

CANADIAN SUPERIOR ENERGY INC.



Project Description for Exploration Drilling Activities on the Marauder (EL2415) and Marconi (EL2416) Blocks

January 2006



Prepared By



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Whitford

An Environment of
Smarter Solutions

Project No.
NSD18989



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REPORT

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Exploration Drilling Activities on
the Marauder (EL 2415) and
Marconi (EL 2416) Blocks

Canadian Superior Energy Inc.

REPORT NO. SD18989

**Jacques
Whitford**

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REPORT NO. SD18989

REPORT TO **Canadian Superior Energy Inc.
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Suite 1409, Purdy's Wharf, Tower 1
Halifax, NS
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FOR **Canadian Superior Energy Inc.**

ON **Project Description for Exploration Drilling
Activities on the Marauder (EL 2415) and
Marconi (EL 2416) Blocks**

January 2006

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1.0 INTRODUCTION

1.1 Project Overview

Canadian Superior Energy Inc. (Canadian Superior) proposes to drill one or more exploration wells located on Nova Scotia Exploration Licenses EL2415 (Marauder Block) and EL 2416 (Marconi Block) (Figure 1.1). The Marauder Block encompasses a total area of 1270 km² 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 240 km² and is located on the Scotian Shelf, approximately 330 km southeast of Halifax and 16 km southeast of Sable Island. Water depth within the blocks varies from approximately 100 to 400 m in the Marauder Block and 50 to 200 m in the Marconi Block.

The drilling schedule depends on the availability of a mobile offshore drilling unit (MODU), delivery of goods and services and regulatory approvals. The number of wells to be drilled within the blocks and the individual well locations and objectives will be identified within the Authorization to Drill the Well (ADW) documents. For the purposes of the assessment, all of the Marauder and Marconi Blocks are considered as prospective drilling areas.

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. To date, Canadian Superior has drilled a total of two exploration wells (one of these with a sidetrack) offshore Nova Scotia.

Canadian Superior intends to contract the well drilling and operational support activities to qualified and experienced firms. For additional information regarding Canadian Superior's Marconi and Marauder Projects, please contact:

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Figure 1.1

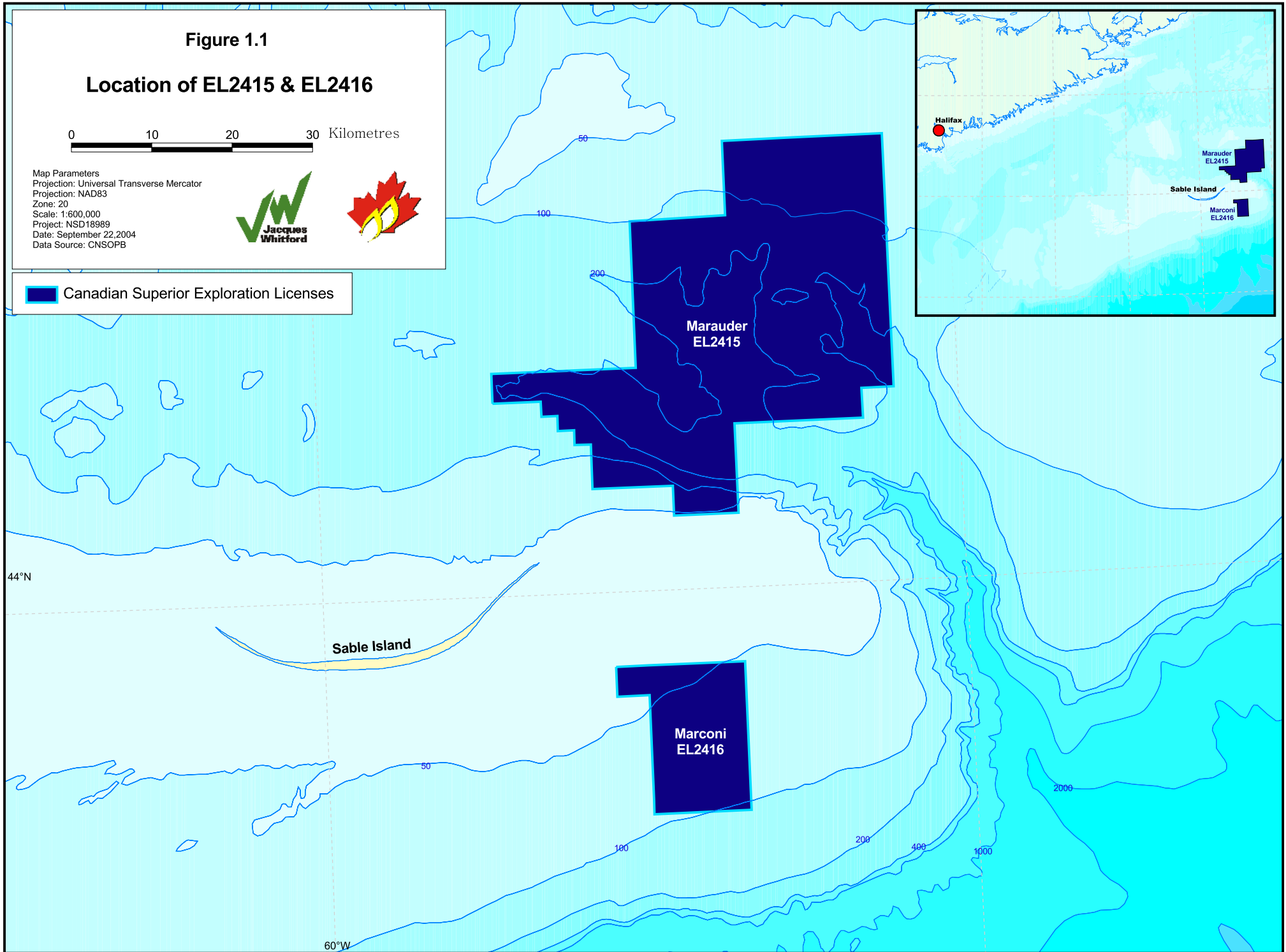
Location of EL2415 & EL2416

0 10 20 30 Kilometres

Map Parameters
Projection: Universal Transverse Mercator
Projection: NAD83
Zone: 20
Scale: 1:600,000
Project: NSD18989
Date: September 22, 2004
Data Source: CNSOPB



Canadian Superior Exploration Licenses



1.3 Purpose and Need for the Project

Canadian Superior proposes to drill one or more exploration wells in the Marconi and Marauder Blocks to evaluate hydrocarbon potential. Seismic data may justify drilling of exploration wells in these blocks. Exploration drilling is necessary to confirm the existence of commercially viable hydrocarbon reserves.

