Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024

Environmental Assessment

FINAL REPORT

Submitted by:

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Appendix A Table of Concordance with C-NLOPB Environmental Assessment Scoping Document

1 INTRODUCTION

ExxonMobil Canada Ltd. (ExxonMobil) is planning to undertake a marine petroleum exploration program, including geophysical, geochemical, environmental and geotechnical survey activities, between 2015 and 2024 in the eastern portion of the Newfoundland and Labrador (NL) Offshore Area (Figure 1.1)[1].

The proposed ExxonMobil Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs, 2015-2024 (hereinafter also referred to as the Project) will require authorizations from the Canada – Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), pursuant to Section 138 (1)(b) of the *Canada – Newfoundland Atlantic Accord Implementation Act* and Section 134(1)(b) of the *Canada – Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (the *Accord Acts*).

This document provides an Environmental Assessment of the proposed 2015-2024 offshore exploration programs. The assessment has been planned, prepared and is being submitted in compliance with the associated requirements and processes of the C-NLOPB.

1.1 Project Overview and Scope

Project Name: ***ExxonMobil Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs, 2015-2024***

In May 2013, the C-NLOPB announced several Calls for Bids in the Eastern Newfoundland Offshore Area, including: 1) *NL 13-01* (Area C: Flemish Pass) which consisted of one parcel totalling 266,139 hectares, and 2) *NL 13-02* (Area C: Carson Basin) consisting of four parcels totalling 1,138,399 hectares, and in June 2014 the Board announced Call for Bids *NL 14-01* (Jeanne d'Arc Region) which consisted of one parcel totaling 108,938 hectares.

On December 12, 2014, the C-NLOPB accepted work commitment bids from ExxonMobil and its co-venturers on NL 13-01 (Area C: Flemish Pass), Parcel 2 of NL 13-02 (Area C: Carson Basin) and NL 14-01 (Jeanne d'Arc Region). With subsequent Ministerial approvals, the Board issued Exploration Licences for all three areas effective January 15 2015.

ExxonMobil is the operating representative for each of these three licences, the breakdown of interests in which are summarized below:

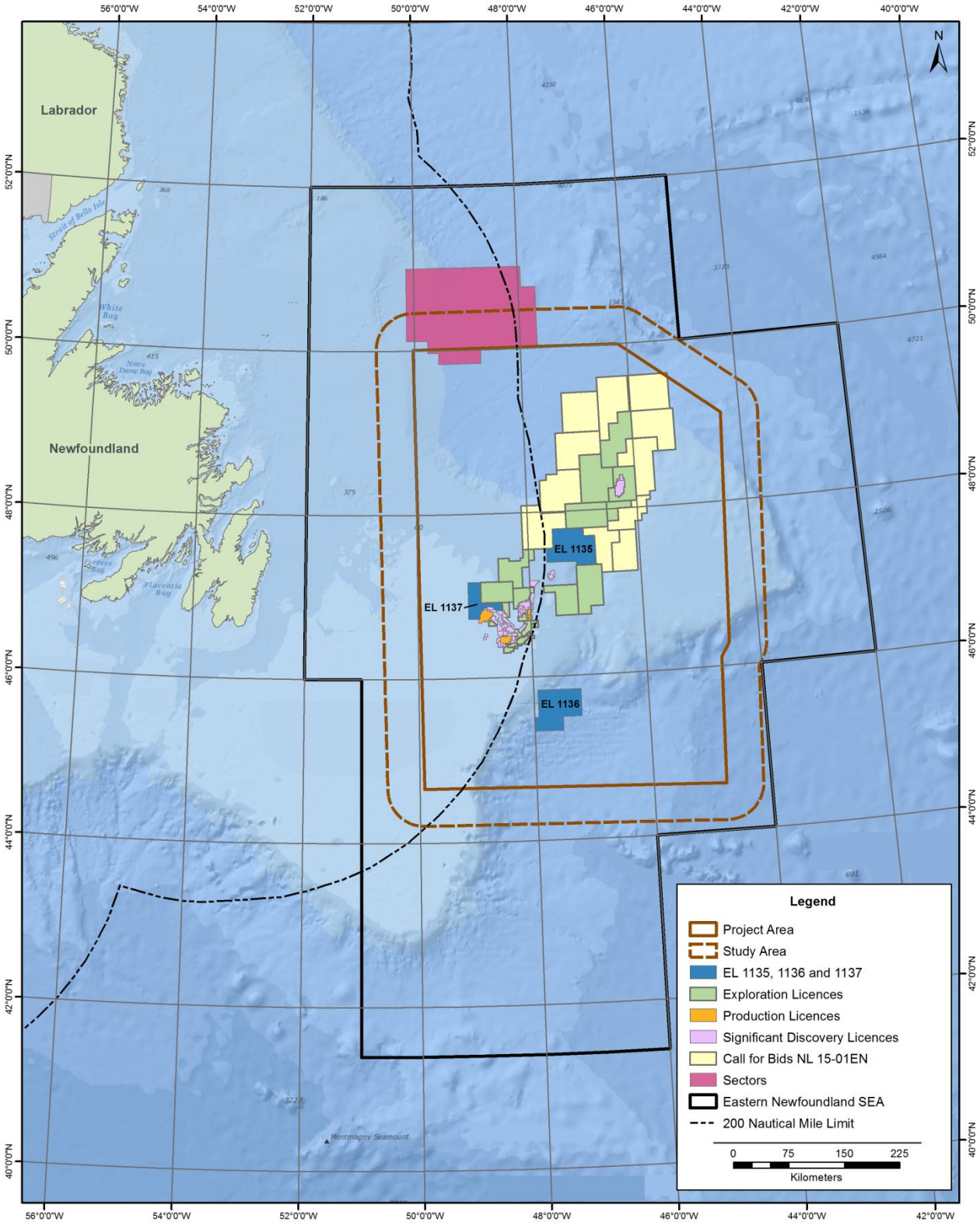
1) *EL1135* (Flemish Pass Parcel 1, 266,139 ha): ExxonMobil Canada Ltd. 40%, Suncor Energy Inc. 30% and ConocoPhillips Canada Resources Corp. 30%;

2) *EL1136* (Carson Basin Parcel 2, 288,800 ha): ExxonMobil Canada Ltd. 50% and Suncor Energy Inc. 50%;

3) *EL1137* (Jeanne d'Arc Region Parcel 1, 108,938 ha) ExxonMobil Canada Ltd. 100%.

[1] Basemap information in all Figures in this EA Report has been derived from: Esri, GEBCO, NOAA, National Geographic, DeLorme, NAVTEQ and other electronic sources.

Figure 1.1 ExxonMobil Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs, 2015-2024



Over the next nine year period (2015-2024), ExxonMobil plans to conduct a variety of exploration survey activities over its existing licenses and other areas of interest in the Project Area (Figure 1.1). This may include other Exploration Licences that the company may successfully acquire or otherwise participate in as a co-venturer with other operator(s) as well as other areas off Eastern Newfoundland. These exploration activities may include two-dimensional (2D) and three-dimensional (3D) seismic data acquisition.

The proposed Project Area upon which this Environmental Assessment is focussed (Figure 1.1) therefore encompasses the areas and locations in which ExxonMobil expects to conduct these exploration surveys over this time period. The Project Area is located entirely within the Study Area for the Eastern Newfoundland Strategic Environmental Assessment (SEA) completed by the C-NLOPB in August 2014 (Amec 2014, Figure 1.1).

Initial Project evaluation consists of a detailed review of archival data and its compilation and analysis to determine any key data gaps. Data review would include: determining existing data coverage; a literature search and review; reviewing existing well logs; reviewing available 2D and 3D data interpretation reports; and the purchase of relevant existing spec data (usually 2D). Many of these components and activities would have been completed prior to the submission of work commitment bids.

It is also important to note that for an offshore exploration initiative, data acquisition is typically a phased process, which would start with 2D and 3D geophysical and geochemical exploration. Pending (and based upon) the results of these geophysical surveys, exploratory drilling would be the next phase, for which wellsite geohazard and environmental survey programs could be required. If a petroleum discovery is made and determined to be considered for development, then geotechnical surveys could be required for front-end engineering and design.

In terms of survey design, once applicable existing spec 2D has been purchased and reviewed a determination would be made as to whether additional 2D infill is required. If the existing and available 2D data is sufficient in the prospective exploration area to drill an exploratory well, then wellsite geohazard as well as environmental data could be acquired. In most exploration areas the 2D data is not sufficient to evaluate whether to drill an exploratory well, in which case 3D data would be acquired.

No ExxonMobil proprietary 3D surveys are planned in 2015. After receiving several unsolicited multi-client speculative 3D seismic proposals for the EL 1135 area, ExxonMobil is working with a vendor on a 3D acquisition program for that area. If opportunity arises, ExxonMobil would consider 2015 geochemical and/or related bathymetric surveys for the Flemish Pass (EL 1135) and Carson Basin (EL 1136) areas.

1.2 Identification of the Proponent

Name of Corporate Body: ***ExxonMobil Canada Ltd.***

Address: 100 New Gower Street, Suite 1000
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ExxonMobil is a leading developer and operator of oil and gas off Canada's East Coast. In Newfoundland and Labrador, ExxonMobil is actively involved in on-going and planned petroleum exploration and production activities.

ExxonMobil conducts its business in a responsible and ethical manner that protects the safety and health of employees, others involved in its operations, its customers and the public. Furthermore, it is committed to conducting business in a manner that is compatible with the balanced environmental and economic needs of the communities in which it operates. This commitment requires compliance with all applicable laws and regulations, facilities that are designed and operated to a high standard and the systematic identification and management of safety, security, health, and environmental risks.

