NEXEN ENERGY ULC
FLEMISH PASS EXPLORATION DRILLING PROJECT (2018-2028)

Environmental Impact Statement Summary

Pursuant to the Requirements of the *Canadian Environmental Assessment Act, 2012*

FINAL REPORT

Submitted by:

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1 INTRODUCTION AND EA CONTEXT

Nexen Energy ULC, a wholly-owned subsidiary of CNOOC Limited (Nexen), is planning to conduct a program of petroleum exploration drilling and associated activities in the eastern portion of the Canada-Newfoundland and Labrador Offshore Area over the period 2018 to 2028 (hereinafter also referred to as the Project). The Project Area includes two Exploration Licences (ELs 1144 and 1150) in the Flemish Pass region for which Nexen is currently the Operator and sole interest holder, and which have not yet been subject to exploration drilling activity to date pursuant to these licences, as well as a 20 km buffer area surrounding those licences to accommodate the location and extent of ancillary activities that may be carried out in support of such drilling activities. The Project will include exploration drilling within these ELs, possible appraisal (delineation) drilling in the event of a hydrocarbon discovery, vertical seismic profiling (VSP), well testing, eventual well abandonment or suspension activities, and associated supply and service activities.

The Project requires review and approval pursuant to the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). It has been determined to constitute a "designated project" under the associated *Regulations Designating Physical Activities*, given that it includes the drilling, testing and abandonment of offshore exploratory wells in the first drilling program in an area set out in one or more ELs issued in accordance with the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act.* The environmental assessment (EA) review of the Project under CEAA 2012 commenced in April 2017 with Nexen's submission of a Project Description and associated Summary Documents to the Canadian Environmental Assessment Agency, which were subsequently made available for government and public review. Following that review period, on June 9, 2017, the Agency determined that a federal EA was required for the Project and issued the associated Notices of EA Determination and EA Commencement, as well as Draft Environmental Impact Statement (EIS) Guidelines, which were subsequently finalized and issued to Nexen on July 25, 2017.

The EIS for the Project has been planned, prepared and submitted by Nexen in accordance with the requirements of CEAA 2012 as well as the Project-specific EIS Guidelines (July 2017) and other generic EA guidance documents issued by the Agency. It has also been designed and completed to address the EA requirements of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) under the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* and the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (the Accord Acts).

This document comprises an EIS Summary under CEAA 2012. Additional, more detailed information on the Project and its existing environmental setting and the results of its environmental effects assessment is provided in the accompanying EIS document.

2 PROJECT OVERVIEW

This section provides an overview description of the Project, including its location and planned components and activities. A more detailed description of the Project, including its need, purpose, justification, location, key components and activities, schedule, potential environmental emissions and their management, and an evaluation of Project alternatives, is provided in the EIS (Chapter 2, Project Description).

2.1 Project Location

The Project will take place in a marine area offshore Eastern Newfoundland (Figure 2.1). The Project Area itself covers approximately 10,634 km^2, the western edge of which is over 400 km from the Island of Newfoundland. The Project Area incorporates ELs 1144 and 1150 in the Flemish Pass region where Nexen is proposing to conduct exploration drilling activities within the term of these current licences and for which Nexen is currently the sole interest holder and Operator (Tables 2.1 and 2.2).

Table 2.1 Nexen Exploration Licences Within the Project Area

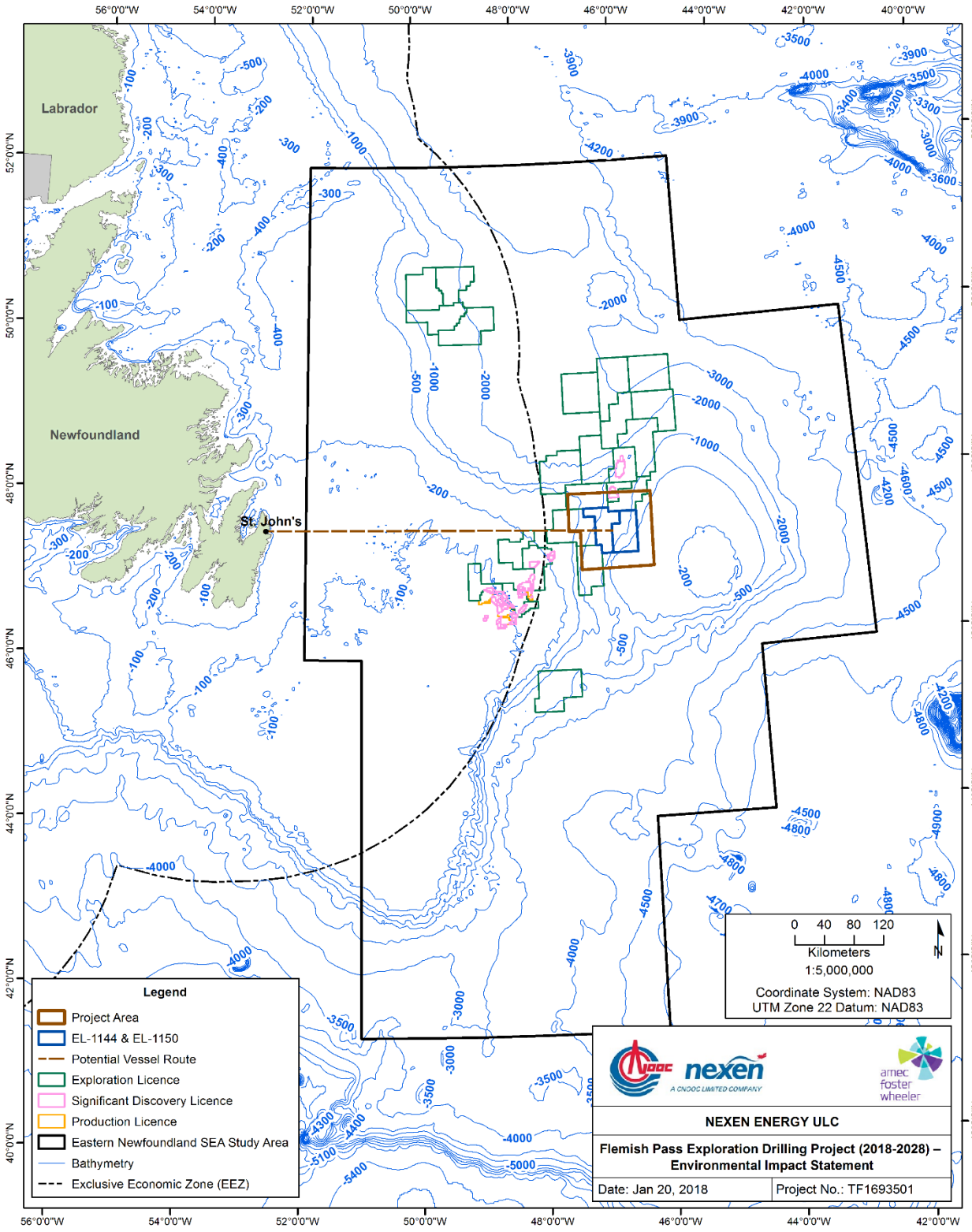
Licence Number	Interest Holder (% ownership)	Licence Area (hectares / km^2)	Expiry: Period I Period II	Drilling Activity Under Current EL
EL 1144	Nexen (100%)	163,008 ha / 1,630.08 km^2	January 15, 2022 January 15, 2025	No drilling has occurred
EL 1150	Nexen (100%)	169,578 ha 1,695.78 km^2	January 15, 2023 January 15, 2026	No drilling has occurred

Table 2.2 Nexen Exploration Licences and Project Area Characteristics

Exploration License	Distance from Island of Newfoundland	Licence Area		Approximate Water Depth (m)	
		Hectares	Km^2	Max	Min
EL 1144	423 km	163,008	1,630.08	1,200	650
EL 1150	460 km	169,578	1,695.78	1,185	330
Project Area					
Remainder of Project Area (Minus ELs)	405 km	730,840	7,308.40	1,190	250
Project Area (Total)	405 km	1,063,426	10,634.26	1,200	250

The Project Area also includes a 20 km buffer area surrounding the two licences to (conservatively) accommodate the location and extent of ancillary activities that may be carried out in support of such drilling activities. These may include, for example, any Project components or activities that are required to extend beyond the immediate boundaries of the ELs themselves, such as the required temporary presence and movement of the mobile offshore drilling unit(s) (MODUs) or support vessels and aircraft during initial mobilization and set up or eventual demobilization from a drill site, as well as any required non-drilling activities that could conceivably extend to outside the licence boundary. All drilling operations carried out as part of the scope of this Project will, however, be conducted within the defined boundaries of EL 1144 and EL 1150. The EIS also considers and assesses an identified potential supply vessel and aircraft traffic route from Eastern Newfoundland to the Project Area (Figure 2.1).

Figure 2.1 Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018-2028)



As also illustrated in Figure 2.1, ELs 1144 and 1150 and the surrounding Project Area are located off Eastern Newfoundland, outside Canada's 200 nautical mile Exclusive Economic Zone (EEZ) on the outer continental shelf. They are also located entirely within the Study Area for the Eastern Newfoundland Strategic Environmental Assessment (SEA) completed for the C-NLOPB in August 2014[1].

2.2 Planned Project Components and Activities

The objective of the Project is to determine the potential presence of commercial hydrocarbons within the ELs offshore Eastern Newfoundland that are currently held by Nexen. The key components and activities of the Project are: exploration drilling within the various ELs identified above; possible appraisal (delineation) drilling in the event of a hydrocarbon discovery; VSP; well testing; eventual well abandonment or suspension procedures; and associated supply and service activities.

2.2.1 MODUs and Drilling Activities

Exploration and appraisal wells are drilled to confirm the presence, or delineate the extent, of oil and gas resources at particular locations. Exploration wells are drilled to determine whether areas of interest identified from previous geophysical surveys and other information contain oil and gas resources. Depending on the results of these wells, an operator may then drill appraisal wells into different parts of the identified hydrocarbon accumulation to confirm its size and the characteristics of the hydrocarbons found.

This Project will involve the drilling of up to 10 wells within the two ELs that comprise the Project Area over its temporal duration. Particular wellsite locations are not currently defined, and will be selected as Project planning and design activities move forward. Similarly, specific well designs have not yet been completed by Nexen, and these will require consideration of a variety of factors, including well location (both surface and bottom-hole), water depth, subsurface geological properties, total well depth, evaluation requirements, and other factors. Individual well designs will be developed and submitted for approval to the C-NLOPB as required per the applicable authorization and approvals processes.

During exploration and appraisal drilling activities, sidetracking of the lower portions of the main wellbore may be required for geologic or mechanical reasons. This will be conducted by directionally drilling around obstructions in the main wellbore to either secure the original target or to intersect alternate subsurface geologic targets. Considerations such as additional time for the MODU on location as well as additional discharges associated with sidetracking have been addressed in this EIS. The 10 exploration and appraisal wells referenced above represent surface (seabed) locations and not any additional subsurface bottom hole locations associated with sidetracking from the main wellbore or subsequent sidetracked wellbores.

[1] Amec Environment and Infrastructure. (2014). Eastern Newfoundland Strategic Environmental Assessment (SEA). Prepared for the Canada-Newfoundland and Labrador Offshore Petroleum Board (August 2014).

Wells may be drilled using a semi-submersible MODU or a harsh environment drillship MODU (Figure 2.2). The type of MODU chosen for drilling a particular well will be based primarily on the characteristics of the physical environment at the proposed drill site, particularly water depth, expected drilling depth and expected weather and ice conditions and associated mobility requirements. There may be up to two MODUs actively engaged in drilling activities in the Project Area at any one time as part of this Project. All MODUs and vessels that are used for this Project will meet the operational and environmental capabilities needed for the associated exploration activities, and will be in compliance with applicable legislation and regulations.

Pending receipt of all required regulatory approvals for the Project (and for each individual drilling campaign within it), as well as the completion of the various associated corporate planning, procurement and approval processes required, the selected MODU will be mobilized to the planned drilling location. In preparation for MODU arrival at the well location, positioning transponders may be placed on the seabed and met ocean equipment (wave rider and current meters) may be deployed.

Prior to the start of drilling, a seabed investigation will be conducted. This seabed investigation would typically be conducted using a ROV, sonar (multi-beam or side scan) or other relevant equipment, which is deployed from the MODU or a support vessel for a visual inspection of the seabed prior to initiating drilling activities.

Once the MODU is mobilized and in place and all of the above described preparatory activities have been completed, the offshore exploration well will then be progressively drilled in sections over a period of up to several months. In each drilled section, the well bore is gradually reduced in size. After each section is drilled, steel pipe or casing is installed and cemented into place to stabilize the well bore, isolate pressure/fluids and prevent drilling fluid losses prior to drilling ahead with the next hole section, according to the general sequence summarized below:

1) *Riserless Hole Sections:* For the first two to three hole sections, there is no closed loop circulating system in place (no riser) so the drilling fluids and cuttings are circulated onto the seabed. Drilling fluid is used to cool the bit, maintain wellbore stability and transport the drilled cuttings to the seabed. Typically seawater and/or water-based mud (WBM) is used during the drilling of these riserless hole sections.

The riserless hole sections are comprised of the following:

a) The largest hole section, approximately one metre in diameter, is drilled to approximately 100 m below mud line (BML).

b) The conductor casing and low pressure wellhead housing are installed on a landing string. The conductor casing is typically cemented into place. Generally, the top of cement is brought to the mudline. Sometimes a second conductor hole section is drilled below the conductor casing but this is not usually required in this region.

c) Next, the surface hole section is drilled, generally to depths of approximately 700 to 1,000 m BML.

Figure 2.2 Examples of Semi-submersible (*Top*) and Drill Ship (*Bottom*) MODUs

Source: Seadrill (2017): *http://www.seadrill.com/media-centre/image-library/our-rigs/west-aquarius.aspx*

Source: Stena Drilling (2017): *http://www.stena-drilling.com/fleet-availability/stena-carron*

d) The surface casing and high pressure wellhead housing are installed on a landing string. The surface casing is cemented into place. Generally, the top of cement is brought to the mudline.

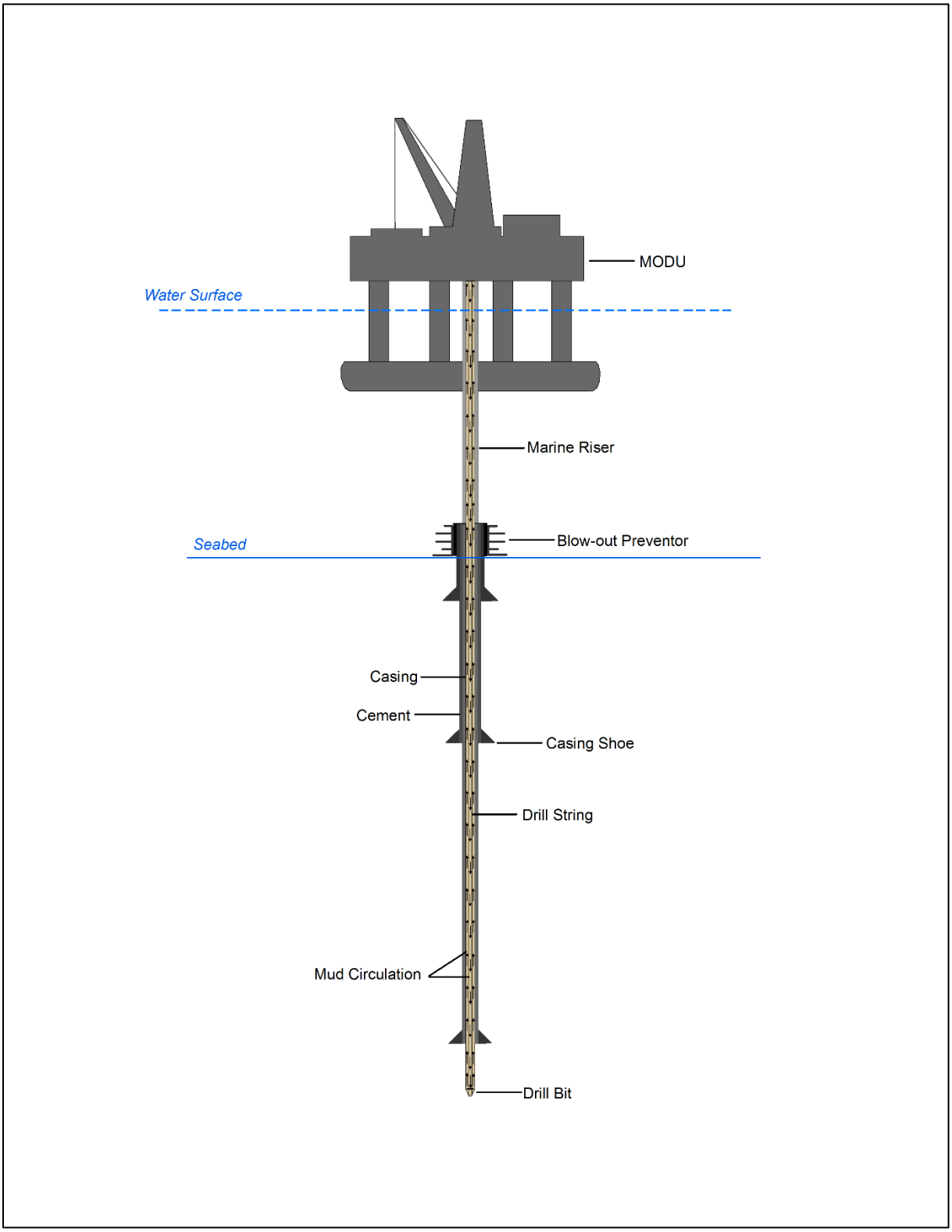
e) The blowout preventer (BOP) is run on the marine riser pipe and is connected to the wellhead system, creating a closed system conduit between the MODU and the well. The BOP comprises a system of high pressure valves that prevent hydrocarbons from escaping into the environment in the event of an emergency or equipment failure during drilling.

2) *Riser Drilling:* Once the riser is installed, the remainder of the hole sections may be drilled with WBM or synthetic-based mud (SBM). The riser creates a conduit for the circulation of drilling fluids down the drill string, through the bottomhole assembly / drill bit, back up the open hole / casing annulus to the riser annulus and back to the MODU. Drilled cuttings are also transported back up the annulus to the MODU for processing. At various intervals, depending on pore pressure, formation fracture gradient and presence of geohazards, intermediate casing strings or liners are installed and cemented in place as part of ensuring safe well operations.

Figure 2.3 provides a generalized schematic of a typical offshore well. For the planned exploration drilling activities being undertaken as part of this Project there will be no excavated drill centers and no required underwater construction activities.

In addition to the somewhat more traditional approach of mobilizing the MODU to a well location and fully completing that well before moving on to the next, the Project may also include “batch drilling” activity, in which the riserless sections for multiple wellsites are initially and consecutively drilled, after which the MODU returns to these sites to complete the remaining portion of the wells.

Figure 2.3 Conceptual Diagram of a Typical Offshore Exploration / Appraisal Well



NOTE: For general illustration only, MODU and well components not to scale. Additional intermediate casing strings / liners may be installed, depending on well specific conditions and detailed well design

2.2.2 Vertical Seismic Profiling

VSP (which is also at times referred to as a "check-shot" survey) will also be conducted at individual well sites as required. VSP is a technique that is used to further define the characteristics and depth of identified geological features and potential petroleum reserves by obtaining high resolution images of the target. If required, a VSP survey will be undertaken by placing a string of receiver (geophones) down the well at pre-determined depths, with a seismic source (usually mid-sized sound source arrays) suspended from the MODU. Walk-away VSP surveys may also be undertaken, which involve placing a sound source on a vessel which then moves away from the MODU while activating the seismic source at pre-determined distances from the borehole receiver. The check-shots are recorded at multiple intervals down the well, and the resulting information assists in determining and confirming the depth of the drilled well and for reconciling drilling information with that obtained through seismic survey work.

VSP surveys are typically short term activities (usually one to two days duration), with seismic source activation often limited to just a few hours. They also utilize seismic sound sources that are considerably smaller than those used in regional seismic (geophysical) surveys for oil and gas in the offshore. The overall nature and specific characteristics of any VSPs required and conducted for this Project will depend on various factors, including the individual well in question, the geological target being investigated, and the particular objectives and data requirements associated with the survey.

2.2.3 Well Testing

2.2.3.1 Wireline Logging

Petrophysical data will be acquired via wireline logging tools, provided by a third party contractor. These tools are used to record continuous measurements of the formation properties, including reservoir rock and fluids. The aim of wireline logging is to characterise the reservoir properties, in particular understanding the composition and heterogeneity of the reservoir and predicting the distribution of the porosity, permeability and saturation.

2.2.3.2 Well Flow Testing

If there is an indication of commercial hydrocarbons found during the drilling and evaluation of an exploration well, a well flow test may be conducted to sample and identify formation fluids (which may contain hydrocarbons and/or water) and to measure produced flow rates. During such testing, produced fluid is flowed back to the MODU, where hydrocarbons are separated from any produced water and samples are collected and analyzed. A typical formation flow test involves perforating a casing that has been set across the hydrocarbon-bearing reservoir, after which reservoir fluids flow into and up the wellbore to the MODU where the well fluids are measured, analyzed and possibly stored for future analysis. Produced hydrocarbons are flared using high-efficiency burners supplied by a third party. If there is a significant amount of produced water involved, it will be treated in accordance with the relevant regulatory requirements prior to ocean discharge.

