with Construction, would include an increase in noise, resulting in an increase in noise control enforcement, as well as the potential for public concern associated with the Project, resulting in the need for additional security.

With respect to local emergency medical services, planned changes associated with the recent transition to two Regional Health Authorities, coupled with the upgrade of the Saint John Regional Hospital, would be expected to facilitate better access to medical services.

Concern over the potential environmental effects of the Project on level of service would remain, however, particularly regarding additional indirect demands placed on the system, outside of any direct needs of the Project. In addition to fire services provided by the Saint John Fire Department, it would be expected that the Project would provide emergency response services on site, similar to what is currently provided at the existing Saint John refinery.

In consideration of the above, it would be expected that the potential environmental effects on local emergency response services (*e.g.,* fire, medical and police) could be mitigated with the existing codification, and adherence to standards for levels of service, as well as in consideration of service provisions, and planned changes to local emergency response services.

The added taxation revenue associated with an increased tax base for the City, as a direct result of the Project, could assist in financing any required emergency service or infrastructure upgrades required, in the unlikely event that service levels fall below standards or acceptable requirements.

Regardless, the Proponent would work closely with the City of Saint John and its emergency service providers (*i.e.,* fire, medical and police) throughout the Project, to further identify means of mitigating environmental effects to the extent that they would not be significant, and to identify the requirement for and implementation of any improvements that might be needed. Consequently, it was the professional judgment of the Study Team that the potential environmental effects of the Project on local emergency response services would not be significant.

With respect to on-going health care services, both Construction and Operation could result in both positive and adverse environmental effects. The increase in regional employment would be expected to result in an overall increase in health status. Working individuals with higher relative incomes are generally healthier individuals. However, some challenges could be faced due to an increase in the population, including maintaining sufficient public resources and access to routine medical care.

Many support services currently offered are reportedly facing challenges, with respect to resourcing and staffing. Program wait times can be lengthy and certain services are not readily available.

Much of the current focus has been on maintaining current level of service with limited resources, rather than on strategic planning for increases in demand that could result from an increase in the regional population.

With respect to the public education system, direct and indirect Project employment associated with Construction and Operation might lead to an environmental effect on the functional capacity of School Districts 6 and 8, which serve the communities of Greater Saint John and adjacent regions. Current available capacity might not be sufficient to accommodate the additional needs of families moving into the region.

The Greater Saint John region has numerous food and entertainment facilities, and it would be expected that any unfulfilled demand for such services would be mitigated through further expansion of these services by the private sector. Therefore, for the purpose of this VEC, the potential adverse environmental effects on food and entertainment services were predicted to be not significant.

There are, however, concerns for the potential environmental effects of the Project on recreation programs and services, which are largely provided by municipalities, NGOs, and the volunteer sector. These providers could face difficulties in expanding capacities to meet changing needs. All potential environmental effects on community services and public infrastructure would be anticipated to be similar for Construction and Operation, although more pronounced during Construction, given the larger direct and indirect regional employment and expenditure effects of the Project.

The Report notes at this juncture that the potential effects of a Change in the Level of Service from Community Services and Public Infrastructure, resulting from the Project during Decommissioning and Abandonment, were rated not significant.

Assessment of Project-Related Environmental Effects

The residual environmental effects of the Project on Community Services and Infrastructure are summarized in Table 16.4.

Change in the Accommodation Market

As noted previously, the environmental effects of the Project could include changes in the accommodation market resulting in shortages in supply, lack of diversity of available supply, and price inflation. Low income families and individuals would be particularly vulnerable to shortages in affordable housing, potentially resulting in displacement.

As mitigation, if required, small and localized Project accommodations would be built specifically to house non-local workers during Construction. Large scale Project accommodations might also need to be considered. With respect to long-term accommodation, lower availability and price inflation could also be experienced.

The Report notes, however, with mitigation, such environmental effects would be expected to be local, and of moderate magnitude. It further states that strategies for mitigation should be developed through continuing community engagement and the development of partnerships among government, developers and social service NGOs. Given that poverty is a prevalent obstacle faced by a large number of citizens in the Greater Saint John area, affordability is a primary housing need. Strategies designed to enhance properties in need of renewal would be required, as well as measures to increase affordability. With the continued advancement of community strategies to address affordable housing needs, it was predicted that residual environmental effects on vulnerable individuals and households could be mitigated. The Proponent would continue to work with interested parties to communicate its accommodation needs, and plans for worker accommodation.

Existing Conditions for Change in the Accommodation Market

Within Greater Saint John, there are a total of over 1,500 guestrooms offered within a number of hotels, motels, inns, and bed and breakfasts. During 2005 and 2006, the average annual vacancy rate for all short-term accommodations was approximately 54%, with monthly rates lowest in December to February, and highest in July to August. The focus of the energy hub in the business community would be expected to create an impetus for investment in hotel accommodations to take advantage of the opportunity afforded by the Project.

Housing listings and sales by neighbourhood for September 2007 are shown in Table 16.5. Average sales prices are also shown (all figures in 2007 Canadian dollars). Total housing construction starts in the Greater Saint John area have increased over the last five years, with over 500 starts each year since 2002.

Present statistics on rental market availability indicate a decline in vacancies, but still within the range of variability evidenced over recent years (Table 16.6). Vacancy rates tend to be generally lower for newer and higher-end units, for which there is a greater demand. Although older units have a higher vacancy rate, many such vacant units are reportedly in such disrepair, that they are essentially uninhabitable.

According to Canadian Mortgage and Housing Corporation definitions, a household is said to be in core housing need, if its housing falls below at least one of the following:

- Adequate dwellings are those reported by their residents as not requiring any major repairs relating to plumbing, fire, structural and physical condition;
- Suitable dwellings have enough bedrooms for the size and make-up of resident households, according to National Occupancy Standard requirements; or
- Affordable dwellings cost less than 30% of total before-tax household income.

According to a 2007 study, 57% of core housing needs in Rothesay were directly attributed to lack of affordability, while in Saint John, affordability represented 71% of the need. Consequently, access to affordable housing is the primary housing need within the Saint John Census Metropolitan Area (CMA) and also a primary concern for renters.

The percentage of renters spending more than 30% of their household income on rent for communities within the Saint John CMA is shown in Table 16.7. Comparably, 13.3% of owner households experienced affordability needs in 2000, while, overall, 37.2% of renters experienced affordability needs. Of that 37.2%, almost half of those households were spending more than half of their income on rent.

A considerable discrepancy was also noted between household types, with respect to affordable housing needs (Table 16.8). Rates were particularly high among one person households and lone parent households.

Project Environmental Effects Mechanisms for Change in the Accommodation Market

During Construction, initial estimates have predicted that the Project would require up to 1,500-2,000 accommodation units, depending on the number of workers that would ultimately be sourced locally. Based on recent housing construction levels (*i.e.,* approximately 500 units per year), the market in Greater Saint John is currently projected to be able to meet the existing trend in demand, without the Project.

During Operation, additional accommodations would be required for an estimated 750 workers and their families, on a permanent basis. During refinery maintenance/upgrade periods, accommodations for an estimated 1,500 to 2,000 workers could also be required. As previously noted, this could lead to displacement of low income individuals and families due to increased housing costs. Eventual gentrification of neighbourhoods might specifically affect those who presently rely on affordable and subsidized housing.

Mitigation for Change in the Accommodation Market

As mitigation, Project accommodations built specifically to house non-local workers during Construction would likely be required, even with phasing the pace and sequence of construction activities over the longer 6-8 year period. It would be expected that these developments would be undertaken, owned and managed by third parties.

They would be subject to the relevant municipal approval process, and required to adhere to established Project design principles, to avoid potential adverse environmental effects. Though many of these workers could be housed in existing accommodation and housing units in the Greater Saint John area if capacity exists at the time, the following options for providing additional accommodations for workers would be considered:

- The probable requirements for additional accommodation and housing units over the life of the Project would be communicated to private developers, local municipal authorities, and local NGOs. Particular attention would focus on developer' plans for the adaptive reuse of the facilities, after completion of the Project, such as conversion to affordable family or senior-oriented housing units.

- Developing one or more privately managed worker accommodations to house a large group of non-local workers, with the same objective of considering longer term use, following Project completion. Regarding operation of such large facilities, additional mitigation would be considered, where feasible and appropriate, such as:

    - Provision of 24-hour security services for each facility, with gated and controlled site access;
    - Application and enforcement of a Drug and Alcohol Policy;
    - Application and enforcement of a Residential Standards of Behaviour Policy;
    - Provision of dedicated health and dental care services, either on site or at an alternate Project site; and
    - Provision of essential retail and entertainment services on site (*e.g.,* convenience store, video store, *etc.*).

Phasing of the pace and sequence of Construction activities over a longer duration (approximately 6-8 years) would also extend the time over which labour is required, and reduce the annual demand for accommodations.

The above measures would reduce adverse environmental effects on Community Services and Infrastructure, due to the Project accommodations. In particular, this would include potential adverse environmental effects on the level of service provided by emergency response services, ongoing health care services, and social service providers within the Greater Saint John area. Such mitigation would also assist in preventing low income families and individuals that are vulnerable to shortages in affordable housing from potential displacement.

Continued discussion with the broader Greater Saint John community would be undertaken by the Proponent to help develop appropriate strategies to mitigate adverse environmental effects

on affordable housing. Further mitigation, if implemented by the Greater Saint John community, would include programs identified by the Benefits Blueprint Initiative. A Saint John housing strategy would also be recommended. This would be focused on expanding accommodation options to avoid housing shortages and escalating rent levels, as well as providing more higher-end housing options.

Characterization of Residual Project Environmental Effects for Change in the Accommodation Market

Residual environmental effects on short-term accommodations would be predicted to be low in magnitude, and within the vacancy rates currently experienced. For long-term accommodation, shortages would be expected in regard to supply, as well as price inflation. With Project accommodations developed during Construction, the predicted residual environmental effects would be local, and of moderate magnitude.

Given continued advancement of community strategies to address affordable housing needs, it would also be expected that residual environmental effects on vulnerable individuals and households could be mitigated. With the proposed mitigation, as well as mitigative measures already in place, the environmental effect of Change in the Accommodation Market on Community Services and Infrastructure, during all phases of the Project, was rated not significant. This prediction has a moderate level of confidence, with uncertainties primarily due to the unknown extent to which the private sector would respond to the change in accommodation demand.

Change in the Level of Service from Community Services and Public Infrastructure

The Report states that residual environmental effects with respect to a Change in Level of Service from Community Services and Public Infrastructure would be expected to be moderate in magnitude. Service levels would be expected to decline, particularly in the short to medium-term (less than five years), but remain within acceptable service standards.

Existing Conditions for Change in the Level of Service from Community Services and Public Infrastructure

The former Region 2 Heath Authority has approximately 4,700 employees, including about 400 physicians on staff. Statistics on the number of beds; bed occupancy rates; number of beds occupied for acute care, and long term beds, are shown in Table 16.9. Table 16.10 shows the number of clients for addictions services by type of dependency. Regarding public education, current total enrolment in School District 6 is approximately 12,750 students among about 23 schools, while total enrolment in School District 8 is approximately 10,370 students among about 37 schools.

According to the functional capacity report released for School District 8 in September 2007, only two of the 37 schools within the District were assessed as having over 80% of available space occupied. Within School District 6, many of the schools are operating at full capacity. A new five-year plan is expected to include recommendations that will see a new elementary school built, as well as an addition to an existing high school.

The types of recreation facilities available within the Saint John CMA, and associated capacity estimates, are shown in Table 16.11. These facilities served a baseline population within the Saint John CMA of approximately 122,400 in 2006.

Project Environmental Effects Mechanisms for Change in the Level of Service from Community Services and Public Infrastructure

Employment and expenditure activities associated with both Construction and Operation could increase demands on on-going health and social services. Many support services provided by public sector facilities and social service NGOs could experience increasing strain on resources and staffing, as well as a lack of physical space, therefore affecting the level of service. Many workers moving to the region, particularly for permanent positions during Operation, would be expected to bring families with children, and school districts could experience a strain on resources, staffing, and physical space.

Employment and expenditure activities associated with both Construction and Operation might also increase demands on existing recreational programs, services and facilities. As many of these services are provided by municipalities and the volunteer sector, the result could be a decline in the availability of recreation services.

Mitigation for Change in the Level of Service from Community Services and Public Infrastructure

Mitigation for change in the level of service from community services and public infrastructure would include continuation of community-level dialogue with government and NGO service providers, in support of maintaining and improving the level of service to vulnerable groups. This would include, for example, provision of addiction services, crisis intervention, and mental health services. Although provision of these services is ultimately the responsibility of, and best delivered by, government and NGOs, the Proponent might play a role by effectively communicating the activities of the Project and the schedule of those activities, as it could affect regional service demand.

As mitigation for environmental effects on health services, it is expected that some non-emergency health care would be provided to individuals employed by the Project, as well as an Employee Assistance Program. Workforce education to encourage healthy lifestyle choices, sensitivity training, and strict enforcement of the Proponent's health and safety policies, would also serve to mitigate environmental effects.

Various planned projects, including the Peel Plaza development, construction of the new YMCA, as well as upgrades to the Saint John Regional Hospital, would add to existing infrastructure and service capacities within the Greater Saint John area. Further mitigation would include programs identified by the Benefits Blueprint Initiative.

Lack of available childcare services, for example, could potentially reduce participation in the workforce. Relevant recommendations in the Benefits Blueprint Initiative include an after-hours facility to accommodate those persons who work shifts and odd hours, as well as creation of 250 new caregiver positions, improved wages and annual salaries, incentives for both regulated and unregulated child care facilities to participate in Early Childcare Education, and a contingency fund for physical improvements.

Another Benefits Blueprint recommendation proposes creation of a prioritized list of infrastructure initiatives for the region, while the Government's recent provincial health plan also highlights plans for a number of changes and upgrades to medical services.

Characterization of Residual Project Environmental Effects for Change in the Level of Service from Community Services and Public Infrastructure

The Report states that, with mitigation, the increase in demand for services would be expected

to be less than what would be predicted, on a per capita basis, in connection with the increase in regional population.

To maintain the same level of on-going health care service during Construction, as that provided by the former Region 2 Health Authority, the estimated number of employees would need to increase by less than about 126, and the number of physicians on staff by less than about 11. Similarly, the total average number of beds occupied within Saint John Regional Hospital and St. Joseph's Hospital would be expected to increase by less than about 15, and average hospital bed occupancy rates by less than 2.4% The estimated projected increase in need for addiction services during Construction are provided in Table 16.12.

To maintain the same level of on-going health care service provided by Region 2 Health Authority during Operation, the estimated number of employees would need to increase by less than about 63 and the number of physicians on staff by less than about 5. Similarly, the total average number of beds occupied within Saint John Regional Hospital and St. Joseph's Hospital could be expected to increase by less than about 7 and the average hospital bed occupancy rates by less than 1.1%.

The estimated projected increase in the need for addiction services during Operation are provided in Table 16.13. The Report predicts in this context that the residual Project environmental effects would be less than is stated in the table.

With an average of approximately 1,500 new workers to the Greater Saint John region during Construction, based on initial estimates, and an average of about 750-1,000 new workers during Operation, the corresponding additional demand for public education for children would will be low in magnitude, relative to the current number of students. The Report also points out that funding of public education in New Brunswick is based on enrolment. As such, any increases in demand would be expected to be matched by increases in resources to the school district.

Regarding community recreation facilities, the Report states that increases in regional population due to Construction and Operation would be small, relative to the diversity of facilities and capacities currently serving the Saint John CMA. Limited availability with certain recreation programs (*e.g.,* hockey) for specific age groups might be expected. Over time, however, municipalities would be expected to make adjustments, in response to such changes in demand. The Proponent would work with the City in respect of recreation issues, as appropriate.

In summary, many residual environmental effects with respect to a Change in the Level of Services from Community Services and Public Infrastructure would be expected to be moderate in magnitude. Service levels would be expected to decline, particularly in the short to medium-term (less than five years), but remain within acceptable service standards.

Additional efforts would be required to mitigate environmental effects due to the activities of temporary non-local workers within the community, so that they would not be significant. This would include the need to directly address potential environmental effects associated with consumption of alcohol and substance abuse, and the direct and indirect environmental effects that the influx of a large number of these workers might have on vulnerable individuals.

As discussed previously, Project accommodations would be built specifically to house the required non-local workers during Construction. The Report states that, through this environmental effects analysis, it became apparent that it would be desirable to have a single, relatively isolated accommodation facility, instead of a number of smaller facilities, to further mitigate potential environmental effects on Community Services and Public Infrastructure.

A single, large, and well-provided accommodation facility would be expected to mitigate potential adverse environmental effects on community health and social services, by helping to prevent large numbers of workers from directly interacting with the community in an un-moderated manner. The overall approach would be to provide a state-of-the-art accommodations complex, in terms of rooms and dining; recreation; entertainment facilities, and services, so that construction workers would be less likely to overwhelm the local community.

The Proponent would work on developing this mitigation and, should the facility require permits, or EIA approval, a separate EIA registration would be provided. With the additional mitigation, the residual environmental effects of Change in the Level of Service from Community Services and Public Infrastructure, during all phases of the Project, were rated not significant. This prediction has a moderate level of confidence, with uncertainties primarily due to the extent to which the public sector will respond to the change in community services and public infrastructure demand.

Assessment of Cumulative Environmental Effects

There is the potential for cumulative environmental effects with a number of other projects and activities, as noted in Table 16.14. They include existing and planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, Potash Corporation expansion of mining operations, development of the Coast Guard site in Saint John), as well as projected increases in industrial activity associated with the Port of Saint John.

During Construction and Operation, the potential effects on Community Services and Public Infrastructure described earlier could also occur as cumulative environmental effects with other projects, which would add to the influx of workers. Planned infrastructure projects would have potential for positive cumulative environmental effects, given that rejuvenation of existing infrastructure, as well as direct expenditure and employment with the new construction, would add to, and enhance, the infrastructure available to Greater Saint John in support of further economic development.

Table 16.15 provides a summary of the assessment of residual cumulative environmental effects on Community Services and Infrastructure. Recreation, forestry and agricultural land use projects and activities were predicted to not act cumulatively with the Project (Table 16.14) because they do not involve substantial employment and expenditures.

Project Cumulative Environmental Effect Mechanisms for Change in the Accommodation Market

For the purposes of cumulative environmental effects assessment for Change in the Accommodation Market, all projects within the Regional Assessment Area (RAA) were considered, with emphasis placed on those projects that would have considerable labour demands and Project-related expenditures, which could overlap with either Construction or Operation.

Base Case Current industrial land use, infrastructure land use, and marine projects have the potential to act cumulatively with the Project due to their labour demands and local expenditures. These projects would include the Lepreau Refurbishment Project, Canaport Liquefied Natural Gas Marine Terminal and Multi-purpose Pier, Potash Corporation expansion of mining operations, and Port of Saint John shipping activities. These projects would be complete, however, before the Construction of the Project.

Project Case During Construction and Operation, a high cumulative demand for accommodations could lead to shortages in supply, a lack of diversity in the available supply,

and price inflation. This might also lead to the displacement of low income individuals and families due to an increase in housing costs. Particularly vulnerable households would be those defined as having core housing needs.

Future Case Future projects that could act cumulatively on the accommodation market would include other planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, development of the Coast Guard site in Saint John). Given current unknowns in the design and implementation schedule of these projects, the specific nature and timing of the additional demand which might be placed on the accommodation market is uncertain, and could occur during Construction and/or Operation. Such a cumulative increase in demand could result in housing shortages, price inflation, rental shortages, inflation, and potential displacement of low income families and individuals.

Mitigation of Cumulative Environmental Effects for Change in the Accommodation Market

Mitigation of cumulative environmental effects for changes in the accommodation market would be that previously identified for mitigation of environmental effects. Further mitigation would include programs previously discussed and identified by the Benefits Blueprint Initiative. A Saint John housing strategy could also be focused on expanding accommodation options towards avoiding housing shortages and escalating rent levels, as well as providing more higher-end housing options.

Characterization of Residual Cumulative Environmental Effects for Change in the Accommodation Market

Cumulatively, considering current and foreseeable future projects, it has been estimated that direct construction-related employment would peak at approximately 8,300 in the year 2014 within the Saint John CMA, with approximately 5,800 construction-related workers required from outside the Greater Saint John area. It has been further estimated, through to 2031, an average of approximately 450 new accommodation units per year would be required, above that currently being produced by the market.

The Project's needs for accommodations during Construction, however, would be largely met by the development of up to 1,500-2,000 Project accommodations. Needs for short-term accommodations would also be expected to be met by the over 1,500 existing guestrooms available in the Greater Saint John area, new hotel construction, and interest in constructing additional hotels in the area to meet the demand.