This Project, if successful, will allow Canadian Superior to maximize returns to shareholders. 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 Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) regulates oil and gas activities under the *Canada-Nova Scotia Petroleum Resources Accord Implementation (Nova Scotia) Act*. Proponents are required to obtain a Drilling Program Authorization (DPA) and ADW before conducting drilling operations offshore Nova Scotia. The DPA authorizes the proponent (Operator) to conduct a drilling program consisting of one or more wells within a specified location and time using one or more drilling installations, and includes all operations and activities ancillary to the program. The ADW permits the Operator to drill a particular well using drilling and evaluation procedures described in the application and accompanying well prognosis (CNSOPB 2001).

This Project will also require an environmental assessment (EA) to meet the requirements of the Canadian Environmental Assessment Act (CEAA). Amendments to the *Federal Authorities Regulations* in January 2001 designated the CNSOPB as a Federal Authority (FA) under CEAA. In July 2003 and November 2005, a number of amendments to regulations pursuant to CEAA came into force. These amendments have resulted in the following changes:

- Work authorizations issued under paragraph 142(1)(b) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* are included in the *Law List Regulations*. This means that if the CNSOPB must issue a work authorization for a “project”, an environmental assessment must be completed prior to issuing the authorization.
- The *Comprehensive Study List Regulations* were amended on November 17, 2005 whereby offshore oil and gas exploratory drilling projects are now subject to a screening level assessment rather than a comprehensive study.

As a result of these changes, a screening level assessment for the Project is required pursuant to 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 for the assessment. 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), 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 accidental events (e.g., spills) will be examined and potential scenarios will be modeled. 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. 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 proposes to drill one exploration and up to three delineation wells on various prospects in the Marauder and Marconi Blocks. The determination of the number of wells, and individual well objectives and locations, will be addressed within the ADW documents. For the purpose of this environmental assessment, the entire Marconi and Marauder Blocks will be considered as a prospective drilling area (Figure 1.1). The exploration wells in the Marconi and Marauder Blocks are expected to encounter similar fluid composition as the Sable Offshore Energy Project (SOEP) (ExxonMobil Canada Properties) Venture well (*i.e.*, natural gas and/or gas condensate). Up to three additional wells to delineate, exploit and develop the prospective area may be drilled from surface locations in this general vicinity at each prospect.

The EA Report will consider the potential for a multi-year, multiple well program. Canadian Superior has 100% ownership of the exploration licenses for the Marconi and Marauder Blocks; but, over time, joint venture partners may earn varying interests in these licences. The licences are for a nine-year period, effective January 2004 until January 2013. The EA Report will, therefore, address a drilling program that could continue until January 2013. Given the length of this Project timeframe, the EA Report will address Canadian Superior's commitment and approach to the periodic review of proposed mitigation and monitoring to ensure on-going validity and applicability.

2.2 Project Components

At this stage of the planning process, certain specific Project details are not finalized. For completeness, reasonably foreseeable options for major components are discussed below. The following description of Project components was partially adapted from the "Environmental Assessment of Exploration Drilling off Nova Scotia" (Thomson *et al.* 2000); a generic document designed to streamline environmental assessments of exploration drilling in offshore Nova Scotia.

2.2.1 Jack-up MODU

For drilling on the shelf area in water depths up to approximately 100 m, a bottom-supported jack-up MODU is generally used (Figure 2.1). Jack-up MODUs are towed to the drill site. Once on site, the legs are jacked down until they are in contact with the seafloor, then the drilling barge/rig platform is elevated up the legs until it is approximately 20 m above the water surface. Hazard assessments, using geotechnical surveys, boreholes, bottom scanning, and other studies are carried out to ensure the seabottom can safely support the rig, prior to its arrival at the drill site.

Figure 2.1 Typical Jack-up MODU



2.2.2 Drillship

Drillships (Figure 2.2) are used to drill in very deep water; but generally in water depths greater than the deeper locations on the Marconi and Marauder Blocks. Drillships may be anchored or dynamically positioned and either technique could be used for this Project. The latter requires a series of thrusters or powered propellers fore and aft and on both sides of the vessel. A computerized system automatically activates the thrusters to maintain the vessel in a relatively constant position in relation to subsea beacons on the drill site and geostationary satellites. The computer controls the actions of the thrusters to offset the effects of wind, waves, and currents. These types of ships usually incorporate a double-hulled, supertanker design. With more surface exposed to the sea, heave on drill ships is greater than that for semi-submersibles; therefore, drillships generally cannot operate in as rough seas.

Figure 2.2 Typical Drillship - West Navion (Courtesy of Smedvig)



2.2.3 Semi-Submersible MODU

A semi-submersible MODU (Figure 2.3) consists of two longitudinal and streamlined lower hulls that support several vertical cylinders or columns, which in turn support the main deck of the rig. The hulls and columns are filled with water so that the rig floats; the main deck is above water and the hulls are below the water surface. Because much of the mass is well below the waterline, semi-submersibles

are quite stable in rough seas, thereby providing a relatively stable drilling platform. They can be towed or can move under their own power to the drill site. Once on site, the bottom part of the rig is flooded and the rig may be moored to the bottom with a series of 6 to 12 anchors and a combination of chain and cable running several thousand feet from the anchors to the rig. Some semi-submersibles use a dynamic positioning system to maintain position in deep waters. For ultra-deepwater locations, typically deeper than 6,500 ft (1,981 m), semi-submersibles rely solely on dynamic positioning to keep on station. An anchored semi-submersible rig may be used to drill at deeper locations on the Marconi and Marauder Blocks.

**Figure 2.3 Typical Semi-submersible MODU - Cajun Express
(Courtesy of Transocean Sedco Forex)**



2.2.4 Supply and Servicing

Supply vessels and helicopters will be used to transport personnel, fuel, food, drilling equipment and other materials required to maintain a crew, vessel and drilling operations. In addition, there are regular crew changes, visits from regulatory agencies and others that need to be transported to and from the MODU.

Support Vessels

Supply boats (workboats) will be used to supply the MODU with materials. Supply vessels hold liquid drilling mud, drill water, potable water, barite (mud weighting material), fuel, cement, bentonite (fresh water gel), drill pipe, casing and various equipment necessary for drilling operations. The vessels will make periodic round trips from a dockside shorebase to the MODU; selection of the dockside shorebase location is in progress. In addition, a standby vessel is required by CNSOPB regulations. It is likely that a total of two or three vessels will be used to support the drilling operation. Approximately one boat every two days will be transiting between the MODU and the shorebase. This assessment, including mitigation measures, is considered applicable for any dockside shorebase location in Nova Scotia

Helicopters

Personnel will be transported to and from the drilling rig via helicopters with flights occurring approximately three times per week depending on the crew change schedule, aircraft used and distance traveled. These helicopters will be used primarily to transport crewmembers, company personnel and service personnel. In some cases, small equipment and parts are transported via air transportation. Only in certain emergency situations will helicopters fly over Sable Island.