Formation flow test would only be carried out as part of this Project on any wells where hydrocarbons are discovered and additional information on the specific characteristics of the discovery is therefore required. The duration of any such well testing is dependent upon various factors but is typically in the

order of several days, although this may be of longer duration depending on the particular characteristics of the hydrocarbons found and the analysis being undertaken. Alternative testing technologies, with the potential for improved safety and environmental performance, may also be proposed.

2.2.4 Well Abandonment or Suspension

Once drilling and any associated well testing is completed, offshore wells are typically then abandoned permanently, or in some cases, suspended. Abandonment or suspension involves the isolation of the well bore by placing cement plugs, potentially in combination with mechanical devices, at various depths. If removal of the equipment extending above the mudline is required, the casing will be cut just below the mudline and upper sections of casing and the wellhead will be recovered to surface. This may be done immediately after the well is drilled and evaluated using the MODU or sometime after the well is suspended using a vessel. A remotely operated vehicle (ROV) or other equipment is then used to inspect the seabed to ensure that no equipment or obstructions remain in place. Alternatively, approval may be sought to leave the wellhead in place on the seabed. In this case, wellhead position would be reported to Canadian Hydrographic Services so nautical charts can be updated. In some circumstances, a well may not be abandoned permanently but rather suspended for future re-entry. In such cases, the same activities as those described above would be undertaken in ensuring isolation of all hydrocarbon-bearing intervals, but the casing / wellhead would be left in place for future use.

Well abandonment or suspension for this Project will be carried out as per Nexen's internal requirements and procedures, as well as applicable industry practice and in compliance with relevant regulatory requirements. Wells will be monitored and inspected in accordance with applicable regulatory requirements at the time of abandonment.

2.2.5 Supply and Servicing

A supply base provides re-fueling, temporary storage, staging and loading of materials and supplies to support offshore exploration activities. One or more existing facilities in Eastern Newfoundland are expected to be utilized for these purposes for this Project. Aircraft support for the Project will be based at St. John's International Airport. Supply vessels will make regular trips to the MODU throughout the program, and a dedicated stand-by vessel will attend to the MODU throughout the drilling campaign. Personnel will be transported to and from the MODU by helicopter or supply vessel. These services will be procured from existing, established third party suppliers that service the offshore oil and gas sector.

Supply vessels that are involved in Project activities will travel directly between an established port facility in Eastern Newfoundland and the MODU operating within an EL in the Project Area, a practice which is common in the oil and gas industry that has been active in this region for several decades. It is anticipated that with a single operating MODU there will be two to three return transits per week by the supply vessels during the course of the Project. In the case that two MODUs are operating at the same time, the number of vessel transits could increase to between four to five trips (or more) per week. Helicopters will also be used for the transportation of personnel and key materials to and from the MODU(s) as required throughout the course of the Project. It is estimated that there would be one to three helicopter transits per day to the MODU, which would increase proportionally in the event that two MODUs are being used simultaneously (i.e. to two to six transits per day).

All vessels and aircraft that are used for this Project will meet the operational and environmental capabilities needed for the associated support activities, including for implementing relevant environmental mitigations and safety and emergency response procedures.

2.3 Project Personnel

The various exploration activities associated with the Project will be overseen by Nexen's multidisciplinary team based in its St. John's, NL office, with support from Nexen's offices and staff in Calgary and elsewhere as required. The number of personnel on the MODU during offshore operations will likely range from about 100 to 200 persons. Onshore personnel will support the Project as required.

2.4 Project Schedule

The planned temporal scope of this Project, which covers the period from 2018 to 2028, has been defined so as to encompass the terms of the existing ELs identified previously (within which EA and other associated regulatory approvals must be obtained and drilling planned and commenced), as well as any potential approved extensions to these ELs, and the associated stages of well drilling, testing and abandonment or suspension as required. Within this period, the planned exploration activities that comprise this Project may occur at various times of the year for each and all years of the exploration program.

Detailed planning and procurement processes for the Project are in progress in 2018, and will continue throughout the life of the Project. Pending the receipt of applicable regulatory and corporate approvals, the identification of suitable drilling targets and other technical, logistical and commercial considerations, exploration drilling could commence on one or both of the ELs as early as 2019. It is expected that each well will require approximately 45 to 160 days for drilling and evaluation (including sidetracking and potential well testing) and associated well abandonment or suspension (Figure 2.4).

Figure 2.4 Project Schedule (Illustration of Single Well in Multi-Well Program)

Event	Duration	1st year				2nd Year				3rd Year				4th Year			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Stakeholder engagement	Ongoing																
Regulatory approvals	2-3 years																
Well engineering, design and planning	1.5-2 years																
Pre drill site investigation and site preparation	5-20 days																
Drilling operations (single well including a well test)	45-160 days																
End of drilling reporting	1 year																
Evaluation of drilling results																	

The specific nature and timing of each Project phase and activity within each year of the program will continue to evolve and become further defined as planning and implementation progress. This will include the on-going analysis and interpretation of seismic data and other information, the nature and results of Project related exploration activities in previous years and their findings, and Nexen's specific exploration requirements, obligations and objectives.

2.5 Accidental Events

During an offshore exploration drilling project, an accidental event or malfunction is an unlikely, although potential, occurrence. Environmental incidents that may be associated with offshore drilling activities include potential subsurface blowouts, as well as spills of hydrocarbons or other substances from a MODU or associated supply and support vessel activities.

2.5.1 Spill Prevention

Health, Safety, Environment and Social Responsibility (HSE&SR) are core values at Nexen. The success of every activity undertaken by the company is measured on its ability to execute the work in a safe and environmentally responsible manner.

Nexen's first priority is to prevent incidents from occurring. Nexen achieves this by providing a high degree of stewardship, risk assessment and scrutiny of potential hazards through its Leadership and Safety culture, its personnel competency and training programs, the Nexen Management System, Nexen's robust Process Safety Management (PSM) system, and the Well Delivery Process (WDP).

Process Safety is a disciplined framework for managing the integrity of operating systems and processes, handling hazardous substances by applying good design principles, engineering, and operating practices. It deals with the prevention and control of incidents that have the potential to release hazardous materials or energy. The Nexen Hazard Identification and Risk Assessment (HIRA) processes form a key component of PSM and allow Nexen to identify hazards and potential incidents, develop preventative barriers and recovery measures, identify the necessary training and conduct response exercises to mitigate potential risk.

The WDP is a six stage process which covers well design, planning, and execution as well as post-well review and is a Nexen requirement to undertake the construction, modification, intervention, and/or operation of wells. The goal of the WDP is to ensure that all wells are planned, designed, and executed to meet regulatory requirements, industry and Nexen corporate standards. The WDP affects the entire well and project life cycle, from exploration through field development and ultimately to field abandonment. Each stage of the WDP has a set of defined tasks including HIRA activities, technical assurance, and specific deliverables and each stage ends with a decision gate prior to proceeding into the next stage of work activity.

In addition to Nexen-derived and implemented mitigations and precautionary approaches, an added layer of safety comes from the various post-EA regulatory review and planning processes that will apply to this exploration drilling program. The regulatory review and approval processes and other requirements that apply to oil and gas activities in the Canada-NL Offshore Area are amongst the most rigorous and stringent in the world, and operators are required to demonstrate that they have the ability

and capacity to undertake such activities in a safe and environmentally responsible manner through various project design measures, operational procedures, and response mechanisms. As part of its regulatory review and decision-making processes regarding proposed drilling programs and other activities in this jurisdiction, for example, the C-NLOPB receives and considers information from operators that detail the proposed drilling location and activities, the equipment and procedures involved, and the qualifications and training of personnel. The C-NLOPB regulatory process requires, firstly, an authorization of the overall drilling program in the form of an Operations Authorization (OA), and secondly, a well approval in the form of an Approval to Drill a Well (ADW) for each well to be drilled.

2.5.2 Spill Response

In the unlikely event of a spill incident, effective preparedness measures can ensure a timely and coordinated response limiting any adverse environmental effects or other consequences. Nexen will have the necessary Emergency Response Plans (ERPs) in place to ensure a timely and effective response to potential major incidents. Although Nexen maintains the capability to respond to an incident, the potential for additional support may be contracted with external resources or providers and integrated where relevant into the ERPs. Spill response coordination in the oil and gas industry allows the industry to access additional relevant technical assistance and response resources in the event of a major incident.

The Nexen emergency response management system is based on the Incident Command System (ICS). ICS is an international, standardized on-scene emergency management system specifically designed to allow users to adopt and integrate an organization structure equal to the complexity and demands of single or multiple incidents without being hindered by jurisdictional boundaries. Nexen has highly trained specialists and resources ready at all levels of the organization, from site and field first responders to Crisis Management teams.

For this Project, Nexen will employ a tiered system to categorize and respond to any type of incident:

- *Tier 1*: Response is within the capability of on-site resources.
- *Tier 2:* Response is within capability of regional resources.
- *Tier 3*: Response requires both national and international resources.

Determining the appropriate tiered response level and method for response to an incident will be dependent upon several factors including, but not limited to, the type of incident, location, size or volume of spill, time of year, weather, sea state, and resource availability.

Nexen is committed to responding to such an incident with a full complement of response tools and strategies. Project specific ERPs will be developed for all critical activities contemplated for this Project including plans for all vessels and MODUs in addition to the onshore Emergency Response support teams at the local, regional and corporate level. Where necessary, bridging documents that clearly outline the requirements, interfaces and responses used among various parties will be developed for the Project. Outlined below is a list of proposed plans that will be developed for Project operations:

- *Vessel ERP:* A vessel-specific ERP that deals with managing emergency events related to the supply / support vessels used for the Project.

- *MODU ERP:* A MODU-specific ERP that outlines how various emergency teams (medical, fire, etc.) respond to and interface with the MODU Emergency Operations Centre (EOC) dealing with an emergency event related to the MODU.

- *Nexen Onshore ERP (St. John's):* This Plan will detail Nexen's emergency response organization, process and tactical support activities to assist the field asset (vessel or MODU) dealing with an emergency event.

- *Well Control ERP:* A regional well control ERP to reduce the potential effects of a blowout by preparing contingency equipment, procedures, and agreements in advance of an event and to facilitate a prompt and immediate response.

- *Oil Spill Response Plan (OSRP):* This Plan will detail Nexen's response protocols and strategies for responding to an oil spill of any size.

2.5.3 Potential Accidental Event Scenarios

A Major Accident Hazard (MAH) is an unplanned event with escalation potential for multiple fatalities, substantial environmental damage, significant asset damage that may include the loss of the asset, and high negative financial and/or reputational effects. MAH events are typically high consequence – low frequency (HCLF) events, which tend to make standard risk assessment processes unsuitable due to the unlikely chance of occurrence and the potential catastrophic consequences.

Nexen utilizes a MAH governance document for drilling and completions which describes the management of MAH events that have the potential to cause multiple fatalities, serious damage including environmental damage, and/or large financial or reputational loss. The purpose of the document is to provide a proactive and consistent approach that emphasizes the identification, prevention, mitigation, control and response of MAHs. It supplements the Nexen PSM Framework. For all drilling and completions projects, a MAH Risk Register is created based on a dedicated MAH risk assessment which has the advantage of focusing on aspects of HCLF events.

MAH scenarios may include but would not necessarily be limited to the following:

- Vessel collision;
- Dropped objects (onboard the MODU or subsurface);
- Loss of MODU stability or structural integrity; and
- Loss of well control results in mudline blowout with hydrocarbon release

The EIS includes an analysis of the potential causes of the MAHs listed above along with potential safeguards and plans to mitigate the risk and control the hazard.

Some of the risks and potential accidental events described above could result in an unplanned release of hydrocarbons, chemicals, synthetic based drill cuttings or emissions, potentially resulting in adverse environmental effects. Additionally, there are some potential operational spill events that could occur

from anywhere that hydrocarbons or chemicals are stored or transferred on the MODU or support vessels.

Based on a consideration of Project activities and potential environmental risk, three accidental spill scenarios were selected for detailed spill fate and behaviour modelling. These spill scenarios are considered representative of credible worst case spill scenarios that could result from an accidental event, and include:

1) Diesel spills ;
2) Subsurface blowout; and
3) Drill fluid (SBM) spills

Spills to the marine environment can occur during the standard and routine use, storage and movement of fuels on MODUs and supply vessels. These often comprise instantaneous or short-duration discharges into the marine environment during planned drilling activities. A large diesel spill could also occur as a result of a vessel collision and complete loss of cargo or fuel from a supply vessel.

A blowout is an unplanned and uncontrolled release of petroleum from a well after a failure in the drilling system and its associated pressure control barriers, resulting in the continuous discharge of hydrocarbons into the surrounding waters. Blowout events could potentially occur at various stages of drilling, the nature, duration, behaviour and outcomes of which depend on various factors, such as water depth, the amount and properties of the hydrocarbons involved, currents and other oceanographic features, and other factors..

Another potential spill scenario involves a spill of synthetic-based drilling muds (SBM) during drilling operations in the Project Area. These spills may occur as a result of an accidental deck release, a subsurface release through a crack or orifice in a flex joint, riser or lines, or a bottom release due to an emergency riser disconnect event (due to hazardous weather or other cause).

2.5.4 Spill Probabilities

The probability and frequency of potential blowout and batch spills that may result from the various activities that comprise this Project were calculated based on a review of national and international records of historical offshore spill events. This analysis found that the highest potential frequencies are for the smaller, operational spills. Spills less than one barrel in size (less than 159 litres) may occur one to two times per well, based on recent petroleum development experience off Newfoundland and Labrador. Although these smaller spills may occur more often, the median volume is four litres. Historical spill records for very small spills do not differentiate between production and exploration activities, and so the probability of very small spills during exploration activities may be overestimated. Batch oil spills during exploration drilling that are larger than one barrel but less than 50 barrels have about a 1-in-70 (1.43 percent) chance of occurring per well. Oil spills in the 50 to 999 barrel range may have about a 1-in-300 (0.33 percent) chance of occurring per well, based on experience in the U.S. Outer Continental Shelf. There is about a 1-in-3,200 (0.03 percent) chance per well of having any sort of blowout. (i.e., liquid or y gas) during normal drilling, after the blowout preventer is installed.

The chances of an extremely large (greater than 150,000 barrel), very large (greater than 10,000 barrel), and large (greater than 1,000 barrel) oil well blowout during exploration drilling are very small: about a 1-in-25,000 (0.004 percent), 1-in-13,000 (0.008 percent) and 1-in-10,000 (0.01 percent) chance per well, respectively. It should also be noted that due to the infrequency of these occurrences, these predictions are based on worldwide data, and are strongly influenced by blowouts that occurred in parts of the world where drilling regulations may be less rigorous than those in the Canada-NL Offshore Area, and in most cases occurred prior to modern safety improvements.

2.5.5 Fate and Behaviour of Potential Spills

In order to assess the fate and behavior of potential Project-related spill scenarios, trajectory and fate modelling was conducted related to potential (hypothetical example) exploration wells for the Project. To be conservative, the oil spill modelling did not include consideration of mitigations such as prevention and response procedures.

Two hypothetical release locations of different water depths were used for modelling subsurface blowouts, including one site in each of ELs 1144 and 1150. EL 1144 was a deeper Jurassic example well and the EL 1150 was a shallower Cretaceous example well. Subsurface blowouts near the seafloor were modelled separately with *OILMAPDeep* and *SIMAP* at each location in a stochastic analysis that included 119 individual model runs per location. This analysis investigated the influence of environmental variability, throughout the year over multiple years, on trajectory and fate. Results from the stochastic analyses were broken into two seasons depending on the majority of modelled days during ice free conditions (summer) from May – October or periods with ice-cover (winter) from November – April. Analysis of representative deterministic scenarios were conducted for individual trajectories that were identified as the 95th percentile for surface oil exposure, contact with shoreline, and water column contamination from blowouts near the seafloor modelled in the stochastic analysis, as well as for instantaneous surface “batch spills” of marine diesel. Two hypothetical release locations were used for the modelling of the batch spills and vessel collision; the surface spills were modelled at site EL 1144 and the “vessel collision location” spill represents the midpoint between St. John’s, NL and the Project Area.

For each of the modelled releases, oil on the surface was most likely to move to the east due to the prevailing westerly winds and surface currents within the region. Winds and currents in and around the Project Area are similar throughout the year, with most notable differences in wind intensity. The increased winds during wintertime conditions have the potential to enhance surface breaking waves and results in more complete entrainment of oil, which lowered the amount of oil that would remain on the surface for extended periods of time. In general, after 60 days, the majority of the oil was predicted to evaporate, entrain, and degrade, with very little oil remaining on the surface after 30 or 60 days, negligible sediment oiling, and extremely limited or non-existent shoreline oiling. Shoreline contact with oil was not predicted to be likely from any of the modelled releases. Of the 59 individual oil spill trajectory simulations for wintertime releases at the EL 1144 example well site, only three percent had shoreline oiling and only at Sable Island. There was no shoreline oiling predicted from summer scenarios for the EL 1144 example well site.

2.6 Alternative Means of Carrying Out the Project

As an important and valuable planning tool, EA is intended to help inform and influence project design, and in doing so, to help proactively address the potential environmental outcomes of proposed development activities. The EA process therefore allows for the identification, analysis and evaluation of potential alternative project concepts and approaches, in order to incorporate environmental considerations into project planning at an early stage. As part of Project planning and design, and as specified in the EIS Guidelines, alternatives were identified and evaluated for the following aspects of the Project:

1) Drilling Fluids Selection;
2) MODU Selection;
3) Drilling Waste Management;
4) Waste Management and Location of Final Effluent Discharge Points;
5) Offshore Lighting;
6) Well Testing – Nighttime Flaring; and
7) Chemical Selection

These evaluations were completed early in the Project planning stages (and in the EIS) to allow for a focused and thorough assessment of a feasible Project, the results and outcomes of which are summarized in Tables 2.3 to 2.7 below.

Table 2.3 Identification and Evaluation of Drilling Fluid Options

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
WBM	YES Standard / routine and approved activity. Use in accordance with regulatory requirements	YES Use of WBM for initial hole sections when drilling without riser installed BUT Technically inferior in deeper sections of well (particularly associated with borehole instability)	YES Use of WBM for initial hole sections when drilling without riser installed BUT With high probability of increased non-productive time (NPT) and cost associated with borehole stability problems for deeper well sections	Standard / routine and approved activity. Use in accordance with regulatory requirements	**YES** Use of WBM for initial hole sections when drilling without riser installed

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
SBM	YES Standard / routine and approved activity. Use in accordance with regulatory requirements	YES Technically feasible and superior for deeper sections of well	YES Use of SBM for deeper hole sections when riser installed	Standard / routine and approved activity. Use in accordance with regulatory requirements	**YES** SBM likely to be used at deeper well sections, when riser installed. Fluids use and cuttings treatment and disposal in accordance with applicable regulatory requirements

Table 2.4 Identification and Evaluation of MODU Options

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
Semi-Submersible	YES	YES	YES	Both semi-submersible and drillship options can be used in environmentally acceptable manner, provided that appropriate approvals and mitigations are implemented	**YES** Both semi-submersibles and drillships may be used for the Project and are therefore assessed in the EIS
Drill Ship	YES	YES	YES		
Jack-Up	YES	NO	Not considered viable given Project requirements and environmental conditions		

Table 2.5 Identification and Evaluation of Drilling Waste Disposal Options

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
Discharge to Water Colum (Following treatment, as applicable)	YES	YES	YES	Non-toxic, but with some localized seabed effects	**YES**
Offshore Reinjection	YES	NO	Not considered a feasible alternative (See above)		**NO**
Ship to Shore	YES	YES	YES Potentially, but costs from increased transportation and operational delays	Air emissions and environmental exposure (vessels and trucking)	**NO**

Table 2.6 Identification and Evaluation of Lighting Options

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
No Lighting or Limited Lighting	NO	Not considered a feasible alternative			
Standard Lighting	YES	YES	YES	Potential localized effects on marine-associated birds	**YES**
Spectral modified lighting	YES	NO	NO Restricted by commercial availability and cost	Potential for reduced interactions with marine avifauna	**NO**

Table 2.7 Identification and Evaluation of Flaring at Night Options

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
No Flaring	NO Well testing is required to obtain an SDL	NO	NO	Not considered a feasible alternative	
Reduced Flaring (no	YES	NO Testing can	YES	Potential for reduced interactions with	**NO**

Alternative	Potential Regulatory Acceptability	Technical Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option and Rationale
flaring at night or during low-visibility weather)		last several days so night time flaring cannot be avoided	If flaring is shut down at the night, well test will need to be extended meaning higher cost and higher overall risk exposure	marine avifauna, but with increased emissions and overall duration of flaring Increased risks of spills associated with starting and stopping flaring activities	
Flaring as Required	YES	YES	YES	Potential localized effects on marine-associated birds	**YES**

As the specific drill fluids and other materials (including chemicals) that are to be used for the Project, have yet to be identified and selected, Nexen is unable to evaluate and select alternative chemicals as part of its Project planning and design processes. As part of Project planning and eventual operations, Nexen and its contractors will undertake the selection and screening of chemicals pursuant to the detailed guidance and effective procedures outlined in the *Offshore Chemical Screening Guidelines*. Nexen will develop a Chemical Screening and Management Plan that will meet or exceed all regulatory requirements.

3 GOVERNMENTAL, INDIGENOUS AND STAKEHOLDER ENGAGEMENT

Engagement is considered to be the cornerstone of the EA process, and is a key component of Nexen's approach to the planning and implementation of its oil and gas exploration programs and other business activities. A number of associated initiatives have been undertaken, are in progress, or are being planned in relation to the Project, including discussions with relevant government departments and agencies, Indigenous groups and stakeholder organizations.

