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REPORT

Project Description for Seismic Exploration Activity on the Marauder (EL 2415), Marconi (EL 2416) and Mariner (EL 2409) Blocks

Canadian Superior Energy Inc.

REPORT NO. SD18989

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REPORT TO	**Canadian Superior Energy Inc.** **1959 Upper Water Street** **Suite 1409 Purdy's Wharf Tower 1** **Halifax, NS** **B3J 3N2**
FOR	**Canadian Superior Energy Inc.**
ON	**Project Description for Seismic Exploration Activity on the Marauder (EL 2415), Marconi (EL 2416) and Mariner (EL 2409) Blocks**

January 2006

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Table of Contents

1.0 INTRODUCTION....1
1.1 Project Overview....1
1.2 Proponent Information....1
1.3 Purpose and Need for the Project....3
1.4 Regulatory Context....3
1.5 Consultant Information....4
1.6 Consultation....4
1.7 Project Study Area....4

2.0 PROJECT DESCRIPTION....5
2.1 Project Overview, Location and Schedule....5
2.2 Seismic Activities....5
2.2.1 Survey Vessel....7
2.2.2 Marine Mammal Safety Zone and Ramp-up Procedure....7
2.3 Emissions and Waste Discharges....8
2.4 Malfunctions and Accidents....9
2.5 Project Alternatives....10
2.5.1 Alternatives to the Project....10
2.5.2 Alternative Means for the Project....10
2.6 Canadian Superior HSE Policy and Other Health, Safety and Environmental Plans....11
2.6.1 HSE Policy....11
2.6.2 Other Health, Safety and Environmental Plans....11

3.0 ENVIRONMENTAL SETTING....12
3.1 Biophysical Setting....12
3.1.1 Oceanography....12
3.1.2 Climate....13
3.2 Biological Environment....13
3.2.1 Benthic Community....13
3.2.2 Fish and Shellfish....13
3.2.3 Marine Mammals and Sea Turtles....14
3.2.3.1 Whales....14
3.2.3.2 Seals....15
3.2.3.3 Sea Turtles....15
3.2.4 Marine Birds....15
3.2.5 Species at Risk....16
3.2.6 Special Places....17
3.2.6.1 The Gully....17
3.2.6.2 Sable Island....26
3.3 Socioeconomic Setting....26
3.3.1 Fishery....26
3.3.2 DFO and Industry Research Surveys....26
3.3.3 Marine Shipping....26
3.3.4 Military Use....27
3.3.5 Petroleum Industry....27

3.3.6 Cables 27

4.0 REFERENCES 28
4.1 Personnel Cited 30

List of Tables

Table 2.1 Summary of Seismic Vessel Related Discharges and Emissions 9
Table 3.1 Temporal Distributions of Spawning Fish on Sable Island Bank* 14
Table 3.2 Temporal Distributions of Marine Birds Likely to be Found in the Vicinity of the Project Area 15
Table 3.3 Species at Risk that may Occur in the Study Area 19

List of Figures

Figure 1.1 Location of Canadian Superior's Marauder, Marconi and Mariner Blocks 2
Figure 2.1 Typical Survey Configuration 6
Figure 3.1 Special Places in Relation to the Marauder, Marconi and Mariner Blocks 18

REPORT

1.0 INTRODUCTION

1.1 Project Overview

Canadian Superior Energy Inc. (Canadian Superior) proposes to conduct multi-year, multi-survey seismic exploration on Nova Scotia Exploration Licenses EL 2409 (Mariner Block), EL 2415 (Marauder Block), EL 2416 (Marconi Block) and the lands between the Mariner and Marauder Blocks (Figure 1.1). Surveys would occur at any time in any given year. It is anticipated that individual surveys could occur as early as 2006 and as late as 2013**.**

The Marauder Block encompasses a total area of approximately 1270 km^2 and is located on the Scotian Shelf, approximately 310 km southeast of Halifax and 12 km northeast of Sable Island. The Marconi Block encompasses a total area of approximately 240 km^2 and is located on the Scotian Shelf, approximately 330 km southeast of Halifax and 16 km southeast of Sable Island. The Mariner Block is approximately 407 km^2 in size and is located on the Scotian Shelf, approximately 275 km southeast of Halifax and 2-10 km north of Sable Island. Water depth within the blocks varies from approximately 100 to 400 m in the Marauder Block, 50 to 200 m in the Marconi Block and 50 to 150 m in the Mariner Block.

1.2 Proponent Information

Canadian Superior is a Calgary, Alberta, based oil and gas exploration and production company, with activities in Western Canada, Nova Scotia, and Trinidad and Tobago. Canadian Superior is active offshore Nova Scotia, currently holding rights to six offshore Nova Scotia exploration licenses.

Canadian Superior intends to contract the seismic and operational support activities to qualified and experienced firms. For additional information regarding Canadian Superior's proposed seismic activities, please contact:

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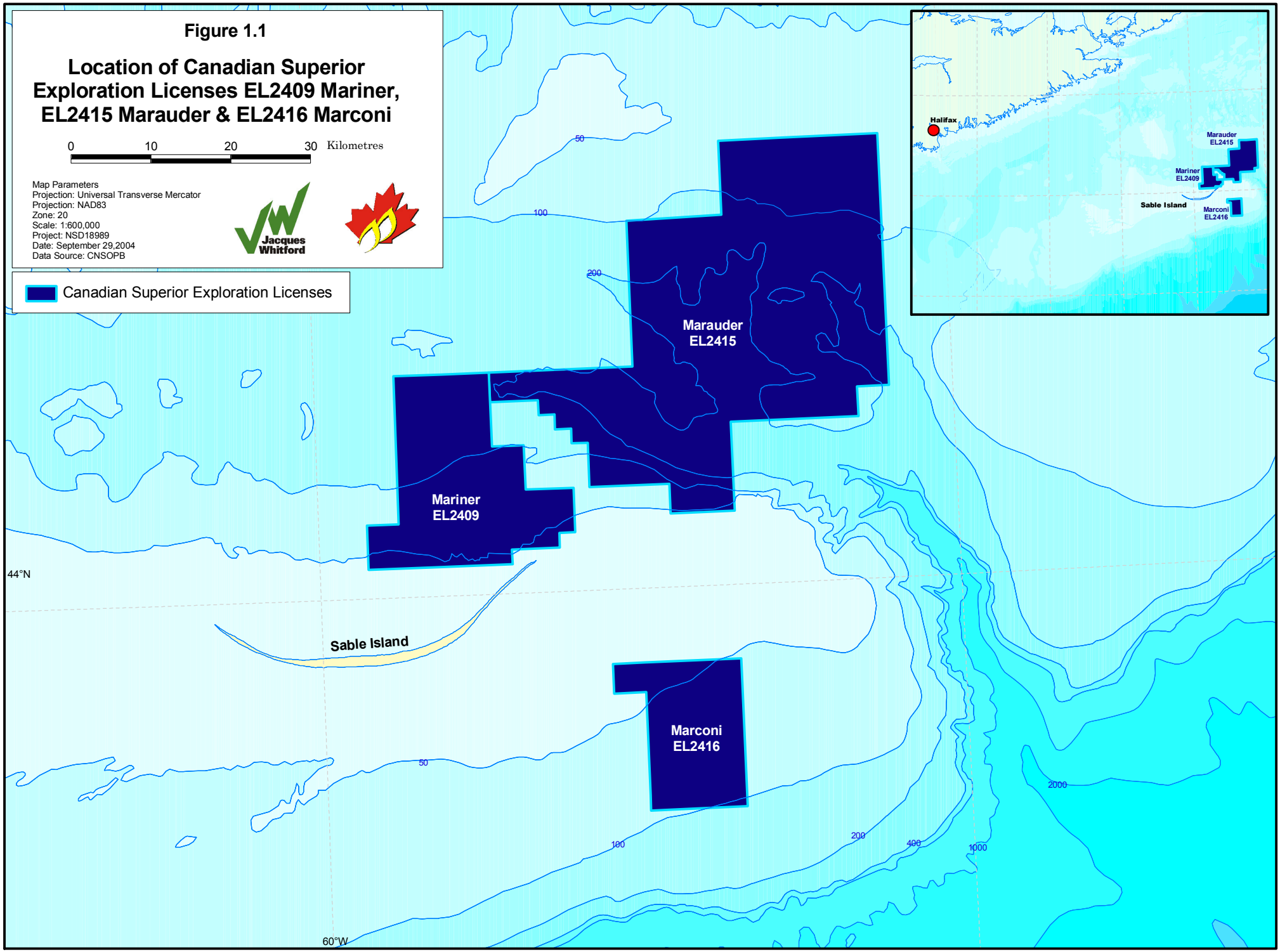
Figure 1.1
Location of Canadian Superior Exploration Licenses EL2409 Mariner, EL2415 Marauder & EL2416 Marconi
0 10 20 30 Kilometres
Map Parameters
Projection: Universal Transverse Mercator
Projection: NAD83
Zone: 20
Scale: 1:600,000
Project: NSD18989
Date: September 29,2004
Data Source: CNSOPB
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Canadian Superior Exploration Licenses
Halifax
Marauder EL2415
Mariner EL2409
Sable Island
Marconi EL2416
50
100
200
Marauder EL2415
Mariner EL2409
44°N
Sable Island
Marconi EL2416
50
100
200
400
1000
2000
60°W

1.3 Purpose and Need for the Project

The purpose of the proposed Project is to determine the presence and likely locations of geological structures within Canadian Superior's exploration licenses that might contain hydrocarbon deposits. Seismic data provide high resolution and quality images that are then used to find potential locations for exploration drilling. With regard to location, survey lines will be selected based on existing understanding of the geological conditions within the areas of interest and are intended to test geological concepts.