2.3 Drilling Activities

As details on the drilling program have not been determined, the following generic discussion on well drilling activities has been adapted from existing reports (Thomson. *et al.* 2000; Petroleum Communication Foundation 1999; USCG *et al.* 2000).

Wells are drilled in stages, starting with a surface hole drilled to reach a depth anywhere from 6 to 400 m, depending on final well depth and site-specific conditions. The crew then pulls out the drill string and inserts steel pipe called casing, which is cemented in place to prevent the wall of the hole from caving in, prevent seepage of mud and other fluids, and facilitate hydrocarbon extraction. A conductor casing lines the upper section of the well. Water-based mud (WBM) is used to drill this portion of the well and, as there is no way to return the mud to the rig before the first casing is installed, the drilling mud and cuttings are released onto the seabed, as is currently approved by the CNSOPB for this activity.

The next casing string is the surface casing, which ensures adequate pressure integrity to allow blowout preventers (BOPs) to be installed. Typical surface casing depths are approximately 600 m below the surface of the seabed. Intermediate casings may be also be required, the size, depth and number of which will vary according to formation depths and pressures. Drilling conductor pipe is used to connect the casing set at the seafloor up to the drilling unit, allowing transport of cuttings and drilling mud to the rig where processing will take place. Additional information on drill muds and cuttings is provided in Section 2.5.1.

If significant quantities of hydrocarbons are found, production casing may be installed. The well would then be further evaluated and either abandoned or suspended. If no significant quantities of hydrocarbons are found, the well will likely be plugged, cut off below the seabed level, and abandoned.

Details on a typical drilling plan are provided in Table 2.1.

Table 2.1 Typical Casing Plan and Drilled Hole Characteristics

Drill/Casing String	Outside Diameter	Depth (below sea floor)
Conductor	914 mm	200m
Surface	473 mm	850 m
Production	340 mm	3,050 m
Liner	244 mm	4,420 m
Liner	178 mm	6000 m

Note: Total Depth (TD) of well is approximately 6000 m.

If significant quantities of hydrocarbons are found, the production casing will be installed and cemented into place. The well will then be secured and temporarily abandoned in accordance with CNSOPB Regulations, pending further geologic interpretation of the results.



2.4 Associated Activities

2.4.1 Well Site Surveys

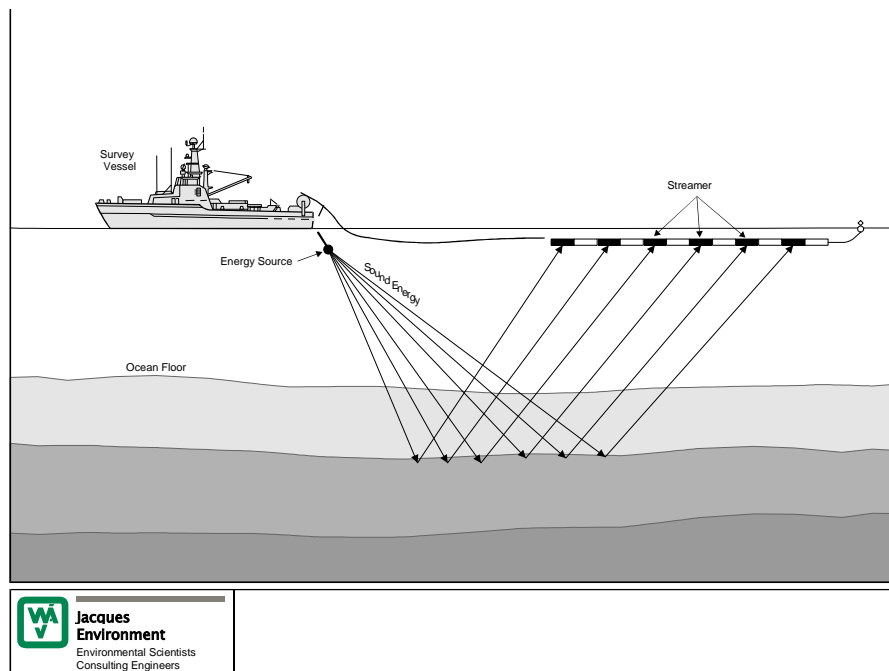
The assessment considers the potential for a number of wellsite surveys required by a multiple well program. The size of the individual wellsite surveys varies according to the area of interest. A typical wellsite survey acquires a full suite of high resolution geophysical data, in compliance with regulations of the CBSOPB and Canadian Superior's specifications.

During typical wellsite surveys, digital multichannel seismic and other high resolution geophysical equipment is deployed concurrently minimising survey time. A magnetometer is usually deployed on an as-needed basis, if suspected wreckage, man-made targets or communications cables are identified or suspected. A review of existing public domain (and proprietary, where permitted) geophysical and geotechnical data will be performed prior to the commencement of survey. In addition a number of stations could be identified for benthic sampling using a grab sampler (Vanveen or Shipek) and underwater video camera.

The detailed technical specifications for potential wellsite surveys will be finalized when the Geophysical Contractor has been selected. However, the detailed technical specifications are quite standard. The specific equipment to be used in each wellsite survey will be listed in Canadian Superior's Geophysical/ Geological Work Authorization submitted to the CNSOPB and will be consistent with CNSOPB regulations and guidelines.

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 2.4). Both the air gun "pops" and their reflected echoes are recorded on magnetic tape.

Figure 2.4 Schematic of Typical Seismic Survey



The typical energy source for a wellsite survey will consist of one to four different types of equipment (boomer, sounder, sidescan and sleeve guns). All of the types of equipment have a different maximum peak pressure (Table 2.2). The largest energy source in typical wellsite surveys are sleeve guns which typically have a total volume of 160 cu. in. consisting of 4 x 40 cu in. sleeve guns operating at 151.56 psi (Table 2.2). The total pressure for sleeve guns is approximately 10.45 Bar-meters.

Table 2.2 Typical Energy Sources – Wellsite Survey

Type	Manufacturer	Output	Max Peak Pressure (Bars @ 1m)	Max Peak Pressure (psi)
Boomer	Huntec	2kV – 6kV (1kV increments)	0.69	10
Sounder	Odom	1000 watts	0.87	12.61
Sidescan	Edgetech		2.51	36.4
Sleeve Guns (4 x 40 cu. in.)	Input/ Output		10.45	151.56

Typical wellsite surveys have a peak pressure output of 230dB re 1 µPa @ 1 m (Davis *et al.* 1998). Smaller energy sources are also utilized in the survey and are also listed in Table 2.2. However, the only energy source which requires an environmental assessment under Section 19.1 (a) of the CEAA's is the sleeve guns since the maximum peak pressure is over 275.79 kPa (40 psi). The assessment will address all wellsite survey activities including the impacts from the sleeve guns (Table 2.2).