Project Manager: David Kasper
Geoscience Ops Tech Manager
ExxonMobil Canada Ltd.
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Principal Contact Person for the Purposes of the Environmental Assessment: Hanna Janzen, P.Eng.
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1.3 Regulatory Context

The C-NLOPB is responsible, on behalf of the Governments of Canada and Newfoundland and Labrador, for petroleum resource management in the NL Offshore Area. The *Accord Acts,* administered by the C-NLOPB, provide for joint management of the NL Offshore Area and govern all oil and gas activities in the region. In the implementation of its mandate, the role of the C-NLOPB is to facilitate the exploration for and development of the hydrocarbon resources in the NL Offshore Area in a manner that conforms to the statutory provisions for:

1) worker safety;
2) environmental protection;
3) effective management of land tenure;
4) maximum hydrocarbon recovery and value; and
5) Canada / Newfoundland and Labrador benefits.

The C-NLOPB's associated regulatory responsibilities include the administration and issuance of specific licences, authorizations and approvals pertaining to offshore oil and gas exploration and production activities in the NL Offshore Area.

In proposing to carry out offshore geophysical exploration programs for petroleum resources in the NL Offshore Area, an Operator must apply for and obtain a *Geophysical Program Authorization* (GPA) from the C-NLOPB. The GPA process and information requirements are described in the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines (January 2012).* These Guidelines also include various measures and requirements related to environmental planning, mitigation and reporting.

In addition, in proposing to carry out geochemical, environmental and geotechnical offshore programs for petroleum resources in the NL Offshore Area, an Operator must apply for and obtain a *Geological, Geotechnical and Environmental Program Authorization* from the C-NLOPB. This process and information requirements are also described in the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines (January 2012).*

The C-NLOPB also requires that project-specific Environmental Assessments be conducted and submitted by Operators in relation to various types of proposed oil and gas exploration activities in the NL Offshore Area.

A number of other federal and provincial government departments and agencies also may have regulatory responsibilities, information and advice and/or other interests regarding the proposed Project and its environmental setting and potential effects, pursuant to their associated legislation. These include the:

- Fisheries and Oceans Canada (DFO);
- Environment Canada (EC);
- Transport Canada (TC);
- Department of National Defence (DND);
- NL Department of Environment and Conservation;
- NL Department of Fisheries and Aquaculture; and the
- NL Department of Natural Resources

Legislation and associated regulations that are or may be relevant to the Project and its Environmental Assessment therefore include:

- The *Accord Acts* and associated *Regulations* and Guidelines, including the associated:
    - Geophysical, Geological, Environmental and Geotechnical Program Guidelines (January 2012), and the
    - Canada-Newfoundland and Labrador Exploration Benefits Plan Guidelines (February 2006);
- *Fisheries Act*;
- *Oceans Act*;
- *Navigation Protection Act*;
- *Canada Shipping Act*;
- *Migratory Birds Convention Act*; and the

- *Species at Risk Act (*CA) and *Endangered Species Act* (NL)*.*

In planning and conducting its oil and gas exploration activities, ExxonMobil will comply with these and all relevant provincial and federal legislation, regulations and guidelines, as well as applicable international conventions and standards. The company also has in place its own comprehensive corporate Health, Safety and Environment policies, plans and procedures for planning and conducting its oil and gas exploration and development projects and activities, and requires its contractors to adhere to these as applicable.

The C-NLOPB's mandate also includes the administration of the various provisions of the *Accord Acts* that pertain to industrial and employment benefits resulting from the exploration for, and development of, oil and gas resources in the NL Offshore Area. This includes the creation and optimization of such benefits for Canada in general and the Province of Newfoundland and Labrador in particular. The *Accord Acts* require that before any work or activity is authorized in the NL Offshore Area, a Canada-Newfoundland and Labrador Benefits Plan must be submitted to, and approved by, the Board. This Plan must identify and describe the measures to be taken regarding the employment of Newfoundlanders and Labradorians and other Canadians, as well as providing manufacturers, consultants, contractors and service companies in the province and other parts of Canada with full and fair opportunity to participate on a competitive basis in the supply of goods and services to such a project.

ExxonMobil is committed to creating and optimizing opportunities and benefits for Newfoundland and Labrador and Canadian workers and companies as part of its activities and operations in the NL Offshore Area, and to carrying out its business in full compliance with relevant Canada-Newfoundland and Labrador Benefits Plan Guidelines and other applicable requirements.

1.4 Purpose and Organization of the Environmental Assessment Report

Environmental Assessment is a regulatory review and planning process that is often applied to proposed development projects or other activities. Its purpose is to identify and evaluate the potential environmental effects of such proposals, in order to help ensure that these issues can be considered and incorporated into planning and decision making. It involves predicting a project's potential effects and identifying and proposing measures to avoid or reduce adverse outcomes and to enhance any benefits, and often includes public and stakeholder consultation at various stages of the process.

ExxonMobil, as the Proponent of the Project, is submitting this Environmental Assessment Report which was prepared by Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited. The assessment has been planned and undertaken in accordance with the requirements of the C-NLOPB's review process, and in full compliance with the Scoping Document issued by the Board on March 2, 2015. It has also been guided by the information and input received, and questions and issues identified, through various communications and consultations with other government departments and agencies, industry and interest groups and key stakeholders.

The Environmental Assessment that follows provides the required information about the Project, its existing environmental setting, potential environmental effects, proposed mitigation and any associated residual environmental effects and environmental monitoring and follow-up initiatives. This will form the basis for a review of the Project and its likely environmental implications by the C-NLOPB

and other applicable government departments and agencies and non-governmental organizations, and will be an input into associated regulatory decisions about the Project.

This document has been designed and prepared to provide the results of the Environmental Assessment and other required information in a clear, concise and well-organized manner, in keeping with current practice. The Environmental Assessment Report is structured as follows:

Chapter 1 (this Introduction): Provides a general overview of the Project and its background and scope, identifies the Proponent, outlines the regulatory context for the Project, and describes the purpose of the Environmental Assessment Report and the overall organization of the document.

Chapter 2 (Project Description): Sets the overall context for the Project and its Environmental Assessment initially by discussing its need, purpose, rationale and alternatives. It goes on to describe the proposed Project Area and schedule, as well as providing a description of the planned survey equipment and activities. This Chapter also describes potential environmental emissions and interactions, possible accidental events and malfunctions, and potential effects of the environment on the Project, including the manner in which environmental conditions have and will influence Project planning and implementation.

Chapter 3 (Environmental Assessment Scope, Focus and Approach): Outlines the scope and focus of the assessment, including its various regulatory requirements and consultative activities and inputs. It also identifies the various Valued Environmental Components (VECs) upon which the Environmental Assessment is focussed and the rationale for same, and describes the overall approach and methods that were used to conduct the assessment.

Chapter 4 (Existing Environment): Describes the existing environmental setting within the Environmental Assessment Study Area and adjacent areas, including the natural and human environments that overlap, and may interact with, the proposed Project. This includes relevant aspects of the physical, biological and socioeconomic environments.

Chapter 5 (Environmental Effects Assessment): Provides the detailed results of the environmental effects assessment for the selected VECs, each of which is addressed in a separate section using the overall Environmental Assessment structure and methodology described in Chapter 3.

Chapter 6 (Environmental Assessment Summary and Conclusions): Provides a summary of the key results and overall conclusions of the Environmental Assessment.

Chapter 7 (*References*): Provides a bibliography of all information sources used in the Environmental Assessment Report, including personal communications and literature cited.

2 PROJECT DESCRIPTION

The following Chapter provides an overview description of the proposed Project, including its rationale and objectives, alternatives to and within the proposal, the proposed Project Area and survey timing, planned Project equipment and activities, and various associated environmental planning and management considerations and measures.

2.1 Project Overview and Rationale

ExxonMobil is proposing to undertake offshore exploration activities over its recently acquired Exploration Licences and other areas of interest throughout the Project Area (see Figure 1.1) annually over the 2015-2024 period, generally within the May – November timeframe. This may include 2D and 3D seismic surveys, as well as wellsite geohazard, geochemical, geotechnical and environmental survey activities. No ExxonMobil proprietary 3D surveys are planned in 2015. After receiving several unsolicited multi-client speculative 3D seismic proposals for the EL 1135 area, ExxonMobil is working with a vendor on a 3D acquisition program for that area.

The petroleum industry is an important and valuable component of the Newfoundland and Labrador economy, and one that has been identified as having considerable potential for future growth. Oil and gas exploration has been a key aspect of the province's offshore petroleum industry to date, and on-going and future exploration is required in order to identify and further understand the existence of currently unknown and undeveloped hydrocarbon reserves in the region, and in doing so, to help facilitate the further development of this important economic sector. ExxonMobil is committed to further Canadian East Coast oil and gas development, with an extensive planned exploration program in the region.

In proposing, planning and eventually undertaking this Project, ExxonMobil's primary objectives are therefore to:

- Acquire additional geological data to better understand and image structural and stratigraphic trends;
- Define and assess prospects for potential future drilling and development activities; and to
- Assess the overall hydrocarbon potential of key parts of the Project Area.

In the immediate term, the proposed petroleum exploration activities that comprise this Project and which are the subject of this Environmental Assessment will result in a number of direct and indirect economic benefits, including the creation of employment and business opportunities over the course of its planning and operational phases in 2015 and beyond. As noted earlier, the Project has been planned and will be carried out in full compliance with the C-NLOPB's *Canada-Newfoundland and Labrador Exploration Benefits Plan Guidelines*.

Should the exploration program be successful in helping identify important and commercially viable oil and/or gas resources in the region, it could also eventually lead to additional economic activity in Newfoundland and Labrador related to further exploration, and possibly, petroleum development and production activities. An important potential outcome of this proposed Project could therefore be future economic development and growth in the province's offshore oil and gas sector and overall economy.

2.2 Project Alternatives

As an important and valuable planning tool, Environmental Assessment is intended to help inform and influence project design, and in doing so, to help proactively address the potential environmental outcomes of proposed projects and activities. The Environmental Assessment review process therefore allows for the identification, analysis and evaluation of possible, alternative project concepts and approaches, in order to help incorporate environmental considerations into project planning directly at an early stage. This includes considering potential alternatives to a project, as well as possible alternative means of carrying out a project that are technically and economically feasible.