With respect to long-term accommodation, it has been predicted that residual cumulative environmental effects could result in shortages in supply, and price inflation. But, over time, housing markets would be expected to be able to respond and help meet the unfulfilled demand.

With the continued advancement of community strategies to address affordable housing needs, it has been predicted that residual cumulative environmental effects on vulnerable individuals and households could largely be avoided, although some level of displacement would be expected. The proponents of other projects, expected to act cumulatively on the displacement of low income individuals and families, would also have a responsibility to become engaged in developing mitigation initiatives.

Overall, the environmental effects would be predicted to be of moderate magnitude, and limited primarily to within the Saint John CMA. With the proposed mitigation, as well as the planned improvements and market response to increased demand, the environmental effect of Change

in the Accommodation Market on Community Services and Infrastructure of all past, present and reasonably foreseeable projects/actions, in combination with the environmental effect of the Project, was rated not significant.

With the proposed mitigation, the Project contribution to cumulative environmental effects of Change in the Accommodation Market on Community Services and Infrastructure was rated not significant. This prediction has a moderate level of confidence, with uncertainties primarily due to the unknown extent to which the private sector would respond to the change in accommodation demand.

Project Cumulative Environmental Effect Mechanisms for Change in the Level of Service from Community Services and Public Infrastructure

Base Case As noted earlier, current industrial land use, infrastructure land use, and marine projects have the potential to act cumulatively with the Project. These projects would include the Lepreau Refurbishment Project, Canaport Liquefied Natural Gas Marine Terminal and Multi-purpose Pier, Potash Corporation expansion of mining operations, and Port of Saint John shipping activities. These projects would be complete, however, before the Construction of the Project.

Project Case As noted earlier, through Project-related employment and expenditures, there would be potential for cumulative environmental effects resulting in a Change in the Level of Service from Community Services and Public Infrastructure through an increase in the level of demand.

Future Case Foreseeable future projects that might act cumulatively with the Project would include other planned industrial land uses and infrastructure projects (*e.g.,* Point Lepreau II, development of the Coast Guard site in Saint John). Planned projects that would have potential to mitigate cumulative environmental effects would include the upgrade to Saint John Regional Hospital, which is expected to provide better access to medical services to the Greater Saint John population. In addition, the planned construction of a new YMCA and the Harbour Passage Extension would be expected to increase recreational opportunities (*e.g.,* jogging and bicycling along the Harbour Passage trail system).

Mitigation of Cumulative Environmental Effect for Change in the Level of Service from Community Services and Public Infrastructure

Mitigation of cumulative environmental effects for Changes in the Level of Service from Community Services and Public Infrastructure would be as previously identified for mitigation of environmental effects. This would include an increase in the capacity and quality of existing child care services. As noted earlier, a further result of the Benefits Blueprint Initiative was a prioritized list of infrastructure initiatives for the region.

Characterization of Residual Cumulative Environmental Effects for Change in the Level of Service from Community Services and Public Infrastructure

Considering all major current and foreseeable future projects throughout the Province of New Brunswick, it has been estimated that new direct, indirect and induced provincial employment would peak at approximately 33,200 in 2012. Within the Saint John CMA, it has been estimated that the total number of new permanent residents settling within the Saint John CMA would be approximately 12,700, from 2006 to 2016.

With respect to the residual cumulative environmental effects for change in the level of service from on-going health services, the Report states that the described mitigation would mean the increase in the demand for the services would be less than what would be predicted on a per capita basis. To maintain the same level of on-going health care service provided by the former Region 2 Health Authority, it has been estimated that the number of employees would need to increase by less than about 445 and the number of physicians on staff by less than about 38.

Similarly, the total average number of beds occupied within Saint John Regional Hospital and St. Joseph's Hospital could be expected to increase by less than about 52, and the average hospital bed occupancy rates by less than 8.3%. The total increase in the need for inpatient treatment for addiction services has been estimated at less than 64, and for community outpatient services, less than 174. These maximum changes in demand would be predicted to occur over an eight year period, thus allowing time for adjustments in program resourcing and delivery to occur. Certain mitigative activities, such as the upgrade of the Saint John Regional Hospital, would be expected to further reduce the residual cumulative environmental effects.

With respect to public education, the Report notes that School District 8 is currently operating well below functional capacity, while School District 6 is challenged with accommodating existing demand. Overall, the corresponding additional demand for public education, with the cumulative addition of families within the Greater Saint John region, would be expected to be moderate in magnitude relative to the current number of students, and be particularly challenging for School District 6. But again, these cumulative increases in public education capacity requirements would occur over the long term, allowing increases in demand to be matched by increases in resources to the school district.

Regarding community recreation facilities, the Report states that the cumulative increase in the regional population would be moderate, relative to the diversity of facilities and capacities currently serving the Saint John CMA. Limited availability with certain recreation programs for specific age groups would be expected, but over time, municipalities would be expected to make adjustments to the programs and space offered, in response to changes in demand.

In summary, the residual cumulative environmental effects with respect to Community Services and Public Infrastructure would be expected to be moderate in magnitude, with current levels of service predicted to decline, but within acceptable service standards. Service levels would be expected to occur primarily in the short to medium-term (less than five years). Cumulative changes in demand would be predicted to occur over an eight year period, thus allowing time for adjustments in program resourcing and delivery to occur.

Because of planned initiatives and improvements, with public sector and service groups responding to increased demand for services, and the proposed mitigation, the cumulative environmental effects of a Change in the Level of Service from Community Services and Public Infrastructure on Community Services and Infrastructure of all past, present and reasonably foreseeable projects/actions, in combination with the environmental effects of the Project, were rated not significant.

With the proposed mitigation, the Project's contribution to cumulative environmental effects of a Change in the Level of Service from Community Services and Public Infrastructure on Community Services and Infrastructure was also rated not significant. This prediction has a moderate level of confidence, with uncertainties primarily due to the unknown extent to which the public sector would respond to the change in community services and public infrastructure demand.

Follow-up and Monitoring

No follow-up and monitoring would be recommended specifically related to Community Services and Infrastructure. However, the Proponent would work closely with the City of Saint John and its emergency service providers (*i.e.,* fire, medical and police) throughout the Project, to further identify means of mitigating environmental effects to the extent that they are not significant, and to identify the requirement for, and implementation of, any improvements that might be needed.

Chapter 17 – Land Use

Chapter 17 covers pages 17-1 to 17-27, including I figure and 6 tables. It explains that Land Use was selected as a Valued Environmental Component (VEC) to assess the interaction between the Project and current and proposed land uses, including occupation, as well as public and private use of the lands within, and adjacent to, the Project.

Potential environmental effects of Project structures and emissions on visibility, and aircraft navigation along a nearby flight path to the Saint John Airport, were included in this assessment as well. It also focused on property values and compatibility of adjacent land uses, including the Red Head Marsh and the Courtenay Bay Environmentally Significant Areas (ESA).

The Project would result in changes to the current visual environment, and could change the landscape, as viewed from key areas of the City. It would also reduce access to land for recreational activities (*e.g.,* hunting, trapping, ATV and snowmobile use). Use of these private lands for these purposes is not currently authorized, however, and carried out at the convenience of the landowner.

Other lands for similar recreational uses are readily available in the area. Nuisance environmental effects on adjacent recreational and residential land uses have been predicted to be low in magnitude, and restricted to sites adjacent to the Project.

Designated land use, as expressed through municipal zoning regulations, was an important consideration, as the Project would require a formal change in designated land use and zoning. This amendment would require public participation and approval by the City of Saint John Municipal Council.

The residual adverse environmental effect on property values due to the Project would be expected to be low in magnitude and localized, although changes to property value are difficult to predict because of multiple contributing factors, such as local market conditions, economic conditions, as well as social and cultural context.

Residual environmental effects in the visual environment, from Project facilities as well as potentially from visible emissions (*e.g.,* water vapour plumes from cooling towers, if built), were anticipated to be low in magnitude because, although the Project would represent a change to visual aesthetics of the area, other land use activities could continue largely unaffected.

The Report notes that the industrial landscape in the Mispec area is currently part of the visual fabric of the area, as it has been for more than a century.

With mitigation, residual environmental effects of the Project on Land Use were rated not significant. Many adjacent properties in the area of the Project have been purchased by the Proponent, which would have indirect benefits in reducing potential nuisance environmental

effects. The Report notes that property owners in the area are well aware of the Project, and have been kept informed of developments throughout the planning stage.

Reflecting public consultation, the Project would be expected to incorporate a number of customized measures to mitigate adverse environmental effects on existing land use (*e.g.,* lighting design). Best management practices would be incorporated where appropriate (*e.g.,* dust suppression on construction sites, odour control during Operation). Other mitigation would include advance communication of construction activities and schedules with recreation organizations and nearby land owners.

Sections 17.1 and 17.2 cover pages 17-2 to 17-9 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

The Project would interact with Land Use in a number of ways, resulting in changes to both formal designated use and informal land use. Construction and Operation environmental effects could extend to adjacent lands and linear corridors. Generally, the Project would complement the substantial industrial activity in the immediate area of the Project Development Area (PDA); however, other uses could be adversely affected. Potential interactions between the Project activities and Land Use are identified in Table 17.2.

The Report notes that, since changes in land use designation and zoning would be assessed and approved, if appropriate, by the City of Saint John prior to Project Construction, and Construction or Operation of the Project could not possibly proceed without such changes in land use designation and zoning, the zoning amendments required for the Project are not discussed further in this EIA.

The Report also points out that much of the land which would be developed has been vacant under private ownership, although unauthorized hunting, trapping and ATV/snowmobile use occurs on this private land within the PDA. Much of these current activities would be disrupted by Project Construction and Operation. Access and trail connections to adjacent lands for private recreational use could also be affected, although indirectly, which was highlighted as a concern during consultation.

In addition to informal recreational uses, residential property use also occurs in the vicinity of the Project (Figure 17.1). These residential land uses could experience increased exposure to potential sources of nuisance, such as increased noise, light, odour and air emissions levels,

during Construction and Operation. Consultation highlighted residents' concern about these potential nuisances and associated effects on property values.

Also of potential concern to local residents were the potential psychosocial environmental effects associated with any real, or perceived, environmental, or health and safety, concerns associated with the Project. Red Head Marsh is located west of the PDA (Figure 17.1) and is recognized as an ESA. It is anticipated that there would not be any specific environmental effects to Land Use to this area, as all recreational activities currently occurring within and around Red Head Marsh would not be interrupted. Thus, the potential environmental effects of the Project on Land Use within Red Head Marsh were rated not significant.

Changes in commercial or industrial land use, directly and indirectly associated with the Project, would be expected to occur within the Local Assessment Area (LAA), in areas appropriately zoned for such use (*e.g.,* within the Grandview and McAllister Industrial Parks) or otherwise subject to municipal land use regulation. Consequently, the potential environmental effects of the Project on commercial and industrial land use were rated not significant.

Project-related light emissions and associated interference with navigation of aircraft on the approach to Saint John Airport had also been identified as potential interactions of concern. Appropriate separation distances (*e.g.,* from the flare system) and potential interference with facility lighting would be discussed in detail with the regulator, Transport Canada, during Project planning, to ensure no unacceptable interaction with air traffic safety. Thus, the potential environmental effects of the Project on aircraft navigation were rated not significant.

Construction Site and Right-of-Way Preparation, as well as Physical Construction and Equipment Installation, would cause disruption to the informal land use patterns in the LAA, which consist primarily of recreational activities such as hiking, cross-country skiing, snowmobiling, ATV use, hunting, trapping, and fishing. Recreational users would no longer be able to access this land, even though access is currently conducted at the landowner's convenience.

During Construction, potential nuisances such as light, air emissions, and noise in the area could increase, potentially affecting the use and enjoyment of surrounding residential properties. The visual environment would also be altered, due to the visual presence of the Project itself.

Construction of the linear facilities would result in an interaction to Land Use. They would be positioned to avoid conflict with existing land uses. In some cases, however, interaction might be unavoidable. Routing of the specific linear facilities would be conducted in consideration of potential interaction with any existing or proposed future Land Uses. Some of these environmental effects would also be mitigated through standard Best Management Practices, and adherence to City of Saint John By-Laws.

Construction of Watercourse Crossings and Road Transportation would interact with Land Use as well. However, traditional controls and construction procedures would assist in mitigating these interactions. Other interactions with Land Use activities would be anticipated due to increased traffic within the LAA, but they would be expected to be limited, as increased traffic could be accommodated within existing road capacity. Consequently, an increase in traffic would not be expected to be of concern. The results of the environmental effects assessment on Land-Based Transportation is presented in Chapter 20.

Operation Operation of the refinery would result in changes to the physical Land Use environment. Nuisances such as light, air, odour, and noise emissions would increase, potentially affecting the use and enjoyment of surrounding residential properties. Activities of

concern would include Operation and Maintenance of Refinery Processes and Equipment; Emissions Control; Management of Effluents and Wastes, as well as Water Supply and Use.

The Project has raised concerns among local residential land owners that the ongoing presence and Operation of the Project could result in a decrease in property values. It is important to note that the Proponent has purchased and is continuing to pursue the purchase of additional properties, focusing on selected properties close to the PDA, at, or above, fair market value.

The overall intent is to establish a buffer at key areas around the Petroleum Refinery and Other Land-Based Infrastructure which would help mitigate potential adverse environmental effects on Land Use, and prevent future residential encroachment on industrial activities associated with the refinery. This was a concern expressed by close neighbours to the existing Saint John refinery, and nearby residential communities that were subsequently built around the refinery. All purchases are being conducted on a voluntary basis with a mutually agreed-upon price as compensation.

Refinery facilities would be visible from various points within the area. Mispec Park has been noted as a specific area of concern, given its close proximity to the PDA. The potential for the Project to alter the existing viewscape of the area, and detract from the overall enjoyment, was raised during consultation. This included consideration of the potential environmental effects of lighting and of visible emissions from the Project facilities (*e.g.,* water vapour plumes from cooling towers, if built), during certain atmospheric conditions.

Decommissioning and Abandonment It is anticipated that Decommissioning would involve removing some or all of the facilities and reclaiming the land to, or near to, its former state. Any decommissioning would follow the necessary environmental requirements in place at such time as it occurs. In the case that some facilities are left in place for other purposes, they would be dealt with through municipal land use planning and regulatory processes. Thus, the potential environmental effects of Decommissioning and Abandonment on Land Use were rated not significant.

Marine Terminal and Other Marine-Based Infrastructure The Marine Terminal and Other Marine-Based infrastructure would have minimal interactions with Land Use. There are limited existing uses along the shoreline, primarily consisting of informal shoreline recreational activities such as: gathering shells, periwinkles, rockweed and driftwood; swimming; wind surfing; picnicking; rock climbing; and ice climbing.

The shoreline areas and marine waters where the Project would be located are already designated as part of the Port of Saint John. Although recreational activities would be restricted from the PDA, access to portions of the PDA along the shoreline is currently restricted (i.e., Canaport and Canaport LNG properties), and such activities would continue to be available along other stretches of shoreline in the area. Given the topography and the minimal presence of these activities in the PDA, it is anticipated that standard Best Practice Management Procedures (*i.e*., public notification of activities) would mitigate any potential environmental effects.

Construction would result in some changes in the visual environment, particularly from Mispec Park. The main anticipated change in the Mispec Park viewscape would be the barge landing facility and associated vessel traffic. Given the limited size and use of the barge landing facility, and the fact that the larger existing Canaport LNG facility (*i.e.,* the jetty and LNG storage tanks) is currently visible from the beach, it would be anticipated that the visual environment effects due to the Project would be limited in magnitude. Consequently, the potential environmental

effects of the Marine Terminal and other Marine-Based Infrastructure on Land Use were rated not significant.

Environmental Effects Assessment

Residual environmental effects of the Petroleum Refinery and other Land-Based Infrastructure on Land Use are summarized in Table 17.3. Those activities rated as 2 in Table 17.2 were carried forward for more detailed analysis and consideration.

Assessment of Project-Related Environmental Effects

The Project and its activities would result in changes to: outdoor recreation activities (*i.e.,* hiking, cross-country skiing, snowmobiling, ATV use, hunting, trapping, and fishing); use and enjoyment of residential properties; residential property values; and the visual environment. Such changes would occur during both Construction and Operation.

The change in outdoor recreation might involve both physical displacement of currently unauthorized activities within the PDA, and disruption of activities due to nuisance-related environmental effects (*e.g.,* noise, light, and odour emissions).

Nuisance environmental effects might also affect the potential enjoyment and use of nearby residential properties. Nuisances and the perception of environmental or health and safety concerns might have an adverse environmental effect on property values, and could potentially result in changes in psychosocial well-being. The Project would also be expected to change the visual landscape.

Changes to the Land Use would be mitigated through changes made to Land Use zoning; purchase of property where mutually agreed upon with the property owner; communication with land owners and recreation users regarding Project activities and schedules; restriction of site access, and management of nuisances through a range of mitigation strategies including avoidance, design, use of best available proven technology, and Best Management Practices for Construction and Operation.

Existing Conditions for Change in Land Use

Recreational Land Use The Report notes that, presently, the Red Head Mountain area is frequented by ATV and snowmobile users, as well as for hunting, fishing, trapping, and hiking.

Although there is no formal network of trails in the LAA, the area could have anywhere from 30 to 100 recreational users on an average weekend, year-round.

Residential Land Use Residential land use in the LAA consists primarily of single-unit family residential dwellings. Many of the dwellings are located in the Harbourview and Debly Subdivisions, located northwest from the Project (Figure 17.1). There are approximately 70 residential dwellings in these two subdivisions. The majority of dwellings are located on the various roadways that encircle the Project, reflecting a pattern of rural ribbon development. These are detailed in Table 17.4. The PDA contains no residences that are occupied. Any owner-occupied residences in the area have been buffered from development for the Project. Further, the Proponent has acquired several residential properties proximal to the PDA including, in particular, along the Red Head Road near Canaport, and on Proud Road and Old Black River Road. Few occupied residential properties remain proximal to the PDA.

The Report states that the average sales price for private dwellings in the Red Head area in 2007 was $101,827. There are approximately 700 properties in the local Census Tract zoned as residential and occupied by a residence. There are approximately 200 additional properties zoned as residential, which are currently vacant.

Visual Environment The PDA can be divided into two main sites: the crude and product tank area; and the refinery facility. The tankage area would rest on fairly level ground abutting the coast line. The refinery facility would be sited to the east of Red Head Mountain, near and along the recently constructed extension to Bayside Drive, on land which slopes away from the City.

Noise The PDA and LAA are rural areas with residential development along roadways, and in two subdivisions. These areas currently have an acoustic environment within acceptable limits for rural residential living. The main sources of sound are road traffic and residential household activities (*e.g.,* speaking, cars, lawn mowers, and snowblowers).

Air Quality Greater detail regarding the existing air quality in the region was previously provided in Section 7.2. In the PDA and LAA, odours are primarily natural (from the surrounding forest) or residential (arising from residential human activity such as wood-fired heating and related smoke). Odour was often cited as a potential concern to residents in the vicinity of the PDA during public engagement efforts, likely in response to concerns experienced occasionally by residents near the existing Saint John refinery, during periods of reduced dispersion.

Given the suburban nature of the area surrounding the PDA, existing odour levels in the Mispec/Red Head area are generally low. Industrial odours are not experienced, or if they are, they would be infrequent and a result of unique weather conditions and upset operating conditions in local industries. The same would be the case for fugitive dust emissions. The environmental effects of odour, fugitive emissions, and air quality associated with the Project, were previously addressed in Section 7.4.1.

Project Environmental Effects Mechanisms for Change in Land Use

Construction and Operation of the Petroleum Refinery and Other Land-Based infrastructure would result in a number of environmental effects outlined below:

- Land uses occurring within the PDA would change from informal recreational to industrial. Public access to the Proponent's property would be controlled and restricted, and informal recreational use of these lands would cease.

- The enjoyment and use of residential properties on adjacent lands could be affected by increased nuisance-related environmental effects including air contaminant, noise, odour, and light emissions. Any real or perceived environmental or health concerns potentially associated with the Project might result in real or perceived psychosocial changes in the enjoyment of property for residential use.

- There might be a change in property values for lands adjacent to, or in close proximity to, the Project, relative to other areas in Saint John Census Metropolitan Area (CMA), due to the presence of the Project and the potential nuisance-related changes (odour, noise, dust, and light), as well as the perception of environmental or health and safety concerns potentially associated with the Project.