About 30 minutes prior to arriving at the start of a line, the airgun array is slowly brought up to maximum power, a procedure referred to as a soft start. This procedure is an environmental protection measure to permit marine animals opportunity to temporarily vacate an area if the noise levels are perceived as a disturbance. Vessels towing streamers have limited manoeuvrability when the equipment is deployed. Canadian Superior will include a one kilometre vessel turn-around perimeter around the survey area. The soft start approach to commence a new line will occur within this perimeter. The environmental assessment will take into account this expanded area.

Typical wellsite survey parameters consist of a single streamer, which is about 600 m long with 48 or 96 hydrophones spaced at 12.5 or 6.5 m apart. The streamer will be towed at a water depth of three metres. The line orientation has not yet been determined. Table 2.3 summarizes the typical wellsite survey acquisition parameters.

Table 2.3 Typical Wellsite Survey Parameters

Total Linear Length of Lines (km)	35km
Line spacing	150 m
Active Length	600 m
Group Interval	12.5 m
Sampling Rate	1 millisecond
Source Array Tow Depth	3 m

2.4.1.1 Survey Vessel

The survey vessel will be selected prior to each wellsite survey according to availability and suitability. The survey vessel will be a conventional survey vessel, with a crew of 14-30 people. The vessel M/V Anticosti has been used in a previous wellsite survey in the Mariner Block and may be used again and

would be indicative of the vessel type. 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). Typically, the survey vessel will require a turning radius of 500 to 900 metres outside the identified survey area during wellsite surveys. However the turning radius is dependent on the vessel, water depth and length of streamer. Operations are limited to a Sea State of 5 or wave heights of about 3 m.

2.4.1.2 Timing

Wellsite surveys are expected to be conducted from time to time over the duration of the license. The exact number of wellsite surveys and timing is dependent on a variety of factors mostly linked to the exploration drilling phase. Typical wellsite surveys are expected to take approximately 15 days to complete (including mobilization, demobilization, streaming to and from the blocks, testing equipment, deploy and recover equipment, and collect data) and may occur at any given time throughout the year. However, wellsite survey data acquisition typically requires only 3-5 days for a 2 x 2 km area and often last less than three days. Time spent on data acquisition could vary with the size of the area to be surveyed; but is constantly a relatively small area (less than 10s of km², not 100s of km²) over a short duration of time (days not months). The determination of the number of wells, and individual well objectives and locations, will be addressed over time within other regulatory filings (e.g. DPA, ADW).

2.4.2 Geotechnical Site Investigations

Geotechnical site investigations are conducted to determine the foundation properties of the surficial geology for the support of offshore structures. These investigations normally consist of boreholes drilled into the seabed by specialized drill ships to depths ranging from 10 m to 125 m below seafloor using motion-compensated rotary drilling methods, mud system, seabed frame, and various samplers and downhole tools. A typical site investigation requires a combination of drilling, sampling and in situ testing.

The crucial component of the marine and drilling equipment is the platform from which the geotechnical investigation is conducted. In the harsh environmental conditions offshore eastern Canada, specialized geotechnical drillships have been found to be the most effective platform for these investigations.

During drilling operations, the power swivel advances the drill pipe down to the depth required. The hole is cleaned out using fluids and a variety of tools and samplers are deployed. Several sampling techniques, including piston sampling, push sampling, and wire-line percussion sampling can be used on the vessel to acquire samples from the borehole. Downhole tools or samplers are deployed and retrieved via wireline.

Geotechnical vessels typically have an onboard laboratory equipped for basic soil examination and testing. The laboratory is divided into separate areas for sediment testing and inventory storage. Space is also provided for general office work. A full complement of routine sediment testing and classification equipment is normally provided in the test area.

Recovered sediment samples are examined, classified, tested, and packaged for transportation while in the field. The extent and types of field testing of select sediment samples depends on the sediment type.



2.4.3 Vertical Seismic Profile

Canadian Superior may potentially conduct Vertical Seismic Profiles (VSPs) during the drilling of each proposed exploration well. It is estimated that each VSP would take place within a radius of 2.5 km from each well site.

2.4.3.1 Zero Offset Vertical Seismic Profile

Using a Vertical Seismic Imaging Tool (VSI) run in an exploration wellbore, a series of VSI geophones would be anchored in the wellbore successively, at regular intervals to cover the entire recording depth. An acoustic source array similar to the array described below (Table 2.4) would be deployed over the side of the MODU to a depth of approximately four metres of water.

Table 2.4 Sonic Source Specifications

Source Type	No. Sources	Pressure (PSi/bar)	Calibrated Peak Vertical Amplitude (bar@1m)	Peak Sonic Pressure Level (db re 1 micro PA @1m)	Total Chamber Size(in ³)	Array Depth (m)
SLB, ITAGA Sleeve Array	8	2000/140	13.4	242.5	760	4

At each anchoring of the VSI toolstring in the wellbore, the acoustic source would be triggered approximately 5-6 times to create a sonic wave that would be recorded by the VSI geophones anchored in the wellbores. The sonic wave recorded by each of the downhole geophones would be digitized and transmitted to the surface recording equipment.

This operation would be conducted twice, once at the end of the shallow open hole section, and subsequently at the final total drilling depth.

2.4.3.2 VSP Sonic Source

The sonic source would consist of an acoustic source array similar to the ITAGA sleeve array described below. The ITAGA array is made up of 4 x 40 in³ acoustic sources, pressured up to 2000 psi. The total volume of the acoustic source array is 760 in³. The acoustic source array provides a calibrated peak vertical amplitude of 13.4 bar @ 1 m (*i.e.*, a sound pressure level of 242.5 dB re 1-micro Pa @ 1 m). Refer to Table 2.4.

2.4.3.3 Walkaway Vertical Seismic Profile

A Walkaway VSP may be conducted using the same VSI toolstring. This would involve anchoring the VSI toolstring at different depths, successively, within each wellbore (as with the Zero Offset VSP). A second acoustic source array would then be deployed over the side of a workboat to an approximate depth of four metres of water.

For each anchoring, the workboat would navigate away from the MODU in a straight line, for a distance of approximately 2,500 m. This would be repeated in two directions away from the MODU. While the workboat navigates along these lines, the acoustic source array would be triggered regularly to create a sonic wave that would be recorded by the VSI geophones anchored in the wellbores. The sonic waves recorded by each of the downhole geophones would be digitized and transmitted to the surface recording equipment.



2.4.3.4 Timing

Two Zero Offset VSPs may be conducted, once at the end of the shallow open hole section and subsequently at the final drilling depth. Should a Walkaway VSP be conducted, it would occur simultaneously with the last Zero Offset VSP at the total depth of each wellbore, using the same VSI toolstring, one acoustic source array on the MODU and one acoustic source on the workboat. The two acoustic source arrays would be triggered alternatively; never at the same time during the recording process.

The expected time of data acquisition (with an active sonic source) for each VSP (Zero Offset and potential Walkaway) would be less than 9 hours. The total time of each VSP (Zero Offset and potential Walkaway) is expected to be less than 15 hours.