Although a considerable amount of oil and gas exploration (geophysical and drilling) has previously been completed in various parts of the proposed Project Area, the proposed exploration activities that are the subject of this Environmental Assessment will be located in areas with limited seismic data coverage and previously drilled well locations.

The main alternative to the Project would be to not explore for oil and gas offshore Eastern Newfoundland, but rather pursue opportunities elsewhere in the world in order to assist in meeting current and future market demand for petroleum products. In that case the important geological information and understanding that it will yield would not be obtained, and the likely (and potential long-term) socioeconomic benefits resulting from this Project would not be realized, particularly in terms of its related employment income, profits, taxes and potential royalties.

Possible alternative means of carrying out the Project would involve choices between different contractors' survey vessels and equipment, each of which will be evaluated though ExxonMobil's eventual competitive bid process. Environmental features and potential interactions will also be key considerations in the planning and implementation of the proposed Project, such as the scheduling and conduct of Project activities in particular areas and times. The information and results of this assessment will therefore also play a role in identifying and evaluating particular operational procedures as the Project moves forward, in order to avoid or reduce any potential adverse environmental effects.

2.3 Project Area

The Project Area encompasses the overall marine area within which all Project-related survey equipment use and data-acquisition activity will take place, and is located off the eastern coast of the Island of Newfoundland.

Coordinates for each of the identified corner points of the proposed Project Area are provided in Figure 2.1 and Table 2.1.

Figure 2.1 Project Area Corner Points and Coordinates

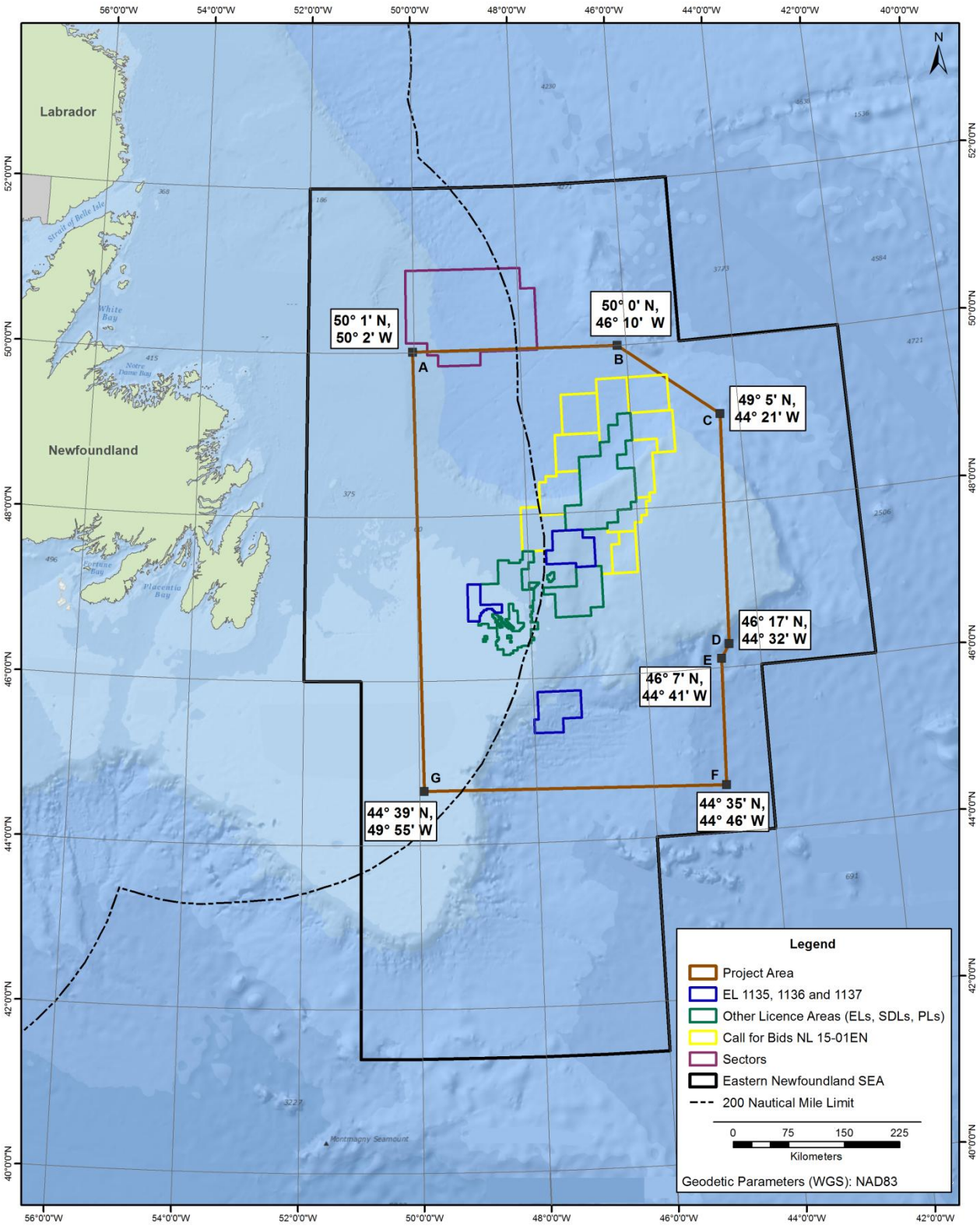


Table 2.1 Project Area Corner Points and Coordinates

Corner Point ID *	Longitude	Latitude
A	50° 2' W	50° 1' N
B	46° 10' W	50° 0' N
C	44° 21' W	49° 5' N
D	44° 32' W	46° 17' N
E	44° 41' W	46° 7' N
F	44° 46' W	44° 35' N
G	49° 55' W	44° 39' N
* See Figure 2.1 Geodetic parameters (WGS): NAD 83		

As illustrated in Figure 2.1, portions of the Project Area are located within Canada's Exclusive Economic Zone (EEZ), whereas over half is located beyond the 200 nautical mile limit. All Project survey activities and operations, including survey equipment deployment, use and recovery, testing, other data acquisition and seismic survey line turns, will be completed within the identified Project Area boundary. Water depths in the Project Area range from approximately 100 m to 4,700 m, whereas those in EL 1135 itself range from approximately 245 m to 1,150 m.

2.4 Project Equipment and Activities

As outlined previously, ExxonMobil is planning to undertake offshore oil and gas exploration activities over its recently acquired Exploration Licences and other areas of interest throughout the Project Area over the 2015-2024 period. These may include 2D and 3D seismic data acquisition, as well as associated wellsite geohazard, geochemical, geotechnical and environmental survey programs.

2.4.1 Seismic Surveys

The main elements of an offshore seismic program for petroleum exploration include a survey vessel, a sound source array (typically compressed air), receivers (streamers) and associated supporting components and activities. In a marine seismic survey, sound source arrays are towed behind a vessel while it travels along pre-determined survey lines. The source is fired at regular distance based intervals and directs high energy (low frequency) sound pulses toward the seafloor which can penetrate below the surface. The reflected acoustic energy is then recorded by sensitive hydrophones in the streamer(s) which are towed behind the vessel. Computer-based data processing systems then convert the reflected acoustic signals into seismic data that can be used to map geological features and structures of interest within the survey area.

2.4.1.1 2D Seismic Surveys

2D seismic programs tend to cover relatively large geographical areas, and are therefore of short-term duration at any given location. These surveys typically use a single source array and single streamer, and survey lines are often widely spaced, long regional lines greater than 5 km apart that are often laid out in a number of different directions. A 2D survey is often used for exploring a large area in order to identify sites or zones which may warrant further investigation, and to tie relatively unexplored areas into regions with well established seismic and well data.

As part of this Project, it is anticipated that a number of 2D surveys could be planned and undertaken over newly offered prospective areas to infill the existing grid of available spec 2D seismic and other

data. It is currently estimated that the amount of 2D infill survey activity would range from approximately 1,000 – 5,000 line-kilometers per survey.

The duration of the planned 2D seismic surveys would typically range from approximately 10-30 days, and the primary components would include:

- seismic acquisition vessel;
- towed seismic air source array;
- towed receiver streamer;
- sound velocity profilers;
- magnetic and gravity sensors;
- guard vessel(s);
- logistics supply vessel; and
- a shorebase.

The 2D seismic acquisition vessel will be a fully equipped, modern vessel suited to the operating environment and task, which would be approximately 75 – 90 m in length. The seismic source towed arrays which will be used during the 2D surveys are contractor and vessel dependent. A typical 2D seismic source consists of air source arrays, ranging in volume from 3,000 in^3 to 5,500 in^3 which operate at towed depths between 5 m and 9 m. The seismic source towed array operates on compressed air at pressures of approximately 1,800 - 2,000 pounds per square inch (psi), and produce approximate peak-to-peak pressures of 100 to 180 bar-metres (bar-m).

The proposed 2D seismic surveys will use a single towed streamer, with a length ranging from 6,000 - 10,000 m which will be deployed at a depth of about 6 - 30 m. The streamers are planned to be solid or gel-filled to minimize any potential for environmental effects in the case of breaks or tears. Streamer configurations and characteristics may vary dependent upon the particular contractor selected and its associated vessel and equipment.

Standby or guard vessel(s) will be used to scout for hazards and for interacting and communicating with other marine users in the area, including fishers. Resupply of the seismic acquisition vessel during the survey will be accomplished with a supply vessel. An existing shorebase will be utilized, and a shore based representative will be located in St. John’s for the duration of the Project.

The 2D survey vessel may also passively collect and record gravity and magnetic data at the same time, and will have an echosounder for depth soundings.

2.4.1.2 3D Seismic Surveys

As part of this Project, it is also anticipated that a number of 3D seismic surveys will be acquired over the newly acquired (2015) Exploration Licenses and any others which the Proponent may be successful in bidding on in the future, possibly as a co-venturer with other operators in coming years.