This Project, if successful, is a necessary step in allowing Canadian Superior to maximize returns to shareholders and in fulfilling work commitments related to its licensing agreements with the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). Furthermore, exploration, development, and production of oil and gas resources contribute to the provincial and federal economies by providing new business opportunities within the region, through large capital and operating expenditures, transference of technology, providing employment opportunities, and generating royalties to government.

1.4 Regulatory Context

The CNSOPB regulates oil and gas activities under the *Canada-Nova Scotia Petroleum Resources Accord Implementation (Nova Scotia) Act*. The proposed Project will require an authorisation referred to in paragraph 142(1)(b) of the *Canada-Nova Scotia Petroleum Resources Accord Implementation Act*, which triggers the requirement for an environmental assessment (EA), pursuant to the *Canadian Environmental Assessment Act (CEAA)*. Section 19.1 (a) of *CEAA*'s Inclusion List Regulations identifies those projects relating to seismic surveys for which a screening level of assessment is required, *i.e.*, a marine or freshwater seismic survey during which the air pressure measured at a distance of one metre from the seismic energy source is greater than 275.79 kPa (40 psi). This proposed Project meets this criterion and is, therefore, subject to a screening assessment under *CEAA*.

This Project Description is required to initiate the Federal Coordination Regulation process under *CEAA*. The purpose of the Project description is to identify the basic features of the Project to be assessed under *CEAA*, as well as areas potentially affected by the Project. This Project description is provided to federal departments (*i.e.,* Federal Authorities or FAs) to determine whether they will have decision-making responsibility under *CEAA* (*i.e.,* become a Responsible Authority or RA in relation to the Project) or possess expert knowledge relevant to the evaluation of potential Project impacts. The CNSOPB will be a RA for the purposes of the assessment. The CNSOPB will also serve as the Federal Environmental Assessment Co-ordinator (FEAC). The role of the FEAC is to coordinate the participation of FAs in an assessment, as well as to facilitate cooperation with other appropriate jurisdictions, such as provincial governments.

Environment Canada (EC) is responsible for the administration of the Canadian *Environmental Protection Act*, the *Fisheries Act* (Section 36), the *Migratory Birds Convention Act*, and the *Species at Risk Act (SARA)*. EC is also the lead federal department in promoting the Federal Policy for Pollution and the Toxic Substances Management Policy. Fisheries and Oceans Canada (DFO) is responsible for authorizations required under Sections 35-42 of the *Fisheries Act* related to the protection of fish habitat, as well as for the administration of the *Oceans Act*, portions of the *SARA*, and the *Navigable Waters Protection Act*.

Potential onshore activities associated with the Project (*e.g.*, shore base activities, onshore disposal of wastes) will be regulated by the Province of Nova Scotia. The Project will not trigger any provincial environmental assessment requirements.

1.5 Consultant Information

This Project Description has been prepared by Jacques Whitford Limited (Jacques Whitford) on behalf of Canadian Superior. For additional information regarding this Project Description and assessment, please contact:

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1.6 Consultation

During the preparation of the EA Report, Canadian Superior intends to consult with the CNSOPB, DFO and EC with respect to the scope and methodology of the EA Report. Additional consultation will be conducted with various stakeholders, focusing on fisheries associations that may have overlapping interests in the Project area. The approach to Project consultation will be discussed with and approved by the CNSOPB in advance.

1.7 Project Study Area

The Project study area will be defined in the EA Report and will include the limits of the exploration licenses (Figure 1.1), and areas for vessel turning, as well as the zones of influence of various Project interactions, as they extend beyond the limits of the licenses. For example, the potential for noise propagation beyond the limits of the licenses will be examined and the potential worst case scenario will be modeled. In this case, the spatial boundary identified by the modeling, to the extent that it extends beyond the limits of the license, will further define the Project study area. Although this is a seismic project, Canadian Superior will refer to the Operational Policy Statement entitled *The Process for Defining the Spatial Boundary of a Study Area During an Environmental Assessment of Offshore Exploratory Drilling Projects* (CEA Agency 2003) when defining the Project study area.

2.0 PROJECT DESCRIPTION

2.1 Project Overview, Location and Schedule

Canadian Superior is proposing to conduct a multi-year, multi-survey seismic exploration program over three of its exploration licenses, Marauder, Marconi and Mariner Blocks, as well as the lands located between the Marauder and Mariner Blocks. For the purposes of the assessment, it is assumed that any portion of these licenses could be subject to seismic exploration at some point in the future.

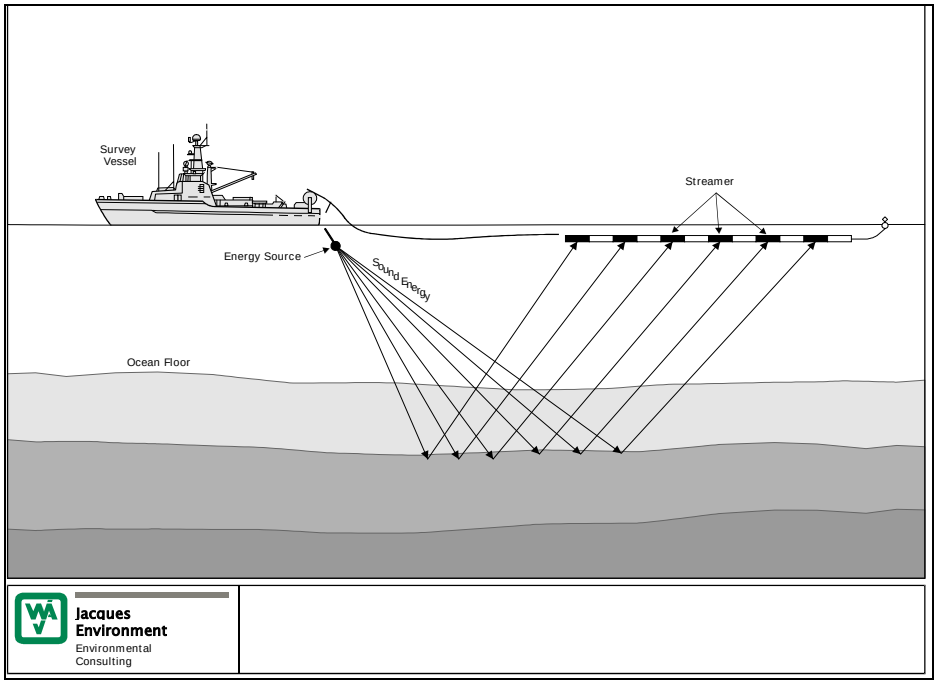
Canadian Superior's has 100% ownership of the exploration licenses for the Mariner, Marconi and Marauder Blocks. The licences for Marconi and Marauder are for a nine-year period, effective January 2004 until January 2013. The EA Report will, therefore, address a seismic program that could continue until January 2013. Although exact timing of potential surveys is not known at this time, it is assumed that surveys would occur at any time in any given year. Given the length of this Project timeframe, the EA Report will address Canadian Superior's commitment and approach to the periodic review of the existing environment, proposed mitigation and proposed monitoring to ensure on-going validity and applicability.