Nexen's engagement activities for this Project and its EA have been designed and implemented using various mechanisms to share and receive information and perspectives about the Project. This approach has provided interested and potentially affected groups and individuals with information on the Project, and has allowed them to formulate informed questions and concerns and to provide feedback. A key objective of Nexen's EA engagement program to date has been to provide detailed Project information, and to gather comments, questions, concerns and issues related to the Project and its potential environmental effects that require consideration in the EIS. This feedback also provides valuable input to support on-going and future Project planning.

3.1 Government Departments and Agencies

Nexen recognizes that a number of federal and provincial government departments and agencies have specific responsibilities or interests related to the Project and its potential environmental effects. In planning and developing the EIS, Nexen has engaged with key regulatory agencies to share information on the Project, identify and obtain useful and relevant environmental baseline information for the EIS, and identify any other issues which required consideration in the assessment, as listed below:

- Canadian Environmental Assessment Agency;
- C-NLOPB;
- Department of National Defence (Maritimes);
- Environment and Climate Change Canada (ECCC);
- Fisheries and Oceans Canada (DFO);
- Health Canada;
- Major Projects Management Office (MPMO);
- Natural Resources Canada;
- NL Department of Fisheries, Forestry and Agrifoods;
- NL Department of Municipal Affairs and Environment;
- NL Department of Natural Resources;
- St. John's Port Authority; and
- Transport Canada

Nexen's engagement initiatives with government departments and agencies have included discussions and information sharing through various other means (e.g., through meetings, letters, email, telephone conversations), the results of which have also been considered in the scope and content of the EIS as applicable.

3.2 Indigenous Groups

Nexen is committed to ensuring that Indigenous groups are appropriately informed and engaged regarding the company's on-going and planned activities. Nexen's engagement initiatives are designed to allow for meaningful engagement with Indigenous communities and organizations using multiple forms of engagement including letters, meetings, phone conversations, email dialogue, and other means, as per the preferences of each particular group. The objective is to establish and maintain constructive relationships with Indigenous groups potentially affected by the Project through on-going communications, and the sharing of information in an open, cooperative, and respectful manner.

In March 2017, Nexen wrote to each of the following Newfoundland and Labrador Indigenous groups:

1) Labrador Inuit (Nunatsiavut Government);
2) Labrador Innu (Innu Nation);
3) NunatuKavut Community Council;
4) Miawpukek First Nation; and
5) Qalipu Mi'kmaq First Nation Band.

The correspondence provided an initial notification of and overview of the Project, and an opportunity for these groups to identify any questions or comments regarding the Project and its potential environmental effects for consideration in the EIS, as well as inviting further information sharing and engagement as the EA progresses. In addition, Nexen has individually followed up with each group to confirm receipt of correspondence, and to identify a specific contact for future engagement.

In July 2017, similar correspondence and Project overview information was also sent to each of the following Indigenous groups in the Maritime Provinces and Quebec, which were included in the EIS Guidelines issued for the Project.

Nova Scotia

- 11 Mi'kmaq First Nation groups represented by Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO):
  - Acadia First Nation
  - Annapolis Valley First Nation
  - Bear River First Nation
  - Eskasoni First Nation
  - Glooscap First Nation
  - Membertou First Nation
  - Paqtnkek Mi'kmaw Nation
  - Pictou Landing First Nation
  - Potlotek First Nation
  - Wagmatcook First Nation
  - Waycobah First Nation
- Millbrook First Nation
- Sipekne'katik First Nation

New Brunswick

- Eight Mi'gmaq First Nations groups represented by Mi'gmawe'l Tplu'taqnn Inc. (MTI)
  - Fort Folly First Nation
  - Eel Ground First Nation
  - Pabineau First Nation
  - Esgenoôpetitj First Nation
  - Buctouche First Nation
  - Indian Island First Nation
  - Eel River Bar First Nation
  - Metepnagiag Mi'kmaq First Nation
- Elsipogtog First Nation
- Five Maliseet First Nation groups represented by Wolastoqey Nation of New Brunswick (WNNB):
  - Kingsclear First Nation
  - Madawaska Maliseet First Nation
  - Oromocto First Nation
  - Saint Mary's First Nation
  - Tobique First Nation
- Woodstock First Nation
- Peskotomuhkati Nation at Skutik (Passamaquoddy)

Prince Edward Island

- Abegweit First Nation
- Lennox Island First Nation

Quebec

- Three Mi'gmaq First Nation groups represented by Mi'gmawei Mawiomi Secretariat (MMS)
  - Micmas of Gesgapegiag
  - La Nation Micmac de Gespeg
  - Listuguj Mi'gmaq Government
- Les Innus de Ekuanitshit
- Montagnais de Nutashkuan

These initial letters were followed by a number of subsequent engagement initiatives throughout the preparation of the EIS. This included a second letter In November 2017 to follow-up on the introductory correspondence, and to request information related to any relevant traditional land and resource use activities and traditional knowledge. Follow-up emails and phone calls were made to all 41 Indigenous groups in Eastern Canada to confirm receipt of previous correspondence and their level of interest in the Project, as well as to identify any preliminary concerns and interest in meeting with Nexen. The engagement activities to date have allowed interested groups to understand the Project and evaluate its potential effects on their communities, activities, and potential or established section 35 rights, including title and related interests.

Nexen will continue to communicate with Indigenous groups about the Project, through established and/or informal engagement processes, as required and requested. These will be undertaken to provide Project information and updates on on-going and planned activities, as requested, as well as to facilitate

discussion of any issues and potential means of addressing them during the various phases of this Project and any Project-related monitoring or follow-up, as required. The specific nature, frequency and format of any such future engagement will be determined in discussion with the Indigenous groups themselves.

3.3 Stakeholder Organizations

As part of EIS planning and development, Nexen has also designed and implemented a stakeholder engagement program which provides various mechanisms and opportunities for individuals and organizations to receive and review information as well as to provide information and feedback related to the Project and its potential effects. This has included meetings with individual community and stakeholder groups, as well as additional discussions and on-going information sharing through various other means (such as through letters, email, telephone conversations), the results of which have also been considered in the scope and content of the EIS as applicable.

Nexen has met or communicated directly with a number of groups to share information on the Project and to identify questions or concerns that may require consideration in the EA process, as listed below. Groups initially identified and contacted by Nexen were those that are known to have an interest in offshore oil and gas activities off Eastern Newfoundland and who have participated in similar, recent EA reviews for such projects in the region, with additional groups also being identified as the stakeholder engagement program progressed.

- Association of Seafood Producers
- Atlantic Shark Association
- Canadian Association of Prawn Producers
- Canadian Parks and Wilderness Society (CPAWS)
- Clearwater Seafoods
- Davis Strait Fisheries
- ExxonMobil Canada Ltd.
- Fish, Food and Allied Workers Union (FFAW-Unifor)
- Groundfish Enterprise Allocation Council
- Harbour Grace Shrimp Company
- Husky Energy
- Icewater Seafoods
- MV Osprey Ltd.
- Nalcor Energy
- Nataaqnaq Fisheries Inc
- Nature NL
- Netukulimk Fisheries Limited
- Newfound Resources Ltd.
- Newfoundland and Labrador Oil and Gas Industries Association (NOIA)
- NL Aquaculture Industry Association
- NL Wildlife Federation
- Northern Peninsula (Mekap'sk) Mi'kmaq Band
- Nova Scotia Swordfish Association

- Ocean Choice International (OCI)
- One Ocean
- Protected Areas Association of NL
- Sambro Fisheries
- Seafreez Foods Inc. (Barry Group Inc.)
- Statoil Canada Ltd.
- Suncor Energy Inc.
- World Wildlife Fund (WWF) Canada

3.4 Identified Questions and Issues

A key purpose of the engagement program outlined above was to identify questions, concerns and issues related to the Project and its environmental effects that require consideration in the EIS and in on-going and future Project planning. Specific to Indigenous groups, in addition to potential environmental effects, an important purpose of the engagement program was to understand any potential impacts to Aboriginal and Treaty rights.

A summary of Project-related questions and issues raised through the above described engagement activities is provided below (Table 3.1). Further details on the questions and issues raised and where they are addressed in the EIS, can be found in Chapter 3 of the EIS itself.

Table 3.1 Key Questions and Issues raised through Nexen's EIS Engagement Program

Questions and Issues Raised
Project and Proponent Information
• Drilling methods and equipment
• Light, noise, and vibration reduction measures for drilling activities
• Location of and schedule for planned Project components and activities
• Nexen corporate overview
• Oil spill notification and communication protocols
• Planned Project components and activities, including schedule
• Project socioeconomic benefits
• Project-related supply and transportation activities
• Socioeconomic benefits of offshore oil and gas exploration activities
• Spill-prevention equipment and measures
• Training and capacity building
EA Process and Engagement
• EA and other regulatory processes and requirements
• EA initiation, planned EIS structure and content
• EA review processes and associated engagement procedures and capacity / funding issues
• Indigenous groups / interests and engagement protocols
• Stakeholder consultation
Existing Environment and Potential Effects / Mitigation
• Atlantic salmon migrations (outgoing smolts and spawning adults) and potential effects
• Commercial swordfish fisheries and possible effects on these
• Corals and sponges and associated mitigations
• Cumulative effects of drilling with other activities and their effects (fishing, forestry, aquaculture)

Questions and Issues Raised
• Drilling wastes and their potential environmental effects
• Environmental baseline data (especially, benthos)
• Environmental monitoring and follow-up programs
• Existence and use of Indigenous knowledge
• Fisheries baseline data to be used in the EIS
• Fisheries related mitigation requirements, especially FLOs and on-going communications
• FSC and commercial fisheries and possible effects on these
• Indigenous commercial fishing licences in the area, including fishing resources in the Project Area that support traditional activities, jobs, well-being and culture
• Interests in, and potential effects on, Atlantic salmon
• Key commercial fisheries in and near the Project Area, and potential interference with these
• Marine mammals and possible effects on these species
• Need for additional salmon data and research
• Need to consider cultural value, including potential effects on cultural practices
• Offshore lighting and its effects on marine avifauna
• Possible effects of operations and spills, leaks, releases of oil on fishing resources
• Possible environmental effects of drilling and VSP (seismic) activities
• Potential effects on American eel
• Potential oil spills and their effects, including on any “in river” fisheries
• Presence of and possible effects on cold water corals

4 ENVIRONMENTAL ASSESSMENT SCOPE, APPROACH AND METHODS

The Project requires review and approval pursuant to the requirements of CEAA 2012. The EIS provides the required information on the Project and its potential environmental effects and associated mitigation, including the:

- Project purpose;
- Project description (components, activities, schedule);
- Project alternatives;
- Changes to the Project that may be caused by the environment;
- Existing environmental setting (biophysical and socioeconomic);
- Government, stakeholder, and Indigenous engagement activities, including the various comments provided;
- Environmental effects of the Project (planned activities and potential accidental events);
- Mitigation measures to avoid or reduce environmental effects of the Project;
- Predicted residual effects and their significance;
- Predicted cumulative environmental effects; and
- Any proposed environmental monitoring and follow-up activities

4.1 Scope of the Project and its Environmental Assessment

The scope of the Project for the purposes of the EA includes each of the components and activities defined in Part 1, Section 3.1 of the EIS Guidelines, namely:

- *The mobilization, operation and demobilization of Mobile Offshore Drilling Unit(s) designed for year-round operations for the drilling, testing and abandonment of up to ten wells (exploration or delineation) within exploration licences operated by Nexen Energy ULC (1144 and 1150), including consideration of any proposed safety exclusion zones. Drilling may occur in various water depths under consideration, with various types of drilling units, and with multiple drilling units operating simultaneously;*

- *Vertical seismic profiling surveys and in-water works (e.g. well evaluation and testing) to support the specific exploration wells under consideration, but excluding surveys potentially required to support conduct of the EA (e.g. environmental baseline surveys) and surveys related to the broader delineation of resources (e.g. use of 2D high-resolution reflection seismic, sub-bottom profilers, side-scan sonar, multi-beam echosounder, magnetometers); and*

- *The loading, refuelling and operation of marine support vessels (i.e. for re-supply and transfer of materials, fuel, and equipment; on-site safety during drilling activities; and transport between the supply base and Mobile Offshore Drilling Unit(s)) and helicopter support (i.e. for crew transport and delivery of light supplies and equipment) including transportation to the Mobile Offshore Drilling Unit(s).*

As defined in Section 19(1) of CEAA 2012 and specified in Section 3.2 of the EIS Guidelines, the following factors are considered and addressed in the EIS:

- Environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other physical activities that have been or will be carried out;
- The significance of the effects referred to above;
- Comments from the public;
- Mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- The requirements of the follow-up program in respect of the project;
- The purpose of the project;
- Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
- Any change to the project that may be caused by the environment; and
- The results of any relevant regional study pursuant to CEAA 2012.

These items have been considered and addressed in establishing the scope, focus, and spatial and temporal boundaries of the analysis and the overall content of the EIS, including the description of the Project, the planning and implementation of EA-related engagement activities by Nexen, the description of the existing environments and in the environmental effects assessments. The EIS has been completed in compliance with the Project-specific EIS Guidelines issued to Nexen by the Agency, which outline the factors to be considered in the assessment and the scope of those factors, as well as specifying particular requirements for environmental information and analysis that must be included in the EIS. A detailed Table of Concordance that outlines these requirements and indicates where and how each of them have been addressed is provided at the beginning of the EIS itself.

4.2 Identification and Selection of Valued Components

In keeping with most recent EAs for other oil and gas related exploration projects offshore Newfoundland and Labrador, the following Valued Components (VCs) are considered in this assessment:

a) Marine Fish and Fish Habitat (including Species at Risk);
b) Marine and Migratory Birds (including Species at Risk);
c) Marine Mammals and Sea Turtles (including Species at Risk);
d) Special Areas;
e) Indigenous Peoples;
f) Fisheries and Other Ocean Uses; and
g) Atmospheric Environment

The rationale for the selection of these VCs is further described in Table 4.1 below.

Table 4.1 Identified VCs and the Rationale for their Selection

Valued Component	Overview and Rationale
Marine Fish and Fish Habitat (including Species at Risk)	• Fish and their habitats are an important consideration in the EA of any proposed activities that occur within, and that may affect, the marine environment. • Consideration of fish and fish habitat is also required under Section 5 (1)(a) i) of CEAA 2012 • This VC includes relevant fish species (finfish and invertebrates), as well as marine plants, plankton, algae, 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 VC is in keeping with current and standard practice, and provides for a more comprehensive, holistic assessment approach while at the same time reducing unnecessary repetition. • Offshore oil and gas exploration drilling and associated activities may affect fish and fish habitat through their associated environmental disturbances (noise, lights, others) and resulting behavioral effects, as well as through possible environmental emissions leading to changes in water quality and the contamination, smothering or other alteration of marine habitats and benthic organisms due to physical disturbance of the substrate, the discharge and deposition of drill cuttings and/or fluids, or other solid and liquid wastes. • The VC (description of the existing environment and effects assessment) also gives specific consideration to any particular species that have been identified by regulatory agencies, stakeholder groups and Indigenous communities.
Marine and Migratory Birds (including Species at Risk)	• 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, and may be relatively vulnerable to certain types of environmental disturbance. • They are also an important resource for recreational and tourism related pursuits. • Consideration of migratory birds is also required under Section 5 (1)(a) iii) of CEAA 2012. • Marine-associated birds may be affected by offshore exploration activities as a result of attraction and disturbance/disorientation due to lighting or other disturbances (leading to potential injury or mortality), as well as through possible health effects due to contamination of individuals and/or their habitats from emissions to the marine environment. • The VC (description of the existing environment and effects assessment) also gives specific consideration to any particular species that have been identified by regulatory agencies, stakeholder groups and Indigenous communities.
Marine Mammals and Sea Turtles (including Species at Risk)	• Whales, dolphins and seals have been and remain an important element of the environmental and socio-cultural settings of the province and elsewhere in Eastern Canada. • Consideration of these species is also required under Section 5 (1)(a) ii) of CEAA 2012.

Valued Component	Overview and Rationale
	• These species are important from an ecological perspective, with a number of species having been designated as species at risk under Canadian legislation or other processes. • Some marine mammal species are also important and valued due to current consumptive (seal harvests) and non-consumptive (whale watching) uses, which are important commercial, traditional and/or recreational activities in some areas. • Although sea turtles are generally uncommon off Eastern Newfoundland, they are also typically included as part of this VC given their rare and often protected status. • Offshore exploration drilling and associated activities may affect these marine biota through underwater noise and other disturbances leading to associated behavioral effects, as well as environmental emissions leading to possible health effects through contamination of individuals, habitats and prey species. • The VC (description of the existing environment and effects assessment) also gives specific consideration to any particular species that have been identified by regulatory agencies, stakeholder groups and Indigenous communities.
Special 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. • Some of these areas are protected under provincial and/or federal legislation and others are protected under international agreements and processes. • 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. • Environmental interactions between petroleum activities and special areas may be both direct and indirect in nature and cause, and may result from conducting an activity directly within or near such an area, and/or by adversely affecting the larger environmental components and systems that are relevant to their identification and their key and relevant characteristics and importance.
Indigenous Peoples	• A number of Indigenous groups reside in Newfoundland and Labrador and in parts of the Maritimes Provinces (Nova Scotia, New Brunswick, PEI) and Quebec. • The proposed components and activities that comprise this offshore Project will be located at considerable distance from the communities, activities and other known interests associated with Indigenous groups. • It may, however, potentially affect marine-associated species and other resources that are used by these groups, and which move through, and thus may interact with, the Project's anticipated environmental zone of influence • This VC has been included in the EIS in order to assess the potential for the Project to interact with and affect Indigenous Peoples, as required under Section 5(1)c of CEAA 2012 and as specified in the EIS Guidelines.

Valued Component	Overview and Rationale
Fisheries and Other Ocean Uses	• Marine fisheries are key elements that have shaped the history and socioeconomic character of Newfoundland and Labrador and are important aspects of the current economic and socio-cultural fabrics of the province and other parts of Canada. • As noted in the existing data and through Nexen's engagement with fishing industry representative, commercial fisheries in this region are extensive and diverse, and involve a range of species and gear types at various times of the year. Fishing activities are undertaken in and around the Project Area by fishing interests from Newfoundland and Labrador (including several Indigenous organizations), Canadian and international fishing enterprises • Other activities take place in parts of the Project Area and adjacent areas on either a year-round or seasonal basis, including other oil and gas related activities, general vessel traffic, research, and military exercises. • 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). • Potential effects on commercial fisheries and associated mitigation were raised during Nexen's engagement processes with multiple groups.
Atmospheric Environment	• Atmospheric emissions during Project activities will include exhaust from the drill unit(s), support vessels and associated equipment (such as on-board power generators), as well as emissions from the storage and flaring of hydrocarbons associated with well testing (if and as required). • Noise emissions into the atmospheric environment associated with an offshore drilling program include those associated with drilling and other activities on the drilling unit itself, as well as from supporting vessel and aircraft traffic. • Light emissions from the drilling platform include platform lighting as well as those which may be associated with any flaring that is required during well testing operations and that generated by the support vessels.

4.3 EA Approach and Methods

As a first step in assessing the potential effects of the Project on each of the selected VCs, spatial and temporal boundaries were established, within which potential Project-related environmental effects on the VC were assessed and evaluated (Table 4.2, Figure 4.1).