3D seismic surveys are typically more focussed and tend to cover smaller geographical areas than the regional 2D survey grid. High quality 3D seismic surveys provide structural and stratigraphic imaging of geological features and potential oil and/or gas bearing prospects in the region. 3D seismic surveys may use one or two source arrays and up to 14 closely spaced streamers. This enables a greater resolution of potential oil and gas bearing geological structures. Line plans are generated so that the outer streamer lines overlap the outer lines of the previous pass to provide total 3D coverage.

Average 3D survey areas would range in area from 1,000-5,000 km^2 full-fold coverage (estimates based upon the EL1135, 1136, 1137 block areas). In order to obtain full-fold coverage over the final required area, up to an additional 6,000 m of coverage would also be required at each end of the prospective survey area. Detailed and specific line headings and lengths are finalized once the specific target area has been determined, with consultations and input from other stakeholders also being considered as part of detailed survey planning each year.

The duration of the planned 3D seismic surveys would typically range from approximately 30-100 days, the primary components of which would include:

- seismic acquisition vessel;
- towed seismic air source array;
- towed receiver streamer(s);
- sound velocity profilers;
- magnetic and gravity sensors;
- guard vessel(s);
- logistics supply vessel; and
- a shorebase.

The 3D seismic acquisition vessel will again be a fully equipped, modern vessel suited to the operating environment and task, and will be approximately 75 – 90 m in length.

The source array volumes will range from 3,000 – 5,500 in^3 in volume with operating pressures of approximately 1,800-2,000 psi, producing approximate peak-to-peak pressures of 100 to 180 bar-m. The source array(s) will be towed at depths of approximately 5 to 9 m, and the array configurations would be optimized to direct the signal downward. If two source arrays are used for the 3D survey activity, they will not fire simultaneously but rather have an alternate firing pattern (“flip-flop” mode). The source arrays’ discharge frequency is based on distance along the survey line. Based on a typical

vessel speed of 4-4.5 knots, this would be approximately every six seconds. Again, in order to obtain full-fold coverage over the survey region, up to an additional 6,000 m of coverage will also be required at each end of the area, during which the source array will be firing. Firing of the complete source array will be stopped during the turns from line to line. Due to the length of the streamers, such turns require approximately four hours to complete. Within this period, a single and smallest unit from a source array may be fired at a much reduced frequency to act as a mitigation (deterrent) source for marine animals (see Chapter 5).

The 3D seismic survey will use up to 14 towed streamers, with lengths ranging from 6,000 - 10,000 m and deployed at a depth of approximately 6 to 30 m. The streamers will be separated by distances of 50 / 75 / 100 m, and are currently planned to be solid or gel-filled to minimize any potential for adverse environmental effects in the case of breaks or tears. Streamer types and configurations may also vary dependent upon contractor selection. Hydrophones in the streamers receive the sound waves reflected from structures underneath the ocean floor and transfer the data to an on-board recording and processing system.

The particular vessel that will work on the Project in any given year might be different, as could the source array (which is typically vessel specific). Vessel, source array and seismic streamer characteristics and acquisition towing configuration may therefore vary dependent upon the seismic contractor and vessel selected, but these will be generally within the parameters described above.

Standby or guard vessel(s) will be used to scout for hazards and for interacting and communicating with any other marine users in the survey area. Resupply of the vessels during the survey will be accomplished with a supply vessel. An existing shorebase will be utilized, and a shore based representative will be located in St. John’s for the duration of the Project.

The 3D survey vessel may also passively collect and record gravity and magnetic data at the same time, and will have an echosounder for depth soundings.

2.4.2 Wellsite Geohazard, Geochemical and Environmental

Wellsite geohazard, geochemical and environmental survey activities will also be conducted in order to collect additional information to help determine the hydrocarbon potential of, and/or environmental conditions within, relevant parts of the Project Area.

These survey programs involve a variety of activities, the underlying purpose and timing of which is variable. Geochemistry is often associated with exploration for hydrocarbon prospects, wellsite-geohazard and environmental work is undertaken to complete site investigation prior to exploratory drilling. The specific nature, location and timing of these activities in any year will be subject to regulatory approvals, as well as such factors as weather and ice conditions, the location of other marine activities in the region and other considerations. With the exception of geochemical surveys, which are an exploration tool, the timing of these activities will all be dependent upon the exploration results and the number of potential exploration well prospects identified from the 3D seismic data.

The main components of the wellsite geohazard, geochemical and environmental surveys associated with this Project will include:

- A site-survey acquisition vessel;

- Engineering geophysical equipment including 2D HR seismic;
- Seabed and water column sampling equipment; and
- Shallow seabed geotechnical sampling equipment.

The geochemical and associated bathymetric surveys are associated with exploration for prospects. Geochemical and environmental data acquisition may be collected using a towed or ROV mounted seabed camera / video system, grab samplers, gravity or piston core, box corer and water sampler.

Site investigation prior to exploratory drilling geohazard and engineering geophysical data would be collected using 2D high-resolution reflection seismic, sub-bottom profilers (possibly involving deep tow, mid water tow, hull-mounted or over the side mounted equipment), side-scan sonar, multi-beam echosounder and magnetometers. Core, grab and seabed samples may also be acquired to determine seabed sediment characteristics. For each of these activities, the survey vessel could be either a dedicated survey ship, or involve the equipment being deployed from a vessel of opportunity.

Environmental surveys could include metocean water column characterization and environmental effects characterization and environmental baseline studies. Instrumentation could include water samplers, CTD, current meters and wave rider bouy for metocean and seabed grab and core samples for environmental baseline survey. Environmental characterization may also include a biological survey of commercial fish using fish sampling gear such as a commercial groundfish trawl.

In conducting each of these types of marine survey activities, each individual survey (vessel mobilization) would be an estimated 4-20 days.

2.4.3 Geotechnical

Geotechnical surveys often occur prior to any future front-end engineering and development design. The duration of a typical geotechnical survey typically ranges from approximately 4-20 days, the primary components of which would include:

- geotechnical drill ship or vessel of opportunity;
- seabed sampling equipment; and
- geotechnical sampling equipment.

Pre-development geotechnical surveys can range from seabed sampling from a vessel of opportunity to in-situ sampling up to hundreds of meters below seabed using a dedicated geotechnical drillship.

2.5 Project Logistics and Personnel

Any and all vessels that are used for this Project would fully meet the operational and environmental capabilities needed for the associated exploration activities, including in implementing relevant environmental mitigations, pollution prevention, safety and emergency response. All vessels will be in compliance with all applicable legislation and regulations, and will be inspected by Transport Canada and approved for operation by the C-NLOPB before beginning any Project-related work. They will

have appropriate oil spill / pollution prevention and emergency response plans in place, and each will be fully MARPOL compliant.

2.5.1 2D / 3D Seismic Surveys

Details of logistical operations to support the 2D and 3D seismic surveys will largely depend on the contracted seismic acquisition company. The seismic vessel will use shorebased facilities in or near St. John's, NL for initial authorization to enter and work in Canadian waters. Resupply of the vessels during the survey will be accomplished with a supply vessel from a Newfoundland port, most likely St. John's. A shore based representative will be located in St. John's for the duration of the Project.

A standby or guard vessel(s) will be used to scout for hazards and for interacting and communicating with other users of the area about the survey and associated gear, including working with fishers in the survey area (if any). The guard vessel will also provide a means for towing the seismic vessel in the case of a loss of propulsion. This will help avoid a major loss of equipment and any potential environmental issues.

No new shorebased facilities will be required for the Project. Existing port infrastructure will be used for all support aspects, and fuel and supplies will be sourced from existing, local suppliers.

A typical 2D / 3D seismic acquisition vessel can accommodate approximately 50-100 personnel, depending on the size and capabilities of the contractor's vessel. Personnel on a seismic vessel typically includes: the vessel owner / operator (ship's officers and marine crew), and technical and scientific personnel from the main seismic contractor. The seismic vessel will also have a Fisheries Liaison Officer (FLO) and Marine Mammal Observer(s) (MMO) on board, as well as an ExxonMobil representative(s). This representative serves as Client Quality Control, Navigation Data Processing Quality Control, and Health, Safety, and Environment oversight. All Project personnel will have each of the required certifications specified by relevant Canadian legislation and the C-NLOPB.

Any required crew changes and resupply for the 2D vessel will likely take place at an existing onshore facility in Eastern Newfoundland. Those for the 3D seismic vessel will be completed by vessel to vessel transfer offshore. Refuelling of this vessel will also take place offshore, utilizing the offshore supply vessel. Helicopter support may also be used intermittently and as required for the transportation of personnel or materials to and from the vessels.

2.5.2 Wellsite Geohazard, Geochemical, Environmental and Geotechnical Program

A typical vessel for the other wellsite geohazard, geochemical, environmental and geotechnical survey activities outlined above can typically accommodate 20-40 personnel, made up of technical personnel and the maritime crew, ExxonMobil representatives and MMO(s) for the wellsite geohazard survey. All Project personnel will have all of the required certifications as specified by relevant Canadian legislation and the C-NLOPB.

2.6 Project Schedule

The proposed Project activities will occur within the May 1 to November 30 period for each and all years of the proposed exploration program, which will potentially extend from 2015 to 2024.

It is anticipated that all proposed seismic survey activities would occur within these months each year, with the actual timing of data acquisition in any given year being determined at that time based on factors such as local weather, sea state and ice conditions, the nature, timing and intensity of commercial fisheries, and required coordination with other marine activities in this area and elsewhere.

No ExxonMobil proprietary 3D surveys are planned in 2015. After receiving several unsolicited multi-client speculative 3D seismic proposals for the EL 1135 area, ExxonMobil is working with a vendor on a 3D acquisition program for that area.

2.7 Potential Environmental Emissions and Their Management

Potential environmental emissions and discharges that may be associated with marine-based geophysical surveys include seismic sound and other noise, as well as vessel discharges, atmospheric emissions (exhaust) and the noise and general presence of vessels and lights associated with offshore shipping activity.