2.2 Seismic Activities

Given that Canadian Superior is proposing a multi-year, multi-survey exploration program, it will not be possible to define the technical specifications for each of these surveys at this time. Depending on the objectives of the survey, 2D or 3D data may be collected at any given time within the exploration licences of interest. A 2D survey is typically used for exploring a large area to identify potential prospects which require further seismic exploration in the form of a 3D survey. 2D survey lines are generally further apart (most often 1 km or greater) and often run in several different directions. 3D seismic surveys enable a greater resolution of potential existing oil and gas reservoirs, and therefore, the survey lines are in closer proximity (400 m to 25 m). These surveys provide a detailed picture of the area under investigation allowing for a more detailed analysis of the potential quantity and potential distribution of hydrocarbons (Davis *et al.* 1998).

Regardless of the exact nature, all seismic surveys share the same basic concept. Seismic airguns send sound waves through the water, and formations beneath the seafloor reflect the sound waves back to hydrophones trailing behind the vessel (Figure 2.1). Both the air gun sound waves and their reflected echoes are recorded on magnetic tape.

Figure 2.1 Typical Survey Configuration



A typical marine seismic airgun array source has a total volume of 3000 to 4800 cu. in. consisting of 20 to 30 airguns (type Bolt, Sodera-G or Input-output Sleeve Gun II airguns) operating at 2000 psi. The total pressure per source is approximately 100 Bar-meters. The peak-to-peak pressure output is about 262dB re 1 µPa @ 1 m.

As detailed survey parameters are not yet known, typical acquisition parameters for a 2D or 3D program have been referenced from Davis *et al.* (1998). A typical 3D survey would require the seismic vessel to tow 6 to 8 streamers, with each streamer being approximately 4600 m long, supporting several hundred hydrophones. The streamers are normally towed at a depth of 7 or 8 m, and they are about 100 m apart. Typically, the airguns are discharged every 25 m, or about once every 10 to 12 seconds. During a 2D survey, the survey vessel typically tows a single streamer between 4500 and 6000 m in length.

About 30 minutes prior to arriving at the start of a line, the airgun array is slowly brought up to a specified power, a procedure referred to as a "soft start". This procedure is an environmental protection measure to permit marine animals opportunity to temporarily vacate that area if the sound levels are perceived as a disturbance. This is discussed in greater detail in Section 2.2.2. Vessels towing streamers have reduced manoeuvrability when the equipment is deployed. Canadian Superior will include a ten kilometre vessel turn-around perimeter around the survey area. The EA will take into account this expanded area.

2.2.1 Survey Vessel

The survey vessel has not been selected at this time; however, it will be a conventional, dedicated seismic research vessel, with a crew of up to approximately 50 people. Typical vessel speed will be approximately 4.5 knots when the survey gear is deployed. Typical survey vessels are capable of cruising at 10 to 16 knots (with gear onboard). It is estimated that survey vessels will require a turning radius of five kilometres outside the identified survey area. However, the turning radius is dependent on the vessel, water depth and length of streamer. Operations are normally limited to a Sea State of 5 or wave heights of about three metres. Deployment and retrieval of survey equipment can take significant time, particularly in adverse weather, where retrieval can require a minimum of 24 hours and deployment can take several days.

2.2.2 Marine Mammal Safety Zone and Ramp-up Procedure

Canadian Superior will implement a safety zone monitoring program for whale species at risk during survey data acquisition. The airguns will be shut down every time an endangered whale enters the defined safety zone. A Fisheries Observer, trained for marine mammal observations, will watch for marine mammals from the bridge of the seismic vessel throughout the survey. Safety zones for marine mammals are commonly defined by the areas within which specific sound level thresholds are exceeded. These have been quantified by the National Marine Fisheries Service (NMFS). NMFS policy regarding exposure of marine mammals to high-level sounds is that whales should not be exposed to impulse sounds exceeding 180 and 190 dB re 1µPa (rms), respectively. These sound levels are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS, one cannot be certain that there will be no injurious effects, auditory or otherwise, to marine mammals. Discussion with acoustic specialists indicated that in deep water conditions, it is a safe estimate to employ a radius of 800 m for a 180 dB safety zone (this range is thought to be conservative for horizontal propagation and realistic for downward propagation). A 1-km safety zone is a very conservative measure considering that at 100 m from the contractor's array at 90^{o} from vertical, the sound pressure is estimated at 180 dB.

To minimise environmental impacts, an approved "ramp-up" procedure will be followed when airgun operations begin for every survey line. The ramp-up procedure to be used follows the Joint Nature Conservation Committee (JNCC) Guidelines for Minimizing Acoustic Disturbance to Marine Mammals from Seismic Surveys (Draft, 2002).

The Statement of Canadian Practice for mitigation of seismic noise in the marine environment will also provide guidance to the seismic program. The Statement of Canadian Practice, not yet finalised, aims to formalise and standardise the mitigation measures used in Canada with respect to the conduct of seismic surveys in the marine environment. It is based on a DFO-sponsored peer review by Canadian and international experts. The following points outline the mitigation measures described in the Statement of Canadian Practice:

- Avoid death, harm, or harassment of individuals of marine mammals and sea turtles listed as endangered or threatened on *SARA*; and population-level effects for all other marine species.
- Avoid, to the extent reasonably practical, causing a dispersion of an aggregation of spawning finfish from a known spawning area; a displacement of a group of breeding, feeding or nursing, or migrating, marine mammals, if it is known there are no alternate areas available to those marine mammals for those activities.

- Avoid, to the extent reasonably practical, displacing an individual marine mammal listed as endangered or threatened on *SARA* from breeding, feeding or nursing, or migrating, if it is known there are no alternate areas for those activities that the individual could be expected to use.
- Establish a safety zone of 500 metres from the centre of the seismic source array or arrays.
- Conduct regular on-going visual monitoring of the safety zone by a qualified Marine Mammal Observer, including continuous visual monitoring during a period of at least 30 minutes prior to start-up of the seismic array.
- Delay start up if a sea turtle or whale, other than a dolphin or a porpoise, is seen within the safety zone during the 30 minute visual survey until the sea turtle or whale has not been observed for at least 30 minutes within the safety zone or has been observed leaving the safety zone.
- Shut down seismic array immediately when a sea turtle or whale is observed to be in the safety zone if that sea turtle or whale is listed as a species of, endangered or threatened on *SARA* or is listed as a species of special concern for which there could be significant adverse effects.
- Operations may re-commence, using ramp-up / soft-start measures if the array has been shut down for more than 30 minutes. This includes commencing the ramp-up by firing a single source, preferably the smallest source in terms of energy output and volume; and continually activating additional sources in ascending order of size over a 20 to 40 minute period until desired operating level is attained.
- Shut down seismic source array(s) or reduce to a single energy source for line changes. If shut down occurs, ramp-up/soft-start procedures will not be required as alternative measures to maintain the safety zone will be used.
- During periods of low visibility or during other conditions when the safety zone is not visible, and if the array has been completely shut down for more than 30 minutes, use of passive acoustic monitoring before beginning ramp-up/soft-start again is strongly encouraged if vocalizing whales, other than dolphins, have been encountered within 24 hours under good visibility conditions; or there is a reasonable expectation that vocalizing whales, other than dolphins, will be present.
- During periods of low visibility and if the seismic program is in an area known to be an area where a vocalizing whale, other than a dolphin, that is listed as endangered or threatened on *SARA*, is reasonably expected to be encountered, a ramp-up / soft-start will only commence if passive acoustic monitoring is used to listen for the presence of vocalizing whales, other than dolphins.
- When passive acoustic monitoring is used, a period of 30 minutes will elapse from the last recording of a vocalizing whale, other than a dolphin, until the ramp-up / soft-start begins.

Although the Statement of Canadian Practice is not yet finalised, Canadian Superior will follow the recommendations of the most recent version of the Statement in implementing mitigation during the seismic program.

2.3 Emissions and Waste Discharges

Offshore survey vessels routinely produce a variety of other discharges and emissions. The significant ones are described below (Table 2.1).