Table 4.2 Environmental Assessment Study Areas

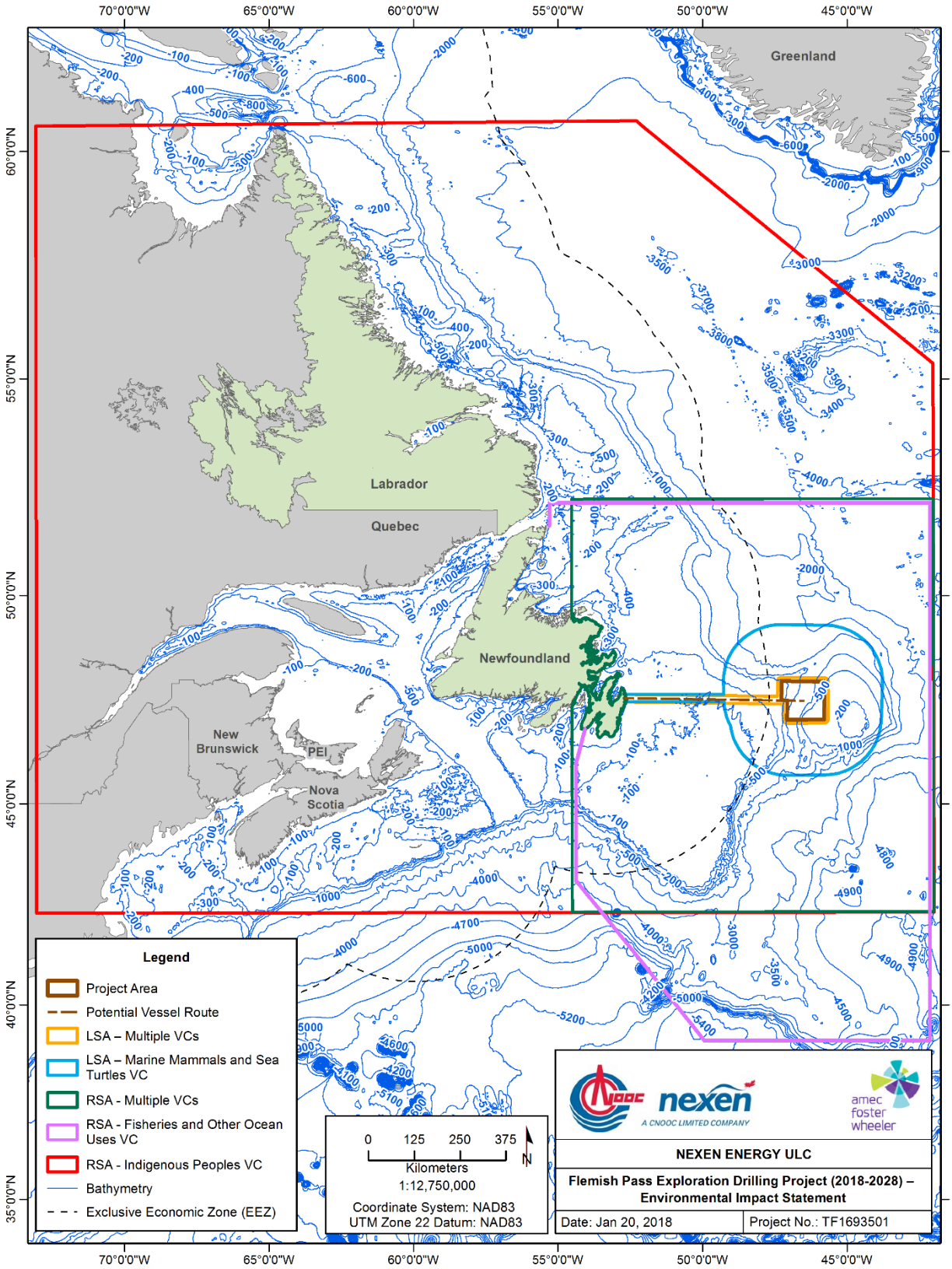
Spatial Study Areas	Description
Project Area	• This is the overall geographic area within which all planned Project-related exploration activities will take place, as described in the Project Description (Chapter 2) and based on those aspects that are considered to be within the defined scope of the Project for EA purposes. • The Project Area is defined as a single polygon that encompasses the two ELs in the Flemish Pass region where Nexen may conduct exploration drilling activities, as well as including a surrounding (20 km buffer) area to account for

Spatial Study Areas	Description
	planned and potential ancillary and support activities at and around the wellsites themselves. • The EIS also considers related supply vessel and aircraft traffic to and from this offshore Project Area. • It should be noted that while this overall Project Area covers an area of over 10,000 km^2 the various components and activities associated with the drilling of each individual well and other planned components will occupy small, defined areas within this overall area, as illustrated in the VC specific environmental effects assessments. All drilling operations carried out as part of the scope of this Project will be conducted within the defined boundaries of the ELs themselves.
Local Study Area (LSA)	• These boundaries are defined on a VC-specific basis, and encompass the overall geographic area over which all planned and routine Project-related environmental interactions (including emissions and other disturbances) may occur. • The LSA therefore represents the predicted environmental zone of influence of the Project's planned components and activities, within which Project-related environmental changes to the VC in question may occur and can be assessed and evaluated. • For each VC, the LSA will depend on the geographic extent of an environmental disturbance or change and may vary based on its specific nature, timing, or location. • Therefore, while the LSA for each VC has been defined to conservatively account for the overall zone of influence of potential Project activities at location within the Project Area, in some cases these environmental changes may occur only within a portion of the LSA itself. • To further address this, all predicted environmental effects are described in the effects assessment according to a number of criteria, which includes defining the anticipated "geographic extent" of any such effect.
Regional Study Area (RSA)	• In addition to planned Project environment interactions, from an ecological and socioeconomic perspective the environmental effects assessments also recognize and consider the characteristics, distributions, and movements of the individual VCs under consideration, including the larger regional areas within which they occur and function. • The EA assesses potential effects to marine biota (individuals and populations) and human activities which are known or likely to occur in the LSA for the VC in question, but also considers the overall extent of affected individuals and populations during the time period at which they may be affected by planned Project components and activities. • In addition to the potential environmental effects of planned Project components and activities and their emissions (see LSA definition above), the EIS also considers and assesses the potential effects of accidental events or malfunctions that may be associated with the Project, including the potential nature and geographic extent of an oil spill. • Figure 4.1 illustrates the overall RSA that has been defined and used for most VCs in the EIS, which has been defined with consideration of a number of factors, as referenced above. • These include, for example, the possible movement patterns of the marine fish, birds, mammals, and sea turtles that occur in the respective LSAs for

Spatial Study Areas	Description
	each VC over the time periods and durations for which they may be affected by planned Project activities (which may, in some cases extend up to several hundred kilometres), as well as a larger distribution and geographic extent of fishing and other human activities surrounding the Project Area/LSA for regional context purposes. • The RSA also encompasses the predicted zone of influence of a potential oil spill event, and specifically, the ecological and socioeconomic thresholds for the 95th percentile case for both surface (oil thickness) and water column exposure. The 95th percentile case is selected from 119 model runs that capture the seasonal and annual variability in currents, winds, and ice cover. • In doing so, the RSA extends west to the shoreline of Eastern Newfoundland and to the east to the general area for which available and validated environmental (including metocean and bathymetric) data are available, as well as reaching the eastern boundary of the various Northwest Atlantic Fisheries Organization (NAFO) Divisions in this area. • It should be noted that this RSA has been defined and used as a general guide and area of focus for the environmental assessment, and represents the amalgamated consideration of each of the (quite diverse) VCs under consideration and the various factors noted above. The environmental effects assessment considers specific areas within this larger RSA as relevant and appropriate to the specific environmental component or interaction in question. • In addition, it likewise considers and describes environmental components and potential effects that may extend outside this area where relevant, based on the nature and coverage of the environmental baseline datasets and mapping used. • The Indigenous Peoples VC considers the location and overall geographic extent of the various Indigenous communities and activities that comprise the VC, as well as the distribution and movements of the various marine-associated resources that are used for traditional purposes by these communities. For this VC, therefore, the RSA includes an overall region of Eastern Canada that generally encompasses each of the Indigenous communities and their activities throughout Newfoundland and Labrador, the Maritime Provinces and Quebec. • The RSA for the Fisheries and Other Ocean Uses VC generally captures the marine waters offshore Eastern Newfoundland, namely NAFO Divisions 3K, 3L, 3M, 3N and 3O.

The temporal boundaries for the EIS encompass the potential timing and duration of Project-related activities and any resulting environmental changes and effects. The planned temporal scope of the Project covers a period from 2018 to 2028 with the planned exploration activities that comprise this Project possibly occurring at various times of (and throughout) the year for the duration of the proposed exploration program. In conducting the environmental effects assessment, consideration is also given to the relevant temporal characteristics of the VCs, including the timing of their presence within the Project Area and LSA/RSA, any particularly sensitive or critical periods, potential environmental interactions (both Project-specific and cumulative), likely response to and recovery times for potential effects, and any known natural (without-Project) variation in that environmental component over time.

Figure 4.1 Environmental Assessment Study Areas



It is within these spatial and temporal boundaries that the potential environmental effects on the VC resulting from Project components and activities and their significance are assessed and evaluated, based on VC specific significance criteria.

In order to identify and focus on key environmental issues, and to help ensure that these are fully considered and addressed in the EIS, the assessment of potential effects on each VC considers the various questions and issues that have been identified in the EIS Guidelines, as well as those identified through Nexen's engagement with relevant government departments and agencies, Indigenous groups and stakeholder organizations (Chapter 3). Based on the issues scoping exercise, the environmental effects assessment focuses on likely environmental interactions between the Project and the VC, and particularly, the associated environmental changes and resulting effects that may potentially occur as result.

An overview of the potential for each of the Project's planned components and activities to result in one or more of the above noted potential environmental effects on each VC is presented in Table 4.3.

Table 4.3 Potential Project-VC Interactions and Associated Effects

Potential Environmental Effects	Presence and Operation of MODUs	Drilling and Associated Marine Discharges	VSP	Well Testing	Well Abandonment or Suspension	Supply and Servicing
Marine Fish and Fish Habitat						
Change in habitat availability and quality	●	●				
Change in food availability and quality	●	●				
Change in fish mortality, injury, health	●	●	●	●		●
Change in fish presence and abundance (behavioral effects)	●	●	●		●	●
Marine and Migratory Birds						
Change in mortality / injury levels and bird health	●	●	●	●		●
Change in avifauna presence and abundance (behavioral effects)	●		●	●		●
Change in habitat availability and quality	●					
Change in food availability and quality	●	●	●			
Marine Mammals and Sea Turtles						
Change in mortality / injury levels and health (individuals or	●	●	●	●		●

Potential Environmental Effects	Presence and Operation of MODUs	Drilling and Associated Marine Discharges	VSP	Well Testing	Well Abandonment or Suspension	Supply and Servicing
populations)						
Change in habitat availability, quality and use (behavioral effects)	●	●	●	●	●	●
Change in food availability or quality	●	●	●	●	●	●
Special Areas						
Change in environmental features and/or processes	●	●	●	●	●	●
Change in human use and/or societal value	●	●	●			●
Indigenous Peoples						
Change in health and socio-economic conditions	●	●		●		●
Change in the current use of lands and resources for traditional purposes	●	●	●	●	●	●
Change in physical and cultural heritage and change in any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance	●	●				●
Fisheries and Other Ocean Uses						
Direct interference with fishing or exclusion from established fishing grounds	●		●		●	●
Damage to fishing gear or vessels	●	●	●		●	●
Decreases in the abundance, distribution and actual or perceived quality of fisheries resources	●	●	●	●		●
Direct contact with and damage to in situ component	●	●				
Interference with other marine activities	●		●		●	●

Potential Environmental Effects	Presence and Operation of MODUs	Drilling and Associated Marine Discharges	VSP	Well Testing	Well Abandonment or Suspension	Supply and Servicing
Atmospheric Environment						
Change in air quality	●		●	●	●	●
Change in GHG levels	●		●	●	●	●

To help avoid or reduce the potential adverse effects of the Project, general and issue-specific mitigation measures are identified and proposed in the EIS, based upon current industry practice and standards, applicable regulatory requirements, those suggested through Nexen's engagement with regulatory authorities, stakeholders and Indigenous groups (Chapter 3), and as defined through the professional judgment of the EIS team. A summary of the various mitigation measures and commitments set out in the EIS is provided in Chapter 6.

The application of these mitigation measures is considered in a fully integrated manner in the environmental effects assessment. This includes technically and economically feasible measures that have been "built-in" to the Project through its planning and design so as to proactively avoid or reduce potential adverse environmental effects, those required by applicable regulations and guidelines, as well as any other mitigation measures identified by Nexen as part of the effects analysis that is reported in this EIS.

The effects assessment for each VC has been structured to consider and address each planned Project component or activity (Table 4.3) and potential accidental events. The predicted (residual) environmental effects of the Project are described based on a number of standard and widely accepted environmental effects criteria or "descriptors" (see Section 5.8). The environmental effects assessment for each VC concludes with a summary of the predicted residual environmental effects of the Project, and evaluates the significance of these based on the VC-specific significance definitions referenced above. Any key sources of uncertainty or assumptions made in defining and determining environmental effects significance are also presented and justified where relevant. If significant effects are predicted, the likelihood of their occurrence is also evaluated and described.

5 ENVIRONMENTAL EFFECTS ASSESSMENT

The following sections provides a summary of the key results of the environmental effects assessment for each VC, including an overview of its existing environmental setting and predicted environmental effects for both planned Project components and activities and potential accidental events. Further details are provided in Chapters 6 – 14 of the EIS, which can also can be referred to for the sources of the information that is summarized below.

5.1 Marine Fish and Fish Habitat (Including Species at Risk)

The Project Area and surrounding marine environments are known to be inhabited by a diversity of marine biota and are used by fish and invertebrate species of commercial, cultural, and/or ecological importance and support regionally important areas of biodiversity and marine productivity. Marine fish and fish habitat, and the potential effects of the Project on this VC, are subject to the relevant provisions of the federal *Fisheries Act* and its associated Regulations, which provides protection to commercial, recreational, and Aboriginal fisheries by protecting the fish resources and habitats that support these activities. Certain fish species and their habitats may also be provided with legislative protection within Canadian (federal *Species at Risk Act*; SARA) and/or provincial (Newfoundland and Labrador *Endangered Species Act*; NL ESA) jurisdictions. For the EIS, this VC includes consideration of relevant fish species (both stable and at risk), as well as plankton, algae, marine plants, benthos, and relevant components of their habitats (such as water and sediment), given the clear interrelationships between these environmental components.

5.1.1 Existing Environment (Description of the Baseline)

Marine fish and fish habitat components that are relevant to the Project Area and the EIS include plankton, benthos and finfish. The presence, abundance and distribution of particular species varies considerably based on habitat characteristics (both abiotic and biotic) and variability across this rather large and diverse marine environment, which includes parts of the Grand Banks / Newfoundland Shelf, Flemish Cap and adjacent slope and deepwater habitats in the Flemish Pass. Marine assemblages in these environments, represent groups of organisms that through ecological preferences are adapted to coexist within a particular environment in an ecosystem. Within these areas and associated habitat types, a variety of fish species and assemblages occur with “shallow water” groups (e.g., lanternfish, redfish, soft corals, echinoderm species) giving way to “slope” assemblages (e.g., corals, sponges, Greenland halibut, lanternfish, grenadier species) and finally to “deep slope-abyssal assemblages” (e.g., sea pens, sponges, blue hake, longnose eel, dogfish). Within such depth zones, habitat complexity can also be a determining factor of species presence and prevalence. The Project Area hosts numerous commercially relevant fish and shellfish species which are important for both Canadian and/or international fishers.

The Grand Banks Shelf is relatively shallow, with areas generally less than 100 m deep, and is strongly influenced by the upwelling of nutrients from mixing of the Labrador Current, shelf waters, and Gulf Stream. The Grand Banks Shelf is largely dominated by echinoderms (e.g. pale sea urchin, sand dollar, brittlestar), bivalves (Icelandic scallop, propeller clam), shrimp, and snow crab. Finfish commonly captured in Canadian RV trawls on the Grand Banks Shelf in the Project Area include lanternfish, redfish.

The Flemish Cap is a largely distinct marine ecosystem separated from the Grand Banks shelf by the Flemish Pass. A quasi-permanent, anticyclonic gyre dominates the oceanography of the Flemish Cap, leading to local retention of eggs and larvae. The highly oxygenated waters on the Flemish Cap that are strongly influenced by the Labrador Current, are also relatively nutrient rich. These oceanographic conditions are thought to contribute to the elevated biodiversity found in these areas relative to the Grand Banks Shelf habitats. Characteristic benthic invertebrates of the shelf and slope assemblages on the Flemish Cap are mainly sea stars and sea anemones. Based on European RV surveys, redfish (Acadian, deepwater, and golden), and Atlantic cod are typical finfish species found on the Flemish Cap in shallow slope areas. In deeper slope areas of the Cap, dominant finfish species include Greenland halibut, longnose eels, blue hake, grenadiers (roundnose, roughhead, and common), and dogfish.

The Flemish Pass is a perched slope basin that reaches approximately 1,300 m depths and is dominated by sandy mud substrate with some areas of rocks deposited by icebergs. As the Labrador Current reaches the Flemish Pass, it splits with the main branch flowing southwards towards the southeastern slope of the Grand Banks and the side branch circulating around the Flemish Cap. Characteristic benthic invertebrate species of middle slope assemblages are predominately comprised of corals (soft, cup, gorgonian, black wire and sea pens), sponges, and echinoderms. Deeper areas of the slope are dominated by sea pens, sponges and echinoderms (seastars). Finfish typically captured on the middle slopes of the Flemish Pass included lanternfish, longnose eel, blue hake, grenadiers, redfish, halibut and barracudina. Dominant finfish species transitioned to grenadiers, longnose eel, blue hake, lanternfish, Greenland halibut, dragonfish, viperfish, and blacksmelts.

Deep-sea corals, sea pens, and sponges are often of particular environmental interest due to the habitat-forming capacity aspects of these benthic invertebrates and their sensitivity to anthropogenic stressors. Existing and available information for corals, seamounts, and sponges in this region indicates that portions of the overall Project Area will overlap with several areas of known occurrence for these species. There are at least 56 species of corals and sea pens distributed on the Flemish Cap, Flemish Pass and the Grand Banks (within and outside the Project Area and RSA), as determined by previous bottom trawling and video surveys. Corals in the Project Area were dominated by sea pens including *Anthoptilum grandiflorum*, *Halipteris Finmarchicia* and *Pennatula phosphorea* and were mainly prevalent on the slopes and bottom of the Flemish Pass. Gorgonian corals were not commonly observed in the Project Area. In the buffer area outside of the EL areas, soft corals including *Duva florida* and *Nephtheidae* species were common in shallow shelf areas of the Grand Banks Shelf and Flemish Cap. There are at least 60 sponge species distributed in the region, however due to the fragile nature of sponges, they are often not identified to species in various surveys. Sponges exhibit a wide depth range (100-1,500 m) with the highest sponge biomass in northwest portion of the RSA located on the upper slopes of the Flemish Cap. Within the Project Area itself and adjacent environments, sponge densities were mainly present on the bottom of the Flemish Pass and shelf areas of EL 1144 and remaining Project Area. There were few observations of sponges in EL 1150. Sponges from the order *Astrophorida,* including *Geodia barreti, Geodia macandrewii, Geodia phlegraei,* were dominant species in terms of sponge biomass.

The EIS consider species that are secure as well as those listed as species at risk under the SARA or identified by “arm’s length” conservation organizations such as the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the International Union for the Conservation of Nature (IUCN) as species of conservation concern.

There are currently four *SARA* (Schedule 1) listed and one *NL ESA* listed species that may occur within the Project Area and RSA, including three species of wolffish, the white shark, and the American eel (Table 5.1). Of the 30 listed species in the North Atlantic, 12 species have a higher potential to have ranges that overlap with the Project Area and/or the RSA and include Atlantic cod, white hake, thorny skate, grenadier species (roughhead and roundnose), redfish species (Acadian and deepwater), Atlantic salmon, shark species (basking, shortfin mako, porbeagle) and Atlantic bluefin tuna.

Table 5.1 Fish Species at Risk or Otherwise of Special Conservation Concern

Family	Species		Status / Designation[1]			
	Common Name	Scientific Name	*NL ESA*	*SARA* Status (Schedule 1)	COSEWIC Designation	IUCN
Anarhichadidae	Striped (Atlantic) wolffish	*Anarhichas lupus*		SC	SC	
Anarhichadidae	Northern (Broadhead) wolffish	*Anarhichas denticulatus*		T	T	
Anarhichadidae	Spotted wolffish	*Anarhichas minor*		T	T	
Anguillidae	American eel	*Anguilla rostrata*	V		T	E
Carcharhinidae	Blue shark	*Prionace glauca*			NR	NT
Cetorhinidae	Basking shark	*Cetorhinus maximus*			SC	V
Gadidae	Atlantic cod (Newfoundland and Labrador Population)	*Gadus morhua*			E	V
Gadidae	Cusk	*Brosme*			E	
Gadidae	Haddock	*Melanogrammus aeglefinus*				V
Lamnidae	Porbeagle	*Lamna nasus*			E	V
Lamnidae	Shortfin mako	*Isurus oxyrinchus*			T	V
Lamnidae	White shark	*Carcharodon carcharias*		E	E	V
Macrouridae	Roughhead grenadier	*Macrourus berglax*			SC	
Macrouridae	Roundnose grenadier	*Coryphaenoides rupestris*			E	CE
Phycidae	White hake (Atlantic and Northern Gulf of St. Lawrence Population)	*Urophycis tenuis*			T	
Pleuronectidae	American plaice (Newfoundland and Labrador Population)	*Hippoglossoides platessoides*			T	
Pleuronectidae	Atlantic halibut	*Hippoglossus hippoglossus*				E
Rajidae	Barndoor skate	*Dipturus laevis*				E
Rajidae	Little skate	*Leucoraja erinacea*				NT
Rajidae	Smooth skate (Funk Island Deep Population)	*Malacoraja senta*			E	E

Family	Species		Status / Designation[1]			
	Common Name	Scientific Name	*NL ESA*	*SARA* Status (Schedule 1)	COSEWIC Designation	IUCN
Rajidae	Spinytail skate	*Bathyraja spinicauda*				NT
Rajidae	Thorny skate	*Amblyraja radiata*			SC	V
Rajidae	Winter skate (Eastern Scotian Shelf – Newfoundland)	*Leucoraja ocellata*			E	E
Salmonidae	Atlantic salmon (South Newfoundland Population (T); Quebec Eastern North Shore (SC), Quebec Western North Shore (SC), Anicosti Island (E), Inner St. Lawrence (SC), Gaspe-Southern Gulf of St. Lawrence (SC), Eastern Cape Breton (E), Nova Scotia Southern Upland (E); Outer Bay of Fundy Population (E))	*Salmo salar*			T; E; SC	LC
Scombridae	Albacore tuna	*Thunnus alalunga*				NT
Scombridae	Atlantic Bluefin tuna	*Thunnus thynnus*			E	E
Scombridae	Bigeye tuna	*Thunnus obesus*				V
Scorpaenidae	Acadian redfish (Atlantic Population)	*Sebastes fasciatus*			T	E
Scorpaenidae	Deepwater redfish (Northern Population)	*Sebastes mentella*			T	LC
Squalidae	Spiny Dogfish	*Squalus acanthias*			SC	V

[1] Not at Risk (NR), Least Concern (LC), Vulnerable (V), Near Threatened (NT), Special Concern (SC), Threatened (T), Endangered (E), Critically Endangered (CE)

5.1.2 Anticipated Changes to the Environment

The key potential environmental interactions between planned Project activities and marine fish and their habitats, including the associated environmental changes and possible resulting environmental effects on this VC, include the following:

- The possible destruction, contamination or other alteration of marine habitats and benthic organisms due to the discharge and deposition of drill cuttings and/or fluids, the deployment and use of other Project equipment, and possibly the introduction and spread of aquatic invasive species.