2.4.4 Well Testing (Drill Stem Testing/ Flow Testing)

Once an exploration well has been drilled to depth, through the prospective reservoirs, well testing may occur depending on the nature and content of any hydrocarbons encountered. The decision whether or not to drill stem test the well is made based on an evaluation of the rock and fluid properties gathered by running a series of evaluation tools known as logging tools into the borehole across the reservoir and other relevant factors at the time.

Typically, during well testing operations, a short string of casing called a liner is cemented into place into the reservoir to both ensure the hole remains open and provides a conduit for setting and sealing well test tools. Controlled explosive charges are used to perforate this liner at a specified zone of interest within the reservoir to allow reservoir fluids to enter the wellbore. These reservoir fluids are allowed to flow to the MODU through a steel tubing conduit (essentially a small diameter casing) that contains well testing tools designed to both control and measure the flow of fluids. These fluids may contain hydrocarbons (oil and gas) and/or water, which is often contained in oil and gas-heavy formations. Produced hydrocarbons will be separated from produced water on the rig. Hydrocarbons and small amounts of produced (formation) water are flared using high-efficiency igniters to ensure relatively complete combustion of hydrocarbons and minimize emissions. Produced water will be treated to the Offshore Waste Treatment Guidelines (OWTG) (NEB *et al.* 2002) prior to ocean discharge.

Even if a reservoir is encountered and it contains hydrocarbons that are thought to be commercial, well testing may not be carried out immediately. Instead, the well may be temporarily suspended with a drilling rig returning at a later date to test the well; or, alternatively, the reservoir may be flow tested after drilling a delineation/appraisal well.

2.4.5 Well Suspension and Abandonment

All wells will be eventually abandoned following the completion of drilling, any well testing activities, and production. Well abandonment procedures will follow industry standard practices, in accordance with CNSOPB regulations.

The typical abandonment process for a well, among other down hole operations, consists of placing mechanical and cement plugs at strategic depths in the wellbore to separate and permanently seal off zones of varying ages and pressures. This process isolates these zones from each other and prevents any subsurface fluids (including oil, natural gas and brine) escaping from the wellbore in the future.

The final abandonment process in shallow water consists of cutting the conductor and surface casing about three metres below the mudline and recovering the wellhead and short length of casing. This process removes any possible obstruction for subsequent fishing or other activity.

If appropriate, Canadian Superior may seek approval from the CNSOPB to temporarily suspend the wellhead in place.

2.5 Emissions and Waste Discharges

Discharges from the rig will be managed in accordance with the OWTG (NEB *et al.* 2002). The environmental assessment and review process may generate other requirements pertaining to waste discharges.

2.5.1 Drilling Muds and Cuttings

Drill wastes not approved for ocean discharge will be transported to shore for disposal at an approved facility according to Nova Scotia Department of Environment and Labour (NSDEL) requirements. The exploration wells considered in this assessment will be drilled using non-toxic water-based mud (WBM). If during drilling it is identified that a non-aqueous mud is required, appropriate approvals will be obtained with the necessary planning, consultation and documentation provided to the CNSOPB for consideration. The probability that Canadian Superior will use non-aqueous drilling fluids (NADF) is low. If the delineation wells are to be highly directional, then the use of NADF might be the only option available to Canadian Superior. Canadian Superior will operate within the Offshore Waste Treatment Guidelines (OWTG) (NEB *et al.* 2002) and receive approvals to discharge the cuttings at sea. However, if the cuttings are brought to shore, they will operate within the NSDEL guidelines for onshore disposal. The drilling of the hole for the conductor and surface casing will use a WBM, with bentonite (clay) and barite being the primary additives. WBM is approved by CNSOPB for direct ocean discharge.

The estimated volume of mud and cuttings to be discharged at the seafloor and from the surface are shown in Table 2.5. Dispersion of drill muds and cuttings are further discussed in Section 2 of Appendix A.

Table 2.5 Estimated Drill Waste Discharge Volumes and Scenarios

Casing Size (mm)	Depth (m)	Days	Bulk Cuttings (m ³ /day)	Mud Release (m ³ /day)	Fate of muds and cuttings
914	200	2	65	400	WBM cuttings returned to seafloor
773	850	5	40	200	WBM cuttings continuous discharge. Bulk dump of 120m ³ of WBM at the end of this section.
340	3050	30	15	43	WBM and cuttings continuous discharge
244	4420	25	5.2	16	WBM or NADF cuttings continuous discharge
178	6000	30	2.3	6.7	WBM or NADF cuttings continuous discharge. Bulk dump of 120m ³ of WBM mud at the end of this section or the previous.

A final scenario as to the type of muds used in the final two sections (244 and 178 mm) of the well has not been finalized by the proponent. This assessment will cover three different drilling scenarios. The first scenario is to drill the whole well using WBM. The second and third scenarios would have Canadian Superior drill the first three sections (casing size 914, 773 and 340 mm) using WBM while the

fourth and/or the fifth sections would be drilled using a low toxicity oil-based mud (LTMO) or synthetic-based mud (SBM). The cuttings and associated muds would either be discharged if Canadian Superior meets the new guidelines or they will skip and ship the cuttings to an approved facility onshore. In no case will whole LTMO (*i.e.*, the mud) be discharged to the marine environment.

The environmental assessment will include oceanographic plume modelling for discharge of mud and cuttings at sea. Modelling will consider seafloor return of cuttings, seafloor return of WBM and surface release of WBM. Modelling will also consider the LTMO scenario.

2.5.2 Other Discharges

Offshore drilling rigs routinely produce a variety of other discharges and emissions. The significant ones are described below (Table 2.6).

Table 2.6 Summary of Other Project Related Discharges and Emissions

Discharge/ Emission	Description and Handling/Disposal Procedures
Grey and Black Water	There may be 70 to 130 persons on a deepwater drilling rig at any one time. For a Mobile Offshore Drilling Unit (MODU) accommodating about 100 people, Mobil (1985) estimated that grey water discharge (showers, dishwashing, deck drains, <i>etc.</i>) 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 <i>et al.</i> 2002) prior to ocean discharge.
Ballast Water	On MODUs and supply boats, 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 <i>Guidelines for the Control of Ballast Water Discharge from Ships in Waters Under Canadian Jurisdiction</i> 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.
Deck Drainage	The deck drainage system on drilling rigs is separate from the system used to collect wastewater from machinery spaces, as specified in OWTG. Deck drainage is typically collected via pollution pans under the rig floor. Drainage is routed to a skimmer tank and discharged at a single point. Deck drainage that is contaminated with oil is treated to reduce concentrations to levels of less than 15 mg/L.
Discharges from Machinery Spaces	As specified in the OWTG, machinery spaces on rigs 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 by a supply boat.
Produced Water	If well testing occurs, small volumes of produced water may be discharged in accordance with the OWTG. Produced hydrocarbons will be separated from produced water on the rig. Small volumes of oil (approximately 0.25 L) are typically released in 30 bbl (~4,800L) of produced water (Thomson <i>et al.</i> 2000). Unlike produced water discharges during production phases, which are chronic, long-term events, well testing would produce a small volume of discharge over a short period of time.
Cooling Water	If chlorine is used as a biocide in cooling water, residual amounts will not exceed 0.5 mg/L prior to discharge.
Solid Waste	Most solid waste is transferred to shore. Solid waste suitable for incineration can be burned if a suitable incinerator is available on the rig. All non-combustible material will be transferred ashore 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 (<i>e.g.</i> , 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.