Table 2.1 Summary of Seismic Vessel Related Discharges and Emissions

Discharge/ Emission	Description and Handling/Disposal Procedures
Grey and Black Water	There may be 30 to 50 persons on a seismic vessel at any one time. By comparison, for a Mobile Offshore Drilling Unit (MODU) accommodating about 100 people, Mobil (1985) estimated that grey water discharge (showers, dishwashing, deck drains, *etc*.) would be 40 m^3/d and that black water discharge (sanitary waste) would be 19 m^3/d. All liquid discharges will be treated in accordance with the Offshore Waste Treatment Guidelines (OWTG) (NEB *et al.* 2002) prior to ocean discharge.
Ballast Water	On survey vessels, ballast water is stored in dedicated ballast tanks to improve vessel stability. No oil will be present in ballast/preload tanks or in the discharged ballast/preload water. If oil is suspected to be in water, it will be tested and, if necessary, treated to ensure that oil concentrations in the discharge do not exceed 15 mg/L, as required by the OWTG. Transport Canada's *Guidelines for the Control of Ballast Water Discharge from Ships in Waters Under Canadian Jurisdiction* will also be followed, as applicable.
Bilge Water	Bilge water often contains oil and grease that originates in the engine room and machinery spaces. Before discharge, bilge water is treated in accordance with OWTG, which specify that the discharge will contain no more than 15 mg/L of oil.
Discharges from Machinery Spaces	As specified in the OWTG, machinery spaces will be equipped with drip trays, curbs and gutters, and other devices to prevent spilled or leaked materials from entering the water. Waste material from drip pans and work spaces will be collected in a closed system designed for that purpose and will be returned to the process cycle, recycled, or transferred ashore.
Solid Waste	Most solid waste is transferred to shore for disposal at an approved disposal facility. Sanitary and food waste will be macerated to a particle size of 6 mm or less and then discharged as per the OWTG. Combustible materials (*e.g.*, oily rags, paint cans) are handled separately in hazardous materials containers. Recycling programs will comply with local regulatory requirements, such as those maintained by the Province of Nova Scotia.
Chemicals and Hazardous Materials	Chemicals and hazardous materials that will be stored on the survey vessel and consumed during the Project include industrial cleaners, paints, lubricants, etc. All hazardous materials will be managed according to applicable guidelines and regulations to prevent environmental and human health impacts. Material Safety Data Sheets (MSDS) and worker training records will be made available according to applicable regulations. All hazardous waste will be brought to shore for treatment and/or disposal.
Lights	The survey vessel will carry operational, navigation and warning lights. Working areas will be illuminated with floodlights as required for compliance with occupational health and safety standards and will be fully equipped with emergency lighting. If a helideck is present, it will be will be floodlit and have omnidirectional guidance lights with an average illumination intensity of between 20 and 25 candelas. Hazards in the vicinity of the helideck will also have omnidirectional hazard lighting. Lighting will comply with relevant offshore standards/regulations, including requirements of the CNSOPB's *Nova Scotia Offshore Area Petroleum Geophysical Operation Regulations*, and Transport Canada's *Guidelines Respecting Helicopter Facilities on Ships.*
Atmospheric Emissions	Operational atmospheric emissions may include vessel exhaust, exhaust fumes from diesel generators and operational emission of halons during fire fighting or maintenance of air conditioning and refrigeration systems. These emissions are not anticipated to be significant and will be further minimized through best management practices and preventative maintenance procedures. These include properly maintaining and routinely inspecting ship equipment, minimizing vapour loss from fuel tanks, and minimizing idling of equipment when not in use.

2.4 Malfunctions and Accidents

There are unplanned situations that may be encountered during seismic operations. Potential hazards are addressed during site-specific planning as part of emergency response planning. Procedures are developed to ensure that such events are managed in a safe and environmentally sound manner. Canadian Superior and their contractors will have policies, plans, and procedures to prevent or mitigate effects of malfunctions and accidents. These will be submitted in advance to the CNSOPB. These policies, plans and procedures will be located on the seismic vessel, in Canadian Superior's Halifax and Calgary offices, and with their contractors.

During seismic surveys, there will be limited amounts of marine fuel and lube oil on board that could potentially be spilled to the ocean. Small spill events of kerosene and mineral oil from streamers during seismic multi-streamer operations have occurred off Nova Scotia. Such occurrences are rare and will be addressed in the EA. There is some potential for flotation fluid to be lost from any non-solid streamer if the streamer becomes damaged. Any accidental spill will be reported to the CNSOPB immediately.

Other accidental events could include damage or loss of seismic gear, entanglement of seismic gear with fishing gear, and vessel collisions. Best management practices and communications will be used on the survey vessel to avoid gear loss or damage.

2.5 Project Alternatives

2.5.1 Alternatives to the Project

Alternatives to the Project are defined as functionally different ways of achieving the same end (CEA Agency 1997). Currently, seismic testing is a critical and proven technology for refining knowledge about geological formations with a relatively high potential for containing petroleum hydrocarbons in commercial quantities and to direct exploration drilling activities which are very costly. There are no functionally different alternatives for defining potential for hydrocarbon resources that are not cost prohibitive.

One alternative to the Project is the null alternative, or "do-nothing" scenario. Oil and gas production, however, cannot occur in the absence of exploration activities. The continued demand for oil and gas within Canada and from international markets necessitates continued exploration activities over time.

2.5.2 Alternative Means for the Project

Alternative means for the Project are defined as methods of similar technical character or methods that are functionally the same (CEA Agency 1997). Alternative means for carrying out this Project include variations in technology, Project schedule and location. Alternatives may have different environmental effects. Canadian Superior will choose the alternatives that maximize Project efficiency, while minimizing potential adverse effects on the environment.

The proposed program may occur in any given year between 2006 and 2013. Although the entire area could be surveyed in one program; it might also be surveyed in two or three smaller surveys. Specific timing of the program within this period depends on a variety of factors, including vessel availability, weather conditions, and timing and sensitivities associated with biological and socio-economic constraints. For example, mitigative options to minimise impacts could include modification of the operations schedule within specific areas (*e.g.,* scheduling of specific lines so as to minimise cumulative interactions).

With respect to the technology proposed, airgun arrays are the most common, environmentally responsible and practical energy sources for marine geophysical surveys (Richardson *et al*. 1995). Noise pulses with high peak levels are produced; however, each pulse is short, limiting total energy. Richardson *et al*. (1995) also indicated that pulses from airgun arrays generally decrease in intensity, but increase in duration further away from the site. Sleeve exploders and gas guns have similar effects to airguns. Although marine vibrators produce lower instantaneous pressure than airguns, the total acoustic energy transmitted is similar due to the extended duration of the signal. Marine vibrators are

also in their development infancy and are not a practical alternative. Marine vibrators cannot substitute for the airgun array in seismic surveys as they provide a lower output at low frequencies.

This Project Description has focused on Canadian Superior's proposed (preferred) Project description. If for some reason alternatives must be considered, Canadian Superior will review the EA to determine any potential environmental implications, and if necessary, discuss these changes with the CNSOPB.

2.6 Canadian Superior HSE Policy and Other Health, Safety and Environmental Plans

2.6.1 HSE Policy

Consistent with the Canadian Superior Health, Safety and Environment (HSE) Policy and procedures, the company will apply the following objectives to the Project:

- comply with all applicable federal and provincial laws, regulations, guidelines and codes of good practice;
- ensure that all managers, supervisors, employees and contractors are aware of their HSE responsibilities;
- ensure the application of both established and innovative HSE management techniques and approaches;
- implement a management program for all HSE aspects of their work and foster cooperation and communications between employer, supervisor and employees, and contractors; and
- review, evaluate and manage work-related risks to the environment and to human health for both our employees and contractors.

With respect to the proposed Project, these objectives are best achieved through a commitment to prevention and preparedness as demonstrated in several Canadian Superior offshore programs. Canadian Superior is also prepared and fully capable of responding to, managing and resolving emergencies that arise from its operations.

2.6.2 Other Health, Safety and Environmental Plans

In support of the application for work authorization, current documentation on file with the CNSOPB will be reviewed, revised, and where necessary, prepared. The documentation for a typical seismic project will include:

- Contractor and sub-contractor Project Specific Health, Safety and Environmental Plan & Bridging Document;
- Contractor and sub-contractor Emergency Response Plan;
- Contractor and sub-contractor Project-Specific Environmental Protection Plan;
- Canadian Superior Energy Inc. Bridging Document;
- Canadian Superior Energy Inc. Emergency Response Plan;
- Canadian Superior Energy Inc. Environmental Screening; and
- Canadian Superior Energy Inc. HSE Management System.

3.0 ENVIRONMENTAL SETTING

The Project area is located on the Scotian Shelf and includes the Mariner and Marauder Blocks to the north and northeast of Sable Island and the Marconi Block to the south. Water depths at the Mariner Block range from less than 50 m to 150 m; from less than 100 m to approximately 400 m at the Marauder Block; and from less than 50 m to 200 m at the Marconi Block. The range of water depths will contribute to species and habitat diversity between blocks. Available data from each area and general information from the Scotian Shelf is summarized below. A large portion of the text for the Physical Environment section has been taken from a report prepared by Coastal Ocean Associates (2002) on behalf of Canadian Superior, "Physical Environmental Assessment – Oceanographic Component for Exploration Drilling within Mariner Block".