- Project structures and/or visible emissions would alter visual landscapes, potentially affecting views from key residential and recreational areas, or obstructing key views.

Mitigation for Change in Land Use

Changes to Land Use would be mitigated through two primary planning activities undertaken prior to Construction:

- Changes in land use designation and zoning to allow for heavy industry within the PDA would be assessed and pursued through the City of Saint John, prior to Construction;

- Purchase, by the Proponent, of selected properties adjacent to the PDA where available and required, and where appropriate compensation can be agreed.

Further mitigation at the planning stage would include avoidance of residential areas and bisecting privately-owned properties in the siting of the linear facilities corridor; detailed routing analysis for Right-of-way (ROW) within the preferred corridor in consideration of surrounding land uses, and buffering requirements. Other mitigation would be employed to reduce adverse environmental effects on Land Use, including:

- Communication with land owners and recreation user groups to inform them of Project Construction activities and schedules;
- Restricted site access;
- Reduction of nuisance environmental effects with the use of Best Management Practices to control light, noise, and emissions;
- Use of best available proven technology for controlling air emissions, effluents, and wastes.(*e.g.,* gaseous fuels, tall stacks, vapour recovery units, floating roofs and other vapour control devices, flare system, tail gas treatment unit, low-NO_x burners, ambient air quality and continuous emissions monitoring, modern wastewater treatment systems).

Characterization of Residual Project Environmental Effects for Change in Land Use

Even with mitigation, the Project would result in the loss of recreational land use throughout all phases of the Project until Decommissioning and Abandonment. The Report states that it is important to acknowledge that the current use of the Proponent's lands by the public is not authorized. Further, restriction of recreational land use within the PDA would be expected to have only minor environmental effects on the recreational use of adjacent land, because the area is not an important trail travel route within the LAA, and there are no formally designated trails in the area.

Use and enjoyment of adjacent properties might be affected by Project-related noise and air contaminant emissions, particularly during Construction, and by air contaminant, odour, and noise emissions, during Operation. As discussed in Chapter 7, the potential environmental effects of the Construction and Operation of the Project on ambient noise, air quality, and odour levels were rated not significant for all phases of the Project, due to planned mitigation of these environmental effects.

The exhaust plumes from cooling towers would contain water vapour and, during cold weather, these plumes could become visible when the vapour condenses to form a mist, which is similar to fog. Based on modelling analysis, fogging events due to facility operation could cause occasional reduced visibility along Proud Road, but only for brief periods of time.

The visual environmental effects of these visible water vapour plumes, while likely to be noticeable in relatively close proximity to the Project, would not be expected to result in

significant adverse environmental effects to Land Use at nearby properties. Any such events would be limited in geographic extent and in duration; would occur infrequently relative to the incidence of fog that normally occurs in Saint John, and would not be expected to be substantive.

Thus, nuisance environmental effects on adjacent recreational and residential land uses were predicted to be low in magnitude, and restricted to sites within, or only immediately adjacent to, the PDA.

The Final Guidelines, and the public, have suggested that changes related to psychosocial well-being might occur because of real, or perceived, exposure to environmental, or health and safety concerns, associated with the Project. Living in proximity to an industrial facility could result in emotional, behavioural or somatic (*e.g.,* headaches, fatigue) consequences, and might exacerbate existing health conditions in individuals. A review of the literature concluded that, overall, communities in proximity to heavy industry generally suffer stress, and may have self-reported complaints such as perceptions of poorer physical and mental health.

However, such environmental effects are typically dependent on the proximity of residents to the industrial development. Recent research suggests that the exposure of some individuals to other nuisance factors, such as odour and noise, might cause anxiety, affect stress levels and result in a perception of risk. The environmental effects assessment related to odour and noise in Chapter 7 demonstrated that, at certain receptor locations, odours might be detected by sensitive individuals for short periods of time, but only within a localized area in close proximity to the Project.

The Report further states that noise levels might change temporarily, but would not exceed noise guideline levels. While such predictions are useful indicators of exposure, it is not possible to predict the associated potential psychosocial responses in exposed residents, due to the individuality and variability of the human reaction to odours, noise, or other nuisance factors, as well as other contributing factors that could lead to a psychosocial response in individuals (*e.g.,* stress occurring from other life events or factors).

Nevertheless, in consideration of the results of the environmental effects assessment, any psychosocial effects that might occur to certain individuals would be expected to occur infrequently, be low in magnitude, and occur over a localized area, such that a significant environmental effect to Land Use would be very unlikely.

The presence of the Project; nuisance-related changes in the environment, and/or public perceptions of environmental or health and safety concerns, would be expected to result in the potential for an adverse environmental effect on local residential property values.

The Report notes, however, that residential housing prices are a reflection of a number of factors that include market conditions, location, property attributes, the characteristics of houses or other structures on the property, local and regional economic conditions, as well as social and cultural context. Thus, it would not be practical to predict the magnitude of this residual environmental effect.

Several studies have explored the relationship between proximity of property to large industrial facilities, and the resulting change in property value. The Report notes that one study identified the relationship between the proximity of a property to two operating oil refineries, spaced 2.4 km apart in Louisiana.

It observed that local conditions (*i.e.,* buffer zone characteristics, local amenities such as schools, prestige of the neighbourhood, and disamenities such as negative media reports) played a very important role in determining property values. In many cases, perceived positive local conditions offset the negative environmental effect of the refinery on property values.

Another study examined the environmental effect of oil and natural gas facilities on rural residential property values in Alberta, and concluded there was an adverse environmental effect on property values of 6%, within 4 km of oil and gas facilities.

The Report notes that other studies have revealed different results. What is clear from the literature is that the actual environmental effects on residential property values of an industrial facility, such as a refinery, are highly dependent on local market conditions, economic conditions, as well as social and cultural context. As such, the environmental effect of the Project could reasonably be expected to be lower than that found in Alberta, but greater than that found in Louisiana.

In summary, the residual adverse environmental effect on property values in the LAA, due to the Project, would be expected to be low in magnitude, localized, and would be a one-time loss, after which values would be expected to increase at rates comparable to similar locations elsewhere in the Saint John CMA. The value of commercial and industrial land properties might, in fact, realize a positive environmental effect from additional nearby industrial development and associated infrastructure. This might extend to local residential properties, if Project-related economic activity led to a high demand for properties in close proximity to the Project

The Report further states that the Proponent has a large land buffer in the PDA and has actively sought to purchase, at fair market value, residential properties proximal to the PDA—key mitigation for environmental effects of different land uses between the Project and nearby residential lands.

With regard to visibility of the Project, the tank area would be expected to be visible from the certain areas of the City of Saint John and Red Head Road, but not from Mispec Park. The barge landing facility and the associated vessel traffic, however, would be visible from Mispec Park. The refinery facility would be expected to minimally obstruct key views from both the City of Saint John and Red Head Road, as well as be visible to a limited extent from Mispec Park and marine vessels.

The residual environmental effect as a result of the change in the visual environment would be anticipated to be low in magnitude because, although the Project would represent a change to the visual aesthetics of the area, other land use activities could continue largely unaffected.

Sufficient lighting would be required to support operations and security. An area of approximately 400 ha would be estimated to have views of the lights from the refinery facility, and approximately 300 ha would have views of lights from the flare systems. But, with design mitigation (*e.g.,* use of directional lighting), the environmental effects of lighting would be predicted to low in magnitude, and largely limited to areas directly adjacent, or in very close proximity, to the Project.

In summary, with the proposed mitigation and environmental protection measures, the potential environmental effect of Change in Land Use arising from the Project on Land Use during Construction and Operation was rated not significant.

Assessment of Cumulative Environmental Effects

The potential for the Project to cause residual cumulative environmental effects on Land Use, in combination with other projects and activities within the RAA, is summarized in Table 17.5.

Project Cumulative Environmental Effect Mechanisms for Change in Land Use

Certain projects which begin Construction or Operation throughout the phases of the Project would result in a cumulative Change in Land Use. Focus has been placed on projects expected to result in a substantial change to existing land use and/or contribute to nuisance-related environmental effects. Also of focus were projects that would have potential to act positively to the mitigation of cumulative environmental effects by adding to land use assets (*e.g.,* addition of trails). While any project or activity affecting land use could have cumulative interactions with the environmental effects of the Project, only other projects of a relatively large scale were considered for the cumulative environmental effects analysis.

Base Case Within the Regional Assessment Area (RAA), cumulative environmental effects could occur as a result of land use requirements of other Projects, as well as air contaminant, noise, and light emissions generated from these projects. Any past and present projects in the construction or operation phase, or a refurbishment period, could result in cumulative environmental effects with a Change in Land Use. Such projects would include:

- Gypsum Wallboard Manufacturing Plant;
- Canaport LNG Liquefied Natural Gas Marine Terminal and Multi-Purpose Pier;
- Brunswick Pipeline; and
- Forest resource harvesting activities.

In addition, the Project could result in cumulative environmental effects to existing recreational land use (*i.e.,* hunting, fishing, ATV and snowmobile use, hiking) on Crown land and on private land, where authorized. This could potentially increase the number of users and/or types of use on these lands, after access to the Project lands ceased.

Project Case The Project would restrict recreational land use within the PDA, but would be expected to have only minor environmental effects on the recreational use of adjacent land. Due to Project emissions, there would also be expected to be some nuisance environmental effects on adjacent recreational and residential land uses, but these would be mitigated in a variety of ways and were rated not significant. Overall, the presence of the Project would augment the industrial use of land, consistent with the economic development goals of the region. Development of the land for use by the Project would also represent an increase in the current value obtained from the land, to the benefit of the people of the City of Saint John, and regionally.

Future Case During Operation, adjacent lands could continue to shift from rural to industrial and commercial use, or further develop as residential lands. The Proponent would have a substantial area of land to act as a buffer between the Project and adjacent properties. Foreseeable future projects that might act cumulatively include other planned industrial and infrastructure land use projects, and planned residential developments. These projects would include:

- Point Lepreau II;
- Potential wind energy projects;
- Highway improvement projects; and

- Eastern Wastewater Treatment Facility.

In addition, the Harbour Passage Extension Project would add to the current system of trails within the City of Saint John and could have a positive cumulative environmental effect on Land Use, by enhancing outdoor recreational opportunities in the region. Design details and implementation schedule of the above projects are presently uncertain. Therefore, the specific nature of a Change in Land Use would be uncertain and could occur during the Construction and/or Operation phases of the Project.

Overall, a cumulative decrease in the amount of land available for recreational and residential purposes might occur, as well as an increase in nuisance-related environmental effects such as air contaminant, odour, noise and light emissions (although not significant).

Mitigation of Cumulative Environmental Effects for Change in Land Use

Mitigation of cumulative environmental effects for Change in Land Use would be similar to that identified for mitigation of Project-related environmental effects, such as changes in land use designation and zoning to allow for heavy industry within the PDA; purchasing by the Proponent of select properties adjacent to the PDA; communication with land owners and recreation groups to inform them of Project activities and schedules; restricted site access; and reduction of nuisance-related environmental effects with the use of a comprehensive range of mitigation strategies and technologies.

It would be expected that other current and planned future projects would be carried out in accordance with applicable regulatory requirements, as well as public policies that seek to promote industrial development and economic prosperity for the region. It would also be anticipated that other current and future planned projects would manage and mitigate environmental effects.

Characterization of Residual Cumulative Environmental Effects for Change in Land Use

The most notable cumulative Change to Land Use would be associated with the contribution to the loss of land for recreational and residential use. Other major projects might contribute to nuisance effects that would potentially reduce the enjoyment of properties. Overall, a cumulative decrease in the amount of land available for recreational and residential purposes might occur, as well as an increase in nuisance-related environmental effects such as air contaminant, noise and light emissions.

However, it would be anticipated that all planned future projects would proceed in accordance with applicable regulatory requirements, and would manage and/or mitigate environmental effects on land use specific to those projects. Implementation of changes to zoning would also aid in reducing potential future land use conflicts.

In summary, residual cumulative environmental effects with respect to Land Use would be expected to be low in magnitude, whereby land use activities of specific user groups, residences or neighbourhoods would be disrupted, but would be expected to continue.

Cumulative environmental effects would be expected to occur regionally within the Saint John CMA and over the long-term. However, the Project's contribution to cumulative environmental effects would be predicted to be primarily restricted to the PDA and adjacent lands.
With the proposed mitigation, the cumulative environmental effects of a Change in Land Use on Land Use of all past, present and reasonably foreseeable projects/actions, in combination with the environmental effects of the Project, were rated not significant.

With the proposed mitigation, the Project's contribution to cumulative environmental effects was also rated not significant. This prediction has a moderate level of confidence, with uncertainties primarily due to the unknown design details and implementation schedule of planned future projects, as well as the unknown extent to which other projects would implement mitigation of environmental effects on Land Use.

Follow-up and Monitoring

No follow-up and monitoring has been recommended with respect to Land Use.

Chapter 18 – Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Chapter 18 covers pages 18-1 to 18-19, including I figure and 5 tables. It begins by noting that there is no documented current use involving traditional hunting, fishing, trapping, gathering, and subsistence purpose activity by Aboriginal persons, on land in the Project Development Area (PDA), or the area between the Project and east Saint John. There is an Aboriginal fishery in the Bay of Fundy, however, and thus potential for interactions between marine-based components of the Project, and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons.

These interactions could include construction of marine infrastructure in the near shore area of the Marine PDA, including the jetty and barge landing facility, as well as Project-related marine vessel traffic in the Bay during Construction and Operation. . Such potential interactions might be of concern to Aboriginal communities in New Brunswick because, without appropriate mitigation, they could result in a loss of access to areas currently fished (if they currently fish near the Marine PDA) and accidental gear loss for Aboriginal fishermen.

Despite these potential interactions, the residual environmental effects of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, including cumulative environmental effects, were rated not significant.

There are currently no documented Aboriginal fishing activities in the near shore environment where the marine-based components of the Project would be built. As such, any potential loss of areas currently fished in this area would not affect Aboriginal fishermen. While there could be potential for residual environmental effects to the existing Aboriginal fishery in the Bay of Fundy due to Project-related vessel traffic, they would not be expected to be significant, because there is no known Aboriginal fishery in the areas where the marine-based construction and operation activity would occur.

The Report notes as well that Project-related vessel traffic would be small, relative to the physical capacity of the established shipping lanes, as previously discussed in Chapter 14. Sections 18.1 and 18.2 cover pages 18-2 to 18-12 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Aboriginal, Public and Stakeholder Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters

- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

- Land-Based Existing Conditions
- Marine-Based Existing Conditions

Potential Project-Valued Environmental Component (VEC) Interactions

Potential interactions between Project-related activities during each phase of the Project, and potential environmental effects to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are shown in Table 18.3. As noted earlier, there is no known current use of land and resources for traditional purposes by Aboriginal persons in the land-based portions of the Local Assessment Area (LAA).

Nevertheless, the following mitigation would be implemented to minimize potential for environmental effects to Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons from the land-based components of the Project:

- Development of a specific protocol to be used in the unlikely event of that Aboriginal archaeological resources are discovered; and
- Ensuring First Nations participation in the planned mitigation and excavation activities associated with archaeological site BhDI-2, discussed in Chapter 19.

Potential Interactions Between the Marine Terminal and Other Marine-Based Infrastructure and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

During Construction and Operation of the Marine Terminal and Other Marine-Based Infrastructure, Project activities might interact with the current use of marine resources by Aboriginal persons. However, while the marine terminal would be constructed and operated in an area that could potentially be used for current use, there is no known or documented Aboriginal fishery activity in that area, either for commercial or subsistence purposes. The Marine PDA is far removed from the home ports for current Aboriginal fishermen.

Thus, the potential environmental effects of Construction and Decommissioning and Abandonment of the Marine Terminal and Other Marine-Based Infrastructure, on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, including cumulative environmental effects, were rated not significant. There is a high level of confidence in the significance prediction. The only substantive interaction would be potentially due to vessel traffic in the shipping lanes during Operation further out into the Bay of Fundy. These interactions are ranked as 2 and are considered further in the assessment.

Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment

Residual environmental effects of the Marine Terminal and Other Marine-Based Infrastructure on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are summarized in Table 18.4.

Assessment of Project-Related Environmental Effects

As noted above, there are no known or documented occurrences of any Aboriginal fishing activity in the immediate area where the marine terminal and other marine-based infrastructure would be located. The only activity with potential for an adverse residual environmental effect would involve Project-related vessel traffic in the Bay of Fundy.

During operation, such vessels would increase traffic in the shipping lanes and anchorage areas of the Bay of Fundy, and in the near shore area of the PDA. It is not known, however, precisely where Aboriginal fishermen are currently fishing within the Bay of Fundy.

General reference to commercial fishing licenses held by First Nations individuals from several communities was made during engagement activities, but none of these discussions identified specific instances of documented Aboriginal commercial or subsistence fishery in the Marine PDA, or the vicinity of the Project.

As a result, Project-related vessel activity would not be expected to adversely affect the commercial or Aboriginal fishery in the Bay of Fundy. Vessel traffic would also be within established shipping lanes that are already avoided for fishing activity.

Determination of Significance

The residual environmental effects of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons would occur only during Operation of marine-based activities associated with the Project. Although such residual environmental effects would be considered to be adverse, the Report notes again that no Aboriginal fishing activity has been documented in areas which would be directly affected by the Construction or Operation of the marine terminal.

Increased traffic in the Bay of Fundy during Operation would not expected to affect commercial fishing, as traffic would be expected to be limited to the shipping lanes (where little fishing occurs), and well within their physical capacity With proposed mitigation, the potential environmental effects of a change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, during all phases of the Project, were rated not significant. There is a high level of confidence in these predictions because of the extent of the available information, confirmed through Aboriginal community engagement, and understanding of the key environmental effect mechanisms.

Assessment of Cumulative Environmental Effects

Residual cumulative environmental effects of current and planned land use on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons are summarized in Table 18.5. All projects or activities within the RAA were considered including those with potential to, in combination with the Project, result in a loss of available areas where fishing currently occurs. Potential cumulative environmental effects on the fisheries resource through potential direct harm to commercial fish species, or their habitat, were assessed in Chapter 13 and rated not significant.

There are no significant land-based Project-related environmental effects on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons. As such, other projects and activities noted in Table 18.5 would have neither direct, nor indirect, overlapping environmental effects with the Project, and were thus rated not significant.

Planned marine use, particularly the operation of the Canaport LNG project, would have potential to interact cumulatively with the Project, due to the vessel traffic associated with the LNG facility which could affect Aboriginal fishing activities (*e.g.,* from exclusion zones or from confirmed damage to fishing gear). However, as noted previously, other than in the vicinity of Mispec Point, where there is no known Aboriginal fishing activity, there will be no substantive loss of access to or availability of access to areas currently fished in the Bay of Fundy as a result of the Project. There would also be no substantive overlap with planned marine use including the vessel traffic associated with the Canaport LNG project.

The cumulative environmental effects of the Project with other projects and activities in terms of increased vessel activity would also be expected to be well within the physical capacity of the existing shipping lanes, and would not adversely affect the commercial fishery in the Bay of Fundy, either alone or cumulatively.

Determination of Significance

Given the proposed mitigation for addressing the potential environmental effects of increased vessel traffic on available areas currently fished, and the fact that residual environmental effects of increased vessel traffic from the Project were rated not significant, the cumulative environmental effects of the Operation, alone and in combination with other projects and activities that would also be carried out, were also rated not significant. There is a high level of confidence in these predictions.

Follow-Up and Monitoring

No follow-up or monitoring for the environmental effects of Change in Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is recommended.

Summary

The environmental effects of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons were assessed, according to the potential environmental effects on available areas where Aboriginal fishing currently occurs, as indicated by anticipated changes resulting from Project-related vessel traffic in the Bay of Fundy.

Cumulative environmental effects were similarly assessed, considering the additional potential environmental effects with operation of the Canaport LNG terminal within the LAA.

Based on the Project Description; specific study results, and the proposed mitigation, the potential environmental effects of the Construction, Operation, and Decommissioning and Abandonment of the Project on the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, including cumulative environmental effects, were rated not significant.

Chapter 19 – Heritage and Archaeological Resources

Chapter 19 covers pages 19-1 to 19-30, including 3 figures and 1 table. It defines heritage and archaeological resources as any physical remnants found on top of and/or below the surface of the ground, including on or below the sea floor, that inform us of past human use of, and interaction with, the physical environment. Such considerations include resources of historical, paleontological and architectural significance.