- Potential contamination of fish/invertebrates and their habitats due to other environmental discharges during planned oil and gas exploration drilling and other associated survey and support activities.

- The attraction of marine fish to MODUs and vessels, resulting in enhanced potential for injury, mortality, contamination or other interactions.

- Possible injury, mortality or other disturbances to marine fish and invertebrates as a result of exposure to noise within the water column during VSP activity.

- The temporary avoidance of areas by mobile marine fish species due to underwater noise or other disturbances, which may alter their overall presence and abundance as well as disturbing movements/migration, feeding or other activities and life stages.

- Possible changes in the availability, distribution or quality of feed sources and/or habitats for fish and invertebrates as a result of planned activities and their associated environmental emissions.

As a result of these identified potential environmental interactions, issues identified in the EIS Guidelines and concerns raised through engagement, the assessment of Project-related environmental effects on marine fish and fish habitat is focused on the following potential environmental effects:

- Change in Habitat Availability and Quality;
- Change in Food Availability and Quality;
- Change in Fish Mortality, Injury, Health; and
- Change in Fish Presence and Abundance (Behavioral Effects)

5.1.3 Potential Environmental Effects (Planned Project Components and Activities)

The overall nature, localized extent and duration of the various components and activities associated with this Project, along with the offshore and dynamic marine environment involved and the planned implementation of standard and effective mitigations, will mean that any potential adverse effects on this VC will primarily be of low magnitude, localized extent, temporary, and reversible in nature. Moreover, the lack of interactions with critical habitat and areas of known and high abundance outside the LSA also indicate that adverse effects to species at risk are considered unlikely.

5.1.3.1 Presence and Operation of MODUs

The presence and operation of the MODU will result in the introduction of a number of disturbances into the marine environment, including underwater noise and vibrations, light emissions and other discharges, as well as resulting in direct interactions with the benthic environment, and possible issues related to aquatic invasive species. MODU presence, lighting and any organic waste emissions may result in some localized fish behavioural (attraction and aggregation) effects, whereas the noise associated with drilling or other activities such as the use of dynamic positioning may result in temporary avoidance by some individuals. Given their short-term and localized nature, however, these changes are not expected to have overall (population level) adverse effects on fish in the LSA or beyond. Drilling

itself and any anchoring will result in direct interaction with the seabed, and could in turn adversely affect sensitive benthic biota or habitats in the immediate area (footprint). Potential effects on coral and sponge aggregations should be avoided through the completion of seabed investigations using ROVs or other equipment, with appropriate mitigation (set-backs) applied as required and relevant. All associated discharges (wastewater, sewage, air emissions) from the MODU will be managed in accordance with applicable regulations and guidelines.

5.1.3.2 Drilling and Associated Marine Discharges

The primary environmental considerations associated with drilling activity itself are related to the discharge of WBMs and WBM-associated cuttings during the initial drilling phases, and the eventual discharge of SBM-associated cuttings from the MODU following their treatment and marine disposal in accordance with the *Offshore Waste Treatment Guidelines*. Drilling fluids themselves are essentially non-toxic, and these and all other chemicals used during the Project will be selected and used in accordance with applicable regulatory requirements and Nexen procedures. The marine disposal and deposition of drill cuttings (and any residual muds) may cause a degree of accumulation on the seabed, but drill cuttings modelling carried out for the EIS indicates that the formed cuttings pile will be limited in size and distribution in this deep offshore environment. In only very limited areas will the cuttings pile thicknesses exceed the established thresholds for creation of anoxic areas and smothering of benthic species. Any cuttings accumulations on the seabed will eventually be recolonized following the completion of each of the up to 10 wells that may be drilled as part of this Project.

5.1.3.3 Vertical Seismic Profiling

Underwater noise resulting from the use of seismic equipment during VSP activities may result in temporary displacement of some fish species, but is not anticipated to result in injury or mortality of fish and invertebrates. These seismic emissions are mainly directed downwards into the well, with limited horizontal range, and VSP surveys typically use sound levels that are lower than the larger seismic (geophysical) surveys that occur throughout the region. Mobile fish and invertebrate species are expected to temporarily avoid areas of VSP operations, minimizing the potential for adverse interactions. The application of standard mitigations such as an initial “ramp up” phase to increase initial fish and invertebrate avoidance will further limit any potential effects.

5.1.3.4 Well Testing

The environmental effects of well flow testing and associated flaring are related primarily to light and atmospheric emissions, and possible treated produced water discharges, as required. During well flow testing, small quantities of oil and produced water may be periodically flared, resulting in short term, localized and reversible air emissions, with little potential to interact with fish and their habitats. The amounts of produced water associated with exploration drilling are typically much lower than those from oil production, and any quantities that are in excess of the flare capacity will be treated in accordance with the *Offshore Waste Treatment Guidelines* and disposed of at the MODU site. The relatively low volumes of produced water involved, coupled with its planned treatment prior to disposal and expected rapid dilution in this dynamic marine environment means that adverse effects on fish and fish habitat are unlikely to occur.

5.1.3.5 Well Abandonment or Suspension

Eventual well abandonment or suspension and the associated removal of the wellhead using mechanical means (if required) will result in short term, low magnitude emissions of noise and light. Individual fish that are sensitive to lighting and noise emissions may temporarily avoid the area during these activities, with no anticipated population level effects or other adverse environmental implications occurring as a result of these activities.

5.1.3.6 Supply and Servicing

Project-related supply and servicing vessels will make regular transits from an Eastern Newfoundland port to the Project Area during each exploration campaign, resulting in a degree of associated vessel noise, lighting and other environmental discharges such as wastewater emissions. These supply and service activities will comprise relatively routine and infrequent marine transits, similar to other types of marine traffic occurring offshore Eastern Newfoundland. All Project-related vessels (and aircraft) will follow applicable environmental and safety regulations and guidelines, and the transitory nature of these activities means that any environmental discharges are not likely to accumulate in any single area, and will not have detectable, adverse environmental effects upon marine fish and fish habitat.

5.1.4 Potential Environmental Effects (Accidental Events)

Potential accidental events may interact with and potentially affect marine fish and fish habitat in terms of habitat availability and quality, fish mortality, injury and health, and fish presence and abundance. Potential accidental effects that are considered involve varying degrees of hydrocarbon interaction and exposure with fish and fish habitat and include SBM spills, batch spills, and subsurface blowouts. The potential effects of the accidental release of hydrocarbons in the marine environment on marine fish and fish habitat are largely dependent on a variety of biotic (species, life history, behaviour, resistance) and abiotic (oceanographic conditions, exposure duration, oil type, oil treatment methods) factors.

Modelling of the two smaller batch spills (100 and 1,000 L) predicts that neither area will exceed the ecological threshold of 100 µg/L total hydrocarbon concentration (THC) for greater than one km^3; therefore, the potential for exposure and the likelihood of adverse effects on marine fish and fish habitat from a batch release are low. For the larger spill (750,000 L), concentrations in the immediate area will exceed the ecological threshold. Only fish near the surface at the time of the spill may be exposed, and at the concentrations predicted a change in habitat availability and quality will likewise be of low magnitude. While batch spills would affect water quality around the spill site, this would be short-term until the slick naturally disperses through surface wave action in the offshore environment.

In the very unlikely event of an offshore oil release, residual adverse effects to marine fish and fish habitat in the area at the time of the accident or malfunction are expected. The type and level of any effects would be dependent on such factors as the degree of exposure, spill type and size, time of year, and species presence and occurrence within the affected area. Potential adverse residual effects may result in decline or change to food availability and quality with implications for higher trophic levels. Interactions with hydrocarbons would also result in sublethal and lethal mortality on fish and invertebrates depending on the species-specific responses and degree of interaction. These potential effects would be similar for both secure and at-risk species.

For the duration of any accidental offshore oil release, there would be reductions in availability or access to fish habitat. The eventual break down of oil material in the water column and surface may become transported to benthic habitats through sinking and flocculation. This pathway would allow for contamination of deep sea environments and potential hydrocarbon interactions with sensitive coral and sponge species. In the context of a batch spill, the potential residual effects would be greatly reduced due to the limited quantities released and therefore localized nature of the such an event.

In the context of applied mitigations, adverse environmental effects are considered unlikely and are not likely to result in an overall detectable decline in population-level fish abundance or change in the spatial and temporal distribution of fish populations in the RSA. It is also unlikely that the overall abundance, distribution or health of any species at risk and its eventual recovery will be negatively affected. With applied mitigations, these unlikely adverse environmental effects are not predicted to have significant effects on fish and fish habitat. Spill prevention techniques and response strategies will be incorporated into the design and operations for all Project activities as part of contingency planning. This planning will further help ensure that effects do not occur, and in the unlikely event of an occurrence, would help minimize any adverse effects to fish populations and fish habitats in the RSA.

5.2 Marine and Migratory Birds (Including Species at Risk)

Marine-associated birds that may occur within the Project Area and larger RSA can be generally divided into three categories: 1) seabirds, 2) waterfowl and divers, and 3) shorebirds. In addition, there are a number of landbird species that are associated with coastal habitats and/or migrate nocturnally over marine waters. As key components and indicators of ecosystem health, birds are often considered to be of high intrinsic ecological importance. Further, they are of socioeconomic importance in Newfoundland and Labrador both in terms of tourism and as a food source.

5.2.1 Existing Environment (Description of the Baseline)

The waters off Eastern Newfoundland support a diversity of avifauna species throughout the year, including seabirds that inhabit the region at particular or extended periods, as well as coastal species and landbirds that are found in nearshore and offshore areas for feeding, migration and other activities. Eastern Newfoundland also contains a number of identified important habitats for birds along its coastline, well outside of the Project Area, although Project-related vessel and aircraft traffic will originate from shore. Most migratory birds found in Canada are protected under the federal *Migratory Birds Convention Act* (MBCA) and its regulations. Further, wildlife in Newfoundland and Labrador (including certain species not protected under the MBCA) are managed under the provincial *Wildlife Act* and regulations. Avian species at risk and their habitats, including some species that are known or have potential to occur in the Project Area and surrounding environments, are protected by both the federal SARA and the provincial NL ESA legislation. In addition to these legal protections, birds have intrinsic ecological and socioeconomic value.

A variety of avifauna species occur within the marine and coastal environments off Eastern Newfoundland at various times of the year. These include seabirds as well as other avifauna that inhabit offshore and nearshore regions for breeding, feeding, migration and other activities according to their individual life histories and habitat requirements, and could therefore be present in the RSA at the time of an accidental event. Seabirds, waterfowl and divers, and shorebirds are the most vulnerable to

perturbation as they spend much of their life in the marine environment; however, certain landbird species may also be affected, particularly those associated with coastal habitats and any that migrate nocturnally over offshore waters. The timing of species presence and overall density can vary considerably depending on the species, with some taxa abundant year-round (such as large gulls and kittiwakes, many alcid species, fulmars, and shearwaters) while some are more likely to be present in the winter (Ivory Gulls, waterfowl) or fall (Leach's Storm-petrels).

Several nesting colonies supporting millions of seabirds, as well as a number of designated and important habitats for birds have also been identified at locations along the eastern coast of Newfoundland and Labrador. As well, there are several Ecologically and Biologically Significant Areas (EBSAs) in the Northwest Atlantic designated in part due to their importance to seabirds.

Very few avian species at risk or species of conservation concern are likely to occur in the Project Area or RSA. The Ivory Gull is found almost exclusively in marine environments, and although its breeding distribution (and critical habitat) is in the Arctic, it regularly occurs in small numbers in the waters off Eastern Newfoundland. Two waterfowl species at risk, the Barrow's Goldeneye and Harlequin Duck, both occur in the marine environment, particularly outside of the breeding season. Like other waterfowl species, they prefer coastal areas and so are considered unlikely to be present offshore Eastern Newfoundland. Red-necked Phalaropes, assessed by COSEWIC as a species of conservation concern were seen in small numbers during Eastern Canadian Seabirds at Sea (ECSAS) surveys in offshore waters from April to December. The other avian species at risk or species that are otherwise of conservation concern that occur in Newfoundland (Table 5.2) are shorebirds and landbirds, and are unlikely to be found in the RSA except on a transient basis during the fall months.

Table 5.2 Avian Species at Risk and their Likelihood of Occurrence in the Project Area and RSA

Species	Provincial Status	Federal Status		Potential Presence
		SARA Schedule 1 Listing	COSEWIC Assessment	
Barrow's Goldeneye (Eastern pop.)	Vulnerable	Special Concern	Special Concern	Unlikely, due to their affinity for coastal habitats.
Harlequin Duck (Eastern pop.)	Vulnerable	Special Concern	Special Concern	Unlikely, due to their affinity for coastal habitats.
Ivory Gull	Endangered	Endangered	Endangered	Potentially present. Because they are typically found among pack ice, interactions with Project activities are unlikely.
Piping Plover (*Melodus* ssp.)	Endangered	Endangered	Endangered	Unlikely, due to their affinity for coastal habitats.
Red Knot (*Rufa* ssp.)	Endangered	Endangered	Endangered	Unlikely, due to their affinity for coastal habitats.

Species	Provincial Status	Federal Status		Potential Presence
		SARA Schedule 1 Listing	COSEWIC Assessment	
Buff-breasted Sandpiper	none	none	Special Concern	Unlikely, due to their affinity for coastal habitats.
Red-necked Phalarope	none	none	Special Concern	Potentially present. Seen in small numbers during ECSAS surveys within the RSA, although scarce in the winter and spring
Peregrine Falcon	Vulnerable	Special Concern	Special Concern	Unlikely to occur regularly. May be an occasional vagrant during fall migration.
Common Nighthawk	Threatened	Threatened	Threatened	Unlikely to occur regularly. May be an occasional vagrant during fall migration.
Bank Swallow	none	none	Threatened	Unlikely, due to their affinity for coastal habitats. As diurnal migrants, they are less susceptible to disorientation from offshore artificial light sources.
Gray-cheeked Thrush (*minimus* ssp.)	Threatened	none	Candidate Species (low priority)	Unlikely to occur regularly. May be an occasional vagrant during fall migration.
Olive-sided Flycatcher	Threatened	Threatened	Threatened	Unlikely to occur regularly. May be an occasional vagrant during fall migration.
Bobolink	Vulnerable	none	Threatened	Unlikely to occur regularly. May be an occasional vagrant during fall migration.
Short-eared Owl	Vulnerable	Special Concern	Special Concern	Unlikely, due to their affinity for coastal habitats.

5.2.2 Anticipated Changes to the Environment

The key potential environmental interactions between Project activities and marine and migratory birds, including the associated environmental changes and possible resulting environmental effects on this VC, include the following as summarized and adapted from the Eastern Newfoundland SEA (Amec 2014):

- Attraction of night-flying birds to MODUs and support vessels, including their lights, flares or other emissions, resulting in possible injury or mortality (strikes, strandings, disorientation, increased energy expenditure, increased predation);

- Disturbance to birds and their activities as a result of activities and equipment associated with oil and gas activities (lights, noise), resulting in possible injury or mortality;

- Potential injury, other associated disruptions to and changes in feeding and other behaviours (particularly for diving birds), as a result of exposure to seismic noise within the water column during VSP;

- Changes in the availability, distribution and/or quality of food sources or habitats for marine and migratory birds due to disturbances (noise, light) and/or project-related environmental emissions (such as drilling fluids, other liquid and solid waste materials); and

- Changes in the presence, abundance, distribution or health of birds as a result of direct exposure (e.g. physical exposure or ingestion) to environmental emissions from MODUs or vessels, which may affect individuals, populations and important habitats.

As a result of these identified environmental interactions, issues identified in the EIS Guidelines, and concerns raised through consultation and engagement, the assessment of Project-related environmental effects on marine and migratory birds is focused on the following potential environmental effects:

- Change in Mortality / Injury Levels and Bird Health;
- Change in Avifauna Presence and Abundance (Behavioral Effects);
- Change in Habitat Availability and Quality; and
- Change in Food Availability or Quality

5.2.3 Potential Environmental Effects (Planned Project Components and Activities)

5.2.3.1 Presence and Operation of MODUs

The predicted environmental effects associated with the presence and operation of the MODU are primarily related to lighting and emissions that may result in changes in mortality / injury levels, presence and abundance of avifauna, and food and habitat availability and quality. This includes the possible attraction of birds due to lighting, avoidance of the MODU due to sensory disturbance, and the creation of new foraging opportunities for predator species (e.g., through prey attraction due to organic waste disposal, creation of new “artificial reef” habitat). There may also be a slight increase in mortality / injury levels due to collisions, disorientation, and potential predation; however, the mortality rate is anticipated to be low as most stranded birds encountered on MODUs and vessels are released successfully. Some localized and short-term behavioural effects (change in presence and abundance) are also likely to occur from the operation of the MODU; however, these effects will be localized, transient, and short-term in nature. Changes in habitat and food availability and quantity, if any, will also be on a localized scale and for a short-term duration.

5.2.3.2 Drilling and Associated Marine Discharges

The predicted environmental effects of drilling and associated marine discharges are primarily related to release of organic wastes, which may result in changes in mortality / injury levels, presence and abundance of avifauna, and food availability and quality. Organic waste will be reduced prior to discharge in accordance with the *Offshore Waste Treatment Guidelines*. Discharge of organic wastes (sewage and food scraps) may result in enhancement of the local food supply and attraction of birds to vessels and MODUs. However, this potentially positive effect may be offset by increased exposure to risk of collision / strandings or predation as well as energetic costs due to deviation from normal movement / migration patterns. Proper waste management will reduce such effects of discharges of organic waste on birds.

5.2.3.3 Vertical Seismic Profiling

The predicted environmental effects of survey activities are primarily related to noise exposure from geophysical testing, which may result in changes in presence and abundance of avifauna, and potentially short-term injury. Deep-diving birds such as alcids (including murres, dovekies, and puffins), as well as other bird species that forage underwater, may be at somewhat higher risk of injury or disruption due to exposure to underwater noise such as that generated by seismic sound sources. VSP surveys using seismic sound arrays or other equipment will be conducted as part of the Project as required. However, these surveys will be short-term and localized in nature, and marine and migratory birds are unlikely to be affected by the underwater sound energy that is associated with these activities.

5.2.3.4 Well Testing

The predicted environmental effects of formation flow testing with flaring are primarily related to attraction of birds to flares, which may result in changes in mortality / injury levels, and in presence and abundance of avifauna. Any flaring events conducted during the Project will occur several hundred kilometres offshore, far away from coastal breeding sites and Important Bird Areas (IBAs) and well beyond the foraging range of almost all species that nest in Newfoundland. Therefore, breeding birds are unlikely to be affected by this activity, with the potential exception of the Leach's Storm-petrel, which may forage thousands of kilometres from the nest site during the breeding season. Although there is some potential for the attraction of migratory landbirds during the fall migration period, it is unlikely that large numbers of landbirds will be affected.

5.2.3.5 Well Abandonment or Suspension

No effects on marine and migratory birds as a result of well abandonment or suspension are anticipated. Wellhead recovery, if required, is conducted underwater, at depth, and in adherence to the requirements set out under the *Newfoundland Offshore Petroleum Drilling and Production Regulations*. Decommissioning activities will be conducted well below diving depths for even the deepest-diving seabirds.

5.2.3.6 Supply and Servicing

The primary environmental effects of supply and servicing activities are related to potential disturbance due to vessel movements, release of organic wastes leading to increased food availability, and attraction / disorientation of birds due to lighting. The various bird species that occupy the Project Area and potential vessel and aircraft traffic routes will not likely be disturbed by Project-related vessel activity or associated aircraft use due to its short-term transitory nature, and because it will generally be in keeping with the overall marine traffic that has occurred throughout the region for years. The release of organic wastes by offshore vessels and activities can attract birds, which may increase the potential for interactions including risk of predation, collision and exposure to contaminants. However, this will be reduced with proper waste management practices and adherence to associated *International Convention for the Prevention of Pollution from Ships* (MARPOL) requirements (e.g., food and sewage waste will not be discharged within 5.5 km (3 nautical miles) of the coast). Potential effects due to lighting on supply vessels, will be highly transient in nature. Overall, the presence of these Project-related vessels in the Canada-NL Offshore Area as part of this Project would result in a negligible addition of night lighting in this region.

5.2.4 Potential Environmental Effects (Accidental Events)

Accidental events such as oil spills can have important, adverse consequences for marine-associated birds, leading to potential changes in the presence, abundance, distribution and/or health of marine birds (individuals and populations). Exposure to accidental oil spills from a MODU or vessels may affect individuals (through physical exposure, ingestion), important habitats and food sources. Marine birds are amongst the biota most at risk from oil spills, as they spend much of their time upon the surface of the ocean. In the event of a spill, and depending upon project and area specific factors, coastal birds may also be at risk on beaches and in intertidal zones.