3.1 Biophysical Setting

3.1.1 Oceanography

From January to March, the prevailing winds are from the west and the northwest while wave directions are from the west and the southwest. From April through September, the prevailing winds and waves are from the southwest. From October to December, winds are from the west and northwest, while waves are from west and southwest.

This area is influenced by the Shelf circulation and the North Atlantic deep ocean circulation, stratification and bathymetry. The seasonal circulation on the central Scotian Shelf includes both Shelf and bank scale components – the dominant flow is a seasonally varying south-westerly current along the Shelf edge, whose origins can be traced to events in the Labrador and Greenland Seas. Further inshore, the south-westerly directed Nova Scotian Current transports waters whose components are supplied by fresh water run-off from the Gulf of St. Lawrence and the Newfoundland shelf/slope. At the western end of Sable Bank, the southwesterly shelf edge current branches off to the north/northeast; part of that branch turns eastward and closes a clockwise gyre around Sable Bank, while a smaller part turns northward. This system of currents and gyre varies seasonally in strength and position (Richardson 1977; Pickart and Smethie 1993, Han *et al*. 1997, Hannah *et al*. 2001, Han *et al*. 1999). Hence, the currents associated with the general circulation are expected to show significant seasonal variations. The Mariner Block, located north of the eastern end of Sable Bank, is at the northeastern end of this clockwise gyre. The mean circulation in the shallower southern half of the Mariner Block is an eastward flow between 5 and 15 cm/s. The deeper northern half has a weaker and predominantly northward flow around 5 cm/s, with a more pronounced seasonal variability in direction.

Currents associated with the semi-diurnal and diurnal tides in the southern half of the Mariner Block are typically 10 cm/s, with a clockwise rotation. Stronger tides up to 15 or 20 cm/s can be expected in the shallowest parts of the block along its southern boundary. For the northern half of the block, tides are of the order of 10 to 15 cm/s. (Department of Fisheries and Oceans databases). However, the presence of internal waves and the possibility of resonant continental shelf waves at sub-inertial frequencies give these currents highly variable amplitudes and phases, leading to a complex spatial structure. Details of the generation of internal tides and their propagation are dependent on the local bathymetry and it is therefore difficult to predict them. Only measurements at each specific site of operation can reveal if internal tides are occurring or not. Internal tidal currents are not predicted by operational tide predictions.

South of Sable Island, the current flow is towards the south and southwest. Surface velocities within the vicinity of the Marconi Block will have peaks around 30 cm/s. The clockwise flow has typical speeds of 5-15 cm/s in all seasons (Hannah *et al.* 2001). On the eastern end of Sable Island Bank, there is a persistent offshore flow with strong vertical shear. This flow is part of a tendency for seasonally varying counter-clockwise circulations over the Gully. Therefore, currents within the Marauder Block will be highly variable and contain components of both clockwise and counterclockwise circulation as the Block straddles both gyre systems.

3.1.2 Climate

The weather conditions in the Project area have been studied extensively as a result of offshore exploration activities and the long period of records from the weather station on Sable Island. The area is subject to rapidly changing weather and harsh conditions for offshore work. Tropical storms, particularly in late summer and fall, track up the East Coast of North America and through the study area. Extra-tropical storms are frequent throughout the winter months.

Fog is frequent in the area, present on 130 days of the year, and contributing to an average of 47 complete days per year with visibility less than 1 km (Environment Canada 2002). Over 30 years of data (1961-1990), Sable Island has recorded a mean daily maximum of 10.1˚C and a mean daily minimum of 4.7˚C (Environment Canada 2002). Total yearly rainfall averaged 1280 mm while it received close to 123 cm of snow per year (Environment Canada 2002). Thunderstorms are only frequent in the summer months, occurring on average 12 days per year (Environment Canada 2002). Wind speed average is in the order of 25 km/h and the most frequent direction is from the west (Environment Canada 2002). Extreme gusts of up to 174 km/h have been recorded on Sable Island (Environment Canada 2002).

3.2 Biological Environment

3.2.1 Benthic Community

The benthic community of eastern Sable Island Bank is dominated by sand dollars, ocean quahogs, surf clams, and northern propeller clams and has been described as the sand dollar assemblage (Mobil Oil 1983). Sea stars, sea cucumbers and several crab species are also common to the area. In areas of coarser substrates, horse mussels, sea scallop, lobster and toad crab are common (Davis and Browne 1996). The infaunal community is dominated by polychaetes (JWEL 2002).

Typical organisms observed on the Scotian slope include: Echinoderms, tube worms, bristle worms (Polychaeta), cnidarian, sea pens, whip corals, stony corals, scaphopod, pelecypod, gastropod and molluscs (Breeze *et al*. 2002).

3.2.2 Fish and Shellfish

The marine habitats of Sable Island Bank support an abundant fish community. Fish assemblages are identified in broad habitat types for the Scotian Shelf and oceanic waters, including soft bottom, pelagic, epipelagic, midwater and demersal fishes. Sixty-six fish species occur on Sable Island Bank, of which forty are ground fish species, twelve are pelagic species, and fourteen are shellfish species. Sable

Island bank is an important spawning and nursery area for many fish species (DFO 1997; O'Boyle *et al*. 1984). Table 3.1 summarizes the temporal distribution of fish spawning on the Sable Island Bank.

Table 3.1 Temporal Distributions of Spawning Fish on Sable Island Bank*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Haddock												
Pollock												
Yellowtail Flounder												
Winter Flounder												
American Plaice												
Silver Hake												
Sand Lace												
Atlantic Herring												
Atlantic Mackerel												

* Source Canadian Superior Energy Inc. 2002

Shellfish larvae known to occur on the Scotian Shelf include American lobster, northern shrimp, snow crab and scallop **(**Canadian Superior Energy Inc. 2002)**.**

Several species of marine fish that have been listed by *SARA* and COSEWIC as having special status may also occur in the Project area. A description and list of Species at Risk is detailed in Section 3.2.5 and Table 3.3.

3.2.3 Marine Mammals and Sea Turtles

Whales and seals are common to the Project area. Species distribution and abundance will vary seasonally and by block, but their presence can be expected year-round.

3.2.3.1 Whales

Pilot whales appear to be the most common species on the Scotian Slope (Canadian Superior Energy Inc. 2002). They likely occur year-round, as shown by stranding records on Sable Island (LGL Limited *et al.* 2000). Fin whales likely occur year round on the Scotian Shelf and Shelf Edge. Other species likely to occur include humpback whales that migrate through the Scotian Slope and Shelf area to nearshore areas. Their peak period through the Project area would be July to September. Sei whales occur both along the Scotian Slope and Shelf migrating north in June and July and returning south from September to November (LGL Limited *et al.* 2000). The minke whale occurs over the entire Scotian Shelf; however, their seasonal distribution and migration patterns are not well defined. Blue whales are widely distributed in the world, but they particularly prefer the edge of the continental shelf. In the fall and spring, they have been known to concentrate where there is a high concentration of euphasids (Breeze *et al.* 2002).

Atlantic white-sided dolphins occupy the cool temperate waters of the North Atlantic, and are noted for their preference for deep water. Their range is the entire Scotian Shelf region (Hoyt 1984). Bottlenose dolphins are occasional visitors to the Scotian Shelf. The Project area would be within the northern marginal range of this species.

Some species of marine mammals that have been listed by *SARA* and COSEWIC as having special status may also occur in the Project area. A description and list of Species at Risk is detailed in Section 3.2.5 and Table 3.3.

3.2.3.2 Seals

Sable Island and the Gully are important year-round feeding areas for seals. Sable Island is an important area for two seal breeding populations. It is home to the world's largest breeding population (tens of thousands) of grey seals and a few hundred breeding harbour seals. The harp seal and hooded seal may also occur within the Project area, but usually are found north of the Scotian Shelf (Canadian Superior Energy Inc. 2002).

3.2.3.3 Sea Turtles

Two species of sea turtle, the leatherback and Atlantic loggerhead may be present as summer migrants within the Project area (LGL Limited *et al.* 2000). The leatherback turtle is classified as an endangered species (*COSEWIC* 2004) and is protected under *SARA* legislation. The loggerhead turtle is listed as threatened by the United States Fish and Wildlife Service (LGL Limited *et al.* 2000). Loggerheads are generally confined to more southern waters and do not venture as far as the Scotian Shelf as consistently as the Leatherbacks. Leatherbacks travel into waters off the Scotian Shelf in late spring and early summer, then north to Cape Breton and Newfoundland (Canadian Superior Energy Inc 2002). Kemp's Ridley turtles are considered rare in the Scotian Shelf region. Please refer to Section 3.2.5 and Table 3.3 for further information on *SARA* and COSEWIC listed species.