2.7.1 Underwater Noise

Underwater sound will be generated as a result of the planned Project activities, which will include the noise generated by the vessels themselves, as well as the sound energy from the source array for 2D / 2DHR and 3D seismic data collection. DFO's "Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment" specifies the mitigation measures that must be met during the planning and conduct of marine seismic surveys, in order to avoid or minimize effects on marine biota. These and other measures are discussed in further detail and considered in the environmental effects assessment that follows (Chapter 5).

As described earlier, the source array volumes will range from 3,000 – 5,500 in^3 in volume with operating pressures of approximately 1,800-2,000 psi, producing approximate peak-to-peak pressures of 100 to 180 bar-m. The source array(s) will be towed at depths of approximately 5 to 9 m, and the array configurations are optimized to direct the signal downward. If two source arrays are used for the 3D survey activity, they will not fire simultaneously but rather this will involve alternate firing along the line ("flip-flop" mode). The source arrays' discharge frequency is based on distance along the survey line. Based on a typical vessel speed of 4-4.5 knots, this would be approximately every six seconds. Again, in order to obtain full-fold coverage over the survey region, up to an additional 6,000 m of coverage will also be required at each end of the area, during which the source array will be firing. Firing of the complete source array will be stopped during the turns from line to line. Due to the length of the streamers, such turns require approximately four hours to complete. During this period, a single and smallest unit from a source array may be fired at a much reduced frequency to act as a mitigation (deterrent) source for marine animals.

During a marine seismic survey, the arrays are configured to maximize the amount of seismic energy projected vertically into the geologic formation being studied. The sound from a seismic array diminishes with increasing distance from the source. There are, however, various other factors that influence the nature and rate of decay in a sound wave in the marine environment, including frequency as well as local conditions such as water temperature and stratification, water depth and bottom conditions. Sound in the marine environment typically spreads in a cylindrical fashion (Davis et al 1998; Thomson et al 2000).

Details about the array and its sound characteristics are provided above, and the characteristics of source array in water and the potential environmental effects of same are described in Chapter 5. Much of the focus of this assessment, and the associated mitigation measures that result from it, is on sound and proposed means of avoiding or reducing its potential effects on the biophysical and socioeconomic environments.

2.7.2 Atmospheric Emissions

Light emissions from the ships will be those typically generated by other ships of similar size, such as a fishing trawler. Since lights can attract birds, lighting will be kept to a minimum at night, to the extent that it does not affect crew / vessel safety. A Migratory Bird permit from the Canadian Wildlife Service will also be obtained to enable the MMO(s) to salvage and release seabirds which may become stranded on the seismic vessel. A seabird salvage log will be maintained to record all seabird interactions as per the permit conditions.

Project-related air emissions will be limited to those which are those typically associated with marine vessels of similar size and type, in general, including the seismic vessel and support vessels.

2.7.3 Potential Liquid Discharges and Waste Management

Wastes that are anticipated to be generated during the execution of the Project and the mechanisms in place to ensure that they are managed in an acceptable manner are described below. This will include compliance with applicable regulations and industry best practices in offshore Newfoundland. Waste types and volumes will be documented as per relevant regulatory requirements.

2.7.3.1 Domestic Waste

Domestic waste will be generated primarily by personnel accommodations as part of routine operations of a vessel in the field. All solid and domestic waste will be collected in dedicated waste receptacles to be emptied on a regular basis. Materials will be separated and recycled where possible. Solids intended for disposal will be stored in dedicated waste skips that will be collected dockside by an approved waste contractor for disposal at an existing and approved waste disposal facility.

2.7.3.2 Grey and Black Water

Grey and black water includes all wash water and sewage effluent generated by the crew accommodations, laundry and cafeteria. All grey and black water will be managed in accordance with applicable requirements under MARPOL and the *Canada Shipping Act*.

2.7.3.3 Bilge and Ballast Water

If discharges of bilge and ballast water are necessary, all such discharges will be conducted in accordance with regulatory requirements described under MARPOL and the *Canada Shipping Act*.

2.7.3.4 Oily Waste Solids / Spent Absorbents

Any and all oily waste solids will be stored in dedicated waste receptacles, and will be directed to a licenced on-shore waste contractor for disposal at an existing and approved waste reception facility. This waste primarily includes any spent absorbents and oily rags.

2.7.3.5 Miscellaneous Industrial Related Solid Waste

All other wastes will also be transported to shore for disposal. Non-hazardous industrial waste will be directed to an approved municipal waste disposal site while hazardous waste will be directed through an approved hazardous waste collection contractor.

2.7.3.6 Used Equipment Disposal

A waste management contractor - to be approved by Operator - will collect used / replaced equipment at dockside and will make the necessary arrangements for disposal or recycling.

2.7.4 Potential Accidental Events and Malfunctions

Because geophysical surveys do not result in the recovery of hydrocarbons, the potential for and likely magnitude of any accidental events that could be associated with such activities are relatively low. In the unlikely event of the accidental release of hydrocarbons or other materials during the Project, ExxonMobil and its seismic survey contractor will implement the measures outlined in its Oil Spill Response Plan which will be filed with the C-NLOPB. In addition, ExxonMobil has an Emergency Response Plan in place which will apply to the proposed activities that are part of this Project.

2.8 Effects of the Environment on the Project

The nature and timing of offshore oil and gas exploration and other marine activities in the NL Offshore Area are often influenced by environmental factors such as winds, waves, currents, visibility, fishing activities and other conditions. Sea ice and icebergs are also potential seasonal hazards that must be considered and addressed in Project planning and implementation. The time of year is a key factor in determining the potential for, and possible effects of, these environmental parameters with regard to operational efficiency and safety. An appropriate understanding and consideration of environmental characteristics and phenomena are therefore required so that offshore activities can be designed and implemented appropriately, and in a manner that helps ensure that human health and safety, equipment and infrastructure and the environment are protected.

The timing of offshore exploration operations is at times affected by wind or sea conditions, which may disrupt vessel operations, and can interfere with the deployment, use and retrieval of seismic equipment (particularly, the streamers).The proposed Project might include survey activities within the May to November period in any Project year. Although this will avoid the winter period (which often produces the most significant weather and oceanographic conditions in the Project Area), such conditions are a required consideration in planning and implementing survey work from day to day. In addition to the general overview of past and recent climate and weather conditions provided in this Environmental Assessment (Chapter 4), future Project planning will include the review and analysis of additional, area-specific information on forecasted meteorological conditions (winds, waves, precipitation, fog / visibility, and temperatures) and oceanographic characteristics (waves, currents,

sea ice and icebergs). Up-to-date weather forecasting and analysis will be accessed throughout the program to address and respond to any severe environmental conditions. Vessels, equipment and materials used by the Project will have the capacity to function within the environmental conditions that are known or likely to be encountered in the Study Area, and will adhere to all applicable standards and codes for safety and data quality.

Icebergs usually occur within the Project Area off Eastern Newfoundland from spring to mid-summer each year, and seasonal outlooks and regular ice surveillance is undertaken for these portions of the NL Offshore Area. Forecasting and monitoring the presence and movements of icebergs is also part of routine operational procedures during offshore operations in areas which are subject to such seasonal intrusions of ice. Given the very mobile nature of the equipment that will be used for this Project, interactions with icebergs can be avoided through appropriate operational and safety procedures.

The presence, timing, duration and thickness of sea ice are also important considerations in planning and implementing any future offshore oil and gas activities in the region. The sea ice climatology for the East Coast of Canada has been extensively documented, and current conditions and ice forecasts are prepared by the Canadian Ice Service of Environment Canada on an ongoing basis. There is therefore considerable information and knowledge available for the Environmental Assessment Study Area to form the basis for project-specific ice avoidance. In addition, ExxonMobil has considerable experience and expertise working in some of the most severe weather and ice conditions in the world.

Other aspects of the existing biophysical and socioeconomic environments will also be a key consideration in the planning and conduct of the proposed Project. The information, analysis, and findings of this Environmental Assessment will also therefore play a key role in such planning as the Project moves forward, in order to avoid or reduce the potential for adverse effects.

3 ENVIRONMENTAL ASSESSMENT SCOPE, FOCUS AND APPROACH

This Chapter outlines the scope and focus of the Environmental Assessment, as well as providing an overview of the approach and methods used to conduct the assessment and its associated analyses. This is followed (in Chapter 4) by a description of the existing environment within and adjacent to the Project Area, which forms the environmental baseline for the eventual prediction and evaluation of the Project's potential environmental effects, and the associated identification of mitigation (Chapter 5).

As specified in the Scoping Document issued by the C-NLOPB, this information and analysis draws from and is informed and influenced by the C-NLOPB's recently completed Eastern Newfoundland SEA (Amec 2014).

3.1 Environmental Assessment Initiation and Scoping Document

The Environmental Assessment review process for this Project was formally initiated with ExxonMobil's submission of a *Project Description* document to the C-NLOPB on February 2, 2015. The Board subsequently determined that the Project would require authorizations pursuant to various provisions of the *Accord Acts* (see Chapter 1), and "formally delegate[d] the responsibility of an acceptable environmental assessment report and any supporting documents to ExxonMobil Canada Ltd., the project proponent."

On February 5, 2015 C-NLOPB staff issued a Draft Scoping Document for review and comment by relevant provincial and federal government environmental and fisheries departments, which was subsequently finalized and provided to ExxonMobil on March 2, 2015 to guide the scope and content of the Environmental Assessment.

This Environmental Assessment Report has been planned, completed and submitted in compliance with the associated regulatory requirements and processes of the C-NLOPB, as well as that Project-specific Scoping Document which outlines the factors to be considered in the assessment, the scope of those factors, and various requirements for specific environmental information and analysis.