The Report explains that Project Construction would represent the greatest potential for interaction with Heritage and Archaeological Resources, as the majority of ground breaking and earth moving activities would take place during this phase. Any surface or sub-surface ground disturbing activities, occurring in either the terrestrial or marine environments, would have the potential for such interaction. The potential for shipwrecks in the marine environment was noted by regulatory agencies and, anecdotally, by some stakeholders, during public engagement activities. The Report states, however, that the only known Heritage and Archaeological features in the LAA are the archaeological site BhDl-2; linear stone features (LSFs) near Anthonys Cove (BhDl-3), and Fort Mispec. Other than Fort Mispec and its associated structures, no other built heritage resources are known in the PDA (Figure 19.1).

The Report states that the residual environmental effects of the Project on Heritage and Archaeological Resources have been rated as not significant.

With respect to archaeological resources, this finding was based on the limited potential for discovery of archaeological resources, and because the proposed mitigation, including excavation of a known archaeological site (BhDl-2) and removal of LSFs under observation by a licensed archaeologist, would mitigate environmental effects to the extent that they would not be significant.

With respect to built heritage resources, the finding was based on historical research undertaken for the Project, as well as the proposed mitigation that would avoid physical disturbance to Fort Mispec.

The Report notes that a discovery of heritage, archaeological or paleontological resources, or underwater archaeological resources, during Project-related activities, would be defined as an unplanned event and is discussed further in Chapter 23.Sections 19.1 and 19.2 cover pages 19-2 to 19-18 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

<u>Scope of Assessment</u>

- Regulatory Setting
- Issues and Concerns Identified During Regulatory, Public, Stakeholder, and Aboriginal Engagement
- Selection of Environmental Effect
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

<u>Existing Conditions</u>

- Land-Based Existing Conditions
    - Overview
    - Built Heritage Resources
    - Archaeological Resources
    - Existing Knowledge from Previous Studies
    - Built Heritage Resources
    - Archaeological Resources
    - Project-Related Heritage Resource Studies

- Built Heritage Resources
- Archaeological Resources
- Paleontology
- Summary

- Marine-Based Existing Conditions

Potential Project-Valued Environmental Component (VEC) Interactions

The potential interactions between Project-related activities, during each phase of the Project, and potential environmental effects to Heritage and Archaeological Resources, are shown in Table 19.3. The Report notes that only Project Construction activities that would result in substantive physical ground disturbance or earth moving activities would be anticipated to interact with known Heritage and Archaeological Resources.

As noted above, other than these activities, any discovery of an archaeological or heritage resource, during any phase of the Project, would be considered an Accident, Malfunction, or Unplanned Event and is discussed in Chapter 23.

The Report states that existing built heritage resources (including Fort Mispec structures) would be avoided during Construction. The addition of structures associated with the Project, in the vicinity of the remaining Fort Mispec built heritage resources, would not be anticipated to result in a significant environmental effect. Project Operations would not be anticipated to result in disturbance to built heritage resources. Therefore, the potential environmental effects of all Project activities, during Operation, on Heritage and Archaeological Resources were rated not significant.

The Report notes that that any issues that might potentially arise with respect to Heritage and Archaeological Resources during Decommissioning and Abandonment could not be considered, until such future time as an appropriate Decommissioning and Abandonment Plan was developed. Therefore, the potential environmental effects of all Project activities, during Decommissioning and Abandonment, on Heritage and Archaeological Resources were rated not significant.

The Report notes at this juncture that no substantive interactions between the Marine Terminal and Other Marine-Based Infrastructure and Heritage and Archaeological Resources would be anticipated during any phase of the Project. Anecdotal evidence from stakeholders had suggested that Unexploded Ordnance could be present in the Bay of Fundy, near the proposed location of the marine terminal.

Following consultation with a local history expert, it appears that such dumping did occur after the Second World War and the most likely location would have been near the Black Point Ocean Disposal Site. The Report points out that side scan sonar and other surveys in the marine environment, near the planned location of the marine terminal and other marine-based facilities, have found no anthropogenic features. It also explains that, if Unexploded Ordnance was present, it would not be considered a Heritage and Archaeological resource, but rather a potential construction hazard.

The Report notes that similar side scan sonar and other surveys in the Marine PDA did not identify shipwrecks. It points out as well that, if any such wrecks had ever existed in the area, they would be unlikely to remain today, based on the scouring of the marine bottom by Bay of Fundy tides and currents.

The PDA in the marine environment is relatively small, and physical environmental effects on the sea bottom would involve a very small area near the barge landing facility; seawater cooling intake structure (if built); the wastewater outfall, and the jetty.

Given that the area has been thoroughly studied and the physical environmental effects to the sea floor would be limited in spatial extent, no substantive interaction was anticipated between the Project and underwater heritage or archaeological resources. Thus, the potential environmental effects of the Construction, Operation, and Decommissioning and Abandonment of the Marine Terminal and Other Marine-Based Infrastructure, including cumulative environmental effects, on Heritage and Archaeological Resources were rated not significant.

Site and Right-of-Way Preparation, and Construction of Linear Facilities and Watercourse Crossings (Including Wetlands) would have potential to interact with Heritage and Archaeological Resources, due to expected ground disturbance and earth moving activities. Although watercourses typically have elevated potential for archaeological resources, testing in these areas did not encounter any such resources. Thus, Site and Right-of-Way Preparation were the only Project-related activities and physical works carried forward in the environmental effects analysis.

Assessment of Project-Related Environmental Effects

Residual environmental effects of the Petroleum Refinery and Other Land-Based Infrastructure on Heritage and Archaeological Resources are summarized in Table 19.4.
Background research, consultation with members of the public and regulatory agencies, as well as detailed archaeological surveys have resulted in the identification of a number of heritage resources, only two of which would be physically disturbed by Project activities. The barge landing facility and the tank farm would be located in areas of known heritage and archaeological resources, namely the archaeological site BhDI-2 and the LSFs in the Anthonys Cove area (BhDl-3).

The addition of Project-related infrastructure to the immediate context of Fort Mispec might also change the viewscapes and context of these built heritage resources, although the presence of existing industrial development near Fort Mispec) would minimize these potential environmental effects.

Site and Right-of-Way Preparation during Construction was the only identified activity with potential to result in adverse residual environmental effects on Heritage and Archaeological Resources.

Site preparation activities would result in a need for mitigation at the archaeological site BhDI-2, as well as removal of LSFs in the Anthonys Cove area (BhDl-3) to be observed by a licensed archaeologist. Given that BhDl-2 is eroding and likely to be completely lost to researchers in the near future, its excavation by professional archaeologists would be an overall positive outcome. Although there would also be potential for disturbing other currently undiscovered archaeological resources, this would be an unplanned event and, as such, is discussed in Chapter 23.

Proposed mitigation of environmental effects to Heritage and Archaeological Resources would include the following:

- Mitigation (excavation) of the Pre-contact period archaeological site BhDl-2 prior to Construction;
- Ground disturbing activities within 100 m of BhDl-2 would be observed by a licensed

archaeologist;
- Removal of LSFs near Anthonys Cove (BhDl-3) would be carried out under observation by a licensed archaeologist;
- Completion of field work in the preferred linear facilities corridor, once the exact route of linear facilities within the preferred corridor was known, to confirm no Heritage and Archaeological Resources in these alignments;
- Avoidance of physical disturbance to remaining Fort Mispec built heritage resources, through the location of Project facilities and implementation of construction practices to minimize potential environmental effects (*e.g.,* controlled blasting practices).
- Periodic visual inspection, during Site and Right-of-Way Preparation, of areas immediately adjacent to Fort Mispec, to determine if construction activities were affecting the integrity of the remaining Fort Mispec structures.

The mitigation of BhDl-2 would involve the excavation and removal of the site by professional licensed archaeologists prior to Construction, with participation from the Aboriginal community. Archaeological observation of ground disturbance activities within 100 m of BhDl-2, and for the removal of LSFs (BhDl-3), would also be done by a licensed professional archaeologist.

Related inspection activities would be undertaken in consultation with Archaeological Services and Heritage Preservation Services. Although removal of any archaeological site is considered moderate in magnitude, the environmental effects would be is limited to the specific area where the artifacts are located, and could be easily mitigated.

The mitigation of the Pre-contact period archaeological site (BhDl-2) would be conducted by professional archaeologists in accordance with an Archaeological Field Research Licence, and thus conducted in compliance with legislation. A rock bluff identified as a location with elevated archaeological potential in the LAA, would be avoided, and it has also been recommended that the removal of LSFs, already documented and reported to Archaeological Services, be monitored and documented by a licensed archaeologist.

The excavation of BhDl-2 would be a positive outcome, in that this archaeological site is eroding and would eventually be lost if it not excavated. The excavation of BhDl-2 would also add to understanding of the archaeology of the Mispec area. Additional recommended mitigation would include carrying out ground disturbing activities within 100 m of BhDl-2 and Site and Right-of-Way Preparation activities adjacent to Fort Mispec, under the directions and observation of a licensed archaeologist.

The location of the linear facilities would be within a 4 km-wide broad linear facilities corridor. Although there is some potential for Heritage and Archaeological Resources in this corridor, particularly for archaeological sites near watercourses, these areas have been studied extensively for past EIAs (especially the Canaport LNG and Brunswick Pipeline projects) and no documented evidence was found of heritage and archaeological resources.

The preferred linear facilities corridor (Figure 19.1) itself does not contain any known archaeological or heritage resources. Further field work would be conducted in the corridor by completing a Heritage Resource Impact Assessment by a professional archaeologist, prior to initiating Construction. Any mitigation required would be developed and implemented in consultation with applicable regulatory agencies.

Project-related infrastructure planned near Mispec Point would not be anticipated to affect its physical integrity, although its context would change. The Report points out that the Mispec Point area is currently heavily industrialized, so the context of Fort Mispec, as it was during the Second World War, has not been evident for some time. It states that a more important issue is

avoidance of potential physical environmental effects, which is planned as mitigation.

With the exception of the remaining Fort Mispec built heritage resources, which would be physically avoided, Project-related activities would result in removal of Heritage and Archaeological Resources (*i.e.,* LSFs near Anthonys Cove and BhDl-2) in their entirety. The duration of this environmental effect would be permanent and irreversible, although changes in the context of Fort Mispec might be reversible at some future time, following Decommissioning and Abandonment. The geographic extent of this residual environmental effect would be very small and limited to the extent of the archaeological resources themselves.

Assessment of Cumulative Environmental Effects

The potential for the Project to overlap with other projects and activities that have been, or would be, carried out, as defined in Table 6.4, is the key consideration for assessment of cumulative environmental effects.

The only potential areas of overlap between the Project, and other projects and activities that have been, or would be carried out, would be the potential changes to the context of Fort Mispec. Since the discovery of any other archaeological or heritage resource would be considered an unplanned event, any cumulative environmental effects of such discoveries would also be an unplanned event. (Chapter 23)

Further, since there would be no Project-related interaction of the Marine Terminal and Other Marine-Based Infrastructure with Heritage and Archaeological Resources (as determined in Table 19.3), there could be no related cumulative environmental effects.

Residual cumulative environmental effects of current and planned land use on Heritage and Archaeological Resources are summarized in Table 19.5.

With respect to the activities of other projects with potential for cumulative environmental effects, identified industrial land use; infrastructure land use; forestry and agriculture land use; recreational land use; planned future industrial and energy projects that are likely to occur; and planned infrastructure projects, would not take place within the LAA. It would be thus expected no direct environmental effects to Heritage and Archaeological Resources would occur, as a result of such other projects.

Construction of the Canaport LNG project led to the removal of Bunker 3 of Fort Mispec, which further added to changes in the context of the immediate surroundings of the Fort (*e.g.,* the addition of a pier and LNG tanks). Mitigation was proposed as part of the Canaport LNG project EIA and subsequently completed in this regard.

Besides the immediate area of Fort Mispec, there is no potential for other projects and activities to overlap with the environmental effects of the Project during the Construction phase at the two other locations of interest (BhDI-2 and the LSFs at Anthonys Cove, BhDl-3) as they would be removed as a result of the Project. Therefore, future cumulative environmental effects would not be possible.

Determination of Significance

Project-Related Environmental Effects

The residual environmental effects of the Project on Heritage and Archaeological Resources would occur only during Construction. Although the known archaeological resources BhDI-2 and

the LSFs would be permanently removed (an adverse environmental effect), their discovery, mitigation and documentation would help advance knowledge of Heritage and Archaeological Resources in the LAA (a positive outcome, particularly because BhDl-2 is eroding and would be lost without mitigation).

The Report notes there has been a trend towards reduced access, and therefore enhanced security, of remaining Fort Mispec built heritage resources since the 1970s. With the proposed mitigation, including excavation; archaeological observation; inspection by licensed archaeologist and additional field work, the potential environmental effects of Construction, Operation, and Decommissioning and Abandonment on Heritage and Archaeological Resources were rated not significant.

Any adverse environmental effects would be counterbalanced by some positive outcomes, such as the preservation of information that will result from the excavation of BhDl-2. There is a high level of confidence in these environmental effects and significance predictions, because of the nature of mitigation of archaeological resources.

Cumulative Environmental Effects

The residual cumulative environmental effects of the Project and other projects would be anticipated to cause a change in heritage resources, due to the additional change in the setting of Fort Mispec. Besides natural decay which is clearly taking place, vandalism has, in the past, caused considerable damage to the Fort Mispec built heritage resources. Project construction would not physically affect the remaining Fort Mispec structures, and the enhanced security of would be a positive outcome that could further assist in the preservation of these structures.

With the proposed mitigation of archaeological inspection and observation by licensed archaeologists, the cumulative environmental effects of Construction, Operation, Decommissioning and Abandonment, in combination with other projects and activities that could be carried out, on Heritage and Archaeological Resources, were rated not significant. There is a high level of confidence in the environmental effects and significance predictions, because of the nature of mitigation of archaeological resources by a licensed professional archaeological team.

Follow-up and Monitoring

No follow-up or monitoring was recommended.

Summary

The environmental effects of the Project on Heritage and Archaeological Resources were assessed according to the potential environmental effects on the heritage resources, as indicated by anticipated changes resulting from Construction in the PDA. Cumulative environmental effects were similarly assessed, considering the additional potential environmental effects with construction of the Canaport LNG Facility, the existing Canaport terminal, and other projects within the LAA.

Overall, the loss of archaeological sites within the PDA would be a residual environmental effect. Although the predicted magnitude of the environmental effects would be moderate, because archaeological sites cannot be replaced once removed, archaeological site excavation, (mitigation) prior to Construction, and inspection during the removal of LSFs during Construction, would take place in accordance with an Archaeological Field Research License from the Province of New Brunswick. Given that BhDl-2 is eroding and will likely be completely

lost to researchers in the near future, its excavation by professional archaeologists would be an overall positive outcome.

The addition of Project-related infrastructure to the context of Fort Mispec would change the way the Fort Mispec area looks, but this change would be reversible, as the removal of Project-related infrastructure at some future time would be likely to restore the context of Fort Mispec to pre-Project conditions.

Based on the Project Description, and in consideration of the proposed mitigation, the potential environmental effects of Construction, Operation, and Decommissioning and Abandonment on Heritage and Archaeological Resources, including cumulative environmental effects, were rated not significant.

Chapter 20 – Land-Based Transportation

Chapter 20 covers pages 20-1 to 20-39, including 6 figures and 11 tables. It begins by noting that Land-Based Transportation was identified by regulatory agencies, during the scoping phase, and the public during engagement activities, as a component to be assessed.

Concern was expressed by some parties regarding existing heavy truck and industrial traffic in east Saint John, and the Project's expected contribution to traffic in this area.

The rail network was also of concern, as to how it might affect road traffic. The Report notes that rail networks in the area are presently under-used, and well below capacity. This would be expected to continue, even with a Project-related increase in rail traffic.

As such, Project-related capacity concern regarding use of existing rail infrastructure would not be anticipated. The Report does note, however, that the rail line between the Project and Grandview Industrial Park, or McAllister Industrial Park, would have at least two level crossings that might result in further delays to traffic, due to crossing trains.

Vehicles would carry both workers and supplies to the Project Development Area (PDA), which would be likely to result in increased traffic volumes on roads leading to, and from, the Project location. Such increased traffic volumes would have potential to cause traffic delays, by reducing level of service (LOS), and/or damaging road infrastructure, as well as the potential to increase the likelihood of accidents or collisions.

The Report notes that phasing the pace and sequence of Construction, over a duration of approximately six to eight years, would lessen the potential for residual adverse environmental effects on Land-Based Transportation. The number of construction workers would be lower, than if the Project was carried out over a shorter period. The number of vehicles travelling to, and from, the Project site each day would also be reduced. With the proposed mitigation, including provision of bussing for Construction workers to, and from, the Project site, as well as road infrastructure improvements to improve traffic flow, the environmental effects of the Project on Land-Based Transportation would be expected to be not significant.

Proposed mitigation measures would include improvements and upgrades to road network infrastructure; scheduling train use of level crossings to occur outside of peak vehicle traffic times; phasing the pace and sequence of Construction in two distinct phases, carried out sequentially, over a 6-8 year period, and providing bussing for workers directly to the Project site from worker accommodations, as well as from remote parking lots located along major highways, or common collection areas. Sections 20.1 and 20.2 cover pages 20-1 to 20-26 and

provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues Identified During Public, Stakeholder, and Aboriginal Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

- Road
    - Road Network Infrastructure
    - Traffic Volumes and Level of Service (LOS)
    - Traffic Safety
- Rail

Potential Project-VEC Interactions

Potential interactions between Project-related activities, during each phase of the Project, and environmental effects to Land-Based Transportation are shown in Table 20.8. Concern had been expressed, in the case of an emergency, that the Project might prevent emergency access to, or from, the Red Head and/or Mispec areas.

The Report points out, however, that there are three access routes to Mispec (Bayside Drive, Hewitt Road, and Red Head Road). Given the location of the refinery facilities, there would be no foreseeable situations where the Project could affect the road network as far east as the Mispec River Bridge, and beyond.

The refinery component of the Project would be located approximately one kilometre, or more, from the Mispec River Bridge. Accordingly, there would be no foreseeable situations where the Project would interact with Land-Based Transportation such that access to, or from, these areas was prevented. The Report also notes in this context that it's the responsibility of municipal, provincial and federal governments to ensure roadways remain in safe operating condition, such that emergency access is maintained.

Potential Project-related environmental effects to Land-Based Transportation would occur primarily as a result of Project traffic using roadways and railways.

The Project would generate vehicle traffic, due to workers and supply vehicles traveling to, and from, the Project site. Refinery products (*e.g*., liquid petroleum gas) and/or by-products (*e.g.,* sulphur) could also be shipped to markets, at least in part, by rail, via a new rail line, which would be constructed to connect the Project to the Grandview or McAllister Spur.

Increased volumes of road traffic on the Principal Project Access Route could lower the level of service (LOS) at intersections on this route below acceptable limits. An increase in heavy

trucks, in particular, could also damage road infrastructure. Level crossings located along the new Project rail line could cause delays to road traffic, as trains cross. The above Project-related activities during Construction and Operation were thus carried forward in the EIA.

Petroleum Refinery and Other Land-Based Infrastructure Environmental Effects Assessment

Residual environmental effects of the Petroleum Refinery, and Other Land-Based Infrastructure on Land-Based Transportation, are summarized in Table 20.9.

Road Transportation Network – Construction and Operation The entire length of Bayside Drive is a City-designated truck route, which allows any truck configurations and loadings permitted on Provincial and National highway networks. Trucks carrying oversized or overweight loads would require special permits from New Brunswick Department of Transportation (NBDOT). The Proponent would not transport oversized loads without a permit from NBDOT deeming the transport acceptable. As such, the potential environmental effects from the movement of oversized loads for Construction or Operation on Land-Based Transportation were rated not significant.

Proud Road, from Bayside Drive to the Project site, is a narrow, poorly constructed, poorly drained gravel road not constructed to withstand the Project activity planned for Construction and Operation.

To service the Project as a portion of the Principal Project Access Route, Proud Road would need upgrading to a highway standard compatible with the adjoining section of Bayside Drive, and not lower than the provincial standards for Property Access Roads, as determined by NBDOT. As mitigation for potential environmental effects to Land-Based Transportation, the Proponent would work with the City to repair or upgrade Proud Road to standards compatible with Project-related traffic.

Other interactions between the Project and road transportation network infrastructure would be expected to be very limited. Project-related vehicles and heavy equipment would comply with provincial and City of Saint John restrictions, unless specifically permitted otherwise by NBDOT.

The Proponent would provide bussing for construction workers, to, and from, the Project, mitigating potential for overuse of the road network, which might cause premature deterioration.

Construction of two level rail crossings would be conducted, under authorization from the City, and the road condition returned to its original, or better, condition.