3.2.4 Marine Birds

Concentrations of marine birds can be found on the Sable Island Bank and Scotian Slope year-round (Table 3.2). During the summer months, the offshore seabird community primarily consists of Greater Black-Backed Gulls, Herring Gulls, Sooty Shearwater, Greater Shearwater and Storm-Petrels. During the winter, Common Murres, Razorbills, Dovekies and Black Guillemot, Black-legged Kittiwakes and Northern Fulmars are most common (Canadian Superior Energy Inc. 2002). As well, large numbers of Leach's Storm-Petrel arrive in Canadian waters in May, breeding on small islands and remaining abundant off Atlantic Canada until they migrate south in early autumn.

Table 3.2 Temporal Distributions of Marine Birds Likely to be Found in the Vicinity of the Project Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Regular Resident/Visitor												
Northern Fulmar												
Northern Gannet												
Greater Shearwater												
Sooty Shearwater												
Wilson's Storm-petrel												
Leach's Storm-petrel												
Herring Gull												
Great Black-backed Gull												
Black-legged Kittiwake *												
Arctic Tern *												
Common Tern *												
Roseate Tern *												
Dovekie												
Common Murre												

Table 3.2 Temporal Distributions of Marine Birds Likely to be Found in the Vicinity of the Project Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irregular Transient/Visitor												
Cory's Shearwater												
Pomarine Jaeger												
Parasitic Jaeger												
Glaucous Gull												

* Birds with special status (COSEWIC, Nova Scotia Department of Natural Resources).

+Source Canadian Superior Energy Inc. 2002

	Present
	Not Present

Small breeding numbers of the endangered Roseate Tern nest with colonies of Common and Arctic terns on Sable Island. Terns are present in the Project area during the breeding season from May to August, after which their young fledge and they migrate out of the Project area. Terns, particularly Roseate Terns, are extremely sensitive to disturbance in their nesting colonies.

3.2.5 Species at Risk

As stated above, this Project must comply with *SARA*, which requires proponents to demonstrate that no harm will occur to listed species, their residences or critical habitat. *SARA* serves to protect listed species by prohibiting activities that may harm individuals or critical habitat. *SARA* has been linked to *CEAA* through requirements in both Acts. Section 79 of *SARA r*equires that an RA must notify the competent minister (likely DFO or EC) in writing if a project being assessed is likely to affect a listed wildlife species or its critical habitat. The RA must identify the adverse effects of the project on the species/critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen the effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plan. *CEAA* specifically includes within its definition of "environmental effect" any change a project may cause to a listed wildlife species (*i.e*., listed under *SARA)*, its critical habitat (*i.e.,* the habitat that is necessary for the survival or recovery of a listed species and that is identified in the recovery strategy or action plan for the species) or the residences of individuals of that species (*i.e*., a dwelling place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating).

SARA does allow for issuance of Incidental Harm Permits under specific conditions. If affecting the species is incidental to the activity being carried out; it must be shown that all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted; all feasible measures must be taken to minimise the impact of the activity on the species or its critical habitat or the residences of its individuals; and the activity must not jeopardise the survival or recovery of the species.

Table 3.3 contains a summary of species at risk (recognized under *SARA* or by COSEWIC) that may occur in the Project area.

3.2.6 Special Places

3.2.6.1 The Gully

The Gully Marine Protected Area (MPA) is located approximately 40 km east of Sable Island on the edge of the Scotian Shelf (Figure 3.1) and lies immediately adjacent to the southeast section of Marauder Block. It is unique among canyons of the eastern Canadian margin because of its depth, steep slopes and extension far back into the continental shelf (DFO 1998). The Gully provides diverse habitats for a variety of marine mammals, groundfish, pelagic and invertebrate species, as well as benthic and planktonic populations. Deep sea corals are a significant feature of The Gully's benthic fauna. The Gully is important as foraging habitat for cetaceans which feed on squid, particularly sperm and northern bottlenose whales, and it provides habitat for an additional eleven species of cetaceans (Faucher and Weilgart 1992; Whitehead *et al*. 1992, 1997a, 1997b). DFO designated The Gully as a Whale Sanctuary in 1994 and a MPA in May 2004, in part to reduce ship collisions and noise disturbance to the whales. Gully Marine Protected Area Regulations (Oceans Act) were published in the Canada Gazette in December 2003.

The purpose of the MPA designation for the Gully serves to conserve and protect the natural biological diversity within the protected area and to ensure its long-term health. The 2,364 square kilometres that define the Gully includes three management zones, each with varying levels of protection based on the conservation objectives and ecological vulnerability (DFO 2003). These zones are outlined in Figure 3.1.