Batch spills, if any, resulting from the Project would cause a temporary decrease in water quality (and thus habitat quality) around the spill site. This would be short-term in nature, lasting until the slick disperses in the offshore environment. Based on modelling results, the potential for exposure and the likelihood of adverse effects on marine birds from a batch release are low. Only those birds occupying the immediate footprint of the spill for this time period would be affected.

A subsurface blowout represents the accidental event with the greatest potential to affect marine birds, given the potentially large volume of discharged oil, and the possibility for such a spill to have a large geographic extent. Shoreline contact was not predicted to be likely from releases at either the EL 1144 or EL 1150 example well sites, with maximum probabilities of shoreline contact of less than three percent from the EL 1144 example well site only. Based on vulnerability indices (French-McCay 2009) the mortality rate would range from 35-99 percent for birds that come in contact with the slick in the 0.01-0.1 mm thickness range. Murres and Dovekies, which spend most of their time sitting on the water's surface, are most vulnerable (estimated 99 percent mortality), while species that dive or feed at the water's surface for their prey but otherwise spend little time on the water, including Leach's Storm-petrels, Great Shearwaters, and Great Skuas, are predicted to have a lower mortality rate of 35 percent. Black-legged Kittiwakes and Northern Gannets, which do often sit on the water but spend more time in the air than alcids (murres and Dovekies), would be expected to have an intermediate mortality rate.

In the unlikely event of an offshore oil release, some degree of residual adverse effects to individual marine and migratory birds in the area at the time of the accident or malfunction are expected. The degree of exposure and type of effects would depend on the type and size of spill, time of year, and location and species of marine and migratory birds within the affected area. Spill prevention techniques and response will be incorporated into the design and operations for Project activities as part of contingency planning.

5.3 Marine Mammals and Sea Turtles (Including Species at Risk)

The waters off Eastern Newfoundland support a diverse assemblage of marine fauna that also includes some 20 marine mammals and as many as five sea turtle species, several of which are considered to be at risk or otherwise of special conservation concern. Marine mammals and sea turtles are often considered to be ecologically, economically, culturally, and/or recreationally important, and these species and their habitats are managed and protected under the SARA. This VC integrally considers species that are considered to be stable, as well as those considered to be at risk under SARA or are otherwise considered to be of special conservation concern.

5.3.1 Existing Environment (Description of the Baseline)

Overall abundance of marine mammals is highest from late spring to autumn, but some species may be present year-round. Baleen whales are most abundant in the summer months, though common minke whale and blue whale may occur in the area year-round. Most toothed whales are thought to be year-round residents of the RSA, with the exception of Risso's and common bottlenose dolphins, which are found only in the summer months, and beluga, which are only observed in the winter months. Seals are most abundant in the winter months, although grey and harbour seals may be present year-round. Sea turtles are most abundant in the area during the summer months, when the Grand Banks and surrounding waters provide important feeding habitat, and they are absent from the area between December and April.

Toothed whales vary in habitat preferences, with belugas and harbour porpoises favouring coastal/estuarine habitats, some dolphins found in both coastal areas and open ocean, and other dolphins as well as beaked whales and sperm whales seldom observed close to shore. The most commonly expected baleen whale species in the RSA are humpback, minke, fin, and sei whales. Harbour seals are concentrated primarily in coastal areas, while grey, harp, and hooded seals are more widespread and can be found in deeper waters of the RSA when not breeding or whelping on land or pack ice. Two sea turtle species may be regularly found in the area; the leatherback and (to a lesser extent) the loggerhead sea turtle occur in Eastern Newfoundland waters from April to December. No designated critical habitat for marine mammals or sea turtles is present within or near the RSA, but there are several EBSAs that overlap with, or are in close proximity to, the Project Area. These EBSAs are important feeding and seasonal refuge areas for marine mammals and sea turtles

A number of marine mammal and sea turtle species at risk protected under the *SARA*, occur in the waters offshore Eastern Newfoundland, as well as other species that have been identified as being of conservation concern by COSEWIC (Table 5.3). The provincial *NL ESA* does not list any marine mammals or sea turtles.

Table 5.3 Marine Mammal and Sea Turtle Species at Risk and their Likelihood of Occurrence

Species	Federal Status		Potential Presence
	***SARA* Schedule 1 Listing**	**COSEWIC Assessment**	
Blue Whale - Atlantic Population	Endangered	Endangered	Present in small numbers throughout the year; most common in the winter and early spring.
Fin Whale - Atlantic Population	Special Concern	Special Concern	Present year-round, most common in the summer months.
North Atlantic Right Whale	Endangered	Endangered	Uncommon in the area; may be present in the summer months.
Northern Bottlenose Whale - Davis Strait population; Scotian Shelf population	Endangered (Scotian Shelf population)	Special Concern (Davis Strait population) Endangered (Scotian Shelf population)	Potentially present in small numbers in the area year round; most sightings have been in the spring and summer. The Scotian Shelf population is believed to be non-migratory; therefore, they are considered unlikely to be present.
Sowerby's Beaked Whale	Special Concern	Special Concern	May be present year round in deep water habitats.
Beluga Whale (St. Lawrence Estuary population)	Threatened	Endangered	Very rare in the area; seldom range far from the St. Lawrence estuary.
Killer Whale (Northwest Atlantic / Eastern Arctic population)	none	Special Concern	Likely present; small numbers have been observed in the area at all times of year.
Harbour Porpoise	none	Special Concern	Fairly common in the area, possibly present year round.
Walrus	none	Special Concern	Extremely unlikely. Single extralimital report in RSA (OBIS 2017).
Leatherback Sea Turtle (Atlantic population)	Endangered	Endangered	Occur with some regularity in the area, mainly from April to December.
Loggerhead Sea Turtle	Endangered	Endangered	Uncommon; most frequently observed in the spring and summer months.

5.3.2 Anticipated Changes to the Environment

The key potential environmental interactions between planned Project activities and marine mammals and sea turtles, including the associated Project-related environmental changes and possible resulting environmental effects on this VC, include the following:

- Possible temporary hearing impairment or permanent injury or mortality caused by exposure to loud underwater noise (such as from a seismic sound source used during VSP surveys) at or above identified threshold levels for the onset of injury.

- Potential injury or mortality due to collisions or other interactions with support vessels (including from associated attraction to vessels).

- Disturbance of marine mammals and sea turtles (behavioural effects) as a result of Project-related activities or equipment (including sound and other emissions). Behavioural effects may include alterations in the presence, abundance, and overall distribution of marine mammals and sea turtles as well as modifications to their movements, feeding, communication patterns and other activities.

- Interference with and the masking of sounds within the marine environment that originate from and/or are used by marine animals (communication, echolocation, identification and detection of predators/prey) as a result of Project-related underwater noise.

- Changes in the availability, distribution and/or quality of food sources or habitats for marine mammals and sea turtles due to emissions and other disturbances (noise, light, drilling fluids, other liquid and solid waste materials).

As a result of these identified environmental interactions, issues identified in the EIS Guidelines, and concerns raised through engagement, the assessment of Project-related environmental effects on marine mammals and sea turtles is focused on the following potential environmental effects:

- Change in Mortality / Injury Levels and Health (Individuals or Populations);
- Change in Habitat Availability, Quality and Use (Behavioral Effects); and
- Change in Food Availability or Quality

5.3.3 Potential Environmental Effects (Planned Project Components and Activities)

Of the various potential environmental issues and interactions that may be associated with Project activities, the underwater noise emissions are often considered to have the highest potential for effects on marine mammals and sea turtles. The potential effects of such underwater noise may be physical (injury or mortality) or behavioural (avoidance, other changes in distribution or activities) in nature.

5.3.3.1 Presence and Operation of MODUs

The presence and operation of the MODU will result in the introduction of a number of disturbances into the marine environment, including underwater noise and other emissions. The noise associated with drilling or MODU positioning may result in medium-term avoidance by some individuals, but is not expected to reach levels that will result in injury or mortality of marine mammals and sea turtles. Given their medium-term and localized nature, these disturbances are also not expected to lead to behavioural effects **t**hat have overall (population level) adverse effects on these biota in the LSA or beyond.

5.3.3.2 Drilling and Associated Marine Discharges

Drilling fluids and all other chemicals will be selected and used in accordance with applicable guidelines and Nexen procedures. All associated discharges (drill muds and cuttings, wastewater, sewage, air emissions) from the MODU will be managed in accordance with applicable regulations and guidelines.

Although the marine disposal and deposition of drill cuttings (and any residual muds) will cause a degree of accumulation on the seabed and associated effects on benthic communities and habitats, none of the marine mammals and sea turtles occurring in the LSA and RSA are known to feed on benthos. Although some primary prey species (such as small fish, plankton, and other pelagic invertebrates such as squid) may be exposed to Project-related marine discharges, any associated effects on these species are expected to be localized and temporary, and detectable adverse environmental effects on this VC are therefore not anticipated.

5.3.3.3 Vertical Seismic Profiling

Underwater noise resulting from the use of seismic equipment during VSP activities may result in temporary displacement of some individuals, but is not predicted to result in injury or mortality of marine mammals and sea turtles. These seismic emissions are mainly directed downwards with limited horizontal range, and VSP surveys typically use sound levels that are lower than the larger seismic (geophysical) surveys that occur throughout the region. Mobile species are expected to temporarily avoid areas of VSP operations, minimizing the potential for adverse interactions leading to injury. The application of standard mitigations such as an initial “ramp up” phase to increase initial avoidance will further limit any potential effects.

5.3.3.4 Well Testing

During well flow testing, oil and small quantities of produced water may be periodically flared, resulting in short term and reversible air emissions localized to the immediate Project Area, and with little potential to interact with marine mammals, sea turtles or their habitats. The amounts of produced water associated with exploration drilling are typically much lower than those from oil production, and any quantities that are in excess of the flare capacity will be treated in accordance with the *Offshore Waste Treatment Guidelines* and disposed of at the well site. The relatively low volumes of produced water expected, coupled with its planned treatment prior to disposal and likely rapid dilution in this dynamic marine environment means that potential adverse effects on marine mammals and sea turtles and their food sources are unlikely to occur.

5.3.3.5 Well Abandonment or Suspension

Eventual well abandonment or suspension and the potential recovery of the wellhead (if required) using mechanical means will result in short term, low magnitude emissions of noise and light. Individuals that are sensitive to lighting and noise emissions may temporarily avoid the area during these activities, with no anticipated population level effects or other adverse environmental implications occurring as a result of these activities.

5.3.3.6 Supply and Servicing

Project-related supply and servicing vessels and aircraft will make regular transits from an Eastern Newfoundland port to the Project Area during each exploration campaign, resulting in a degree of associated vessel noise, lighting and other environmental discharges such as wastewater emissions. These supply and service activities will comprise relatively routine marine transits, similar to other types of existing marine traffic occurring offshore Eastern Newfoundland. This vessel traffic will utilize existing

and established routes wherever possible, and will maintain a steady course and safe vessel speed to reduce the risk of a vessel strike. The potential for exposure of marine mammals or sea turtles to disturbance from helicopter overflights is anticipated to be negligible and infrequent. All Project-related support vessels (and aircraft) will follow applicable environmental and safety regulations and guidelines, and the transitory nature of these activities means that any environmental discharges (including waste water, light and noise) are not likely to accumulate in any single area, and will not have detectable, adverse environmental effects upon marine mammals and sea turtles.

5.3.4 Potential Environmental Effects (Accidental Events)

The potential for interaction of different species of marine mammals or sea turtles with an accidental event such as a hydrocarbon release will vary based on the timing, location, duration, and extent of the spill. Marine mammals and sea turtles may experience a change in mortality or injury (acute or immediate effects) if directly exposed to accidentally-released hydrocarbons or associated volatiles and aerosols. They may experience a change in health (sub-lethal effects) from direct contact with hydrocarbons (including volatiles and aerosols) or consumption of contaminated prey. There may be a change in habitat (marine water or shoreline/haulout) quality due to oiling and associated response measures.

Results of the modelling of unmitigated batch spills suggest that both the potential for exposure and the likelihood of adverse effects on marine mammals and sea turtles from a batch release (e.g., fouling, inhalation of vapours) are low. Only animals in the immediate vicinity at the time of the spill may be exposed, and at the concentrations predicted, change in mortality or injury is considered unlikely and changes in health are predicted to be of low magnitude (e.g., temporary inflammation of mucous membranes), as would any associated changes in habitat quality or use. Such spills are not expected to affect haulout areas on distant shorelines. While there will be a decrease in water quality around the spill site, this would be short-term until the slick disperses (aided by surface wave action in the offshore environment).

Based on modelling of an unmitigated subsurface release at EL 1144 example well site and the EL 1150 example well site, subsurface-released oil is extremely unlikely to reach shorelines, and terrestrial areas affected may or may not be used by marine mammals for haulouts. In the extremely unlikely event of shoreline oiling, fur-bearing marine mammals that haulout in the affected area may experience a change in mortality or injury and a change in health upon exposure to hydrocarbons, although it is probable that only a small proportion of local populations would be affected. Potential for change in habitat quality or use of oceanic habitats (i.e., water quality and air quality at the air-sea interface) will be greater near the location of the subsurface release. The degree of change in mortality or injury and change in health will depend in large part on the occurrence and distribution of marine mammals and sea turtles at the time of the blowout, as well as the duration and extent of oil release (i.e., potential severity of effects will be dependent on the potential for exposure). Depending on the exact nature, extent, and duration of a spill, marine mammals and sea turtles in the spill area are likely to experience a combination of exposures from contaminated air, water, and sediment and via a combination of pathways (inhalation, ingestion, aspiration, and adsorption). Oceanic animals that are closer to the site of the blowout are more likely to be exposed to a more constant flow and higher concentrations of oil as compared to nearshore species.

In the unlikely event of a hydrocarbon release, residual adverse effects on marine mammals and sea turtles present in the area, including SAR, are expected; however, these are not anticipated to result in a long-term detectable change in abundance or distribution of populations within the RSA. The magnitude of these effects would depend on the size and duration of the spill, location, time of year, and species presence and abundance within the affected area. Marine mammals and sea turtles species are highly mobile, and most show large migration or movement patterns across broad ranges. Therefore, presence and abundance within the Project Area (and the RSA) are variable, as, consequently, is the likelihood of interaction with Project-related accidental events. Spill response and prevention strategies will be incorporated into the Project as part of contingency planning, thus ensuring the likelihood and potential severity of such events, and their potential effects on the VC, are minimized.

5.4 Special Areas

A number of marine and coastal areas within and off Newfoundland and Labrador have been designated as protected under provincial, federal or other legislation and processes, or have otherwise been identified as being special or sensitive due to their ecological or socio-cultural characteristics and significance. Special areas have been selected as a VC due to their importance for environmental and socioeconomic reasons, and associated regulatory and stakeholder interest in these areas.

5.4.1 Existing Environment (Description of the Baseline)

Given its location over 400 km offshore, the Project will not occur within, or otherwise interact directly with, any of the existing provincial or federal Parks or Historic Sites (including World Heritage Sites), Ecological Reserves, Wildlife Reserves, Marine Protected Areas or Areas of Interest, Canadian/voluntary Fishing Closure Areas (FCAs) , Marine Refuges, Migratory Birds Sanctuaries, IBAs or other locations that have been designated as protected on or around the Island of Newfoundland. The Project Area likewise does not overlap with either of the identified EBSAs, Vulnerable Marine Ecosystems (VMEs) or preliminary Representative Marine Areas (RMAs) off Eastern Newfoundland.

While the Project Area does overlap with small portions of NAFO FCAs (Table 5.4, Figure 5.1), there are no associated prohibitions of marine activities such as that being proposed as part of this Project.

Table 5.4 Summary of Special Areas That Overlap With the Project Area, ELs 1144 and 1150, the LSA and Potential Vessel and Aircraft Route

Name	Type	Project Area	EL 1144 and/or EL 1150	LSA	Traffic Route
Flemish Pass/Eastern Canyon (2)	NAFO Closure	✓		✓	
Northwest Flemish Cap (10)	NAFO Closure	✓		✓	
Northwest Flemish Cap (11)	NAFO Closure	✓	✓	✓	
Southern Flemish Pass to Eastern Canyons	VME			✓	

Name	Type	Project Area	EL 1144 and/or EL 1150	LSA	Traffic Route
Northeast Shelf and Slope	EBSA			✓	✓
Eastern Avalon Coast	EBSA			✓	
Cape Spear Lighthouse	National Historic Site			✓	
Quidi Vidi Lake	IBA			✓	
Signal Hill	National Historic Site			✓	

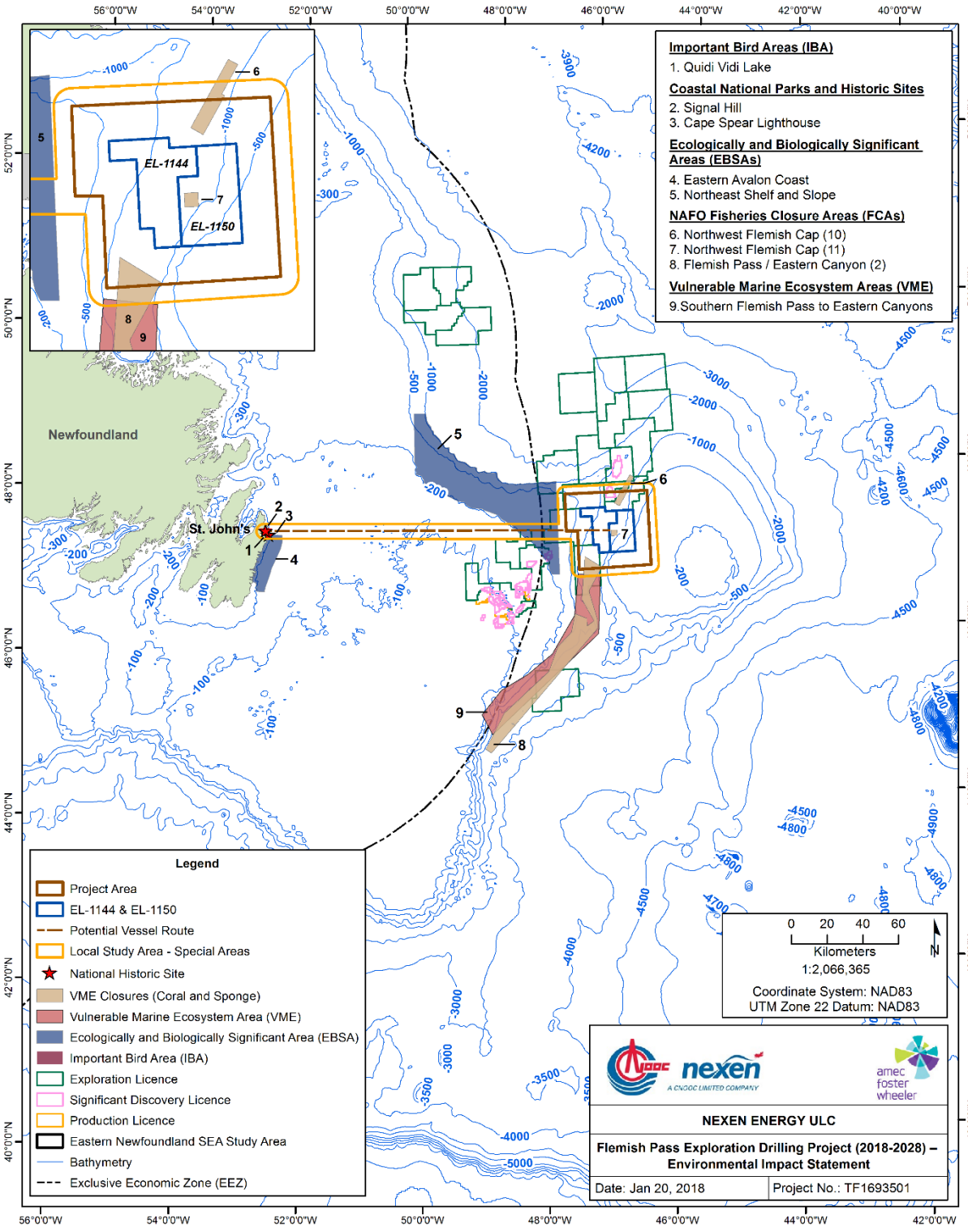
5.4.2 Anticipated Changes to the Environment

Changes to the environment as a result of offshore oil and gas activities and their potential, resulting effects on identified special areas may be both direct and indirect in nature and cause. The conduct of oil and gas exploration activities directly within or near such areas may, for example, have adverse implications for these locations and their important and defining ecological and sociocultural characteristics. These interactions may occur through the possible presence of oil and gas exploration equipment, personnel and activities within the special area in question, as well as the associated emissions and resulting environmental disturbances that may occur in these marine environments. Biophysical effects resulting from oil and gas exploration or other human activities may also "spread" to adjacent special areas by affecting the actual or perceived water quality and marine fish, birds, mammals or other environmental components that move to and through these areas. Any resulting decrease in the real or perceived integrity of these areas in the short or long term may also affect their ecological and/or societal importance, use and value.