Table 2.6 Summary of Other Project Related Discharges and Emissions

Discharge/ Emission	Description and Handling/Disposal Procedures
Chemicals and Hazardous Materials	Chemicals and hazardous materials that will be stored on the rig and consumed during the Project include drilling fluids, aviation fuel, industrial cleaners, radioactive sources for certain instruments, and explosives in sidewall core guns. The specific chemical constituents of items such as drilling fluids are not known at this time, but all chemicals/substances used by Canadian Superior for the Project will be selected in accordance with the Offshore Chemical Selection Guidelines (OCSG) (NEB <i>et al.</i> 1999) prior to being used. The goal of these guidelines is to reduce or eliminate the use of any chemical that is known to be hazardous to human health and the environment. The guidelines accomplish this by using a decision-tree system. If a chemical is not located on the approved chemicals lists, a hazard analysis is undertaken and results are submitted to the CNSOPB for consideration. The decision-tree system incorporates consideration of the <i>Pest Control Products Act</i> , <i>CEPA</i> (Canadian Domestic Substances List and Prohibited, Toxic and Restricted List), Material Safety Data Sheets (MSDS), and various international standards (e.g., OSPAR and PARCOM). 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 MODU and supply and standby ships 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. The helideck will be floodlit and have omni directional guidance lights with an average illumination intensity of between 20 and 25 candelas. Hazards in the vicinity of the helideck will also have omni directional hazard lighting. Warning lighting on the rig is also required to avoid collision with other vessels and aircraft. Lighting will comply with relevant offshore standards/regulations, including requirements of the CNSOPB's <i>Nova Scotia Offshore Petroleum Drilling Regulations</i> and <i>Nova Scotia Offshore Petroleum Installation Regulations</i> , and Transport Canada's <i>Guidelines Respecting Helicopter Facilities on Ships</i> .
Noise	Noise levels will vary depending upon the MODU chosen (<i>i.e.</i> , drillship or semi-submersible). Generally, underwater noise produced by semi-submersible drill rigs is lower than that produced by drillships. Distance required for noise to decline to ambient levels can be in the range of 1 km for a semi-submersible drilling rig (Greene 1986 as cited in Thomson <i>et al.</i> 2000) and 10 km for a drillship (Richardson <i>et al.</i> 1995 as cited in Thomson <i>et al.</i> 2000).
Atmospheric Emissions	<p>Examples of fugitive emissions that may occur include emissions of barite and cement dust from loading operations; emission of volatile organic compounds (VOCs) from fuels and storage of hydrocarbons; 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.</p> <p>Operational atmospheric emissions may include vessel exhaust; exhaust fumes from diesel generators; and flaring of hydrocarbons associated with well testing. A typical deepwater semi-submersible or drillship could have as many as seven diesel generators, which can provide more than 50,000 Hp. Daily fuel consumption in the range of 50-60 mt (70-85 m³) is reasonable, both in mobilization /demobilization and operating modes.</p> <p>The flare is a necessary and integral part of the exploration equipment, and test flaring is essential for assessment of the well potential. The significance of flaring emissions depends on the quantities of gas, quantities of condensates, presence of produced water or other contaminants, and the physical characteristics of the flare system. The exploration drilling will be conducted to restrict the flaring operation to the amount necessary to characterize the well potential, and that which is necessary for the safety of the operation. If flaring does occur it would likely be for short periods (8-24 hours per individual well test), and only if hydrocarbons are present. Typically well testing may involve several individual tests of different reservoirs (Thomson <i>et al.</i> 2000)</p> <p>In accordance with the OWTG (NEB <i>et al.</i> 2002), Canadian Superior, as an operator of a drilling installation (OWTG, NEB <i>et al.</i> 2002, Sec 2.2), will calculate and annually report the greenhouse gases (GHG) emitted from the drilling activities to the Chief Conservation Officer of the CNSOPB. Also in accordance with the OWTG (NEB <i>et al.</i> 2002), Canadian Superior will determine the type and significance of VOC emissions and report them in accordance with existing, best management practices for oil and gas operations in Canada.</p>



2.6 Malfunctions and Accidents

2.6.1 Drilling Activities

There are unplanned situations that may be encountered during drilling operations. These include stuck pipe; loss of circulation; the formation of gas hydrates; and loss of well control. 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 the rig contractor will have policies, plans, and procedures to prevent or mitigate effects of malfunctions and accidents. Such procedures have been prepared for previous exploration drilling by Canadian Superior offshore Nova Scotia and have been approved by the CNSOPB. These will be revised and submitted in advance to the CNSOPB. These policies, plans and procedures will be located on the drilling rig, vessels, and in Canadian Superior's Halifax and Calgary offices, and in certain contractor offices.

Unplanned situations can, but rarely do, lead to lost well control. Mitigating measures with respect to well control focus on well design, equipment testing, and training of personnel. An example of safe well design is the leak-off test. This allows rig supervisors to calculate the limiting conditions under which they can pump heavy drilling fluid to kill the well. An example of equipment testing is the periodic blowout preventer (BOP) and choke manifold pressure test to ensure the equipment can withstand the pressures required to kill a well. Certain drilling personnel (Canadian Superior Senior Representative, Tool Pusher, Driller) are required to maintain formal Well Control Certification, which involves periodic training on computerized rig floor simulators and a written test.

Other accidental events include platform-based spills on the MODU. Small spills/leaks could occur under valves and at hose connections. Bulk transfer and hose handling procedures will minimize spills during transfers of materials between the supply vessels and the MODU. Workers will be trained in other task-specific activities to further reduce the likelihood of small spills.

Canadian Superior will maintain documents specifying actions in case of an unplanned event. The "Well Control Manual" specifies good drilling practices and emergency procedures in case of loss of well control. The site-specific Emergency Response Plan will address certain non-drilling situations as required by the CNSOPB drilling regulations (*i.e.*, collision avoidance, man overboard, medical evacuation, *etc.*). The Emergency Response Plan is designed to mitigate negative environmental effects of small and large spills. Exploration wells on the Marauder and Marconi Blocks are expected to encounter gas/condensate, and the risk of a large oil spill is remote.