Overall, the existing condition of infrastructure in the Saint John road transportation network would be suitable for the Project, which would not be expected to adversely affect it. The Proponent would work with the City to identify planned traffic and maintenance requirements to be undertaken by the City during the course of the Project.

The Proponent would observe provincial and City weight restrictions and delivery of large modules during Construction would generally be by marine transport. Some modules might be transported by road, requiring a permit from NBDOT. Delivery and export of crude oil and refinery products during Operation would be by marine transport.

With these mitigation measures, the potential environmental effects of the Project on the Road Transportation Network infrastructure were rated not significant, because it would not be

degraded to the point that it could not function at the current LOS, and/or result in damage to the infrastructure which would be substantive, and/or irreversible.

Road Traffic Level of Service (LOS) – Construction and Operation The Project would generate vehicle traffic as a result of workers and supply vehicles traveling to, and from, the Project, which would add to existing traffic levels in the City. These increased traffic volumes, although largely confined to the Principal Project Access Route, but also distributed throughout the City, could potentially lower LOS at intersections on this route, below acceptable limits. Level rail crossings could also cause delays to road traffic, as trains cross the road a few times daily. A number of mitigation measures have been incorporated into the Project design and Construction to minimize the potential environmental effects to road network infrastructure and level of service, including:

- Use of marine vessels to transport Very Large Modules and equipment during Construction, to minimize road deliveries of equipment and materials;
- Exclusive use of marine vessels to transport crude oil to the Project;
- Use of rail and marine transportation only to ship finished products from the Project. (Finished products and coke would be shipped by marine vessels. Liquid petroleum gas and sulphur would be shipped by rail, with rail movements scheduled outside peak road traffic times (between 6:00-8:00 and 16:00-18:00). No trucks would be used to ship products;
- Bussing of construction workers, to and from the Project, from designated collection areas at Lorneville, Rothesay, and an appropriate site near the existing refinery.

Phasing the pace and sequence of Construction over approximately six to eight years would mitigate potential environmental effects to Land-Based Transportation, by reducing or limiting road traffic volumes, compared to those which would otherwise result, if construction took place over a shorter period of time.

The Report notes in this context that the LOS analysis was conducted for the Project as a whole, to be conservative, without phasing the pace and sequence of construction. LOS for key intersections along the principal Project access route were predicted for Construction and Operation, based on projected Project traffic volumes detailed in Tables 3.2 and 3.5 Outside of the principal Project access route, potential increased traffic associated with the Project would not be noticeable from current levels, as it would be suitably distributed along various City streets, between areas where workers reside, and where traffic eventually converges at the Principal Project Access Route.

For Construction, LOS estimates were based on traffic volumes expected to be generated by the Project during the morning (AM, 06:00 to 07:00) and evening (PM, 17:30 to 18:30) periods, when Construction workers would be travelling, to and from, the Project. These hours would be the highest periods of Project-generated traffic during Construction. Such AM and PM work trip hours would be outside normal peak traffic periods in east Saint John (which are 07:30 to 08:30 and 16:30 to 17:30). The Report notes that, on occasion, construction work shifts might vary from 07:00 to 17:30 for some workers, although peak Project traffic periods would be expected to remain unchanged.

For Operation, the LOS was calculated for peak traffic periods in the morning and evening (07:30 to 08:30 and 16:30 to 17:30). A comparison of morning and evening peak LOS at these intersections during Project Construction and Operation is presented in Table 20.10, for existing, unimproved and improved intersection configurations.

The Report points out at this juncture that the Land-Based Transportation Technical Study considered overall anticipated traffic requirements for the Project over the previously planned 4-5 year Construction period.

The resulting estimates did not contemplate potential phasing of the pace and sequence of Construction over a 6-8 year period, as currently envisioned. As phasing would reduce daily traffic during Construction, the projected Construction traffic analyzed in the Technical Study was retained in this EIA Report, as a 'worst case scenario.' As such, the LOS data for the phased project would be at least equal to, but likely better than that presented in Table 20.10, and proposed mitigation would be implemented so that an acceptable LOS would be maintained in the LAA.

The Proponent would provide shuttle buses to transport Construction workers, to and from, the Project site. Bussing would also be provided for Construction workers between the worker accommodation facility, if applicable, and the Project site.

The potential location of the worker accommodation facility has not yet been determined, and would be further explored during detailed engineering design. Preference would be given in siting of parking lots to existing lots, or areas within industrial parks or similar facilities, where no clearing, and little (if any) preparation or earth movement would be required. Busing construction workers to the site would greatly reduce the number of vehicles that would otherwise travel in the City and on the Principal Project Access Route each day.

Some limited Construction-related traffic would still occur from passenger vehicles to the Project. With limited parking on-site, however, this would be far less than would otherwise occur with construction workers travelling to the site daily by car or truck.

Table 20.10 shows that, if unmitigated, and ignoring phasing of the Project, the overall LOS at Bayside Drive and Grandview Avenue, during the AM and PM peak, could drop from an existing C to an unacceptable F. The City currently has plans to improve this intersection by realigning Grandview Avenue to intersect Bayside Drive at a right angle, east of its present location. This would also remove the rail spur line from crossing through the Bayside Drive approaches to the intersection. Further mitigation could be implemented for this intersection as well, should the City determine it necessary, in light of phasing of the Project. Such potential improvements would include:

- A second left turn lane from Bayside Drive to Grandview Avenue in the eastbound direction; and
- A second right turn, free flow lane from Grandview Avenue to Bayside Drive.

If these improvements were made, the overall LOS during Construction would be LOS C in the morning, and LOS A during the evening. During Operation, this intersection would operate at LOS B, mornings and evenings. Its operating conditions during the evening peak of Construction, and during Operation, would also be an improvement over the existing operating conditions of LOS C.

Without improvements, and ignoring phasing of the Project, the overall LOS at the intersection of Bayside Drive, at the Courtenay Bay Causeway and Mount Pleasant Avenue, during the AM peak, could be reduced from the existing LOS B to an unacceptable LOS F during Construction and to LOS D during Operation.

With improvements, this LOS could be a very good B during the AM peak. Should improvements be determined necessary by the City, in light of phasing of the Project, potential

improvements at this intersection to mitigate potential effects could include:

- Channelizing, by a median, the right turn lane from the Causeway;
- Adding a receiving lane on Bayside Drive to allow free flow of right-turning traffic from the Causeway; and
- Changing the right turn lane at the Bayside Drive north approach from right turn only to a shared through and right turn lane.

Ignoring phasing, the intersection of Bayside Drive and Red Head Road would operate at LOS F during the morning and evening peaks of Construction, if improvements were not made to the intersection. With mitigation (if determined appropriate by the City in light of phasing of the Project), including improvements to this intersection, the LOS could be improved to B in the morning, and A in the evening. Should improvements be determined to be necessary by the City of Saint John in light of phasing of the Project, improvements to this intersection could include:

- An additional through lane in each direction of Bayside Drive;
- The addition of a 50 m right turn lane on the west approach of Bayside Drive; and
- The addition of a 50 m left turn lane on the east approach of Bayside Drive.

The Heavy Haul Road, located between the barge landing facility and the Project site, would cross Red Head Road to the west of Mispec River Bridge (Figure 20.1) and be used during construction to transport very large modules and equipment, using self-propelled modular transporters. When self-propelled modular transporters cross Red Head Road, traffic would be blocked, resulting in traffic delays. However, crossings would be scheduled outside peak traffic times; local residents notified in advance; warning signs placed, and flag persons would direct traffic during each crossing event.

With the planned mitigation, and in light of Project phasing, the environmental effects of the Project on Land-Based Transportation due to changes in Level of Service during Construction and Operation were rated not significant.

Rail Building the Project rail line would be expected to occur towards the latter phase of Construction. As such, no interactions with the Project would be anticipated during Construction and the environmental effects were are rated not significant. During Operation, the Project would generate rail traffic as the Proponent would ship a limited quantity or products/by-products, including liquid petroleum gas and sulphur to markets, via rail.

The Project would be limited in the number of trains a day, however, as the third party rail operator would maintain three trains per day service to existing customers. As a result, there would be no change in the frequency at which trains would cross roads at existing rail crossings. The Project rail line would have up to two level crossings of roadways along the Principal Project Access Route. Traffic would be stopped while trains cross roadways, leading to slight traffic delays and the potential to lower LOS The length of time roadways would be blocked by trains, however, would be expected to be nominal.

To mitigate any potential environmental effects to Land-Based Transportation, as a result of train traffic lowering roadway LOS, rail car movements would be scheduled to occur outside peak traffic times to minimize traffic delays. Thus, the environmental effects of the Project on Land-Based Transportation due to level crossings during Operation were rated not significant.

Assessment of Cumulative Environmental Effects

Residual cumulative environmental effects of current and planned land use on Land-Based Infrastructure are summarized in Table 20.11.

With respect to other Projects with potential for contributing to cumulative environmental effects, the identified industrial, infrastructure, forestry, agriculture, or recreational land uses, as well as planned or future industrial/energy projects, infrastructure projects, or residential developments, would not be expected to have substantive levels of traffic associated with them.

Associated traffic would also not be expected to travel on roadways within the Principal Project Access Route, or its important feeder streets. Therefore, no direct or indirect cumulative environmental effects would be expected to occur as a result of other projects or activities, and planned mitigation would further reduce the likelihood for such cumulative environmental effects.

The Report points out at this juncture that NBDOT plans to construct a full interchange at One Mile House by 2011. This interchange would extend from Bayside Drive north of Thorne Avenue. It would overpass Rothesay Avenue and Route 1 to connect to Gilbert Street north of Route 1.

The details of this preliminary concept plan are subject to change, as the interchange is presently in the engineering design stage. The final design would provide ramp access to and from Route 1 for all directions of travel. The One Mile House interchange has been conceived to provide a direct connection between the industrial area of east Saint John and Route 1. Its planned completion in 2011 would precede the Operation phase of the Project, and all but the first year of Construction, providing a primary Route 1 access point of the Principal Project Access Route.

A second planned infrastructure improvement is the City of Saint John's plan to improve the intersection of Bayside Drive and Grandview Avenue to allow for better traffic flow. Mitigation implemented specific to the Project was previously described. It would include improvements to the intersection of Bayside Drive, the Causeway and Mount Pleasant Avenue East. Additional signage and careful scheduling of activities would further reduce the likelihood of cumulative environmental effects, as would phasing of construction over approximately six to eight years.

With planned improvements, the residual cumulative environmental effects of the Project, and other projects and activities on Land-Based Transportation, could occur during Construction and Operation and be adverse, though nominal in nature.

With the proposed mitigation, including improvements to road network infrastructure, careful scheduling of Project activities (*e.g.,* train roadway crossings), and provision of bussing for workers to the Project site from remote locations, the cumulative environmental effects of a Change in Land-Based Transportation during the Construction and Operation of the Project, in combination with other projects and activities that would be carried out, were rated not significant.

Similarly, the Project's contribution to adverse cumulative environmental effects of a Change in Land-Based Transportation on Land-Based Transportation during Construction and Operation was rated not significant. There is a high level of confidence in these predictions, because of the nature of the mitigation, and the professional understanding by the Study Team of traffic flow patterns in Greater Saint John.

Follow-up and Monitoring

The Land-Based Transportation Technical Study would be updated, in support of permitting for the Project, to reflect potential changes in mitigation that could arise, as a result of phasing the pace and sequence of Construction, and to confirm the relevant environmental effects predictions. It is largely expected that Phasing of the Project could mitigate the potential environmental effects of the Project on Land-Based Transportation to such an extent, that many of the identified potential road infrastructure improvements might not be required. The determination of which, if any, road infrastructure improvements to the transportation network would be required, in consideration of phasing of the Project, would be made by the City of Saint John.

As the Project design advances, the Proponent would work closely with the City of Saint John to further identify means of mitigating environmental effects, to the extent that they would be not significant, and to identify the requirement for, and implementation of, any improvements that might be needed. On-going monitoring of environmental effects on Land-Based Transportation would be implemented as necessary throughout the Project.

Any incidents that might result from changes in road infrastructure and traffic level of service would be recorded by government agencies. During Construction, if any minor, isolated traffic delays related to specific Construction activities would be expected to occur, additional mitigation, including the use of flag persons to direct traffic, should be considered. It might also be appropriate to periodically monitor traffic flows along the Principal Project Access Route during peak travel periods (morning and evening peaks), during Construction and Operation.

Chapter 21 – Marine Vessel Traffic and Navigation

Chapter 21 covers pages 21-1 to 21-24, including 2 figures and 6 tables. It notes that Marine Vessel Traffic and Navigation was selected as a Valued Environmental Component (VEC), in consideration of the potential effects of Project-related marine traffic and infrastructure on existing patterns of marine transportation and navigation in Saint John Harbour, and the Bay of Fundy shipping lines. Project-related vessel traffic would occur as a result of deliveries of pre-fabricated units and construction materials during Construction, as well as receipt of crude oil, and shipping of finished products, during Operation.

Fishing vessels, cruise ships, a commercial ferry, existing tankers, as well as cargo and container vessels currently operate in the Bay, and their effective safe operation is essential to economic success in the Saint John region.

Project-related shipping activity would be expected to result in higher marine vessel traffic levels in the Bay of Fundy and Saint John Harbour, as well as the area between the existing shipping lanes in the Bay and the Marine Project Development Area (PDA), particularly during Operation. Increased vessel traffic within the jurisdiction of the Saint John Port Authority would result in increased economic activity for the Port, as well as added demand on Port resources, such as tug boats, Harbour Pilots, and anchorage areas.

While there would be potential for these interactions to result in residual environmental effects to Marine Vessel Traffic and Navigation, the existing shipping lanes in the Bay of Fundy, and the capacity of Saint John Harbour, would be able to effectively handle the increased traffic. The responsible authorities would also be able to safely and effectively accommodate Project-related vessel traffic, with use of existing or additional resources (Pilots, tugs, and anchorages) and adapting practices and procedures where required.

With proposed mitigation and adaptation by the authorities responsible for vessel traffic management in the Bay and the Port, the residual environmental effects of the Project on Marine Vessel Traffic and Navigation were rated not significant and would be balanced by increased economic opportunities for the Port of Saint John. Sections 21.1 and 21.2 cover pages 21-1 to 21-13 and provide detailed information on Scope of Assessment, as well as Existing Conditions, under the following sub-headings:

Scope of Assessment

- Regulatory Setting
- Issues and Concerns Identified During Public and Stakeholder Engagement
- Selection of Environmental Effects
- Selection of Measurable Parameters
- Temporal Boundaries
- Spatial Boundaries
- Administrative and Technical Boundaries
- Residual Environmental Effects Rating Criteria

Existing Conditions

Potential Project-VEC Interactions

Potential interactions between Project-related activities, during each phase of the Project, and potential environmental effects to Marine Vessel Traffic and Navigation, are shown in Table 21.3. Marine vessel traffic and navigation activities associated with the Project would occur only within the shipping lanes of the Bay, in Saint John Harbour (at the anchorages), and in the marine PDA. Therefore would be no interactions between the Petroleum Refinery and Other Land-Based Infrastructure and Marine Vessel Traffic and Navigation, for all phases of the Project, including cumulative environmental effects. These environmental effects were therefore rated not significant. There is a high degree of confidence in this prediction.

Potential Interactions Between the Marine Terminal and Other Marine-Based Infrastructure with Marine Vessel Traffic and Navigation

During construction and installation of the jetty and other marine infrastructure, the presence of barges, cranes, and supply vessels could potentially interact with existing vessel traffic in the marine PDA. There would not be large numbers of these vessels, however. The Report also notes there is limited existing vessel traffic in this area, most of which is under the care and control of the Proponent, to supply crude oil to Canaport for the existing Saint John refinery. Such interactions would therefore be minimal.

During Decommissioning and Abandonment, the activities of tugs and barges in the marine PDA would be expected to have only minimal interactions with existing vessel traffic.

Marine Vessel Transportation of construction modules would be anticipated to require approximately 150-200 vessels to travel through the shipping lanes in the Bay, and into the PDA, over the 6-8 year Construction period. This volume of vessel traffic would be very small relative to existing traffic levels (less than 1% of existing levels) and could easily be managed by the Marine Communications and Traffic Services (MCTS) and the Saint John Port Authority with existing resources and procedures. Phasing the pace and sequence of Construction to two distinct phases might also assist in mitigating the potential environmental effects of increased vessel movements delivering equipment to the Project site.

Therefore, the potential environmental effects of Construction, Decommissioning and Abandonment, of the Marine Terminal and Other Marine-Based Infrastructure on Marine Vessel Traffic and Navigation, including cumulative environmental effects, were rated not significant. There is a high level of confidence in this significance prediction.

During Operation, the release of wastewater, cooling seawater (if built) and storm water would be limited to the near shore areas of the marine PDA and would not interact with Marine Vessel Traffic and Navigation, as they would be carried out at depths where they could not interfere with navigation.

The unloading of crude oil at the existing Canaport single buoy mooring (SBM) would require the assistance of tugs and the setting of a safety exclusion zone around the tanker, but this activity is conducted currently by the Proponent, is well managed and understood, and has been demonstrated to be carried out with no significant environmental effects to Marine Vessel Traffic and Navigation.

The utilization of the SBM would not be expected to change substantively from current levels, due to the displacement of smaller crude oil ships, currently unloaded at the SBM, to the jetty. Although these activities would interact with existing vessel traffic, given the low levels of vessel traffic in the PDA, and the existence of mature practices and procedures for these unloading activities, such interactions would not be significant.

The potential environmental effects of these operational activities, including cumulative environmental effects, were therefore rated not significant. The only potentially significant Project interaction with Marine Vessel Traffic and Navigation during Operation would be due to increased marine vessel traffic in Bay shipping lanes, and in the anchorage and pilotage areas, as well as berthing and deberthing activities at Canaport. These interactions were ranked as 2 and considered further in the assessment

Marine Terminal and Other Marine-Based Infrastructure Environmental Effects Assessment

Residual environmental effects of the marine terminal and other marine-based infrastructure on Marine Vessel Traffic and Navigation are summarized in Table 21.4.

The only Project-related activity that would have potential to result in a significant adverse residual environmental effect on Marine Vessel Traffic and Navigation, if not effectively managed, would be the predicted increase in vessel traffic in Bay of Fundy shipping lanes during Operation.

The berthing and deberthing of ships at the jetty, for unloading crude oil and loading finished products onto ships, would require tugs and specialized manoeuvres to facilitate these activities. They would also be subject to a TERMPOL review process to evaluate operational ship safety, route safety, and management and environmental concerns associated with the location, construction and operation of a marine terminal that handles bulk petroleum products, and other navigability concerns.

Once the Project was operational, approximately 30 to 35 very large crude carrier tankers, 25 to 45 Suezmax tankers, and 3 to 15 Aframax tankers would arrive per year to deliver crude oil for the Project. Approximately 280 product tankers and 22 to 30 coke vessels would also be expected to transport finished products to markets each year.

This would represent a 40 to 45% increase in annual vessel calls, relative to 2007 vessel traffic. These vessels, in addition to the tug boats and Pilot ships required for safe navigation, would

place additional demands on the four anchorage areas, and the services of Harbour Pilots and tugs. The increase in vessel traffic could also potentially lead to a change in navigation routes for existing traffic, such as commercial fishermen.

Project tankers entering the Port of Saint John would require the services of Harbour Pilots and tug boats. It is estimated that each vessel would require a minimum of two Pilot-assisted movements per visit; one movement to berth, and one movement to deberth. Some vessels may also visit anchorage areas, before or after berthing, though this occurs less frequently, and vessels often anchor in the outer anchorage areas, outside of the compulsory pilotage area.

Between 2004 and 2007, there were approximately 1,639 Pilot-assisted vessel movements (on average) within the Port of Saint John each year. Assuming a minimum of two Pilot-assisted movements per vessel, during the Operation of the Project, there would be a need for approximately 720 to 810 additional Pilot-assisted vessel movements each year. The Atlantic Pilotage Authority has plans to hire and train at least two additional Harbour Pilots in preparation for the Project to meet this additional demand.

Tug boats would be required to guide vessels in and out of berths, and assist with other manoeuvring. The increase in tanker traffic associated with the Project would place an increased demand on tug services. However, in anticipation of increased vessel traffic from the Project, more tugs would be added to meet the increased demand.