- ***Zone 1*** consists of the deepest sections of the canyon and is preserved in a near-natural state with full ecosystem protection. This zone is highly restricted with few activities permitted.
- ***Zone 2*** provides strict protection for the canyon sides and outer area of the Gully. Some fisheries are allowed in this region
- ***Zone 3*** includes the shallow water and sandy banks that are prone to regular natural disturbance. Some compatible uses are allowed subject to stringent review.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Marine Fish Species				
Atlantic cod (*Gadus morhua*) Maritimes Population	Recommended to not be listed under *SARA* as of November 28, 2005.	Species of Special Concern (COSEWIC 2003)	Cod have been designated since their population in the entire region have declined 14% in the past 30 years, and they have demonstrated sensitivity to human activities (COSEWIC 2003). Threats to persistence include directed fishing, bycatch in other fisheries, natural predation, and natural and fishing-induced changes to the ecosystem (COSEWIC 2003).	Peaks of spawning on Sable Island bank are in November and May/June. However, the Project area represents only a small percentage of Sable Island Bank (458,434 ha) and is not recognized as a critical spawning area.
Porbeagle shark (*Lamna nasus*)	Pending public consultation for addition to Schedule 1 as endangered listing date Mar 2006	Endangered (May 2004)	The abundance has declined greatly since Canada entered the fishery in the 1990s after an earlier collapse and partial recovery. Fishery quotas have been greatly reduced, and the fishery has been closed in some areas where mature sharks occur. The landings are now comprised mostly of juveniles. Its life history characteristics, including late maturity and low fecundity, render this species particularly vulnerable to overexploitation.	Most porbeagle in Canadian waters occur between 5-10ºC with little variation throughout the year, suggesting that they adjust their location to occupy this preferred temperature range (Campana *et al*. 2001). Therefore there is no known critical time for porbeagle shark occurrence within the Project area.
Atlantic salmon (*Salmo salar*) Inner Bay of Fundy Population	Endangered, on schedule 1	Endangered (Inner Bay of Fundy populations) (COSEWIC 2001)	Numbers comprising the Inner Bay of Fundy populations of this medium-sized, schooling, anadromous fish may be less than 500. Population growth appears to be limited by marine survival rather than freshwater production capacity. The cause of the collapse of marine survival is unknown, but may be due to ecological changes in the Bay of Fundy, such as those brought about by tidal barriers placed at the mouths of several rivers and streams. Commercial salmon farms may also be a factor in the decline, since they may attract predators, alter habitat, obstruct migration or harbor disease	Any level of human-induced harm could jeopardize survival or recovery of this genetically distinct population of salmon. Although this species could occur within the study area from December to February, there is no indication that the Project area is of any particular importance.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Spotted wolffish (*Anarhichas minor)*	Threatened, Schedule 1	Threatened (COSEWIC 2001)	The reason for designation of the northern wolfish and the spotted wolfish are declines of 90% in population in three generations, and the number of locations where the fish are found has decreased. Threats to the northern and spotted wolfish include mortality as by-catch and habitat alteration by bottom trawling (COSEWIC 2003). Stock Status Report 2004/ 031, *Allowable Harm Assessment for spotted and Northern wolffish* states that: ■ Mortality of wolffish linked to fisheries directed at other commercial fisheries mainly Greenland Halibut and snow crab. ■ For both species, there is no evidence of a decline on the Scotian Shelf ■ Oil exploration and production, pollution, shipping, habitat alteration, cables, military activities and ecotourism are considered to have negligible impacts on the ability of both wolffish species to survive and recover. There is scope for human induced mortality without jeopardizing survival of this species.	Information on reproduction and growth is poorly known. Spawning is thought to occur from spring to mid fall. The Project area is not within designated critical habitat.
Northern wolffish (*Anarhichas denticulatus*)	Threatened, Schedule 1	Threatened (COSEWIC 2001)	See above Stock Status Report 2004/ 031	Information on reproduction and growth is poorly known. Spawning is thought to occur late in the year. The Project area is not within designated critical habitat.
Atlantic wolffish (*Anarhichas lupus*)[2]	Special Concern, on Schedule 1	Species of Special Concern (COSEWIC 2000)	The total population of Atlantic wolfish has declined significantly since the 1970's. Apparent threats to the Atlantic wolffish are related to fishing and habitat alteration, perhaps compounded by environmental change (COSEWIC 2003).	Information on reproduction and growth is poorly known. Spawning is thought to vary greatly across its range. The Project area is not within designated critical habitat.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Cusk (*Brosme brosme*)	Referred back to COSEWIC for further consideration.	Threatened (COSEWIC 2003)	Cusk is designated since the main cusk population has been in decline since 1970. Over three generations, the decline rate is over 90%, and cusk occurs in fewer and fewer survey trawls over time. Fishing, unrestricted until 1999, is now capped, but remains a source of mortality (COSEWIC 2003).	Cusk spawn from April to July within the western Atlantic. However there is no indication that the Project area is of critical importance for cusk spawning.
Winter skate (*Leucoraja ocelatta*)	- *SARA* status: Pending public consultation for addition to Schedule 1	- COSEWIC Status: Threatened (May 2005)	The Eastern Scotian Shelf Winter Skate is listed by COSEWIC as threatened because the species possesses life history characteristics that increase vulnerability to exploitation, reduce rate of recovery, and increase the risk of extinction. These characteristics include delayed age at maturity, long generation time, low fecundity, and consequently slow population growth rate. Abundance of mature individuals on the Eastern Scotian Shelf is estimated to have declined by more than 90% since the early 1970s and is now at a historically low level. The probable cause of the decline is an unsustainable rate at which they were captured as bycatch in fisheries directed at other groundfish species. They have been caught, and continue to be caught, in a directed fishery for skate, although current reported catches are low (COSEWIC 2005)	Winter skate occur over the Scotian Shelf in preferred depths of 36.6-90 m. Mating probably occurs throughout the year, with egg cases likely deposited from summer to autumn off Nova Scotia. The Project area represents only a small portion of the Eastern Scotian Shelf and has not been identified as critically important for this species.
The Atlantic halibut, yellowtail flounder, barndoor skate and haddock are listed under IUCN, but not under *SARA*.				
Marine Mammals Species				
Blue whale, Atlantic population	Endangered, on Schedule 1	Endangered (COSEWIC 2002)	The blue whale is listed by COSEWIC as endangered (COSEWIC 2003). Whaling reduced the original blue whale population. There are fewer than 250 mature individuals and strong indications of a low calving rate and a low rate of recruitment to the studied population. Today, the biggest threats for this species come from ship strikes, disturbance from increasing whale watch activity, entanglement in fishing gear, and pollution. They may also be vulnerable to long-term changes in climate, which could affect the abundance of their prey (zooplankton) (COSEWIC 2002).	Blue whale in the Project area would be transitory in nature since these species prefer the Scotian Shelf-Slope edge.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Humpback whales (Western north Atlantic population)	Special Concern on Schedule 3	De-listed (COSEWIC 2003)	The western North Atlantic population of the humpback whale is designated as species of special concern (COSEWIC 2003). Although heavily reduced by whaling, the humpback whale population seems to have regrown to at least a substantial proportion of its pre-whaling size. The population does face threats (including entanglement in fishing gear, habitat degradation on breeding grounds, possible resumption of commercial whaling), but neither the North Atlantic population nor any of its breeding sub-populations is at risk from current activity levels or levels that may reasonably be foreseen in the next few years (COSEWIC 2002).	The western North Atlantic humpback whale migrate through the Scotian Shelf from July to September. However the Project area is not known to be of particular importance and is small in comparison to the whole of the Scotian Shelf.
Fin whale, Atlantic population	Special Concern, on Schedule 3; Pending public consultation for addition to Schedule 1 Listing date -July 2006	Species of Special Concern (COSEWIC 2003);	Fin whale are designated as species of special concern. The reason for designation is that the population was decimated by exploitation (COSEWIC 2003).	Fin whale occur year round on the Scotian shelf. However, the Project area, at any time of the year, is not known as being of critical importance to this species.
Sei whale (Atlantic population)		Data Deficient (COSEWIC 2003)	Sei whales are seen off Nova Scotia and Newfoundland. However, data are lacking to determine the degree of depletion caused by whaling, or to assess current population size, or to determine whether the population has recovered in any way since whaling ended. The effects of current threats, especially oil and gas exploration and development, are unknown. There is also uncertainty regarding possible population substructure (COSEWIC 2003).	Sei whale migrate through the Scotian Shelf in June-July and September to November. However the Project area is not known to be of particular importance and is small in comparison to the whole of the Scotian shelf.
North Atlantic right whale	-Endangered, on Schedule 1	Endangered (COSEWIC 2003; NMFS 2003)	North Atlantic right whales, found only in the North Atlantic, were heavily reduced by whaling. The total population currently numbers about 322 animals (about 220-240 mature animals), has been decreasing during the last decade, and is experiencing high mortality from ship strikes and entanglement in fishing gear. A sophisticated demographic model gives an estimated mean time to extinction of 208 years (COSEWIC 2003).	Critical area for the North Atlantic right whale include the Roseway Basin and part of the Bay of Fundy. Therefore, the Project area, at any time of the year, is not known as being of critical importance to this species.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Harbour porpoise, Northwest Atlantic population	Referred back to COSEWIC for further consideration.	Species of Special Concern (COSEWIC 2003)	Harbour porpoise are widely distributed and can be divided into three populations that summer in the Gulf of Maine/Bay of Fundy, the Gulf of St. Lawrence, and Newfoundland-Labrador. Many animals (probably thousands and perhaps a significant proportion of the population) die each year due to incidental capture in fisheries. Reduced fishing for groundfish may have lowered bycatch, but the benefits to porpoise, if any, need to be quantified. Management plans to reduce bycatch are only in place in the Gulf of Maine/Bay of Fundy. Harbour porpoise can be excluded from important habitat by acoustic harassment devices associated with aquaculture (COSEWIC 2003).	The harbour porpoise is a coastal species. Therefore, the Project area, at any time of the year, is not known as being of critical importance to this species.
Northern bottlenose whale (Scotian Shelf population)	Accepted for inclusion as Schedule 1 Endangered (November 28, 2005).	Endangered (COSEWIC 2002)	The Gully population totals about 130 individuals and appears to be currently stable. Bottlenose whales occur elsewhere along the Scotian Slope. Oil and gas development in and around the prime habitat of this population poses the greatest threat and will likely reduce the quality of their habitat. However, there is little information as to how this species is, or is not, affected by oil and gas development activities (COSEWIC 2002). Northern bottlenose whales produce low amplitude social sounds that may be affected by noise from shipping, fishing or seismic vessels. It is for that reason and their low population that COSEWIC upgraded the status of this species to endangered in November 2002.	Critical area for this species includes The Gully and other underwater canyon features. The Project area, at any time of the year, is not recognized as being of critical importance to this species; however, it should be noted that the southeast corner of Marauder Block lies adjacent to The Gully.
Sowerby's Beaked Whale	Special Concern, on Schedule 3 Going through Listing process: Listing Date Potential July 2007	Species of Special Concern (COSEWIC 1989)	Sowerby's beaked whale is also listed as a species of special concern (COSEWIC 2003). The reason for designation is that their limited Canadian range coincides with major shipping lanes.	Very little is known about the preferred habitat of Sowerby's Beaked Whales. They are found in deep offshore boreal waters. Therefore, it is unlikely that the Project area is of critical importance at any time of the year.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Sea Turtles				
Leatherback sea turtle (*Dermochelys coriacea)*	Endangered, on Schedule 1	Endangered (COSEWIC 2001)	The leatherback turtle is undergoing a severe global decline (> 70 % in 15 years). In Canadian waters, incidental capture in fishing gear is a major cause of mortality. A long lifespan, very high rates of egg and hatchling mortality, and a late age of maturity makes this species unusually vulnerable to even small increases in rates of mortality of adults and older juveniles. Stock Status Report 2004/ 035, *Allowable Harm Assessment for Leatherback Turtle in Atlantic Canadian Waters*, states that: ■ Incidental captures, through commercial fishery, in Canadian waters appears to account for a small proportion of the estimated incidental captures in the Atlantic population. ■ It is believed that leatherback turtles can sustain a human-induced mortality of up to 1% (*i.e.*, there is scope for human-induced mortality without jeopardizing survival or recovery of this species).	There is potential for leatherback turtle to be on the Scotian Shelf from late May to early October pursuing prey. The Project area is not recognised as being an important leatherback turtle feeding ground.
Kemp's Ridley turtle and Atlantic loggerhead turtle are listed respectively as endangered and threatened by NMFS and USFWS (1991).				
Marine Birds				
Roseate Tern (*Sterna dougallii)*[1,2]	Endangered, Schedule 1	Endangered (COSEWIC 2003)	Human exploitation (trapping for market) of the Roseate Tern on its wintering grounds is the main limiting factor for the species. Toxic chemicals passed through the food chain and their effects on reproduction (thinning of eggshells, premature breakage of eggs, and reduced reproductive success) are also a concern (COSEWIC 1999). In Canada, the Roseate Tern is at the northern limit of its range. It breeds along the Atlantic coast in Nova Scotia and in Quebec, and has been seen in New Brunswick and in Newfoundland. In 2000, there were an estimated 150 pairs of Roseate Terns counted in Canada. Three large colonies in Nova Scotia (on the Brothers Islands, Grassy Island, and the Country Island complex) account for about 94% of the Canadian population.	The Roseate Tern does not breed within the study area since it almost exclusively breeds on islands of the eastern shore of mainland Nova Scotia. The Project area has not been recognised as critical for this species.