Another malfunction that could occur would be an accidental release of whole NADF (other than WBM) from the riser when using a drillship or a semi-submersible. The likely effects of such an accidental event will be addressed in the environmental assessment.

2.6.1.1 Spill Risk and Probability

S.L. Ross will conduct a blowout and spill probability assessment for Canadian Superior's planned exploration program on the Marauder and Marconi Blocks in support of the environmental assessment. This analysis will provide estimates on the probability of blowouts and "batch" spills, as well as calculated oil spill frequencies. Blowouts are continuous spills that could involve discharging petroleum gas into the atmosphere and crude oil into surrounding waters. Batch spills are instantaneous or short-

duration discharges of oily products that could occur from accidents on the MODU, where fuel oil and other petroleum products are stored and handled.

2.6.1.2 Spill Fate and Behavior

S.L. Ross will conduct spill fate and behavior modeling for the proposed drilling program in support of the environmental assessment. The spill scenarios modeled will include surface well blowouts, deep water blowouts, and small platform or vessel releases.

2.6.2 Potential Accidental Events from Associated Activities

During well site and VSP 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 activities have occurred off Nova Scotia. Such occurrences are rare and particularly unlikely in a single streamer, short duration, wellsite survey program. Entanglement of marine life does not occur since wellsite surveys use only a single streamer. Other geophysical equipment will be towed simultaneously; but, not multiple long streamers, which increase the potential of entanglement between streamers. 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. Gear will be retrieved from the water if wave heights reach or exceed three metres. In case of severe weather, the vessel may return to shore until conditions improve. Entanglements of marine mammals or turtles in wellsite survey gear are unlikely in wellsite survey activities and there have been no reported occurrence in any of the large number of wellsite surveys conducted over many years and many locations offshore Nova Scotia.

2.7 Project Alternatives

2.7.1 Alternatives to the Project

Alternatives to the Project are defined as functionally different ways of achieving the same end (CEA Agency 1997). There is no viable alternative to exploration drilling since potential for reservoirs can only be precisely determined through ground-truthing (*i.e.*, exploration drilling). The CNSOPB requires Canadian Superior to drill exploration well(s) to fulfill leasing obligations.

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.

2.7.2 Alternative Means for the Project

Alternative means for the Project can be defined as methods of similar technical character or methods that are functionally the same (CEA Agency 1997). Alternative means of exploration drilling require consideration of factors related to drilling equipment, methods of station keeping, drilling schedules, number of wells, and types of drilling fluids. Alternatives may have different environmental effects.



Canadian Superior will choose the alternatives that maximize Project efficiency, while minimizing potential adverse effects on the environment.

Another alternative means for the Project includes a change in the Project schedule. Drilling in the winter season is not preferable due to substantially higher costs and operational risk due to severe weather and a very small number of available winterized rigs or drillships. Similarly, the re-injection of cuttings and muds is not an economically viable option with this Project.

With respect to the technology proposed for wellsite and VSP surveys, 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 wellsite 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 (e.g., drilling scheduling, type of drilling), Canadian Superior's will review the EA to determine any potential environmental implications, and if necessary, discuss these changes with the CNSOPB.

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

2.8.1 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.



2.8.2 Other Health, Safety and Environmental Plans

In support of the application for drilling program authorization, current documentation on file with the CNSOPB will be reviewed, revised, and where necessary, prepared. The documentation for a typical drilling 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 Marauder Block to the north of Sable Island and the Marconi Block to the southwest. Water depths range from less than 100 m to approximately 400m 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.

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).

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).

3.1.3 Sediment Quality

Sediment quality data, beyond that collected for ExxonMobil Canada for the Sable Offshore Energy Project, does not exist for the Marauder and Marconi Blocks. Sediment quality in the Olympia A-12 exploration well site was characterized in 1982 and 1983 during pre- and post-drilling phases (Carter *et al.* 1985). The Olympia A-12 well is located close to Sable Island, approximately 5 km north of the East Spit and 2 km south of the Mariner Block. The study's objective was to determine the effect of drilling waste disposal on the trace metal levels in sediments and fauna. Sediment quality at the Marquis Blocks well site was characterized in December 2001 (JWEL 2002). Concentrations of trace metals, including barium, are within the ranges typically observed for marine sediments on the Scotian Shelf and Grand Banks (MacLaren Plansearch 1981; Carter *et al.* 1985, HMDC 1994).

The occurrence of petroleum hydrocarbons in offshore marine sediments is typical on the Scotian Shelf. Background concentrations of petroleum hydrocarbons have been found to range from 1.0 to 94 mg/kg on the Scotian Shelf and Grand Banks (Keizer *et al.* 1978; MacLaren Plansearch 1981; Carter *et al.* 1985; HMDC 1994). The presence of these hydrocarbons may originate from natural hydrocarbon seeps from the seafloor or anthropogenic sources such as shipping and coastal runoff. Petroleum hydrocarbon concentrations at the Marquis Blocks well site were non-detectable in all but one location (JWEL 2002).

The substrate is predominately sand with varying percentages of gravel (Amos and Nadeau 1988), and clay in a few areas. In shallow areas on Sable Island Bank, a single storm event may transport sediment equivalent to the annual rate. The seafloor is relatively featureless and dynamic which is not conducive to a diverse epibenthic community.

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.

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

Sixty-six fish species occur on Sable Island Bank, of which forty are groundfish 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 Scotia 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 (Thomson *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 (Thomson *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. The Gully (see section 3.2.6.1), which is adjacent to the Project area, is habitat for the Northern bottlenose whale, a SARA species of special concern. (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 (Thomson *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 (Thomson *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. (A description and list of Species at Risk is detailed in Section 3.2.5 and Table 3.3.)

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.

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.

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												
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											

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 requires 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 minimize the impact of the activity on the



species or its critical habitat or the residences of its individuals; and the activity must not jeopardize 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.

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).

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 (<i>Gadus morhua</i>) Maritimes Population	Recommended to not be listed under SARA as of Nov 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 (<i>Lamna nasus</i>)	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 5-10°C with little variation throughout the year, suggesting that they adjust their location to occupy this preferred temperature range (Campana <i>et al.</i> 2001). Therefore there is no known critical time for porbeagle shark occurrence within the Project area.
Atlantic salmon (<i>Salmo salar</i>) 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 (<i>Anarhichas minor</i>)	Threatened, Schedule 1	Threatened (COSEWIC 2001)	The reason for designation of the northern wolffish and the spotted wolffish 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 wolffish include mortality as by-catch and habitat alteration by bottom trawling (COSEWIC 2003). Stock Status Report 2004/ 031, <i>Allowable Harm Assessment for spotted and Northern wolffish</i> states that: <ul style="list-style-type: none"> ■ 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 scant. Spawning is thought to occur from spring to mid-fall. The Project area is not within designated critical habitat.
Northern wolffish (<i>Anarhichas denticulatus</i>)	Threatened, Schedule 1	Threatened (COSEWIC 2001)	See above Stock Status Report 2004/ 031	Information on reproduction and growth is scant. Spawning is thought to occur from spring to mid-fall. The Project area is not within designated critical habitat.
Atlantic wolffish (<i>Anarhichas lupus</i>)	Special Concern, on Schedule 1	Species of Special Concern (COSEWIC 2000)	The total population of Atlantic wolffish 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 scant. Spawning is thought to occur from spring to mid-fall. The Project area is not within designated critical habitat.
Cusk (<i>Brosme brosme</i>)	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.