The availability of anchorage areas is also a limiting factor to Port activity. Vessels might anchor for several reasons that include waiting for tide or weather conditions to allow berthing, and waiting for tugs, Pilots and/or a berth to become available. The Saint John Port Authority has indicated that they would accommodate all foreseeable future demands on anchorage areas, and, as such, there would be no shortage in anchorage capacity, as a result of the Project. Because of the small size and quantity of the dredges and scows used in Saint John Harbour, and the mobile nature of their work, the Project would not have any significant environmental effects on dredging activities within the inner Harbour. As a result of navigational simulations; modelling which would be conducted, as well as the training and experience of Harbour Pilots that guide vessels to and from berths, the Project would not have any significant environmental effects on the Black Point ocean disposal site. Groundings of vessels on the disposal site or elsewhere would be considered an accidental event, and are addressed in Chapter 23.

The Port of Saint John has a well-managed traffic control system in place, which is operated by the MCTS, a service of the Canadian Coast Guard, in conjunction with the Saint John Port Authority and the Atlantic Pilotage Authority. Discussions with experts from these regulatory authorities have indicated they would welcome the increase in business and vessel traffic from the Project, and that they would be able to safely manage the increase in vessel traffic, by adding resources and adapting existing practices and procedures where required. The safe and effective management of the increased vessel traffic in the Port of Saint John would be assisted by several mitigation measures, including:

- Use of established shipping lanes and anchorages by Project vessels, in compliance with all applicable legislation, codes and standards of practice for shipping;
- Establishment of practices and procedures for marine terminal operations as defined in a Marine Terminal Manual;
- Hiring of additional Harbour Pilots by the Atlantic Pilotage Authority, if determined to be required by that organization;
- An increase in the capacity of the tug boat fleet in Saint John Harbour, if determined to be required;

- The completion of a TERMPOL review process for the Project and implementation of any required mitigation identified through that process.

Determination of Significance

The residual environmental effects of the Project on Marine Vessel Traffic and Navigation would occur only during Operation of marine-based activities associated with the Project. Although the increase in vessel traffic would affect existing vessel traffic and management, MCTS, the Saint John Port Authority, and the Atlantic Pilotage Authority, would safely and effectively manage the increase in traffic by adding resources (*i.e.,* tugs, Pilots, and anchorages) and adapting existing practices and procedures.

The existing shipping lanes in the Bay of Fundy are not currently fully used, and would be able to handle additional vessel traffic generated by the Project.

With the proposed mitigation, the potential environmental effects of the Change in Marine Vessel Traffic and Navigation resulting from the Operation of the Project were rated not significant. There is a high level of confidence in this effects and significance prediction, because of the extent of the available information, confirmed through expert stakeholder engagement, and understanding of the key environmental effect mechanisms.

Assessment of Cumulative Environmental Effects

Residual cumulative environmental effects of current and planned projects and activities on Marine Vessel Traffic and Navigation are summarized in Table 21.5. For the purposes of cumulative environmental effects assessment on Marine Vessel Traffic and Navigation, all projects or activities within the RAA were considered including those with potential to, combination with the Project, result in a change to Marine Vessel Traffic and Navigation.

As noted previously, there are no significant Project-related environmental effects on land. As such, other projects and activities noted in Table 21.5 regarding industrial land use, infrastructure land use, forestry and agricultural land use, recreational land use, planned future industrial and energy projects, and planned infrastructure projects, were rated not significant.

Residual cumulative environmental effects of current and planned marine use on Marine Vessel Traffic and Navigation are assessed in Table 21.6.

Planned marine use, particularly operation of the Canaport LNG project, has the potential to interact cumulatively with the Project, due to the vessel traffic associated with the operation of the LNG facility and marine terminal.

Construction of the Canaport LNG marine terminal is now complete, and once it becomes operational, approximately 120 LNG tankers would be expected each year. Because of the unique nature of the LNG tankers and marine terminal, three tug boats would be stationed at the marine terminal exclusively to assist LNG vessel movements.

The Canaport LNG project would therefore not place additional demands on tug boat resources within the Harbour. LNG tankers would act cumulatively with the Project to increase the demand for Pilots and for anchorages. However, the Atlantic Pilotage Authority and the Saint John Port Authority have indicated that they would be able to safely accommodate increases in vessel traffic by adding resources and adapting existing practices and procedures.

There are other planned shipping activities in the Port of Saint John (*e.g.,* increased cruise ship activity, potential shipping of natural gypsum via barge for the Atlantic Wallboard Limited Partnership operation, and shipping of petroleum coke for the Coleson Cove Generating Station).

These other activities amount to only a few ships per year, however, and could not possibly be the cause of significant cumulative environmental effects by overlapping with those of the Project. The gypsum plant estimates approximately 41 barges per year for shipping natural gypsum to its operation, and NB Power estimates approximately 12 ships per year for shipping petroleum coke to the Saint John region.

The same mitigation previously identified would minimize cumulative environmental effects to Marine Vessel Traffic and Navigation, in addition to similar mitigative measures for the Canaport LNG project.

Determination of Significance

With the proposed mitigation, including hiring of additional Saint John Harbour Pilots and commissioning of additional tug boats as currently planned by the respective local authorities, the Project contribution to cumulative environmental effects of change to navigation on Marine Vessel Traffic and Navigation, during Construction and Operation of the Project, was rated not significant. There is a high level of confidence in the cumulative environmental effects and significance predictions, because of the extent of the available information and understanding of the key environmental effect mechanisms.

Given the proposed mitigation for addressing the potential environmental effects of increased vessel traffic in the Bay of Fundy, and since the residual environmental effects of increased vessel traffic from the Project were rated not significant, the cumulative environmental effects of the Operation of the Project, alone and in combination with other projects and activities that would be carried out, on Marine Vessel Traffic and Navigation, were also rated not significant. There is a high level of confidence in these predictions.

Follow-up and Monitoring

No follow up or monitoring for the environmental effects of Marine Vessel Traffic and Navigation is recommended.

Summary

The environmental effects of the Project on Marine Vessel Traffic and Navigation were assessed according to the potential environmental effects on the ability of MCTS, the Atlantic

Pilotage Authority, and the Saint John Port Authority to safely and effectively manage the anticipated increase in vessel traffic in the Bay of Fundy.

Cumulative environmental effects were similarly assessed, considering additional potential environmental effects with operation of the Canaport LNG terminal within the Local Assessment Area (LAA). Based on the Project description, and in consideration of the proposed mitigation, the potential environmental effects of Construction, Operation, Decommissioning and Abandonment on Marine Vessel Traffic and Navigation, including cumulative environmental effects, were rated not significant.

Chapter 22 – Effects of the Environment on the Project

Chapter 22 covers pages 22-1 to 22-22, including 3 figures and 1 table. It begins by explaining that CEAA defines effects of the environment as “any change to the project that may be caused by the environment…whether any such change or effect occurs within or outside Canada.” The Report notes as well that potential effects of the environment on any project are a function of project or infrastructure design, and the risks of natural hazards and influences of nature. Such effects might result from physical conditions, land forms, and general site characteristics which could act on the Project, so that its components, schedule and/or costs could be substantively and adversely changed.

The Report states that environmental conditions that could potentially affect Project Construction, infrastructure or operational performance, would be communicated to the Design Team, and addressed through engineering design and industry standards. It points out that good engineering design involves consideration of environmental effects, and loadings or stresses from the environment, on the project concerned.

The Report notes that engineering design for this Project would be no exception. It further explains that long term environmental management and project longevity are inherent considerations in the best management practices of project design and development. As a matter of accepted engineering practice, responsible and viable engineering designs consistently overestimate and account for possible forces of the environment. This means they naturally incorporate several factors of safety to ensure a project is designed in a safe, reliable, and diligent manner.

The Report also notes that the very nature of the Project—refining crude oil to produce transportation fuels using a variety of physical, chemical and catalytic processes—requires that design and construction materials used as part of such a project are able to withstand considerable stresses.

Equipment and materials would be used that could withstand extremely high temperatures, pressures, corrosive environments, and other factors. By selecting construction materials, designs and practices that accommodate these pressures arising from the process itself, environmental stressors—such as those that could arise as a result of climate change, severe weather, acid rain, and other factors—would be more than adequately addressed by engineering design, materials selection, and engineering foresight.

The Report points out that strategies for minimizing the likelihood of a significant effect of the environment on the Project, would also be inherent in the planning process, engineering design codes and standards, construction practices, and monitoring. As such, and considering the best management practices that would be applied throughout the design, Construction, Operation, and Decommissioning and Abandonment of the Project, the effects of the environment on the

Project during all its phases would be managed through responsible design and were thus rated not significant.

Sections 22.1, 22.2, 22.3, 22.4 and 22.5 cover pages 21-1 to 22-21 and provide detailed information on Environmental Attributes, Selection of Effects, Environmental Assessment Boundaries, Residual Effects Rating Criteria, and Effects Analysis, under the following sub-headings:

Environmental Attributes

Selection of Effects

Environmental Assessment Boundaries
- Spatial Boundaries
- Temporal Boundaries

Residual Effects Rating Criteria

Effects Analysis

- Effects of Climate on the Project
    - Existing Conditions: Climatological Background (1971 to 2000)
    - Temperature and Precipitation
    - Fog
    - Wind and Sea Spray
    - Severe Weather Events
    - Tidal Conditions
    - Storm Surges and Waves
    - Climate Change
    - Sea Level Rise and Storm Surges
    - Assessment of Effects of Climate on the Project
    - Effects of Climate on Construction
    - Effects of Climate on Operation
- Effects of Seismic Activity on the Project
- Effects of Acid Rock Drainage on the Project
- Effects of Acid Rain/Acid Fog on the Project
- Effects of Forest Fires on the Project

Determination of Significance

After considering potential effects of the environment on the Project, professional engineers would design the Project to withstand these conditions by applying good engineering practices, various codes and standards from the National Building Code, and other sources. The environment could potentially have an effect on the Project, specifically during Construction and Operation, but this would be mitigated through careful design, in accordance with factors of safety, best engineering practice, and adherence with standards and codes.

Mitigation measures and strategies, as well as selection of materials that would be able to withstand high pressures, temperatures, corrosion, and loads typically found in refineries, would be more than adequate to address these concerns. Additional mitigation to the selection of materials for withstanding these and other potential environmental stressors (*e.g.,* climate, sea spray, seismicity, and other effects of the environment) would include engineering specifications which contain design provisions such as:

- Critical structures, piping, tanks and pressure vessels constructed with resilient materials to prevent brittle fracture at low ambient temperature conditions;
- Piping designed to prevent overpressure due to volumetric expansion as a result of solar heat gains;
- Materials selected and designed to withstand, or be protected from, acid corrosion;
- Winterization and freeze protection.

In consideration of significance criteria, the Project would be mitigated such that the environment would not affect the Project to the extent that there is:

- A substantial loss of the Project schedule;
- A substantive interruption in service;
- Damage to the Project infrastructure resulting in a substantial increase in public health and safety risk, or business interruption;
- Damage to the Project infrastructure resulting in repairs that could not be technically or economically implemented;
- Failed mitigation, causing environmental damage that could not be technically or economically corrected, or compensated in a feasible manner.

Planning, design, and construction strategies intended to minimize the potential effects of the environment on the Project would reduce the risk of serious damage or interruption of service to acceptable levels. Mitigation measures would include, among other things, designing structures to relevant codes and standards and applying conservative factors of safety to mitigate the potential effects of the environment (*e.g.,* earthquakes, climate change, global sea level rise, extreme weather, and other environmental phenomena), and scheduling of activities to allow for weather disruptions.

A significant effect of the environment on the Project would be one that would result in a catastrophic interruption in service, or damage to infrastructure, that would persist for greater than three months, or that would result in repairs that could not be economically implemented. Based on a consideration of the various mitigation measures and strategies described in the Project Description and other sections of this EIA Report, it is concluded that the effects of the environment on the Project during any phase of the Project would not be significant and, would be managed by responsible design. Similarly, the effects of the environment on the Project were cumulatively rated not significant.

Chapter 23 – Accidents, Malfunctions and Unplanned Events

Chapter 23 covers pages 23-1 to 23-120, including 23 figures and 43 tables. It begins by pointing out that, even with the best planning and mitigation, Accidents, Malfunctions, and Unplanned Events might occur during any phase of the Project, as a result of abnormal operating conditions, process upsets, wear and tear, acts of nature, extreme weather events, human error, equipment failure, or other possible causes.

It also notes, however, that many accidents, malfunctions, and unplanned events are preventable, and can be readily addressed, or prevented, by good planning, design, equipment selection, hazards analysis, corrective action, emergency response planning, and mitigation.

The Report states that the Project would be designed, constructed and operated, with utmost regard for health, safety and environmental protection, to minimize potential environmental effects. Prevention and mitigation would be accomplished by adhering to the following general principles:

- Using best available, proven, economically viable technology, for controlling and minimizing releases to the environment;
- Incorporating safety and reliability by design, as well as applying principles and practices of process safety management;
- Implementing effective emergency planning and preparedness;
- Developing and applying procedures, and training, aimed at safe operation of facilities,

in a manner which prevents or avoids potential upsets that might lead to Accidents, Malfunctions and Unplanned Events.

The Report notes that detailed discussion of the elements and assets, selected to accomplish safe, reliable, and environmentally responsible Project implementation were previously provided in Chapter 3, as well as how it would be carefully constructed, operated, and ultimately decommissioned, in a manner which minimizes potential for Accidents, Malfunctions, and Unplanned Events. Project components would be inherently safe by design and follow strict codes and standards. A Quality Assurance system would be implemented to ensure that final design was in accordance with safety standards, with considerable factors of safety.

Hazards and Operability Analysis, Layers of Protection Analysis, and other process safety management initiatives would provide an additional level of assurance to minimize potential for upsets, unintentional releases or hazardous conditions. These and other measures, implemented at the planning and design stages, would be inherently intended to minimize potential for Accidents, Malfunctions, and Unplanned Events. With their development and implementation, the Report states that the probability of, or potential for, such events would be greatly reduced.

In the unlikely event of an Accident, Malfunction, or Unplanned Event, emergency response plans and corrective action would be implemented to minimize resulting environmental effects. Employees would be trained in operational and environmental emergency response procedures, including safety measures, to prevent and respond to Accidents, Malfunctions, and Unplanned Events. Several environmental management measures would be developed, including, among others, the following elements:

- Health, Safety, and Environmental Management System;
- Standard Operating Procedures;
- Public Awareness and Communication;
- Employee Environmental Training;
- Environmental Protection Plan for Construction;
- Emergency Response Plan for Operation;
- Oil Spill Response Planning;
- TERMPOL Review Process;
- Marine Terminal Manual

The focus of this assessment is on credible accidents or scenarios, which would have a reasonable probability of occurrence, and, for which, the resulting environmental effects could be significant, in relation to identified thresholds of significance for each VEC. To further elaborate on this concept of ‘credibility’, the Report explains that its focus is on consequences of the environmental effects resulting from the accident or scenario, rather than on the mechanism by which the accident or scenario might occur.

Accidents, Malfunctions and Unplanned Events, identified as credible, have been evaluated in isolation, as the probability that a series of accidental events might occur in combination with each other is highly unlikely.

The Report explains that, on their own, such events would generally have very low probability of occurring and the likelihood of their environmental effects would also be low. It further notes they would have an even lower likelihood of occurring together. Therefore, such a combination would not be considered credible, nor have any measurable probability of occurrence. The Report also notes that the assessment of Accidents, Malfunctions, and Unplanned Events

necessarily differed from the EA methodology previously described in Chapter 5 for routine Project activities, with respect to the following key issues.

- Only Project-related environmental effects of Accidents, Malfunctions and Unplanned Events were assessed. Since accidents are inherently unplanned events and, for the most part, very unlikely to occur, the Report explains that it's not reasonable to assess their cumulative environmental effects as potentially overlapping with other existing or planned future projects. Any cumulative environmental effects that might possibly occur from accidents overlapping those of other projects and activities would be short-lived, and thus expected to be largely encompassed within the earlier cumulative effects assessments regarding Construction, Operation, Decommissioning, and Abandonment

- The potential environmental effects of Accidents, Malfunctions, and Unplanned Events on many of the socio-economic VECs were not explicitly assessed in any detail, other than to acknowledge their interaction, wherever one existed.

- Other than for incident investigation and corrective action implemented following an Accident, Malfunction, or Unplanned Event, follow-up and monitoring was not further addressed in this chapter, as any Project-related accidental event would be one that would be, by its very nature, unplanned, and thus would require specific measures to be developed, in the unlikely event that it might occur.

Since it was impossible to review and assess all possible accidents, malfunctions and upset conditions, scenarios were conservatively selected, representing higher consequence events that would more than adequately address the consequences of less likely, or lower consequence, scenarios. These Accidents, Malfunctions, and Unplanned Events, along with the scenarios through which they might occur, are summarized in Table 23.1.

Process Malfunctions Resulting in Emissions to the Atmosphere

Scenarios selected in this regard were intended to encapsulate the range of operating conditions of refinery process units that might occur, outside the realm of normal routine operation. Intermittent process malfunctions, generally referred to as 'upsets', could result in adverse environmental effects, particularly if they involved short-term emissions to the atmosphere which would be higher than those during normal operation. Such events would have the potential to result in adverse environmental effects on Atmospheric Environment and other VECs.

However, such potential environmental effects of a Process Malfunction Resulting in Emissions to the Atmosphere would not be expected to be significant. This would mainly be due to the low probability, frequency, or duration of any process upsets, and/or resulting environmental effects, as well as planned mitigation that would be implemented as part of Design, Construction, and Operation of the process units, to inherently minimize potential emissions and resulting environmental effects, even during an Accident, Malfunction, or Unplanned Event. Section 23.1 covers pages 23-7 to 23-29, and provides detailed information on Process Malfunctions Resulting in Emissions to the Atmosphere, under the following sub-headings:

- Description of Scenarios
    - Loss of a Tail Gas Treatment Unit
    - Hydrocracker Unit Depressurization
    - Air Contaminant Emissions
    - Sound Emissions

    - Total Power Failure
    - Loss of a Vapour Recovery Unit
- Environmental Effects Assessment
    - Atmospheric Environment
    - Health and Safety
    - Land Use

Determination of Significance

As summarized in Table 23.8, three VECs were identified as potentially interacting with emissions to the atmosphere during process malfunctions, such that significant adverse environmental effects might occur. The effects of process upsets on all other VECs were previously rated not significant. Those interactions that required further evaluation were:

- Atmospheric Environment;
- Health and Safety;
- Land Use

The residual environmental effects on Atmospheric Environment, due to an increase in emissions to the atmosphere during process malfunctions, would be expected to be local in extent, short-term in duration, and would seldom occur. Occurrence of process malfunctions would be minimized through process design, reliability and training, as well as using the mitigation activities specifically described in Section 23.1.2.

The magnitude of any residual environmental effect on Atmospheric Environment was not predicted to be substantive.

With the exception of the loss of a Tail Gas Treatment Unit (TGTU), the residual environmental effects on Public Health and Safety, due to an increase in emissions to the atmosphere during process malfunctions, would be expected to be negligible, since the health risks at each of the human receptor locations would largely meet benchmark criteria, or would be associated primarily with existing baseline concentrations.

The maximum Concentration Ratio (CR) value associated with the loss of a TGTU would exceed the benchmark of 1.0 for hydrogen sulphide (H_2S) and sulphur dioxide (SO_2). However, the probability of the public being exposed to these predicted maximum ground-level concentrations would be very low, as it would require loss of a TGTU to occur, at the very same time as the worst-case meteorological condition observed during the modelled five year period. Thus, any residual environmental effect on Health and Safety would not be expected to be substantive.

The residual environmental effects on Land Use, due to an increase in emissions to the atmosphere during process malfunctions, would be expected to be local in extent and short-term in duration, with a low frequency of occurrence.

The number of process malfunctions would be minimized through mitigation activities and, as such, any residual environmental effects on Land Use would not be expected to be substantive. The residual environmental effects of a Process Malfunction Resulting in Emissions to the Atmosphere on Atmospheric Environment, Health and Safety, and Land Use, during all phases of the Project, were rated not significant.

There is a moderate level of confidence in these significance predictions, because of the inherent uncertainties in magnitude, frequency and duration of such malfunctions and unplanned events, at this early stage of engineering design for the Project. EIA/EA predictions in this regard would be verified during detailed engineering design.

Fire or Explosion

A Fire or Explosion would have the potential to occur as an Accident, Malfunction or Unplanned Event involving a tank, a process unit, or a hydrocarbon pipeline associated with the Project. While all reasonable precautions have been taken, and would be taken during Project execution to prevent a fire or explosion, if one occurred, and was not carefully managed or responded to in a timely and appropriate manner, it could:

- Cause injury or mortality to people at or surrounding the site of the accident;
- Cause harm or mortality to freshwater, terrestrial, and marine species;
- Increase demands on local emergency response systems.