As a result of these identified environmental interactions, issues identified in the EIS Guidelines, and concerns raised through engagement, the assessment of Project-related environmental effects on special areas is focused on the following potential environmental effects:

- Change in Environmental Features and/or Processes; and
- Change in Human Use and/or Societal Value

Figure 5.1 Overview of Special Areas that Overlap with the Project Area, LSA and Potential Traffic Route



5.4.3 Potential Environmental Effects (Planned Project Components and Activities)

Planned Project activities will not occur within, or otherwise interact directly with, any of the existing provincially-defined special areas (such as provincial ecological reserves, parks and protected areas or historic sites), each of which are between approximately 400 and 650 km from the closest part of the Project Area boundary. Likewise, the Project will not have a direct interaction with most federally designated areas (marine protected areas, fisheries closures within Canada's EEZ, preliminary RMAs, marine refuges, migratory bird sanctuaries, national parks and historic sites). International designations such as IBAs will also not be directly affected by the Project.

As illustrated in Table 5.4 and Figure 5.1, the Project Area does overlap with small portions of three NAFO Fishery Sponge, Coral and Seapen FCAs. Within these areas, Canada's *Fisheries Act* restricts particular fishing activities but petroleum exploration activities such as those being proposed for this Project are not prohibited. Only one of these NAFO FCAs overlaps with any part of the ELs themselves. In addition, a number of special areas (VMEs, NAFO FCAs, a Marine Refuge, a preliminary RMA, IBAs, a provincial park and a provincial ecological reserve) that do not overlap with the Project Area are located within the general vicinity of (within 50 km of) the LSA boundary. The identified general vessel/aircraft traffic route from Eastern Newfoundland to the Project Area does, given its possible commencement at a onland port site in this region, occur within one kilometer of several coastal special areas in Eastern Newfoundland (a National Historic Site and an IBA), and within 5 km of several others. It also overlaps with one EBSA offshore (Figure 5.1).

The overall and defining environmental features and characteristics of the various special areas that overlap with or occur in the vicinity of the Project Area and traffic route will not be adversely affected by the planned Project activities. The planned exploration activities are characterised by small environmental footprints and are temporary in nature. Moreover, the implementation of the various environmental mitigation measures outlined throughout the EIS, including those designed to avoid or reduce Project-related discharges and/or disturbances and their associated environmental changes and resulting effects, will also serve to help address any direct or indirect potential environmental effects that may have implications for overlapping or adjacent special areas.

The various NAFO Fishery Sponge, Coral and Seapen FCAs that overlap with the Project Area have been designated as such to protect important and sensitive benthic components and habitats from further disturbance due to certain types of (bottom dragging) fishing activity, but these designations do not prohibit petroleum exploration activities in these areas. The planned drilling and associated activities will be characterized by a relatively small zone of influence (footprint), with other mitigations proposed and planned to avoid or reduce potential changes to and effects on these aspects of the biophysical environment.

5.4.4 Potential Environmental Effects (Accidental Events)

Based on the previously described modelling of unmitigated batch spills, total hydrocarbon concentrations would be highest in the immediate vicinity of the spill and would be limited in terms of overall magnitude, extent and duration, and thus, their potential adverse environmental consequences. Any such spills, in the event that they did occur, are unlikely to have a detectable effect on any special areas within the Project Area or beyond, and to measurably affect their key environmental and socio-

cultural characteristics, particularly with operational spill prevention plans and response procedures in place.

A subsurface well blowout represents the accidental event with the most potential to affect adjacent special areas. This is due to the potentially large amount of discharged oil that could conceivably be associated with a blowout event and the possibility for such a spill to extend to adjacent areas and resources.

The modelled uncontrolled well event at the EL 1144 example well site was shown to potentially overlap with a number of adjacent special areas, including 2 EBSAs, 11 NAFO FCAs, and six VMEs. The majority of these special areas (NAFO FCAs, VMEs) are designated due to the relative importance of bottom habitats including coral and sponges. Negligible oil on the sediments was predicted by the model (0.01 percent), and therefore a large-scale direct effect on bottom habitat is not anticipated. However, the two EBSAs do have some components of their designation that related to environmental components and processes above the seabed. For example, both have high seasonal aggregations of cetaceans and pinnipeds. These EBSAs are not predicted to have surface oil thickness above the ecological threshold. Similarly, for the EL 1150 example well site, such a spill event could overlap with five NAFO FCAs, and five VMEs. Again, negligible oil on the sediments was predicted by the model (0.02 percent), and therefore a large-scale direct effect on bottom habitat is not anticipated, and there was no predicted shoreline contact with hydrocarbons for this scenario.

A blowout event is a unlikely occurrence, especially with the various prevention measures that are required and committed to as outlined in the EIS. With the various spill response procedures outlined previously, it is considered unlikely that any of these special areas would be subject to oiling to the degree and duration that would result in a change in their overall, important and defining ecological and socio-cultural characteristics, resulting in a decrease in its overall integrity, value or use. In the unlikely instance that an accidental event such as a blowout did occur, the (conservative, without mitigation) oil spill modelling also predicts a very low probability of oil moving west and thus reaching the shoreline of Eastern Newfoundland and other areas of Atlantic Canada and any special areas within these regions.

5.5 Indigenous Peoples

A key focus of the EIS includes assessing and evaluating the potential for the Project, and the various changes to the environment that may be associated with it, to interact with and affect Indigenous peoples, including each of the socio-cultural aspects identified in Section 5(1)(c) of CEAA 2012.

5.5.1 Existing Environment (Description of the Baseline)

The EIS provides baseline socioeconomic information related to each of the Indigenous groups in Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Québec outlined in Section 5.1 of the EIS Guidelines (Table 5.5).

Table 5.5 Indigenous Groups in Eastern Canada Included in the EIS Guidelines

Province	Indigenous Groups
Newfoundland and Labrador	Labrador Inuit (Nunatsiavut Government)
	Labrador Innu (Innu Nation)
	NunatuKavut Community Council
	Miawpukek First Nation
	Qalipu Mi'kmaq First Nation Band
Nova Scotia	11 Mi'kmaq First Nation groups represented by KMKNO:
	- Acadia First Nation
	- Annapolis Valley First Nation
	- Bear River First Nation
	- Eskasoni First Nation
	- Glooscap First Nation
	- Membertou First Nation
	- Paqtnkek Mi'kmaw Nation
	- Pictou Landing First Nation
	- Potlotek First Nation
	- Wagmatcook First Nation
	- Waycobah First Nation
	Millbrook First Nation
	Sipekne'katik First Nation
New Brunswick	Eight Mi'gmaq First Nations groups represented by MTI
	- Fort Folly First Nation
	- Eel Ground First Nation
	- Pabineau First Nation
	- Esgenoôpetitj First Nation
	- Buctouche First Nation
	- Indian Island First Nation
	- Eel River Bar First Nation
	- Metepnagiag Mi'kmaq First Nation
	Elsipogtog First Nation
	Five Maliseet First Nation groups represented by WNNB:
	- Kingsclear First Nation
	- Madawaska Maliseet First Nation
	- Oromocto First Nation
	- Saint Mary's First Nation
	- Tobique First Nation
	Woodstock First Nation
	Peskotomuhkati Nation at Skutik (Passamaquoddy)
Prince Edward Island	Abegweit First Nation
	Lennox Island First Nation
Quebec	Three Mi'gmaq First Nation groups represented by MMS
	- Micmas of Gesgapegiag
	- La Nation Micmac de Gespeg
	- Listuguj Mi'gmaq Government
	Les Innus de Ekuanitshit
	Montagnais de Nutashkuan

This includes providing a brief overview of the background and current socioeconomic conditions of each group, including each of the items specified in the EIS Guidelines, specifically:

- Health and socio-economic conditions;
- Physical and cultural heritage;
- Current use of lands and resources for traditional purposes; and
- Structures, sites or things of historical, archaeological, paleontological or architectural significance

The existing environment description that follows focusses primarily on those socioeconomic components with potential for Project-related interactions and effects, in particular any current use of (marine-associated) lands and resources for traditional purposes.

5.5.2 Anticipated Changes to the Environment

Changes to the environment as a result of offshore oil and gas exploration activities and their potential, resulting effects on Indigenous peoples may be both direct and indirect in nature and cause. In terms of potential direct effects, the conduct of such exploration activities within Indigenous communities or in areas that are used by or otherwise important to these groups may result in reduced access to areas and resources due to required, safety-related access restrictions for defined periods. Project-related components and their "footprints" and other environmental disturbances, such as noise, light, air and water emissions, could also extend to and affect components of the environment that are used by or otherwise important to Indigenous peoples. This may, in turn, have implications for these communities and their health and well-being (physical or social), heritage and other socioeconomic characteristics. Indirect effects can also occur when projects and activities adversely affect fish, wildlife or other environmental components and systems, as these biophysical effects may, for example, reduce the availability or perceived quality of such resources and thus their use and value for traditional purposes.

The environmental effects assessment for this VC considers and focuses upon the following potential environmental effects:

- Change in Health and Socio-Economic Conditions;
- Change in the Current Use of Lands and Resources for Traditional Purposes;
- Change in Physical and Cultural Heritage; and
- Change in any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance

5.5.3 Potential Environmental Effects (Planned Project Components and Activities)

Given the nature, location and timing of the various marine activities and associated Project induced changes to the environment likely to occur as a result of this Project, it is not expected to have adverse effects on Indigenous people. As most Project-related activities will take place in the offshore marine environment, over 400 km from land (and at least 635 km from the closest Indigenous community) and because associated emissions and other disturbances are expected to be quite localized and short-term in nature, they are unlikely to extend to or affect the health (physical or social) and well-being or

other socioeconomic conditions of Indigenous peoples. While some Indigenous groups are known to undertake commercial fishing activities off Eastern Newfoundland, including some fisheries included under commercial-communal licences, Nexen is not aware that these or other Indigenous peoples assert Aboriginal or Treaty rights within or near the Project Area and LSA. Moreover, there are no documented food, social or ceremonial licenses in this area, nor do Indigenous groups otherwise undertake the current use of lands and resources for traditional purposes in this area.

The environmental effects analysis has also indicated that few of the marine associated resources (species) that are known to be used by these Indigenous groups migrate through the Project Area / LSA and are thus likely to be affected by Project activities and disturbances, and the implementation of the various mitigation measures and procedures outlined throughout the EIS will serve to further address direct or indirect potential effects on these resources. There is almost no potential for the availability or quality of resources that are currently used for traditional purposes by Indigenous groups to be reduced or negatively affected in other ways as a result of the Project, especially to a nature and to a degree that would alter the nature, location, timing, intensity or value of these activities or the health or heritage of Indigenous peoples.

5.5.4 Potential Environmental Effects (Accidental Events)

An accidental event such as a large batch spill or a blowout will be prevented through the application of mitigations measures in Project planning and implementation by Nexen, and reinforced through the various post-EA regulatory review processes and requirements that will apply to the proposed drilling activities that comprise this Project. The probability of such an accidental event occurring, and therefore resulting in adverse effects on this VC or any other component of the environment, is therefore very low.

Large diesel spills from Project related MODUs or vessels are unlikely to occur, and in the event that one were to occur, the relatively localized and short term nature of any resulting environmental disturbance and associated effects, coupled with the lack of Indigenous communities and activities in this offshore area, would mean that there is little or no potential for adverse effects on the various components of this VC. These would be responded to through the various response procedures outlined previously, which will further serve to prevent any adverse effects from occurring.

A blowout event is likewise very unlikely to occur, especially with the various prevention measures that are required and committed to in the EIS. In the unlikely event that an accidental event such as a blowout did occur, the (conservative, without mitigation) oil spill modelling predicts a very low probability of oil moving west and thus reaching the shoreline of Eastern Newfoundland and other areas of Atlantic Canada, and thus, coming into direct contact with any Indigenous communities or activities. As described for the various preceding biophysical VC, any such event is also not expected to result in significant adverse residual effects upon marine-associated biota, and would thus not likely have an effect on the presence, abundance, distribution or quality such resources in the area, and thus, their availability for resource use activities by these groups within their traditional harvesting areas. In particular, there would be little potential for such direct and/or indirect biophysical effects to translate into any decrease in the overall nature, intensity, distribution, quality or cultural value of these traditional activities by Indigenous peoples.

5.6 Fisheries and Other Ocean Uses

Fisheries and other ocean uses have been identified and included as a VC because of the economic and/or socio-cultural importance of these activities, their potential for interactions with planned Project-related components and activities.

5.6.1 Existing Environment (Description of the Baseline)

Marine fisheries and other human activities are important components of the socioeconomic environment of Newfoundland and Labrador and elsewhere in Eastern Canada. Commercial fisheries in the region off Eastern Newfoundland are managed by both DFO, primarily within the 200 nautical mile EEZ, and by NAFO, primarily beyond the EEZ, while aquaculture operations in coastal areas fall under provincial jurisdiction.

Commercial fisheries in and around this region are extensive and diverse, with the Project Area overlapping two NAFO Divisions and one Unit Area within each of these Divisions. The waters within and near the Project Area are the focus of fishing activities by a range of participants (both domestic and foreign) and species fisheries, primarily for snow crab and Northern shrimp in recent years (although Project Area shrimp fisheries have now been halted for conservation reasons), along with some redfish, turbot/Greenland halibut, Atlantic cod, Atlantic herring, American plaice, Atlantic halibut and others. These are both directed and by-catch fisheries using a variety of fixed and mobile gear types. Fishing activity in this area occurs year-round, but has been most concentrated in the May-July period in recent years. Seal harvesting also occurs off Eastern Newfoundland with most occurring in the spring to the north and west of the Project Area. Various fisheries science survey programs are also undertaken off Eastern Newfoundland by government and/or industry to aid with stock assessment and management decisions. Owing to the Project Area's distance from shore, no recreational/food fishery activities are known or expected to occur in or near the Project Area.

A variety of other human activities also take place on either a year-round or seasonal basis. General shipping traffic within and through the region includes marine tanker traffic and supply vessels associated with the existing offshore oil development and activities, as well as cargo ships, fishing vessel transits, and other vessel traffic. Naval training exercises also occur in the general area, and there are also known and potential unexploded ordnance (UXO) sites in the Atlantic Ocean, which include shipwrecks and submarines as well as munitions dump sites, none of which occur within the Project Area. A number of existing marine cable networks also cross through or near the region. The area off Eastern Newfoundland is also subject to considerable oil and gas exploration activity, including geophysical surveys and drilling programs, with many thousands of kilometers of seismic survey data collected and several hundred wells having been drilled to date. Offshore oil production activities have also been occurring since the 1990s, including several existing oilfields (Hibernia, Terra Nova, White Rose, Hebron). These offshore oil and gas exploration and development activities include a variety of ancillary and supporting activities as well.

5.6.2 Anticipated Changes to the Environment

The key potential environmental interactions between planned Project activities and fisheries and other marine activities, including the associated Project-related environmental changes and possible resulting environmental effects on this VC, include the following:

- Potential temporary loss of access to established fishing grounds due to Project activities and components, and a resulting decrease in value (economic or otherwise) of these fishing activities.

- The possibility of damage to fishing gear, vessels, equipment, or other components due to interactions between Project vessels, equipment, emissions or discharges and fishing activities.

- The possibility of interference with scheduled government / industry fisheries research activities, which might also affect research results and associated management decisions.

- The possibility of price implications resulting from market or consumer perception of a reduced quality of fish products (eg, taint).

- The possibility of indirect effects on fisheries due to changes in the abundance, distribution or availability of fish species on established fishing grounds.

- Potential interference or conflict with other offshore petroleum exploration activities (seismic and other surveys, supply and service vessels).

- Potential interference with other shipping in the area (commercial, pleasure craft, military operations).

- Potential direct physical conflicts with existing submarine infrastructure (subsea cables) or other human-made components (UXO, including Legacy Sites)

As a result of these identified environmental interactions, issues identified in the EIS Guidelines, and concerns raised through engagement, the assessment of Project-related environmental effects on this VC is focused on the following potential environmental effects:

- Direct interference with fishing or exclusion from established fishing grounds
- Damage to fishing gear or vessels
- Decreases in the abundance, distribution and actual or perceived quality of fisheries resources
- Direct contact with and damage to in situ components
- Interference with other marine activities

5.6.3 Potential Environmental Effects (Planned Project Components and Activities)

For fisheries and other ocean uses, possible Project-induced changes may result from a loss of access due to the presence of a temporary safety zone around Project equipment during exploration activities,

potential interference between Project components and fishing equipment, and biophysical changes to fish and fish habitat from Project activities that may affect the quality and availability of commercial fish resources. These interactions and potential effects may result in lost time, reduced catch volumes, lower economic returns on catches, and increased operational costs for fishers and other ocean users in the area.

The localized nature and short-term duration of Project activities, and the implementation of standard mitigation measures, will avoid or reduce the occurrence and magnitude of any such effects. Although the presence of the MODU and its safety zone and other planned Project activities will temporarily reduce access for fishing and other activities in certain areas, such interactions will be localized and of limited geographic extent as compared to the total fishing areas available in the region, as well as being temporary and reversible once Project activity ceases at a well or survey site. To help mitigate such effects, Notice to Shippers, Notice to Mariners, and other communication protocols will be implemented.

In the unlikely event of fishing gear damage, Nexen will implement a fishing gear damage compensation program, consistent with previous oil and gas exploration drilling programs.

5.6.4 Potential Environmental Effects (Accidental Events)

In the case of an accidental event such as a batch spill or a blowout, the potential for negative interactions with fish harvesting and other ocean uses is likely to be greater than from planned activities, although the actual effects from any such event will depend on the interaction of several factors such as the quantity and type of hydrocarbons released, the specific location of the release, the time of year (in particular, what fisheries and other activities are occurring then), the prevailing environmental conditions at the time, the duration of the hydrocarbon release, the location of hydrocarbons in the water column, the effectiveness of clean-up or other response actions and, overall, the fate of the released substance. These conditions will determine the severity of the effects of a spill, and the type and extent of any effects on fisheries. Other ocean uses (particularly any activities at or near the ocean surface) could also be impeded by the presence of an oil slick and clean-up activities, which would have to be avoided while present.

Based on the result of spill modelling exercises, Project response plans and mitigation provisions, and the availability of financial compensation, the predicted residual environmental effects from an accidental event on fisheries and other ocean uses are likely to be of low magnitude overall. Not only is a large spill unlikely, but if it were to occur, its extent and duration would be reduced through response measures, and affected fishers would be compensated under Nexen's Compensation Program, which includes provisions for lost and future lost income replacement, following the C-NLOPB *Compensation Guidelines Respecting Damages relating to Offshore Petroleum Activities.*

Spill prevention techniques and response measures will be incorporated into the design and operations for all Project activities as part of contingency planning, which will further help to ensure that effects do not occur, and in the unlikely event they did, help avoid or reduce any adverse effects on fisheries and other ocean uses.

5.7 Atmospheric Environment

The atmospheric environment includes various components of the physical environment, including air quality and greenhouse gas (GHG) levels. The main potential interactions between planned Project activities and the atmospheric environment relate to the air emissions associated with Project-related equipment and other activities such as well testing and evaluation.

5.7.1 Existing Environment (Description of the Baseline)

The existing ambient air quality within the Project Area can be generally categorized as good, and is likely occasionally and locally influenced by exhaust emissions from marine vessel and aircraft traffic and from the operations of the existing oil production platforms and other sources.

5.7.2 Anticipated Changes to the Environment

Atmospheric emissions resulting from planned Project activities will include exhaust from the MODU(s), supply vessels and aircraft and their associated equipment (such as on-board power generators), as well as emissions from the storage and flaring of hydrocarbons associated with well testing if and as required.

The potential environmental effects of the Project on this VC that are considered and assessed in the EIS include:

- Change in Air Quality
- Change in GHG Levels

5.7.3 Potential Environmental Effects (Planned Project Components and Activities)

Anticipated air emissions from Project-related sources include products of fuel combustion, mainly criteria air contaminants (CACs, particulate matter, carbon monoxide [CO], sulphur oxides [SO_x], nitrogen oxides [NO_x]) and GHGs. Three classes of particulates were considered: total particulate matter (TPM), fine particulate matter less than 10 microns (PM_{10}) and fine particulate matter less than 2.5 microns ($PM_{2.5}$). Detailed calculations of the various air emissions that will be associated with the Project, by key component and activity, is provided in Chapter 14 of the EIS.

The environmental effects assessment for this VC has indicated that atmospheric emissions from planned Project activities will produce a localized, transient effect on air quality. Also, since the predicted GHG emissions from the Project are low and not significant in comparison to GHG targets, the Project will have virtually no effect on current estimates of future global climate change.

5.8 Environmental Effects Assessment Summary

Tables 5.6 and 5.7 provide a summary of the environmental effects assessments and evaluations for each of the VCs for planned Project activities and accidental events, respectively.