Section 3 of the Scoping Document sets out the scope of the Project for Environmental Assessment purposes, as follows:

> *The project to be assessed consists of the following components:*
>
> > *The conduct of 2D, 3D, wellsite geohazard, geochemical, geotechnical and environmental survey program surveys between May 1 and November 30 in one or more years between 2015 and 2024 within the Project Area; and*
> >
> > *Operation of support craft associated with the above activities, including but not limited to support and guard/picket vessels, and helicopters.*

Section 4 of the Scoping Document outlines the particular factors that are to be considered in the Environmental Assessment, which include:

> *4.1 The purpose of the Project;*

4.2 The environmental effects of the Project, including those due to malfunctions or accidents that may occur in connection with the Project and any change to the Project that may be caused by the environment. Environmental effect is defined as: any change that the project may cause in the environment, including any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada;

4.3 Cumulative environmental effects of the Project that are likely to result from the project in combination with other projects or activities that have been or will be carried out;

4.4 The significance of the environmental effects described in 4.2 and 4.3;

4.5 Measures, including contingency and compensation measures as appropriate, that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;

4.6 The significance of adverse environmental effects following the employment of mitigative measures, including the feasibility of additional or augmented mitigative measures; and

4.7 Report on consultations undertaken by ExxonMobil with interested other ocean users who may be affected by program activities and/or the general public respecting any of the matters described above.

Section 5 of the Scoping Document specifies a number of requirements for environmental information and analysis that are to be included the assessment.

A detailed Table of Concordance which these requirements and an indication of where and how each of them have been addressed in this Environmental Assessment Report is included as Appendix A.

3.2 Consultation Activities and Outcomes

As part of its consultation program for this Project and its Environmental Assessment, ExxonMobil representatives held a meeting with representatives of the FFAW-Unifor and OneOcean on March 18, 2015. This meeting included a presentation by the Proponent outlining its planned Project Area, proposed survey activities, key environmental components, and planned mitigations. This was followed by a general discussion and question / answer session.

In addition, in late March 2015 ExxonMobil forwarded a brief introduction to, and overview of, the Project to a number of identified fishing interests, including the:

- Atlantic Seafood Producers
- Ocean Choice
- Clearwater Seafoods

- Icewater Seafoods, and the

- Groundfish Enterprise Allocation Council

Questions and items that were raised and discussed through these consultation initiatives were fairly typical of any offshore exploration program, and included those related to:

- An overview of ExxonMobil's overall exploration plans, activities and commitments in the region;

- The overall level of exploration interest and activity in the Eastern Newfoundland Offshore Area in 2015 and beyond, and potential interactions and collaboration between the various operators to avoid interactions and cumulative effects;

- Environmental Assessment processes, and likely timing of the development, submission and review of this report;

- Measures and procedures for on-going communication and planning with fisheries activities to avoid potential interactions; and

- Compensation policies and procedures in the event of fishing gear damage.

Each of these issues has been considered as part of the planning and conduct of this Environmental Assessment, and is addressed throughout the environmental effects assessment (Chapter 5).

3.3 Selection of Valued Environmental Components

Environmental Assessments focus on components of the environment that are of particular ecological and/or social importance, which have some potential to be affected (adversely or positively) in some way by the proposed project under assessment and/or which can serve as indicators of environmental change. These are known as Valued Environmental Components (VECs), and include both biophysical and socioeconomic aspects of the environment.

VECs are typically identified early in an Environmental Assessment as a result of experience with similar assessments in the past, questions and issues raised through consultations with government departments and agencies, stakeholder groups and resource users, and through other scoping exercises. The VEC approach is a useful, effective and widely accepted way of helping to ensure that an Environmental Assessment focuses on important and relevant environmental components and issues.

Initial direction and input into VEC selection were obtained through the Scoping Document issued to ExxonMobil by the C-NLOPB in March 2015, with further consideration and analysis by the Environmental Assessment study team and as a result of ExxonMobil's consultation activities and previous experience.

In keeping with most recent Environmental Assessments for oil and gas related projects in the NL Offshore Area, the following VECs are considered in this assessment:

- Marine Fish and Fish Habitat;
- Marine / Migratory Birds;
- Marine Mammals and Sea Turtles;
- Species at Risk;
- Protected and Sensitive Areas; and
- Marine Fisheries and Other Activities.

The rationale for the selection of these VECs is generally described below:

Marine Fish and Fish Habitat: Fish resources are an important consideration in the Environmental Assessment of any proposed activities that occur within, and that may affect, the marine environment. This VEC includes relevant fish species, as well as plankton, algae and benthos and relevant components of their habitats (such as water and sediment), given the clear interrelationships between these environmental components. The consideration of Marine Fish and Fish Habitat within a single VEC is in keeping with current and standard practice, and provides for a more comprehensive, holistic approach while at the same time reducing repetition.

Marine / Migratory Birds: A variety of avifauna species inhabit the marine and coastal environments off Eastern Newfoundland at various times of the year. Birds are important from an ecological, social and economic perspective, as they often function near the top of the food chain, may be relatively vulnerable to certain types of environmental disturbance, and are an important resource for recreational and tourism related pursuits.

Marine Mammals and Sea Turtles: Cetaceans and phocoids (whales, dolphins and seals) have been and remain an important element of the environmental and socio-cultural settings of the province. These species are especially important from an ecological perspective, and due to current consumptive (seal harvests) and non-consumptive (whale watching) activities which are important tourism attractions in some areas. A number of marine mammal species have been designated as species at risk under Canadian legislation. Although sea turtles are generally uncommon in the region, they are also typically included as part of this VEC given their rare and protected status.

Species at Risk: A number of marine fish, bird, mammal and reptile species that occur off Eastern Newfoundland have been designated as being species at risk under federal and/or provincial legislation. These species are identified and their known or likely presence, abundance and geographic and temporal distribution is described integrally under the existing environment sections for each of the above components, as well as in the environmental effects assessment for each of these VECs. These species at risk are, however, given special attention and emphasis in the identification and analysis of potential environmental issues and mitigation measures.

Protected and Sensitive Areas: Several locations within and off Eastern Newfoundland have been designated as protected under provincial, federal and/or other legislation and processes, due to their ecological, historical and/or socio-cultural characteristics and importance. In addition to areas that have existing and formal protections, a number of other locations have been identified as being especially sensitive to possible environmental disturbances, including some that are important ecologically and/or for associated human activities and values. These areas are also given special attention in the identification and analysis of potential environmental effects and mitigation.

Marine Fisheries and Other Activities: Marine fisheries (both commercial and recreational) have been key elements in shaping the history and socioeconomic character of Newfoundland and Labrador and are important aspects of the current economic and socio-cultural fabrics of the province. These and other marine uses and users may be affected both directly (through possible interactions and disturbance) and indirectly (due to any negative changes in the biophysical environment).

3.4 Environmental Assessment Approach and Methods

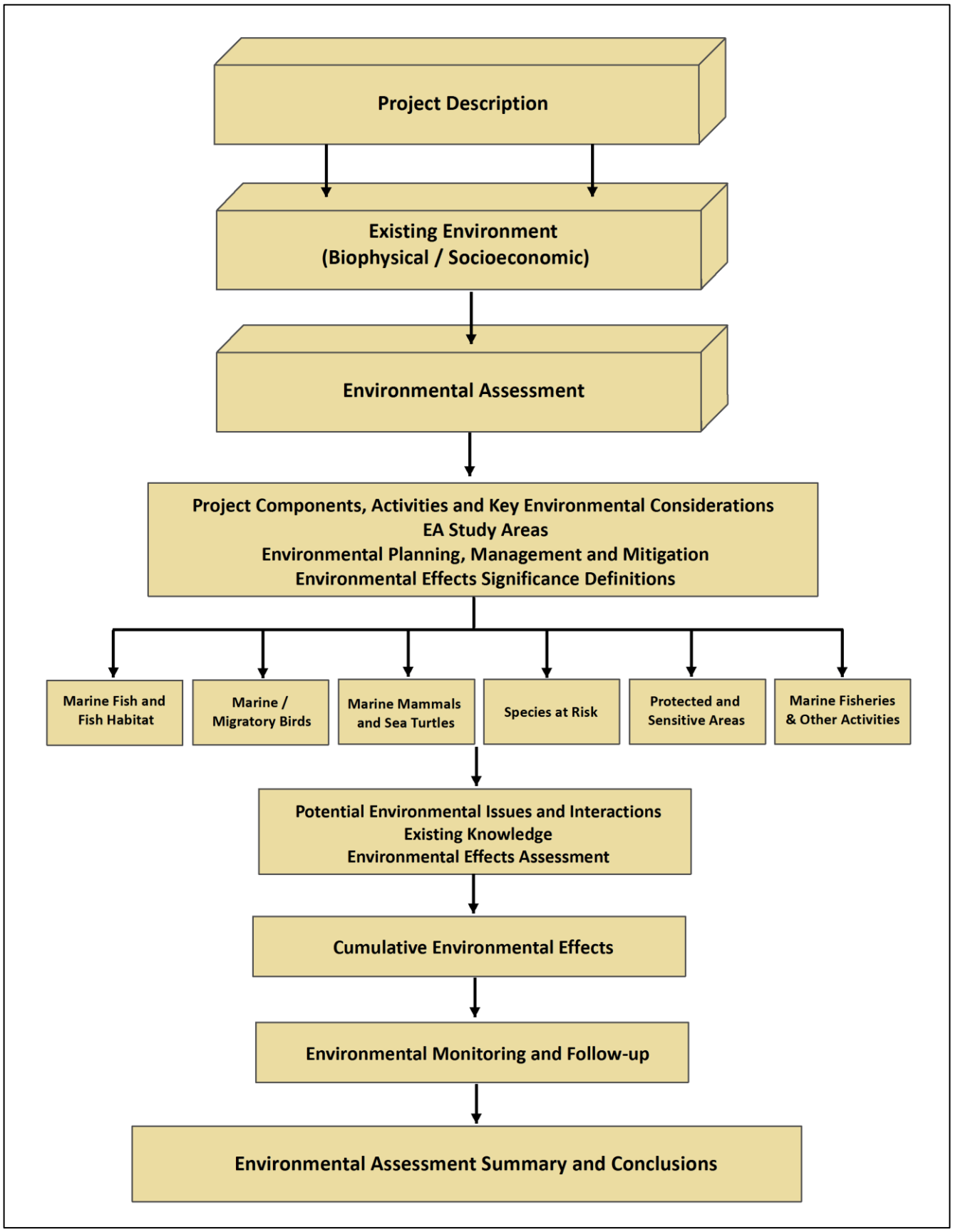
The following describes the Environmental Assessment approach and methodology that have been used to conduct the environmental effects assessment presented in this Report, including each of its key stages and components (Figure 3.1). The methods used are in keeping with current Environmental Assessment approaches and practice, and have been developed and used to ensure a thorough and rigorous analysis, while presenting the results of the assessment in a clear, concise and well-organized manner.