Table 3.3 Species at Risk that may Occur in the Study Area

Species	*SARA* Status	COSEWIC Status	Reason for Designation	Critical Period in the Study Area
Ivory Gull (*Pagophila eburnean)*	Special Concern, Schedule 1	Special Concern (COSEWIC 2001)	This species is very vulnerable to any type of disturbance at certain times of the breeding season. They may abandon eggs if approached. The Ivory Gull breeds in high-Arctic coastal areas with permanent pack ice and open water. It winters primarily in Arctic seas, though may be seen along the Atlantic coast to New York (*SARA* 2004)	The Ivory Gull does not breed within the Project area since it almost exclusively breeds in high Arctic coastal areas. The Project area has not been recognised as critical for this species.
Ipswich (Savannah) Sparrow (*Passerculus sandwichensis princeps*)[1, 2]	Special Concern, Schedule 1	Special Concern (COSEWIC 2001)	The Savannah Sparrow *princeps* subspecies has a limited breeding range (mostly on Sable Island), it is vulnerable to any changes affecting Sable Island. This bird winters in the Middle Atlantic States, between Nova Scotia and northern Florida The migration of this bird is greatly dependent on the weather, which makes it vulnerable to weather-related catastrophes (COSEWIC 1999). The main factor limiting the overall population size of the subspecies seems to be the limited amount of available habitat on its breeding grounds (COSEWIC 1999).	Sable Island is recognised as being of importance for this species. However, Project activities will not have any impacts on Sable Island, other than emergency helicopter traffic and potential impacts due to accidental events which will be assessed in the EA.
Barrow's Goldeneye[2]	Special Concern, Schedule 1	Special Concern (COSEWIC 2003)	During late fall, winter and early spring, large numbers of the eastern population congregate in a few areas along the St. Lawrence corridor. One single oil spill could have a significant impact on this small population. Forest exploitation is a threat to the species' breeding grounds. It destroys nests, reduces the number of potential nest sites, exposes young to predation and increases disturbance by making lakes more accessible. *(*COSEWIC *2000)*	There are no critical areas for this species within or in close proximity of the Project area. This species is generally found in the coastal area of Mainland Nova Scotia.
Harlequin Duck[1,2]	Special Concern, Schedule 1	Special Concern (COSEWIC 2003)	Harlequin Ducks spend most of the year in coastal marine environments, but they move inland each spring to breed along fast-flowing turbulent rivers. Destruction, alteration and contamination of their habitat are the main factors accounting for the decline of the eastern population of the Harlequin Duck. Some of the once fast-flowing streams have been altered by hydro projects, and other human activities have impinged on both the breeding and wintering grounds and the food supply (COSEWIC 1990).	There are no critical areas for this species within or in close proximity of the Project area. This species is generally found in the coastal area of Mainland Nova Scotia.

Fishing for halibut, tuna, shark and swordfish have been allowed in Zones 2 and 3 provided the activities are conducted under a federal fishing license and approved management plan. Scientific research and monitoring may be approved in all three zones provided a plan is submitted and the research meets all regulatory requirements. Other activities may be permitted in Zone 3 provided they do not cause disturbance beyond the natural variability of the ecosystem and are subject to plan submission and Ministerial approval (DFO 2004).

3.2.6.2 Sable Island

Sable Island is 42 km in length, composed of sand, and is the only emergent portion of the Sable Island Bank. It is located approximately 290 km southeast of Halifax. Sable Island is a federally protected area designated as a Migratory Bird Sanctuary, administered by the Canadian Wildlife Service. The island provides unique habitat to several flora and fauna species, some of which are endangered or of special concern according to COSEWIC (2001). The island supports unique sand dune/vegetation habitats, bird species, feral horses, and provides haul-out and breeding habitat for harbour and grey seals. Sable Island is the only breeding ground of the rare Ispwich Sparrow and is also home to small breeding numbers of the endangered roseate tern (Environment Canada 1998).

The geology of Sable Island is unique to Nova Scotia in that the complete sequence of surficial materials is composed of sand-sized particles. There are no bedrock outcroppings, clay deposits, or soil profile developed on the island (JWEL 2000). It is the only exposed portion of the outer continental shelf in the Northwest Atlantic (Environment Canada 1998).

3.3 Socioeconomic Setting

3.3.1 Fishery

The most intensive fishery within the Project area is for halibut within the Marauder Block during spring and summer. Snow crab are fished within the Mariner, Marauder and Marquis Blocks in the fall, primarily. Stone crab are also fished in the Marauder Block. Small amounts of shrimp are harvested from Marquis and Marauder Blocks, while some scallop is harvested from the Mariner and Marquis Blocks. Groundfish species fished in the Marauder Block primarily during summer and fall include catfish, cod, cusk, haddock, white hake, pollock and skate. There is relatively little groundfish taken from any of the other blocks. There is a limited shark fishery within the Marauder Block. Mackerel and herring are also fished within the Project area, during the fall and spring, respectively.

3.3.2 DFO and Industry Research Surveys

Data on the status of various stocks on the Scotian Shelf are collected through a variety of means each year, by DFO research vessels and in conjunction with the fishing industry. Relevant to the Project area are: the DFO July Groundfish Survey, the Halibut survey, and the 4VS/4W Sentinel Fisheries Program.

3.3.3 Marine Shipping

Ships (tankers, general cargo ships, bulk carriers, tug boats, cruise ships, and research vessels) destined for major ports in the Maritimes and eastern seaboard of the United States may occur in the

general vicinity the Study Area. The underwater noise generated by marine shipping within the vicinity of the Project contributes to ambient noise observed in the region. Marine pollution discharged by the marine shipping industry is a serious concern and ranges from sewage, garbage, and exhaust from diesel engines to oil-contaminated bilge water.

3.3.4 Military Use

The Department of National Defence (DND) has designated operational training areas that cover the entire offshore region of Nova Scotia. The majority of DND offshore training activities are conducted between Halifax and Liverpool. Training activities generally fall under the broad areas of weapons firing, ship manoeuvres, activities which support the functioning of the ship (*i.e.*, communication, environmental data collection, replenishment at sea), and countermeasures either to detect the operations of other ships or to hamper detection. Aircraft are used to support some of the training activities.

There are no known unexploded ordinance (UXO) locations within the areas defined by the three blocks or within 30 nm of the areas being surveyed (Kyle Penney, personal communication, November 30, 2005).

3.3.5 Petroleum Industry

In the past decade, the eastern part of Sable Island Bank and the entire Scotian Shelf Break and Slope have become the focus of interest for oil and gas exploration offshore Nova Scotia. The deep waters of the Scotian Slope, ranging in depths from 300 to 3,000 m, and the shallow waters in the vicinity of the Sable Island Bank, in depths less than 80 m, are the two primary areas where exploration is expected to occur over the next five years. Exploratory drilling is currently ongoing in these areas. Exploratory activity in the Laurentian sub-basin is expected to increase with the resolution of the boundary dispute of April 2, 2002, between Nova Scotia and Newfoundland.

3.3.6 Cables

Various submarine cables traverse the offshore study area running to a variety of destinations including England, Sable Island, and the East Coast of the United States. A number of these cables are reportedly inactive.

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