The Report points out at this juncture that this specific discussion relates to a potential fire or explosion that could occur on or in the land-based components of the Project, and is focused on a major fire or explosion that might endanger health and safety. It further notes that the Proponent has operated the existing Saint John refinery for several decades, and accordingly, has considerable experience and expertise in safely operating such a facility and associated infrastructure.

Preventive programs and policies, and a well developed emergency response plan, are in use at the existing Saint John refinery, and would be developed for the Project. Fire fighting capabilities would be available on site, appropriate to the stage of the Project (*i.e.*, Construction or Operation). All Project personnel would be thoroughly trained in safe work practices to prevent a fire or explosion from occurring and, in emergency response procedures, should one occur. Planned safety by design, and other process safety management principles espoused by the Proponent as a part of the Project, would be instrumental in preventing all accidents, including fires and explosions.

If a Fire or Explosion were to occur, its potential environmental effects on the Atmospheric Environment, Health and Safety, and the Freshwater Aquatic Environment could potentially be significant. However, because of the considerable planning, design, prevention, and response measures that would be implemented as part of the Project, it would be very unlikely to occur. Thus, the significant environmental effects of such an event would also be very unlikely to occur. The environmental effects of a Fire or Explosion, on all other VECs, would be not significant.

Mitigation measures proposed to minimize adverse environmental effects of a Fire or Explosion would include that the Project be designed, constructed and operated, using best available, proven, economically viable, technology, to ensure its environmentally compatible operation.

The Report states that safety is the key value that guides the Proponent's operations. As such, safety would be incorporated into the design, construction, and operation of all Project aspects. Process equipment would be monitored and inspected routinely for signs of damage or wear, and repaired or replaced, as determined appropriate by registered professional engineers and other experts. Safety control systems would have redundancy, be able to operate on back-up power, and designed to minimize consequences from any potential failures.

Fail-safe mechanisms would be used to accomplish the safe and effective control of the process during normal operation, as well as during start-up or shut-down. Refinery and tank farm areas would be protected by an extensive fire protection system. Hydrocarbon pipelines would be constructed of durable materials selected to minimize any potential for a pipeline rupture, and follow all applicable codes. The Project would have a comprehensive emergency response plan, with the goal of quickly containing any minor incident, before it could escalate to a major fire or explosion.

Section 23.2 covers pages 23-29 to 23-41, and provides detailed information on Fire or Explosion, under the following sub-headings:

- Description of Scenarios
    - Fire or Explosion from a Tank
    - Fire or Explosion in a Process Unit
    - Fire or Explosion from a Hydrocarbon Pipeline
- Environmental Effects Assessment
    - Atmospheric Environment
    - Health and Safety
    - Freshwater Aquatic Environment
    - Terrestrial Environment
    - Land Use

Determination of Significance

The potential environmental effects of a Fire or Explosion on Atmospheric Environment, Health and Safety (Public Safety), and Freshwater Aquatic Environment, were rated significant, but unlikely to occur.

However, the potential effects of a Fire and Explosion on Health and Safety (Public Health), Terrestrial Environment and Land Use were rated not significant. There is a moderate to high level of confidence in these predictions.

Capacity of Renewable Resources to be Significantly Affected In the unlikely event of a Fire or Explosion that could result in a significant environmental effect on the Atmospheric Environment, the duration of the Change in Air Quality would be short-term and fully reversible. Thus, the capacity of the renewable resource would not be affected.

In the unlikely event of a fire or explosion, a significant environmental effect on Health and Safety (Public Safety) could occur. Issuance of advisories and/or evacuation orders, however, and other means, would limit extent and duration of exposure to conditions that could result in a Change in Public Safety of the general population. Accordingly, the capacity of the renewable resource would not be affected.

In the unlikely event of significant environmental effect on the Freshwater Aquatic Environment, as a result of a fire or explosion from a hydrocarbon pipeline, the capacity of the renewable resource would likely not be affected, as the habitat and population would likely recover. It would also be unlikely that such an event would affect inner Bay of Fundy Atlantic salmon, their habitat or their ability to recover from cumulative environmental effects, as discussed in Chapter 10.

Land-Based Hazardous Material Spill

A Land-Based Hazardous Materials Spill would have potential to occur, primarily due to spills from pipeline ruptures, equipment spills, or tank leaks or ruptures.

The Report notes in this context that the leading cause of spills is due to operational or human error. Such accidents would have potential to spill hazardous substances, such as gasoline, diesel, natural gas, oil, hydraulic fluid, chlorinated drinking water, or industrial chemicals, into the environment, which could result in adverse environmental effects. The accidents described in the assessment were considered to be 'worse case' scenarios. Construction Operation, Decommissioning and Abandonment would be conducted to minimize the potential for adverse environmental effects from such accidents.

Preventive programs, policies, and a well developed emergency response plan, would be developed for the Project. As conceived, planned, and designed, it would inherently provide a high level of mitigation for the potential environmental effects of a Land-Based Hazardous Material Spill. As such, these potential effects were rated not significant, and not likely to occur. Section 23.3 covers pages 23-41 to 23-46, and provides detailed information on Land-Based Hazardous Material Spill, under the following sub-headings:

- Description of Scenarios
    - Spill or Leak from Pipeline Rupture
    - Equipment Spill
    - Tank Leak or Rupture.
- Environmental Effects Assessment
    - Freshwater Aquatic Environment

Determination of Significance

Based on the information provided earlier, and considering the residual environmental effects criteria for Freshwater Aquatic Environment in Chapter 10, as well as planned mitigation, the potential environmental effects of a Land-Based Hazardous Material Spill on the Freshwater Aquatic Environment, during all phases of the Project, were rated not significant. There is a high level of confidence in the prediction.

Loss of Containment

Loss of Containment has potential to occur, primarily due to failure of erosion and sedimentation control measures, breach of secondary containment for tanks, or breach of wastewater treatment systems. Such accidents could spill hazardous substances such as petroleum products, gasoline, diesel, oil, industrial chemicals, or water containing suspended solids, into the environment, resulting in potentially adverse effects. The accidents described in the assessment were considered to be 'worse case' scenarios.

Construction, Operation, and Decommissioning, and Abandonment phases of the Project would be conducted to minimize potential for such adverse environmental effects. Preventive programs, policies, design, and a well developed emergency response plan, would be developed for the Project. As conceived, planned and designed, the Project would inherently provide a high level of mitigation for the potential environmental effects caused by loss of containment. Therefore, such potential environmental effects were rated not significant.

Section 23.4 covers pages 23-46 to 23-51, and provides detailed information on Loss of Containment, under the following sub-headings:

- Description of Scenarios
    - Failure of Erosion and Sedimentation Control Measures
    - Breach of Secondary Containment for Tanks
    - Breach of Wastewater Treatment Systems

- Environmental Effects Assessment
    - Freshwater Aquatic Environment

Determination of Significance

Based on the information provided earlier, and considering the residual environmental effects criteria for Freshwater Aquatic Environment in Chapter 10, as well as planned mitigation, the potential environmental effects of a Loss of Containment on the Freshwater Aquatic Environment, during all phases of the Project, were rated not significant.

In light of Project design and planned mitigation, adverse environmental effects to the Freshwater Aquatic Environment from Loss of Containment would not be likely to occur. There is a high level of confidence in this prediction.

In the unlikely event that the loss of containment might affect an inner Bay of Fundy Atlantic salmon, there would be potential for a significant environmental effect. This would be extremely unlikely to occur, however, because the Atlantic salmon found in the Mispec River, and its tributaries, are not inner Bay of Fundy Atlantic salmon, and because of planned mitigation to prevent significant adverse environmental effects. There is a high level of confidence in this prediction.

Hydrocarbon Spill in the Marine Environment

A Hydrocarbon Spill in the Marine Environment would have potential to occur, primarily due to an accident during loading or unloading activities at the marine terminal, or due to tanker collision, or grounding. Such accidents would have potential to spill diesel and other products, or heavy crude oil, into the marine environment. This assessment focused on crude oil and diesel, the two persistent oils that would be produced by the Project, which are of most concern from a spill perspective.

Recent international oil tanker spill statistics reveals that spill rates have been declining steadily since the 1970s, and spill rates in the 2000s are about half the spill rates recorded before 1999. A review of spill history for Saint John shows there has been only one ship sourced spill since 1999, and none greater than 1 barrel (bbl).

Probabilities indicate that small spills (1 to 49 bbl) would be likely to occur during the life of the Project, but the likelihood of larger spills would be extremely low. Conservative spill rates were calculated for 1985-99, regarding average international oil tankers. The Report notes that tankers, procedures and regulations that apply to, and would be used for the Project, would be much safer than the assumed tanker technology in the 1985-99 spill rate calculations.
For example, all ships operated by Irving Oil are double-hulled, and third parties carrying crude oil or products for the Project would be encouraged to use double-hulled ships. In the past few decades, there has been international focus and effort on improving hydrocarbon shipping safety. Newer, but incomplete, data sets indicate a very substantial trend towards fewer spills. This has been coupled with other improved mitigation, in relation to an increasing trend in double-hulled ships and improved emergency response, which in Canada, is very well regulated under the Canada Shipping Act.

The Report explains in this context that the behaviour of oil spills is dependent on a number of factors, including the size of the spill, the type of oil spilled (heavy crude vs. diesel), location of the spill, time of year, wind speed and direction, air temperature, tidal cycle, as well as the timing and level of emergency response and clean-up. Depending on the specific conditions at the time, a large spill could potentially affect several VECs in the Bay of Fundy. Through all

phases of the Project, preventative measures would be implemented to avoid Hydrocarbon Spills to the Marine Environment, including the following:

- Health, Safety and Environment Management System;
- Standard Operating Procedures;
- TERMPOL review process;
- Marine Terminal Manual; and
- Environmental Protection Plan for Construction.

Prevention of, and response to, oil spills in the Marine Environment are very strictly regulated in Canada to prevent and minimize their consequences. Prior to commencement of Operation, an Oil Handling Facility Oil Pollution Emergency Plan would be prepared in accordance with the Response Organizations and Oil Handling Facilities Regulations under the Canada Shipping Act. The Proponent would also be responsible for having a contractual arrangement with ALERT Inc., the Bay of Fundy Response Organization responsible for having oil spill procedures, equipment and resources to respond to an oil spill of more than 50 bbl and less than 10,000 t.

Ships entering the Bay must be in full compliance with federal regulations; have a Shipboard Oil Pollution Emergency Plan; capability to respond to small spills, and an arrangement with a Response Organization for larger spills. The applicable regulations outline requirements for extensive mitigation measures for the prevention of oil spills from ships. Containment and recovery equipment to deal with small and modest-sized spills would be pre-staged in the area of the marine terminal, so it could be quickly deployed in the event of a spill.

For larger spills at the marine terminal, or for those that might result from a tanker incident away from the marine terminal, activation of additional resources would be required, as outlined in the Canada Shipping Act and regulations. The Report explains that the probability of a large Project-related spill occurring during the life of the Project is extremely low, as evidenced by the spill history at Canaport and elsewhere. Section 23.5 covers pages 23-51 to 23-87, and provides detailed information on Hydrocarbon Spill in the Marine Environment, under the following sub-headings:

- Spill Probability
    - Worldwide Spill History
    - Large Spill Frequency
    - Recent Trends
    - Small and Medium Spills
    - Spill History for the Canaport Marine Terminal
    - Spill Probability Predictions for the Project
- Spill Fate and Trajectory Modelling
    - Model Parameters
    - Model Parameters
    - Spill Locations
    - Diesel Spills
    - Heavy Crude Oil Spills
    - Spill Trajectories
    - Spill Trajectories – Marine Terminal
    - Spill Trajectories – Anchorage, Shipping Lane Approach to Saint John, and Existing Canaport Single Buoy Mooring (SBM)
    - Spill Trajectories – Vicinity of Brier Island
- Environmental Effects Assessment
    - Considerations for Assessing the Environmental Effects of Oil Spills

- Interactions Between VECs and a Hydrocarbon Spill in the Marine Environment
- Wetland Environment
- Marine Environment
- Commercial Fisheries
- Land Use
- Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Determination of Significance

The potential environmental effects of a Hydrocarbon Spill in the Marine Environment on the Wetland Environment, and Land Use, during Operation, were rated not significant. Despite a very low likelihood of occurrence as demonstrated by the probabilistic analysis, the potential effects of such a spill on Commercial Fisheries, and the Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons during Operation were rated significant. The likelihood of the large spill scenarios potentially causing significant adverse environmental effects would be extremely low, however.

The spill frequencies calculated were based on an assumption that oil tankers used in conjunction with the Project would be as safe, or safer, than average tankers that have been used internationally over the past 20 years. Recent statistics indicate that tanker operations in recent years are much safer, as spill rates in the 2000s are about half the rates in the late 1980s and 1990s.

Based on the conservative spill frequencies calculated for the analysis, a spill similar to a marine terminal spill of 500 m^3 of diesel, or a 1,000 m^3 spill of heavy crude oil was only predicted to occur once every 25 years or more. A large spill similar to those modelled for the anchorage area and the shipping lanes was only predicted to occur once every 34 years or more.

Given that the Proponent would be using safer tankers than those in the model assumptions, and given that spill rates in the 2000s have been shown to be only half of the spill rates assumed in the model, the spill scenarios modelled in this analysis, and associated environmental effects, were considered highly unlikely.

The Report notes that, furthermore, the Proponent has a history of ensuring safe transportation of products and crude oil for the existing Saint John refinery. Since 1999, only one ship-sourced spill has been reported, and it was considerably less than one barrel of oil. So, while the potential environmental effects of the hydrocarbon spills modelled in this analysis would be significant for the VECs outlined, such spills are considered highly unlikely to occur.

Capacity of Renewable Resources to be Significantly Affected The capacity of renewable resources associated with the unlikely, but potentially significant, environmental effects on the above noted VECs was discussed in Chapter 14 (Commercial Fisheries), Chapter 18 (Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons), and Chapter 13 (Marine Environment, for SAR only).

Significant environmental effects on renewable resources would be limited to the highly unlikely event of a large hydrocarbon spill in the marine environment. The primary renewable resource of concern would be the Bay of Fundy fishery, which is used for both commercial and traditional Aboriginal purposes.

In the highly unlikely event of a large oil spill in the Bay, some closures of commercial fisheries might occur, as well as temporary exclusion of fishers from traditional fishing grounds due to mitigation, clean-up efforts, or potential contamination of fish habitat.

Although these effects could be considered significant, although likely compensated where documented, they would be temporary, with recovery time contingent on the type and location of the spill, environmental conditions at the time of the spill, and the intensity of fishing activity in the area. It is thus expected that the long-term use of the resource, including use by future generations, would not be significantly affected.

Vessel Accident

Construction, Operation, Decommissioning and Abandonment would add vessel traffic to Saint John Harbour and Bay shipping lanes. While this increased traffic could lead to an increase in vessel accidents, in terms of total number of accidents, there would be no features of the Project which would cause rates of such accidents to increase. The shipping lanes, anchorages, and Port of Saint John have sufficient capacity to handle the increased vessel traffic that would result from the Project.

During Construction and Operation, exclusion zones would be in place around Construction activity, and the marine terminal operation, to minimize interaction with non-Project vessels. Safe management of marine vessel traffic in the Bay shipping lanes and Saint John Harbour is a well-established practice, governed by shipping policies and procedures that ensure marine vessel movements are managed effectively.

The Proponent has committed to completing a TERMPOL review process following this EIA/EA, and after sufficient engineering design has been completed. Such a TERMPOL review would evaluate operational ship safety, route safety, and management and environmental concerns associated with the location, construction and operation of a marine terminal handling bulk petroleum products, and other navigation concerns, primarily including vessel accidents.

With this mitigation, it would be generally expected that a collision with Marine Species at Risk (SAR) or Species of Conservation Concern (SOCC), vessel grounding, or ship to ship collision, would be unlikely to occur, given implementation and adherence to the above mentioned policies, practices and procedures.

A Project-related Vessel Accident resulting in damage to commercial fishing gear would be addressed via continued participation by the Proponent in the Port of Saint John Traffic Committee. These and other measures would help ensure that, should such an accident occur, the resulting environmental effects would be not significant.

Section 23.6 covers pages 23-87 to 23-95, and provides detailed information on Vessel Accident, under the following sub-headings:

- Description of Scenarios
    - Collision with Marine Species at Risk (SAR) or Species of Conservation Concern (SOCC)
    - Vessel Grounding
    - Ship to Ship Collision
    - Damage to Commercial Fishing Gear
- Environmental Effects Assessment
    - Marine Environment

- Commercial Fisheries, and Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

Determination of Significance

Based on the above, and considering the residual environmental effects criteria for Marine Environment, the potential effects of all types of Vessel Accident, during all phases of the Project, were rated not significant with a high level of confidence.

Based on existing and planned mitigation, and considering the commercial fishery, shipping activity in the Bay of Fundy, Saint John Harbour, and water lot, the potential effects of a Vessel Accident on Commercial Fisheries, during all phases of the Project, due to potential damage to commercial fishing gear, were rated not significant. There is a moderate level of confidence in the significance prediction.

For the same reasons, and because notable Aboriginal fisheries have not been documented within the area most likely to result in an interaction between Project vessels and commercial fishing gear, the potential environmental effects of a Vessel Accident on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons, during all phases of the Project due to potential damage to commercial fishing gear, were rated not significant. There is a high level of confidence in the significance prediction.

Vehicle Accident

A Vehicle Accident would have potential to occur involving vehicle to vehicle collisions (including trains), pedestrian or wildlife, strikes, and cause temporary delays to road traffic, property damage, injury or death to the individuals involved, or struck wildlife. Because traffic in the area surrounding the Project would increase, as a result of the Project, the total number of vehicle accidents could potentially increase as well (typically proportional to the increased traffic volume).

The Report notes in this context, however, that overall accident rates would not be expected to increase as a result of the Project. It states that proposed improvements to road infrastructure to manage traffic level of service (LOS) should ensure that vehicle accident rates do not increase, or might even decrease. This area already experiences accident rates well below provincial averages. With the proposed mitigation, the potential environmental effects of a Vehicle Accident on all VECs would be not significant. Mitigation measures proposed, to minimize adverse effects to traffic safety, would be the same proposed to minimize adverse environmental effects to road infrastructure and traffic LOS.

They would assist in minimizing adverse environmental effects to traffic safety, and include improvements and upgrades to road network infrastructure, as well as warning signs and lights.

Section 23.7 covers pages 23-96 to 23-101, and provides detailed information on Vehicle Accident, under the following sub-headings:

- Description of Scenarios
  - Vehicle to Vehicle Collision
  - Pedestrian Strike
  - Wildlife Strike
- Environmental Effects Assessment
  - Land-Based Transportation
  - Vehicle to Vehicle Collision

- Pedestrian Strike
- Wildlife Strike

Determination of Significance

The residual environmental effects of a Vehicle Accident on Land-Based Transportation would be expected to occur during both Construction and Operation. With planned mitigation, however, including improvements to existing road network infrastructure, warning signs and lights, no substantive increased to collision rates would be predicted. Based on the above, the potential environmental effects of a Vehicle Collision on Land-Based Transportation, during all phases of the Project, were rated not significant. There is a high level of confidence in the significance prediction.

Worker Accident

A Worker Accident would have potential to occur during all Project phases. The Report notes that workers might be exposed to noise and dust from construction activities, or hazardous chemicals through materials and equipment required for construction (*e.g.,* oils, lubricants). A Worker Accident might also occur, as a result of working near heavy equipment, at height, welding, cutting, or increased marine vessel and vehicle traffic.

The Proponent would comply with public safety and occupational health and safety legislation of the Province and the Federal Government, during all phases of the Project. Compliance with such legislation would ensure that the potential effects of a Worker Accident would not be significant. Section 23.8 covers pages 23-101 to 23-104, and provides detailed information on Worker Accident under the following sub-headings:

- Environmental Effects Assessment
    - Health and Safety

Determination of Significance

The Project would be in full compliance with the Occupational Health and Safety Act, and other health and safety legislation of the Province and the Federal Government. The Report notes that compliance with the Occupational Health and Safety Act would suggest an acceptable level of risk. In the event that an accident did occur, an investigation would be conducted into the cause, and corrective measures taken.

Based on the above, the potential environmental effects of a Worker Accident on Health and Safety, during all phases of the Project, were rated not significant. There is a high level of confidence in the significance prediction.