An overview description of the proposed Project was provided in Chapter 2, including its proposed location, survey equipment, activities, schedule, emissions and other components. The existing natural and human environmental setting for the Project is subsequently described in Chapter 4, including the key components of the environment that overlap, and may interact with, the proposed Project. This includes relevant elements of the physical (geology, climate, oceanography, ice), biological (plankton, benthos, fish, birds, mammals, turtles) and socioeconomic (fisheries, other marine activities) environments. In the Environmental Assessment, this overview of the existing environment is used as a further basis for identifying potential environmental issues and interactions, and mitigation to avoid or reduce potential adverse environmental effects.

The environmental effects assessment aspect of this Environmental Assessment therefore involves predicting and evaluating the potential environmental effects of the Project, which are generally defined as detectable changes that the Project may cause in the environment. The assessment of potential environmental effects is therefore generally based on the approach of “overlaying” a proposed project on its existing environment to identify and describe whether, how and to what degree the identified VEC may change as a result (Figure 3.1).

The environmental effects assessment is provided in Chapter 5, and is organized and presented on a VEC-by-VEC basis, with each stage of the analysis completed for each VEC in its own separate sub-section. This includes each of the following stages.

Figure 3.1 Environmental Assessment Structure and Approach



3.4.1 Project Components, Activities and Key Environmental Considerations

This section provides a brief introduction to, and overview of, the primary components and activities that will be associated with the proposed Project and the likely (general, non-VEC specific) environmental iterations and considerations that may be associated with these, as initial background and context for the environmental effects assessment.

3.4.2 Environmental Assessment Study Areas

Study Areas (spatial and temporal boundaries) have been established to direct and focus the environmental effects assessment. As noted in the Scoping Document, they reflect a consideration of:

- The proposed schedule / timing of the survey program;
- The natural variation of a VEC or subset thereof;
- The timing of sensitive life cycle phases in relation to the scheduling of survey activities;
- Interrelationships/interactions between and within VECs;
- The time required for recovery from an effect and/or return to a pre-effect condition, including the estimated proportion, level, or amount of recovery; and
- The area within which a VEC functions and within which a project effect may be felt.

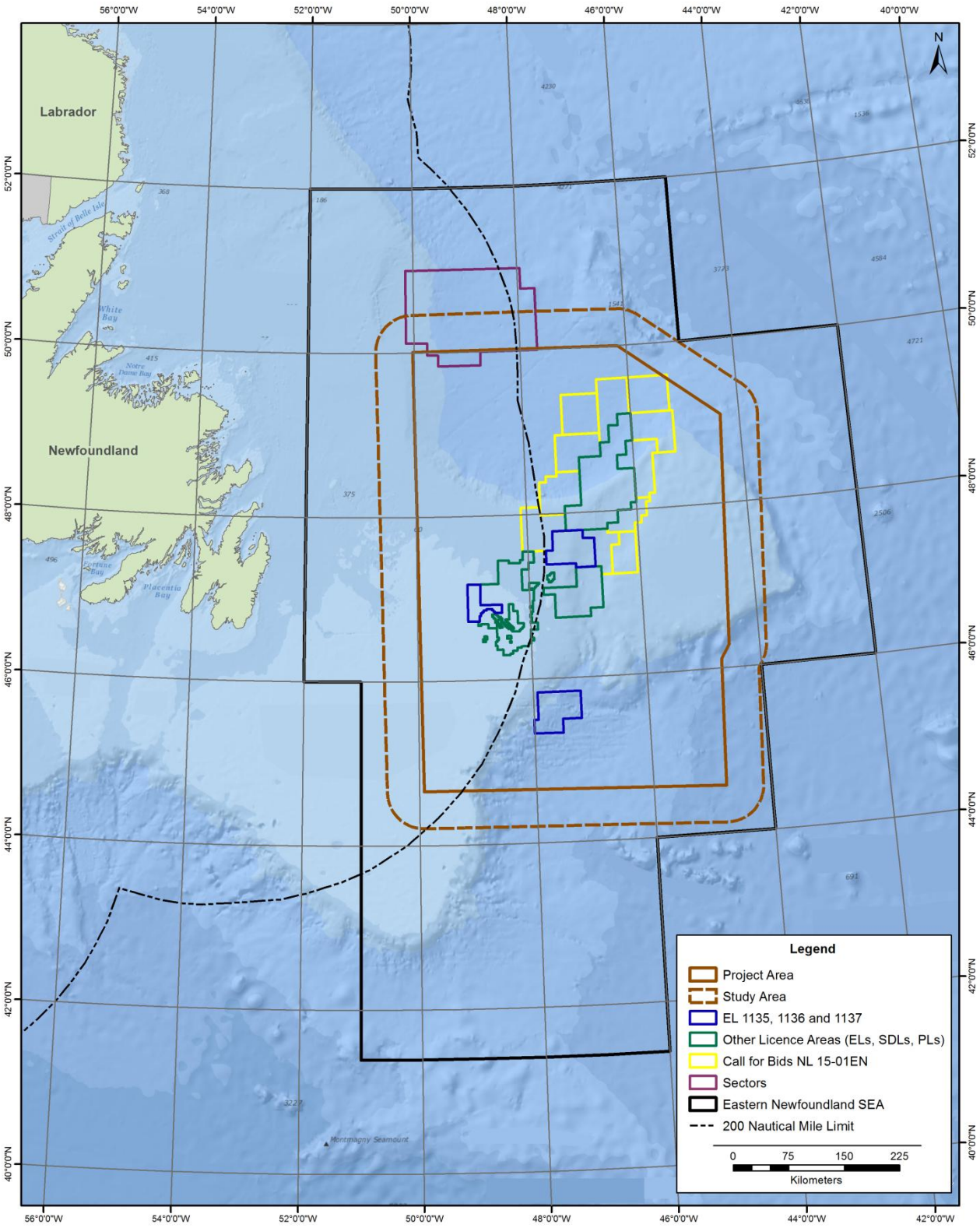
A number of these established study boundaries are generic (i.e., for the Project and Environmental Assessment as a whole) with VEC-specific (Regional) Study Areas also considered given the differences between the VECs in terms of their overall characteristics and in the manner in which they may interact with the Project. These Study Areas have also been defined and used with a flexible and adaptive approach, based on the nature of the VEC and the associated environmental information and processes which influence the analysis.

1) ***Spatial Boundaries***: Three types of spatial boundaries have been identified and considered in conducting the environmental effects assessment for each VEC (Figure 3.2):

Project Area: This area encompasses all Project acquisition-related activities (i.e. equipment deployment, seismic acquisition), and includes the locations of the proposed survey transects and all associated vessel movements with seismic equipment deployed.

Study Area: The area over which the Project and its potential emissions and other possible disturbances and environmental interactions may occur and extend, which for Environmental Assessment purposes is defined as an area that encompasses the Project Area plus appropriately 50 km.

Figure 3.2 Project Area and Environmental Assessment Study Area



Regional Areas: In addition to the Project Area and Study Area, the environmental effects assessment also considers the particular characteristics and larger spatial and temporal distributions of the individual VECs under consideration. This includes the migratory nature and movement patterns of affected fish or other wildlife (both within the water column and/or across larger geographic areas), as well as the overall extent and distribution of fishing and other marine components and activities in the region.

For some environmental components, possible environmental interactions may be limited to the immediate locations of proposed Project activities, whereas others may extend beyond the immediate area of disturbance as the distribution and/or movement of an environmental component can be local, regional, national or even international in extent. Such factors as population characteristics, migration patterns and other factors are therefore important considerations in determining the potential for, and the extent and distribution of, an environmental effect.

2) ***Temporal Boundaries***: In all cases, the temporal boundaries include and encompass the overall potential timing of Project related activities, as well as the likely duration of any resulting environmental effects. In conducting the environmental effects assessment, consideration is also given to the relevant temporal characteristics of the VECs, including the timing of their presence within the Study Area, any particularly sensitive or critical periods, likely response and recovery times to potential effects, and any natural (without-Project) variation in that environmental component.

The Project's likely environmental effects are assessed and their significance is evaluated based on the above described spatial and temporal boundaries.

3.4.3 Environmental Planning, Management and Mitigation

This section provides a listing and description of the various environmental planning, management and mitigation measures that the Proponent and/or its contractors will implement in order to prevent or reduce adverse effects. These are then considered integrally within and throughout the environmental effects analysis for each VEC, as applicable.

3.4.4 Definition and Determination of Environmental Effect Significance

Evaluating the significance of the predicted environmental effects of a proposed project involves first defining what a significant environmental effect is, and then evaluating whether a project's potential environmental effects are significant or not significant.

Significant environmental effects are those adverse effects that will cause a change in the VEC that will alter its status or integrity beyond an acceptable and sustainable level. An environmental effect that does not meet these criteria is considered not significant. Significance definitions are developed and used on a VEC-specific basis within this assessment.

Each VEC-specific effects assessment is then addressed in a separate sub-section, which begins with a brief overview of the VEC, further defining what it comprises and why it is being considered in this Environmental Assessment.

3.4.5 Potential Environmental Issues, Interactions and Existing Knowledge

To identify and focus on key environmental issues, and to ensure that these are fully considered and addressed in the assessment, this section summarizes the various questions and issues associated with the Project and its potential effects on the VEC. This includes those issues that have been included in the Scoping Document, as well as those identified through ExxonMobil's associated consultation process, by the Study Team, and/or through other Project-related environmental issues scoping activities.