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
Winter skate (<i>Leucoraja ocellata</i>)	- 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. Beginning in 1986, there was an overall reduction in abundance on the eastern Scotian Shelf with a possible shift in distribution towards the slope waters (i.e., away from the Project area). 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.
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.

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
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);	The 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 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.
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 areas for this species include 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 Marauder Block lies adjacent to The Gully.

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
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.
Sea Turtles				
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	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, <i>Allowable Harm Assessment for Leatherback Turtle in Atlantic Canadian Waters</i> , states that: <ul style="list-style-type: none"> ■ 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 recognized 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 (<i>Sterna dougallii</i>)	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 Project area since it almost exclusively breeds on islands of the eastern shore of mainland Nova Scotia. The Project area has not been recognized 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 (<i>Pagophila eburnean</i>)	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 recognized as critical for this species.
Ipswich (Savannah) Sparrow (<i>Passerculus sandwichensis princeps</i>)	Special Concern, Schedule 1	<i>Special Concern</i> (COSEWIC 2003)	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 recognized 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 be addressed in the EA.
Barrow's Goldeneye	Special Concern, Schedule 1	<i>Special Concern</i> (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	Special Concern, Schedule 1	<i>Special Concern</i> (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 Study area. This species is generally found in the coastal area of Mainland Nova Scotia.

Figure 3.1

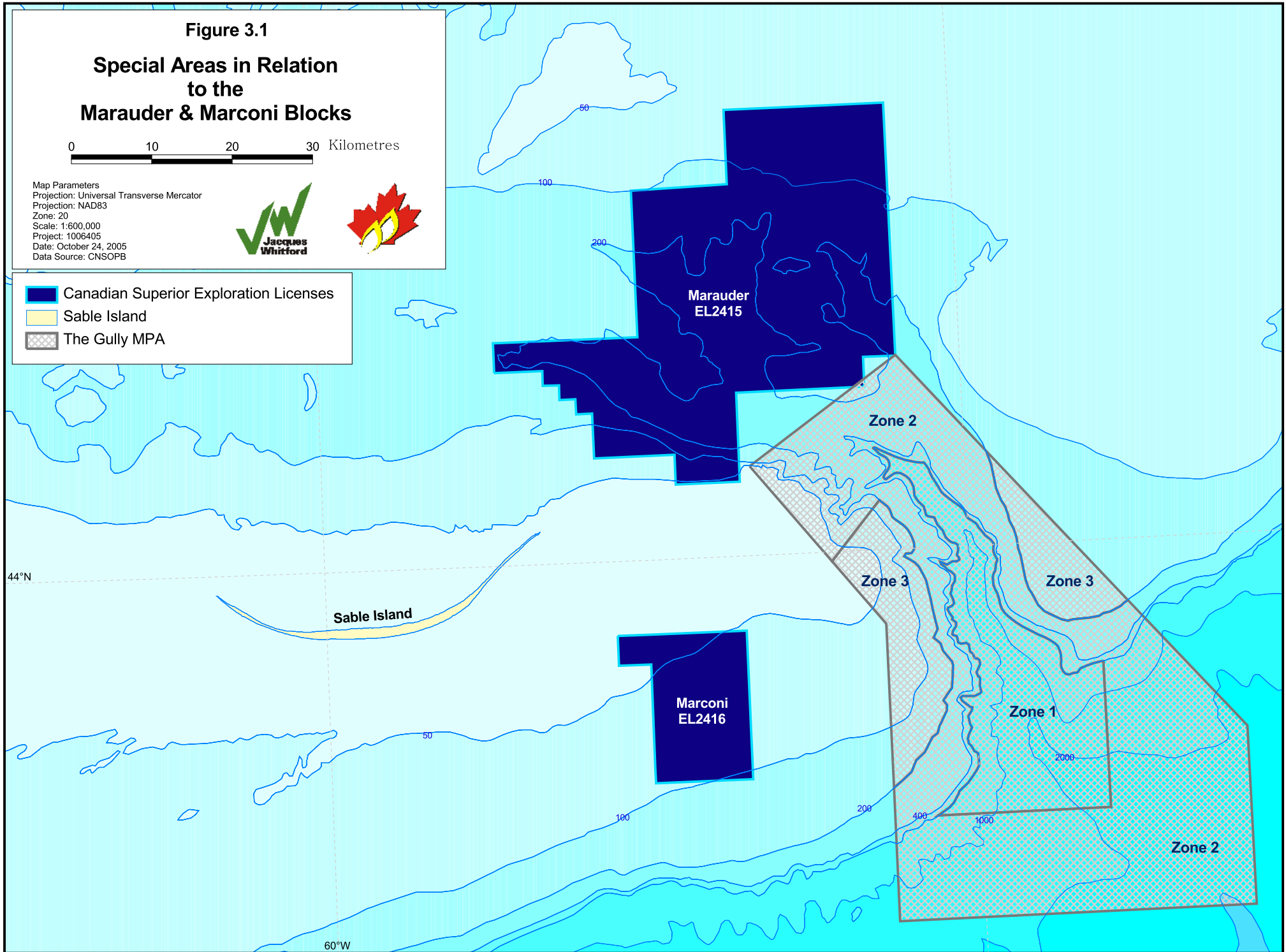
Special Areas in Relation to the Marauder & Marconi Blocks

0 10 20 30 Kilometres

Map Parameters
Projection: Universal Transverse Mercator
Projection: NAD83
Zone: 20
Scale: 1:600,000
Project: 1006405
Date: October 24, 2005
Data Source: CNSOPB



- Canadian Superior Exploration Licenses
- Sable Island
- The Gully MPA



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 (Figure 3.1). 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. 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 during spring and summer. Snow crab and stone crab are also fished in the fall, primarily. Small amounts of shrimp and some scallop are harvested from the Marauder Block. 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 Marconi. There is also a limited shark fishery within the Marauder Block. Mackerel and herring are also fished within the Project area, during the fall and spring, respectively. Hardshell clam fishing is expanding on the Sable Island Bank.

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 ordnance (UXO) locations within the areas defined by Marauder and Marconi Blocks or within 30 nautical miles of the areas being surveyed (Penney, pers. comm., 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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