Project-Caused Forest Fire

A Project-Caused Forest Fire would have potential to occur as a result of the spontaneous combustion of petroleum products, an explosion, spark, or heating of combustible materials caused by Project activities. Such a forest fire could cause a change in air quality, damage to property, injury to individuals, loss of wildlife or wildlife habitat, or loss of forest resources. Because human activity in the area surrounding the Project location would increase as a result of the Project, it would be possible that the total number of forest fires might increase. The probability of a forest fire being caused by Project-related activities would be low, given that the Project would be safe by design, with mitigation implemented to minimize risk.

Proper management of fuel, other hazardous materials, and operational procedures would reduce potential for, and extent of, accidental fires related to the Project. In the event of such an incident, fire fighting activities would be coordinated by the City in consultation with provincial officials, as applicable. With the proposed mitigation, the potential environmental effects of a Project-caused Forest Fire on all VECs would not be significant.

Section 23.9 covers pages 23-104 to 23-109 and provides detailed information on Project-Caused Forest Fire under the following sub-headings:

- Description of Scenarios
- Environmental Effects Assessment
    - Atmospheric Environment
    - Terrestrial Environment
    - Land Use

Determination of Significance

The potential for a Project-Caused Forest Fire during all phases of the Project, and its potential magnitude, would be reduced through due care and attention and proper planning. Site preparation activities would be planned so that potential ignition sources would be minimized and emergency response capability provided.

These measures would be addressed in the Environmental Protection Plan, the Health, Safety and Environment Management System, and the Emergency Response Plan, to ensure achievement of such policy objectives through all phases of the Project. It would be recommended as well that workers and contractors be trained in fire prevention.

The potential for a Project-caused Forest Fire to occur would be mitigated through implementation of the above operational procedures, adherence to safe work practices, commitment to intrinsically safe Project design, and effective emergency response and preparedness.

Based on the above, the potential environmental effects of a Project-caused Forest Fire, on all VECs, during all phases of the Project, were rated not significant. There is a moderate to high level of confidence in this prediction.

Introduction of Invasive Species

The Introduction of Invasive Species would have potential to occur, primarily due to transfer of invasive species in equipment or materials transported to the Project site.
All phases of the Project would be conducted to minimize the potential for adverse environmental effects from invasive species. All care and due attention would be provided to minimize cross-transfer of materials from one location to another on land, and to minimize introduction of invasive species in the marine environment.

As conceived, planned and designed, the Project would inherently provide a high level of mitigation for the potential environmental effects caused by the Introduction of Invasive Species. Therefore, the potential environmental effects of the Introduction of Invasive Species were rated not significant and not likely to occur. Section 23.10 covers pages 23-109 to 23-114 and provides detailed information on Introduction of Invasive Species, under the following sub-headings:

- Description of Scenarios

    - Introduction of Invasive Species in the Terrestrial, Wetland or Freshwater Aquatic Environments
    - Introduction of Invasive Species in the Marine Environment
- Environmental Effects Assessment
    - Marine Environment

Determination of Significance

Given current levels of shipping activity, and the low number of invasive species currently present within the Local Assessment Area (LAA), ballast water regulations and guidelines appear to be effective against the introduction of invasive species in the Saint John Harbour area.

Further, this area may not be suitable habitat for many alien invasive species.

Current regulations and practices, and potential future ballast water treatments, would be considered effective mitigation measures against the introduction of alien invasive species to the Assessment Area and the Saint John Harbour.

Based on the above, the proposed mitigation, and considering residual environmental effects criteria for Marine Environment, the potential effects of the Introduction of Invasive Species on the Marine Environment, during all phases of the Project, would be not likely to occur and were rated not significant. There is a high level of confidence in this prediction.

Wildlife Encounter

A Wildlife Encounter has the potential to occur primarily due to wildlife entering the construction site, and could directly affect wild animals, or endanger the safety of workers, thus potentially resulting in adverse environmental effects.

Increased Project-related activity in the Project Development Area (PDA) during all phases of the Project could increase the number of Wildlife Encounters. However, noise and activity related to construction would be expected to reduce this potential. A Wildlife Awareness Program would be prepared, and implemented, to train Project personnel to respond appropriately. With the proposed mitigation, the potential environmental effects of a Wildlife Encounter on all VECs, during all phases of the Project, would not be significant.

Section 23.11 covers pages 23-115 to 23-117, and provides detailed information on Wildlife Encounter under the following sub-headings:

- Description of Scenarios
- Environmental Effects Assessment

Determination of Significance

The number of wildlife encounters would be expected to be low. Based on the above, the potential environmental effects of a Wildlife Encounter on Health and Safety, Terrestrial Environment, and all other VECs listed above, during all phases of the Project, would not be likely to occur and were rated not significant.

Discovery of a Heritage or Archaeological Resource

Discovery of a Heritage or Archaeological Resource could potentially occur during construction, and result in a Change in Heritage or Archaeological Resources.

The potential for adverse environmental effects from such an unplanned event has been minimized, however, by completion of an Heritage Resource Impact Assessment to locate and document previously unknown heritage and archaeological resources. There is little remaining potential for the presence of currently undiscovered heritage resources in the PDA.

Therefore, the probability that construction could result in such a discovery is low, since the PDA has already been tested for heritage and archaeological resources. Potential environmental effects were thus rated not significant. Section 23.12 covers pages 23-117 to 23-120, and provides detailed information on Discovery of a Heritage or Archaeological Resource under the following sub-headings:

- Description of Scenarios
- Environmental Effects Assessment
    - Heritage and Archaeological Resources

Determination of Significance

Based on the above, the potential environmental effects of the Discovery of a Heritage or Archaeological Resource on Heritage and Archaeological Resources, during all phases of the Project, were rated not significant. There is a high degree of confidence in this significance prediction.

Chapter 24 – Conclusion and Closing

Chapter 24 covers pages 24-1 to 24-2 and provides a two page concluding summary statement describing the full Report and the results of the EIA/EA, formally signed on behalf of Jacques Whitford Stantec Limited.

Acronym/Unit	Definition
ATV	all terrain vehicle
bbl	barrel (oil US, equal to 159 L)
CAC	criteria air contaminants
CCME	Canadian Council of Ministers of the Environment
CCS	carbon capture and storage
CEA	Canadian Environment Assessment
CEAA	Canadian Environment Assessment Act
CMA	census metropolitan area
CO2	carbon dioxide
CO2eq	carbon dioxide equivalent
COPC	chemicals of potential concern
CR	concentration ratio
CSR	Comprehensive Study Report
CWS	Canada-wide Standards
dBA	decibel, A-weighting
DFO	Department of Fisheries and Oceans Canada
DO	dissolved oxygen
EA	environmental assessment
EC	Environment Canada
EHQ	ecological hazard quotient
EIA	environment impact assessment
ENGO	environmental non-governmental organizations
EPP	Environmental Protection Plan
ERA	ecological risk assessment
ESA	environmentally sensitive area
GDI	greenhouse gas design intensity
GDP	gross domestic product
GHG	greenhouse gases
GLC	ground-level concentration(s)
H2S	hydrogen sulphide
ha	hectares (10,000 square metres, or 2.47 acres)
HADD	harmful alteration, disruption or destruction (of fish habitat)
HAZOP	hazards and operability
HDD	horizontal directional drilling
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IQUA	Index for Quality of Air
Km	kilometer (1,000 metres)
Km_2	square kilometer (1,000 metres)

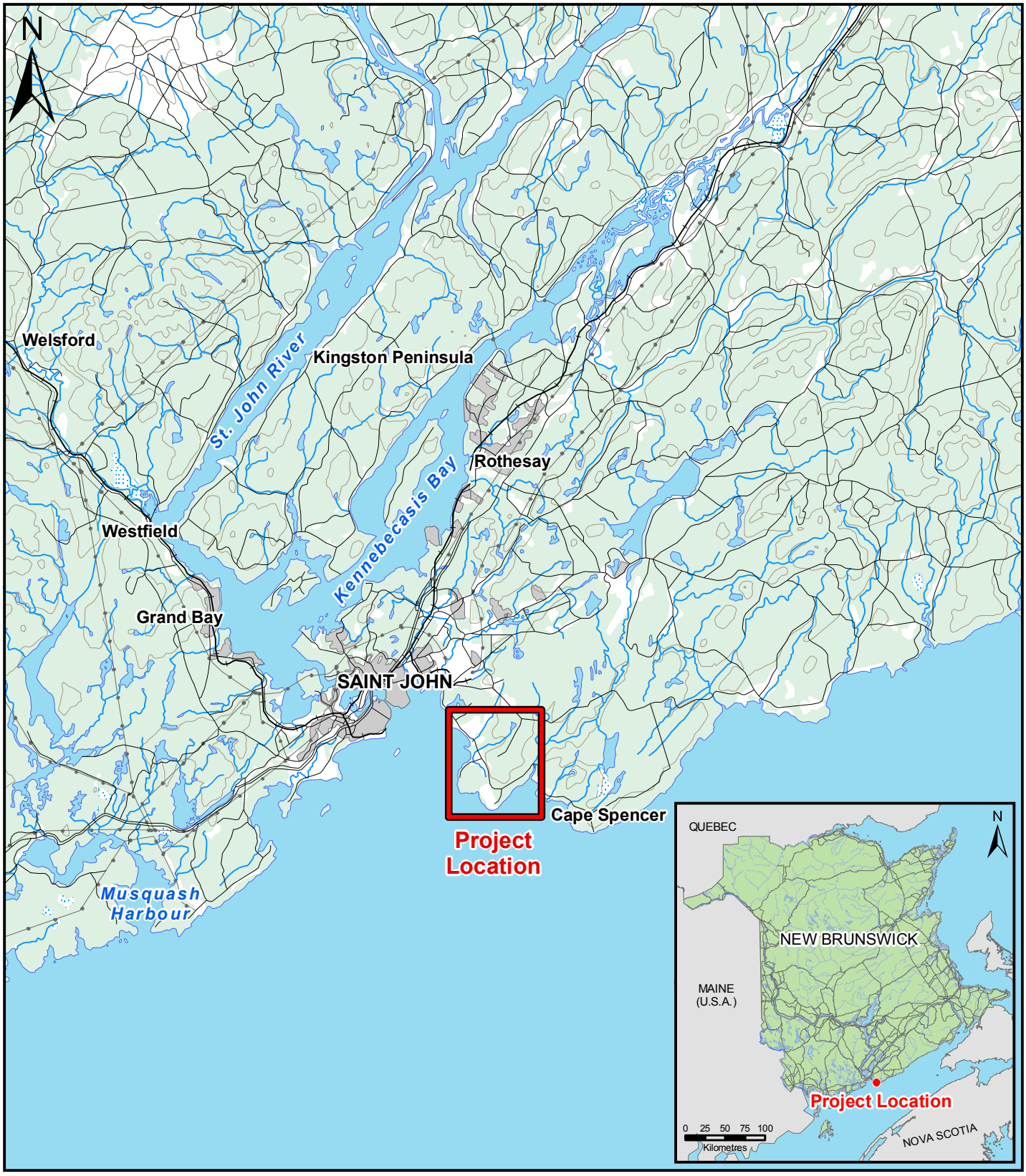
Acronym/Unit	Definition
LAA	local assessment area
LNG	liquefied natural gas
LOPA	layers of protection analysis
LOS	level of service
LSF	linear stone feature
m	metre
MCTS	Marine Communications and Traffic Services
MERA	marine ecological risk assessment
NBDNR	New Brunswick Department of Natural Resources
NBENV	New Brunswick Department of Environment
NGO	non government organizations
Non-CAC	non-criteria air contamination
NO2	nitrogen dioxide
NOx	nitrogen oxides (sum of NO and NO2)
NSA	noise sensitive area
O3	ozone
OMOE	Ontario Ministry of the Environment
PDA	project development area
PM	particulate matter
RAA	regional assessment area
ROW	right-of-way
SAR	species at risk
SBM	single buoy mooring
SOCC	species of conservation concern
SO_2	sulphur dioxide
SO_4	sulphate
TC	Transport Canada
TGTU	tail gas treatment unit(s)
TRC	Technical Review Committee
TSS	total suspended solids
$\mu g/m^3$	micrograms per cubic metre
VEC	valued environmental component
VOC	volatile organic compound(s)
WAWA	wetland and watercourse alteration

Glossary

air contaminant emissions	For stationary sources, the release or discharge of a contaminant from a facility or operation into the ambient air either by means of a stack or as a fugitive dust, mist or vapour.
Anthropogenic	Resulting from the influence of humans on nature.
Aquifer	A geological formation, group of formations or part of a formation that contains sufficient saturated permeable material to yield economical quantities of groundwater to wells or springs.
Assessment Area	The geographic area that may be affected by the Construction or Operation of the Project facilities, directly or indirectly.
attenuation	The reduction of sound intensity by various means (e.g., absorption in air, geometrical spreading, or topographic barriers).
baseline	Background, existing, pre-activity, pre-Construction, or pre-Project environmental conditions.
bedrock	A general term for rock that underlines soil or other unconsolidated material.
benchmark	A regulatory agency target against which predictions of risks are assessed.
Benthic	Of, or relating to, the bottom or floor of a water body.
carcinogen	A chemical directly involved in the promotion of cancer.
Chemicals of Potential Concern (COPC)	Chemicals which have the potential to be released in substantive quantities or elevated concentrations from sources associated with the Project, or which, because of their toxicological properties, are considered to be of concern.
Climate	Defined as a description of the regularities and extremes in weather conditions in a particular geographical location over a certain period. Usually refers to long term trends in weather for time periods which may range from months to centuries, or the more widely recognised 30-year timeframe as advocated by the World Meteorological Organization (WMO)
climate change	The term climate change is used to refer to changes in the earth's climate, which can be caused both by natural forces and human activities. Most commonly associated with global warming and the global greenhouse effect, which highlight discernable changes to the earth's climate, (i.e., increasing temperatures, due to man-made activities and processes).
Criteria Air Contaminants (CAC)	A group of eight common air contaminants released into the air from various processes including industrial production and fuel combustion. They include total particulate matter (PM), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), sulphur dioxide (SO2), nitrogen oxides (NOx, expressed as NO2), carbon monoxide (CO), and ammonia (NH3). Abbreviated in this document as CAC.
cumulative environmental effects	As defined in the Canadian Environmental Assessment Act (CEAA), the environmental effects that are likely to result from a project in combination with other projects or activities that have been or will be carried out.

Glossary

Ecological Risk Assessment (ERA)	A scientific method used to examine the nature and magnitude of risks from the exposure of plants and animals to contaminants in the environment.
Emissions	Technically, all solid, liquid, or gaseous discharges from a processing facility, but normally referring to gaseous and particulate air emissions (with solids referred to as residue and liquids as effluent).
estuary	That part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with freshwater derived from land drainage.
existing ambient	All sounds in a given area (includes all natural sounds as well as all mechanical, electrical and other human-caused sounds).
exposure limit	Maximum dose or amount of chemical that a person or ecological receptor can be exposed to for a specified period without experiencing an adverse health outcome.
fugitive emission	Result from small leaks that while individually very small, can collectively be substantial for large, complex facilities
greenhouse gases (GHG)	Gaseous compounds that inhibit the release of heat from the atmosphere. The greenhouse gases considered in this Study are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
Indigenous	Originating and living or occurring naturally in an area or environment
Linear facilities	Pipelines, a rail line, a transmission line, water mains, and conveyors to be constructed in support of the operation of the Project.
Local Study Area (LSA)	The Local Study Area (LSA) consists primarily of the Refinery Study Area and the Linear Facilities Corridor Study Area (LFCSA), extending north from the existing Saint John Refinery, south to the Red Head area, east from the Mispec area, and west towards the Saint John Harbour.
Mitigation	With respect to a project, refers to the elimination, reduction or control of the adverse environmental effects of the project, including restitution for any damage to the environment caused by such environmental effects through replacement, restoration, compensation or other means.
Non-CAC	Non-criteria air contaminants, that is chemicals of potential concern which are neither criteria air contaminants nor greenhouse gases (*e.g.,* metals).
Project Development Area (PDA)	A 1,132 ha area including the refinery complex and extending to the coast of the Bay of Fundy to include the product storage tanks.
Regional Study Area	The Regional Study Area consists of an area that is beyond the limits of the local study area that may be affected by the Project. For the purposes of this technical study, the regional study area was defined to be an area 70 km by 45 km spanning the Saint John airshed. The regional study area was used for modelling regional emissions sources and to assess transport to sensitive receptors for the HHERA modelling.



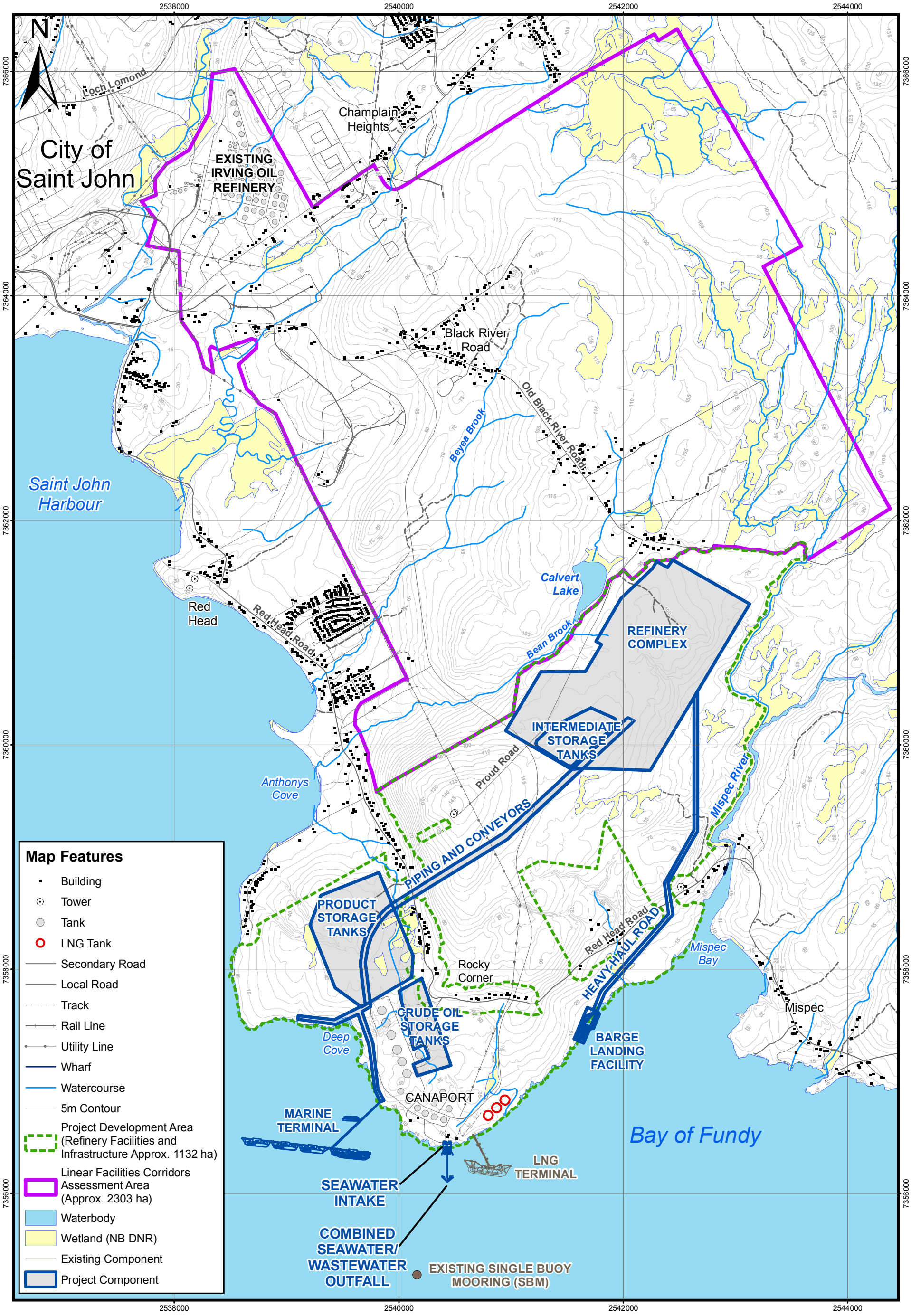
Map Parameters
Projection: NB Stereographic
Scale: 1:320,000
Date: August 8, 2008
Project No.: 1013263.

Data Source: ESRI,
Natural Resources Canada

Figure 1.1
Project Location: Project Eider Rock

0 5 10 20
Kilometres

Jacques Whitford



Map Parameters
Projection: NB Stereographic
Scale: 1:32,000
Date: August 8, 2008
Project No.: 1013263.

Data Source: Service New Brunswick, NB DNR, Fluor, Sandwell Engineering Inc.

Figure 3.1
Location of Major Project Components

0 0.5 1 2
Kilometres

Project Eider Rock

Jacques Whitford