Based on these identified issues and the description of the existing environment for each VEC (Chapter 4), the environmental effects assessment for each VEC then identifies and focuses on relevant *Key Indicators and Parameters*, which are generally defined as an important aspect of the VEC and/or its environment which, if changed as a result of the Project, may result in an adverse effect to the VEC (and to which such changes could conceivably be detected and measured).

A Table (sample provided below, for illustration) is then used to summarize the potential interactions between each of the main Project components and activities and each of these identified Key Indicators and Parameters:

Table 3.1 Potential Project-VEC Interactions

Project Component / Activity	**Key Indicators and Parameters ***				
	1	**2**	**3**	**4**	**#**
Presence of Vessels and Equipment					
Seismic Sound					
Other Sound (vessels, etc)					
Seabed and Environmental Sampling Activities					
Air Emissions					
Lighting					
Solid Waste					
Liquid Waste					
Potential Accidental Spills					
* These indicators and parameters are identified and listed on a VEC-specific basis in the relevant Table / section of Chapter 5					

This section also provides a brief overview of what is currently known and understood about the potential effects of offshore geophysical surveys on the VEC. This includes relevant information and findings from the literature, reported environmental monitoring of other similar projects, and other sources, which is then used to guide and inform the assessment and evaluation of environmental effects and the identification and proposal of mitigation.

3.4.6 Environmental Effects Assessment

This section provides an analysis (prediction) and description of the likely environmental effects of the Project on the VEC. The environmental effects assessment considers the nature, degree, extent and timing of potential Project-induced change from the existing (baseline) environment (as described in Chapter 3).

Within this section, potential environmental effects are assessed and evaluated for both planned Project components and activities, as well as for any potential accidents and malfunctions that may occur as a result of the Project. Environmental effects management (mitigation and optimization) measures are considered integrally and iteratively in the effects assessment. This includes those that have been "built-in" to the Project through its planning and design, so as to avoid or reduce potential environmental issues proactively (Chapter 2) as well as other environmental protection (mitigation) measures identified by the Proponent (see Section 5.3). From there, and with this base of general mitigation and optimization in place, the environmental effects assessment identifies and predicts the likely environmental effects of the Project on the VEC, with the additional identification of further VEC-specific mitigation as required and appropriate.

As a result, and in keeping with standard approaches and to optimize efficiency, the environmental effects assessment is therefore focussed upon assessing and describing the likely residual environmental effects of the Project – namely, those which might occur after the implementation of the effects management / mitigation measures identified and proposed in the Environmental Assessment.

These predicted (residual) environmental effects of the Project are described based on a number of standard and widely accepted environmental effects criteria or "descriptors", as listed and defined below:

1) ***Nature / Direction of the Effect***: Adverse, Positive or Neutral.

2) ***Magnitude***: The degree of change from existing (baseline) conditions in the affected area (see geographic extent, below).

   Negligible: Although there is potential for a Project-VEC interaction, there would be no likely detectable effect that would differ from natural variability

   For the biophysical VECs:
   Low: Affects 0 to 10 percent of individuals in the Study Area
   Medium: Affects 10 to 25 percent of individuals in the Study Area
   High: Affects over 25 percent of individuals in the Study Area

   For the fisheries and other marine activities:
   Low: Affects 0 to 5 percent of fishers / users in the Study Area
   Medium: Affects 5 to 25 percent of fishers/ users in the Study Area
   High: Affects over 25 percent of fishers / users in the Study Area

3) ***Geographic Extent***: The spatial area within which an environmental effect will likely occur

4) ***Duration***: The period of time over which an environmental effect will likely be evident

5) ***Frequency***: How often an environmental effect will likely occur (continuous, or at specific time intervals)

6) ***Reversibility****:* The ability of an environmental component to return to an equal or improved condition once the disturbance(s) has ended.

The current condition of an environmental component as a result of natural and/or anthropogenic factors, and thus, its resulting resiliency or sensitivity to further change (ecological / socioeconomic context) is also considered integrally as part of the prediction of environmental effects.

The following Table is then used to summarize the predicted residual environmental effects of the Project on the VEC. The level of confidence (certainty) in each environmental effects prediction is also indicated throughout.

Table 3.2 Environmental Effects Assessment Summary Table

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels and Equipment							
Seismic Sound							
Other Sound (Vessel, etc)							
Seabed and Environmental Sampling Activities							
Air Emissions							
Lighting							
Solid Waste							
Liquid Waste							
Potential Accidental Events							
Overall, Resulting Effect(s) of Project on the VEC				**Evaluation of Significance**			

Nature / Direction:
A = Adverse
N = Neutral or No Effect
P = Positive

Magnitude:
N = Negligible or No Effect
L = Low
M = Medium
H = High

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

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

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

Reversibility:
R = Reversible
I = Irreversible

Certainty in Prediction:
L Low
M Moderate
H High

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.
- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in detail in Section 5.3

For the biological VECs (Marine Fish and Fish Habitat, Marine / Migratory Birds, and Marine Mammals and Sea Turtles), any associated Species at Risk are addressed integrally within the larger VECs themselves. Following these VEC sections, however, there is a summary discussion of the various relevant Species at Risk, including an overview of those that have the potential to interact with the Project, and a species by species summary of the Project's potential effects on these protected species.

3.4.7 Cumulative Environmental Effects

As also specified in the Scoping Document, the Environmental Assessment Report also assesses and evaluates any cumulative environmental effects that might result from the Project in combination with other projects or activities that have been or will be carried out.

The cumulative environmental effects assessment considers the overall (total) effect on the VECs as a result of the Project's likely residual environmental effects (as summarized above) and those of other relevant projects and activities, using the following approach:

1) Past and on-going projects and activities and their effects are reflected in the existing (baseline) environmental conditions for each VEC (Chapter 4). The current condition of the VEC as a result of these natural and/or anthropogenic factors, and thus its overall sensitivity or resiliency to further disturbance or change, has been integrally considered throughout the environmental effects assessment.

2) The cumulative effects assessment then summarizes and considers whether and how this existing condition could be changed by the introduction of the Project and its residual (with mitigation) environmental effects.

3) Other likely future projects and activities that are relevant to this VEC and its cumulative effects assessment are then identified and considered. These comprise any reasonably foreseeable future projects or activities whose effects on the VEC would likely overlap in space and time with those of the Project (e.g., overlap with the Project area and/or its zone of influence), and/or would affect the same populations, communities, etc as the Project.

4) In any cases where the predicted residual environmental effects of the Project on the VEC will likely accumulate or interact with those of one or more other future projects and activities, the potential cumulative effects of the Project in combination with those of these other relevant future developments are assessed and evaluated (using the same significance definition and approach as was used for the Project-specific effects assessment, as described above).

The cumulative effects assessment considers the following other projects and activities:

- *Hibernia Oilfield*: Discovered in 1979, the Hibernia Oilfield is operated by the Hibernia Management and Development Company Ltd. (HMDC), and is located approximately 315 km east-southeast of St. John's, NL. The development phase of that project commenced in late 1990 and continued until the mating of the Gravity Based Structure (GBS) and its topsides at Bull Arm NL in 1997, after which the platform was towed to and installed at its site on the Grand Banks in June of that year. With estimated recoverable reserves of approximately 1.4 billion barrels, commercial production from the Hibernia field commenced in November 1997 and is on-going. In recent years the project has been further expanded to include the Hibernia South Extension Unit, from which production commenced in 2011.

- *Terra Nova Oilfield*: Discovered in 1984 and declared a significant discovery in 1985, this oilfield has reserve estimates of approximately 500 million barrels of recoverable reserves. The Terra Nova Project is currently in operation by Suncor Energy Inc. using a floating production, storage and offloading (FPSO) vessel, and is located approximately 350 km

southeast of St. John's and 35 km southeast of Hibernia. Dry-dock construction of the Terra Nova FPSO vessel began in early 1999, and it arrived at Bull Arm in May 2000 where outfitting, hook-up and commissioning of the vessel took place. The FPSO arrived at the oilfield in August 2001 and began producing oil in January 2002.

- *White Rose Oilfield and Satellite Expansion:* Discovered in 1984, a significant discovery licence for the field was issued in January 2004. It is located about 350 km east-southeast of St. John's, and approximately 50 km from the Hibernia and Terra Nova fields. The White Rose oilfield and its satellite expansions are operated by Husky Energy Inc. utilizing a FPSO vessel, and first oil was produced in November 2005 followed by the North Amethyst expansion in May 2010.

- *Hebron Oilfield*: First discovered in 1980, this oilfield is estimated to contain in excess of 700 million barrels of recoverable resources. The Hebron Project is currently under development and will utilize a stand-alone concrete GBS being constructed at Bull Arm, which will be designed for an oil production rate of 150,000 barrels of oil per day. First oil from the Hebron Project is planned for 2017.

- *Offshore Petroleum Exploration Activity*: The Eastern NL Offshore Area is also subject to on-going and planned offshore oil and gas exploration activities, including a number of proposed offshore seismic programs which were being subject to Environmental Assessment review or recently approved by the C-NLOPB as of the time of writing (see *http://www.cnlopb.ca/assessments/mg3.php*).

- *Fishing Activity*: Commercial fisheries within the Study Area are extensive and diverse, as described in detail in Chapter 4 of this Report.

- *Other Marine Vessel Traffic*: Includes tanker traffic and supply vessels associated with the existing offshore oil developments, as well as cargo ships, fishing vessel transits, etc.; and

- *Hunting Activity*: Wildlife (especially seabird) populations off Newfoundland and Labrador are subject to hunting activity. Although little or no hunting activity is expected to occur in the far offshore locations that comprise the Project Area, these activities do affect the bird populations that occur in, and move to and through, the region.

3.4.8 Environmental Monitoring and Follow-up

The Environmental Assessment Report then identifies and describes any proposed environmental monitoring and/or follow-up activities. This includes any such measures that may be required or appropriate to meet regulatory requirements, to demonstrate compliance to relevant environmental requirements or Environmental Assessment commitments, and/or to address any related issues of uncertainty, such as to verify the environmental effects predictions or the effectiveness of mitigation measures outlined in this assessment.