KEY FOR TABLES 5.6 AND 5.7

Nature / Direction:

P	Positive
A	Adverse
N	Neutral (or No Effect)

Magnitude:

N	Negligible
L	Low
M	Medium
H	High

Geographic Extent:

L	Localized, In Immediate Vicinity of Activity
PA	Within Project Area
LSA	Within LSA
RSA	Within RSA or Beyond

Frequency:

N	Not likely to occur
O	Occurs once
S	Occurs sporadically
R	Occurs on a regular basis
C	Occurs continuously

Duration:

S	Short term (For duration of the activity / disturbance)
M	Medium term (Beyond duration of the activity / disturbance – weeks or months)
L	Long term (Beyond duration of the activity / disturbance – years)
P	Permanent (Recovery unlikely)

Reversibility:

R	Reversible (Will recover to baseline)
I	Irreversible (Permanent)

Certainty in Predictions:

L	Low level of confidence
M	Moderate level of confidence
H	High level of confidence

Significance:

N	Not Significant
S	Significant

Note: See significance definitions provided for each VC in Chapters 8-14.

n/a	Not Applicable

Table 5.6 Summary of Predicted Residual Effects for Planned Project Activities

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in habitat availability and quality Change in food availability and quality Change in fish mortality, injury, health Change in fish presence and abundance (behavioral effects)	Presence and Operation of MODUs	See Table 6.1	A	L	L-LSA	S-M	R	R	H	N	N/A
			Drilling and Associated Marine Discharges		A	L	L-LSA	M-L	C	R	H	N	N/A
			Vertical Seismic Profiling		A	L	LSA	S	S	R	H	N	N/A
			Well Testing		A	L	L	S	S	R	H	N	N/A
			Well Abandonment or Suspension		A	N-L	L	S	S	R	H	N	N/A
			Supply and Servicing		A	L	L	S	R	R	H	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in mortality / injury levels and bird health Change in avifauna presence and abundance (behavioral effects)	Presence and Operation of MODUs	See Table 6.1	A	L	L-LSA	S-M	R	R	H	N	N/A
			Drilling and Associated Marine Discharges		N-A	N	L	S	S	R	H	N	N/A
			Vertical Seismic Profiling		N-A	N	L	S	S	R	H	N	N/A
			Well Testing		A	L	L-LSA	S	S	R	H	N	N/A
			Well Abandonment or Suspension		N	-	-	-	-	-	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
		Change in habitat availability and quality Change in food availability or quality	Supply and Servicing		A	L	L	S	R	R	H	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in mortality / injury levels and health Change in habitat availability, quality and use Change in food availability or quality	Presence and Operation of MODUs	See Table 6.1	A	L-M	L-LSA	S-M	R	R	M	N	N/A
			Drilling and Associated Marine Discharges		A	N	L	S	S	R	H	N	N/A
			Vertical Seismic Profiling		A	L	L-LSA	S	S	R	H	N	N/A
			Well Testing		A	N-L	L-PA	S	S	R	H	N	N/A
			Well Abandonment or Suspension		A	N-L	L	S	S	R	H	N	N/A
			Supply and Servicing		A	L	L	S	R	R	H	N	N/A
Special Areas	s. 5(1)(b)(i)	Possible change in environmental features and/or processes	Presence and Operation of MODUs	See Table 6.1	N-A	N	L	S	R-S	R	H	N	N/A
			Drilling and Associated Marine Discharges		N-A	N	L	S	S	R	H	N	N/A
			Vertical Seismic		N-A	N	L	S	S	R	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
		Possible change in human use and/or societal value	Profiling										
			Well Testing		N-A	N	L	S	S	R	H	N	N/A
			Well Abandonment or Suspension		N-A	N	L	S	S	R	H	N	N/A
			Supply and Servicing		N-A	N	L	S	R	R	H	N	N/A
Indigenous Peoples	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Health and Socio-Economic Conditions Change in the Current Use of Lands and Resources for Traditional Purposes Change in Physical and Cultural Heritage Change in any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance	Presence and Operation of MODUs	See Table 6.1	N	-	-	-	-	-	H	N	N/A
			Drilling and Associated Marine Discharges		N	-	-	-	-	-	H	N	N/A
			Vertical Seismic Profiling		N	-	-	-	-	-	H	N	N/A
			Well Testing		N	-	-	-	-	-	H	N	N/A
			Well Abandonment or Suspension		N	-	-	-	-	-	H	N	N/A
			Supply and Servicing		N	-	-	-	-	-	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
Fisheries and Other Ocean Uses	s. 5(2)(b)(i)	Direct interference with fishing activity or exclusion from established fishing grounds Damage to fishing gear or vessels Decreases in the abundance, distribution and actual or perceived quality of fisheries resources Direct contact with and damage to in situ component Interference with other marine activities	Presence and Operation of MODUs	See Table 6.1	A	L	L-PA	S-M	R	R	H	N	N/A
			Drilling and Associated Marine Discharges		N-A	N	L-PA	S-M	S	R	H	N	N/A
			Vertical Seismic Profiling		N-A	N	L	S	S	R	H	N	N/A
			Well Testing		N-A	N	L	S	S	R	H	N	N/A
			Well Abandonment or Suspension		N-A	N	L	S-P	S	R-I	H	N	N/A
			Supply and Servicing		N-A	N	L	S	R	R	H	N	N/A
Atmospheric Environment	s. 5(2)(a)	Change in air quality Change in GHG levels	Presence and Operation of MODUs	See Table 6.1	A	L	L-LSA	S	C	R	H	N	N/A
			Drilling and Associated Marine Discharges		N	-	-	-	-	-	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
			Vertical Seismic Profiling		A	L	L-LSA	S	S	R	H	N	N/A
			Well Testing		A	L	L-LSA	S	S	R	H	N	N/A
			Well Abandonment or Suspension		A	L	L-LSA	S	S	R	H	N	N/A
			Supply and Servicing		A	L	L-LSA	S	R	R	H	N	N/A

Table 5.7 Summary of Predicted Residual Effects for Accidental Events

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity (Potential Event)	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in habitat availability and quality Change in food availability and quality Change in fish mortality, injury, health Change in fish presence and abundance (behavioral effects)	100 litre Diesel Spill	See Table 6.1	A	N-L	L-PA	S	N-O	R	H	N	N/A
			1,000 litre Diesel Spill		A	L-M	L-PA	M	N	R	M	N	N/A
			750,000 litre Diesel Spill		A	L-M	RSA	M	N	R	M	N	N/A
			SBM Spill		A	N-L	L-PA	S	N	R	H	N	N/A
			Subsurface Blowout – EL 1144 Example Well Site		A	M	RSA	M-L	N	R	M	N	N/A
			Subsurface Blowout – EL 1150 Example Well Site		A	M	RSA	M-L	N	R	M	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in mortality / injury levels and bird health Change in avifauna presence and abundance (behavioral effects) Change in habitat availability and quality	100 litre Diesel Spill	See Table 6.1	A	L	L-PA	S	N-O	R	H	N	N/A
			1,000 litre Diesel Spill		A	M	PA-LSA	M	N	R	M	N	N/A
			750,000 litre Diesel Spill		A	M	RSA	M	N	R	M	N	N/A
			SBM Spill		A	N-L	L-PA	S	N	R	H	N	N/A
			Subsurface Blowout – EL 1144 Example Well Site		A	M-H	RSA	M-L	N	R	M	S	Low

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity (Potential Event)	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
		Change in food availability or quality	Subsurface Blowout – EL 1150 Example Well Site		A	M-H	RSA	M-L	N	R	M	S	Low
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in mortality / injury levels and health Change in habitat availability, quality and use Change in food availability or quality	100 litre Diesel Spill	See Table 6.1	A	N-L	L-PA	S	N-O	R	H	N	N/A
			1,000 litre Diesel Spill		A	L	L-PA	S	N	R	M	N	N/A
			750,000 litre Diesel Spill		A	L-M	RSA	S-M	N	R	M	N	N/A
			SBM Spill		A	N-L	L-PA	S	N	R	H	N	N/A
			Subsurface Blowout – EL 1144 Example Well Site		A	L-M	RSA	M-L	N	R	M	N	N/A
			Subsurface Blowout – EL 1150 Example Well Site		A	L-M	RSA	M-L	N	R	M	N	N/A
Special Areas	s. 5(1)(b)(i)	Possible change in environmental features and/or processes Possible change in human use and/or societal value	100 litre Diesel Spill	See Table 6.1	A	N-L	L-PA	S	N-O	R	H	N	N/A
			1,000 litre Diesel Spill		A	L-M	L-PA	M	N	R	M	N	N/A
			750,000 litre Diesel Spill		A	L-M	L-RSA	M	N	R	M	N	N/A
			SBM Spill		N	-	-	-	N	-	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity (Potential Event)	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
			Subsurface Blowout – EL 1144 Example Well Site		A	M	RSA	M-L	N	R	M	N	N/A
			Subsurface Blowout – EL 1150 Example Well Site		A	M	RSA	M-L	N	R	M	N	N/A
Indigenous Peoples	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Health and Socio-Economic Conditions Change in the Current Use of Lands and Resources for Traditional Purposes Change in Physical and Cultural Heritage Change in any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance	100 litre Diesel Spill	See Table 6.1	N	-	-	-	-	-	H	N	N/A
			1,000 litre Diesel Spill		N	-	-	-	-	-	H	N	N/A
			750,000 litre Diesel Spill		N	-	-	-	-	-	M	N	N/A
			SBM Spill		N	-	-	-	-	-	H	N	N/A
			Subsurface Blowout – EL 1144 Example Well Site		A	N-L	RSA	M-L	N	R	M	N	N/A
			Subsurface Blowout – EL 1150 Example Well Site		A	N-L	RSA	M-L	N	R	M	N	N/A
Fisheries and Other Ocean	s. 5(2)(b)(i)	Direct interference with fishing activity or	100 litre Diesel Spill	See Table 6.1	A	N-L	L-PA	S	N-O	R	H	N	N/A

VC	Area of Federal Jurisdiction (CEAA 2012 Section)	Potential Effects	Project Activity (Potential Event)	Mitigation	Residual Effect Characterization							Significance of Residual Effect	Likelihood of Significant Effect
					Nature	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty		
Uses		exclusion from established fishing grounds Damage to fishing gear or vessels Decreases in the abundance, distribution and actual or perceived quality of fisheries resources Direct contact with and damage to in situ component Interference with other marine activities	1,000 litre Diesel Spill		A	L	PA	M	N	R	H	N	N/A
			750,000 litre Diesel Spill		A	L	PA-RSA	M	N	R	M	N	N/A
			SBM Spill		A	N	L	S	N	R	H	N	N/A
			Subsurface Blowout – EL 1144 Example Well Site		A	L	RSA	M-L	N	R	M	N	N/A
			Subsurface Blowout – EL 1150 Example Well Site		A	L	RSA	M-L	N	R	M	N	N/A

5.9 Effects of the Environment on the Project

The physical environmental setting of an area is an important consideration in the planning, review and conduct of offshore oil and gas exploration activities. An appropriate understanding, and careful consideration, of environmental characteristics and phenomena such as winds, waves, currents, ice, precipitation and other factors is required so that offshore activities can be designed and implemented appropriately, and in a manner that helps ensure that human health and safety and the environment, as well as ensuring that equipment and infrastructure are protected. This includes avoiding or reducing the potential for any incidents and accidents that may occur as a result of unplanned interactions between oil and gas operations and the physical environment of the marine area in question.

Some of the key environmental factors that could adversely affect the Project include severe weather conditions (such as high winds, low visibility and freezing precipitation), superstructure icing, extreme waves and ocean currents, as well as sea ice and icebergs. Seismicity and geological stability are also considerations, although such events have a low probability of occurrence.

The primary mitigation measures for such potential effects include appropriate engineering design and equipment selection, and adherence to applicable regulatory requirements and guidelines, operational procedures, and standard offshore industry practices. Additionally, as the proposed exploration activities that comprise this Project have a relatively short duration and do not involve the development of fixed offshore infrastructure, the likelihood of an extreme event and associated effects occurring are greatly reduced. Appropriate design and operational standards and regulations will be adhered to, and meteorological, oceanographic and ice conditions will be constantly monitored and considered in planning and decision-making throughout the life of the Project. All of these measures will help to reduce the potential for, and possible magnitude of, any adverse effects of the environment on the Project.

5.10 Cumulative Environmental Effects

The EIS assesses and evaluates any cumulative environmental effects that are likely to result from the Project in combination with other physical activities that have been or will be carried out, as well as the significance of these potential effects.

5.10.1 Approach and Methods

The cumulative effects assessment considers the overall (total) effect on the VCs as a result of any predicted effects resulting from the Project and those of other relevant projects and activities in the RSA. In terms of its scope, the cumulative effects assessment focusses upon the same set of VCs as those considered in the Project-specific analysis, as these represent the key components of the environment that may be affected by the Project, and thus, which it may contribute to cumulative effects upon. The spatial and temporal boundaries for the cumulative effects assessment are also consistent with those established for the Project-specific assessment (see earlier LSA and RSA definitions, Section 4.3), as these were defined to incorporate the likely geographic and temporal zones of influence of the Project and its effects, the overall distributions of the various biota and human activities that comprise the VCs, and the other physical activities that may affect the same individuals or populations.

Past and on-going projects and activities and their environmental effects are reflected in the existing (baseline) environmental conditions for each VC (see above Sections 5.1 to 5.8). The current condition of the VC as a result of natural and anthropogenic factors, and thus its overall sensitivity or resiliency to further change, has been considered throughout the effects assessments. The assessment considers how this existing environmental condition may be changed by the Project, and then, whether and how the effects of other on-going and future projects and activities would affect the same VCs through direct overlap in space and time and/or by affecting the same individuals or populations. The following other projects and activities are considered in the cumulative effects assessment for each VC as relevant: 1) Existing oil production projects (Hibernia, Terra Nova, White Rose and Extension, Hebron; 2) Offshore petroleum exploration programs (seismic, drilling and others); 3) Fishing activity; 4) Other marine vessel traffic; and 5) Hunting.

The assessment also includes the consideration of mitigation measures to avoid or reduce potential environmental (including cumulative) effects, and evaluates the significance of predicted cumulative effects on each VC using the same criteria used for the Project-specific effects assessment

5.10.2 Marine Fish and Fish Habitat (Including Species at Risk)

Marine fish and their habitats in the Project Area, RSA and in the larger Northwest Atlantic have been and are being affected by a variety of natural and anthropogenic factors and processes. These include past and on-going fishing activity, offshore petroleum exploration and production, general vessel traffic and other human activities, as well as illegal activities and accidental events, as well as the effects of climate change and other natural and anthropogenic processes. These have collectively, and to varying degrees, influenced the presence, distribution and abundance of fish and invertebrate species in particular areas and times, as well as the overall size and health of fish populations and the availability and quality of their habitats.

Offshore exploration drilling and associated activities such as those that will comprise this Project may affect marine fish and fish habitat in various ways, including possible injury, mortality or behavioral effects due to noise or other disturbances in the marine environment, effects to benthic communities through the alteration of marine habitats and change in habitat quality from discharges or accidental events. Although the Project will interact with fish and their habitats within parts of the Project Area, it will entail a relatively minor, localized and short-term environmental disturbance at any one location, with various mitigation measures being implemented to avoid or reduce the magnitude, geographic extent and duration of any such effects.

While other oil and gas exploration and production activities have similar effects on fish and fish habitat within their respective zones of influence, their EAs and/or associated environmental effects monitoring (EEM) programs indicate that these have somewhat localized environmental effects. The planned and required distances between Project activities other oil and gas programs and fishing activities (due to EL boundaries and safety zones) will further decrease the potential for interactions between effects. This will reduce the potential for individuals and populations to be affected through multiple interactions with this Project and other activities in the marine environment, and for species to be affected simultaneously and repeatedly by multiple activities, and thus, for cumulative environmental effects to occur.

5.10.3 Marine and Migratory Birds (Including Species at Risk)

The distribution, abundance and health of marine and migratory birds and their populations are often influenced by both natural phenomena such as weather, food availability and oceanographic variation, as well as human activities and their associated disturbances including hunting, fishing activity, vessel traffic, offshore structures and pollution. In addition to these local disturbances, migratory bird species may also be affected by a variety of activities and associated effects within their often very extensive ranges. Although the populations of most marine-associated bird species occurring off Eastern Newfoundland are considered stable overall, some species such as the Leach's Storm-petrel have seen declines in recent years.

Potential interactions with marine and migratory birds as a result of the Project relate primarily to possible attraction and/or disorientation of the birds around the MODU and vessels due to artificial light sources. Because any such interactions are anticipated to be minor and spatially and temporally limited, and given the typically wide variation in marine bird presence and distribution in space and time throughout this very large offshore area, the number of individuals affected by the Project is not expected to have population-level effects, nor to interact cumulatively with similar effects from other projects and activities in the region. The environmental zone of influence of each project and activity in the region is typically localized (especially with regards to the effects of lights and other such disturbances), often short-term, and very small compared with the total amount of habitat available in the region. This reduces the potential for individuals and populations to be affected repeatedly through multiple interactions with this Project, as well as the potential for, and degree and duration of, overlap between the effects of this Project and other activities in this marine environment.

5.10.4 Marine Mammals and Sea Turtles (Including Species at Risk)

The potential effects of human activities on marine mammals and sea turtles include possible hearing impairment or permanent injury or mortality from exposure to loud underwater noise, as well as behavioural effects (avoidance) due to these or other disturbances, which may alter the presence, abundance and distribution of these species and their health, movements, communications, feeding and other activities. The migratory nature of most species and their overall sensitivity to certain types of disturbance somewhat increases the potential for individuals to be affected by multiple environmental disturbances, and thus, for cumulative effects to occur. This is reflected in the fact that many species have been designated as being at risk or are otherwise of conservation concern.

Potential interactions with marine mammals and sea turtles as a result of this Project relate primarily to possible injury or disturbance (behavioural effects) from the noise, lights and possible waste materials associated with the MODU and other related vessel and aircraft traffic. Potential for Project-VC interactions is likely to be highly transient and temporary for individuals, especially in consideration of the large-scale daily and seasonal fluctuations in presence within the assessment areas and the alternative habitats available. Mitigation measures will be applied across a number of Project components and activities and will help prevent or reduce potential interactions with this VC.

Other on-going and future activities which may affect marine mammals and sea turtles in the RSA include the fisheries, general vessel traffic and other offshore oil and gas exploration and development activities. Based on previous studies, most potential effects as a result of these activities occur within

relatively close proximity (several kilometers) of the source, although this propagation of underwater noise in the marine environment results in some potential for overlap and interactions between individual disturbances. Behavioural effects as a result of most such activities would however be temporary in nature, and this along with the known and likely spatial distribution of these activities will reduce the potential for, and degree and duration of, interaction or accumulation between the effects of the Project and other activities in the marine environment. Marine mammals and sea turtles will therefore not likely be displaced from key habitats or during important activities, or be otherwise affected in a manner that causes adverse and detectable effects to populations.

5.10.5 Special Areas

Special areas of various types are located off Eastern Newfoundland, including coastal and marine areas that have been designated as protected through legislated processes or formally identified through other initiatives. The current environmental conditions within these special areas reflect the occurrence and environmental consequences of past and ongoing anthropogenic activities and natural processes within and beyond their boundaries. In some cases, special areas are designated to help conserve the presently pristine nature of these areas, while in others their designation helps prevent further damage to already affected and thus sensitive environments.

Although the Project Area overlaps with a number of special areas off Eastern Newfoundland, there are no prohibitions of the types of activities being planned as part of this Project. Moreover, given the overall nature, scale and duration of the planned Project activities, the overall and defining biophysical and socioeconomic environments within these areas will not be adversely affected by it. While there is some potential for other types of human activities (such as oil and gas exploration or fishing activity) to have varying degrees of effect on the same special areas that may interact with this Project, most such activities result in a short-term disturbance within a relatively limited zone of influence, with applicable mitigation measures implemented avoid or reduce their environmental consequences. This reduces the potential for particular areas and their environmental characteristics to be affected simultaneously and repeatedly by multiple projects and activities, to a degree and duration that will affect their defining characteristics and overall integrity.

5.10.6 Indigenous Peoples

Other past and on-going projects and activities in Eastern Canada have, to varying degrees, interacted with and affected Indigenous peoples, depending on their location, nature and scale in relation to the communities, activities and other components and interests of individual groups. The description of the socioeconomic characteristics of these Indigenous communities provided in the EIS inherently reflects such past and on-going activities and effects.

Given the nature, location and timing of the various activities and associated environment changes likely to occur as a result of this Project, it is not expected to have direct, adverse effects on Indigenous communities and activities. The effects analysis also indicates that few of the marine associated resources (species) that are known to be used by these Indigenous groups migrate through the Project Area / LSA and are thus likely to be affected by Project activities and disturbances. The Project will therefore not result in residual environmental effects on Indigenous peoples, and will therefore not result in or contribute to cumulative effects on this VC.

5.10.7 Fisheries and Other Ocean Uses

Fisheries and other ocean uses may be affected both individually and collectively by offshore oil and gas exploration and production, general marine traffic and other activities, each of which may result in direct disturbance, damage to equipment, effects on marine resources or other interactions, which may accumulate or interact on a regional scale. The extensive and dynamic nature of fishing and other marine activity throughout the region (in terms of locations, seasons, gear types and key species), and possible future changes in the fisheries off Eastern Newfoundland, makes it difficult to predict specific areas and times from year to year for both domestic and foreign activities, and thus, the potential for interactions between the effects of separate projects on these.

Although Project components and activities, including the associated safety zones, will temporarily reduce access for fishing and other activities in certain areas, such disturbances will be localized, short term, and reversible once Project activity ceases at a particular location. The potential for interference by offshore oil and gas MODUs and vessels as well as general marine traffic can be further mitigated through good communication and cooperation between industries, with fishing gear damage compensation initiatives being implemented as required. These mitigation measures will apply to the Project and other oil and gas activities in the region. This, along with the relatively localized and in most cases short-term duration of these disruptions, and the amount of alternative fishing areas available, mean that detectable, cumulative effects are unlikely.

5.10.8 Atmospheric Environment

The analysis of the anticipated types and levels of Project-related air emissions and their contribution to regional ambient air quality and GHG levels has shown that the Project will make a negligible contribution to same, and therefore will not result in or contribute to detectable effects on the atmospheric environment overall. As a result, the Project will not result in detectable effects on regional air quality, nor will its emissions likely interact with those of other projects and activities.

5.10.9 Cumulative Effects Summary

The Project is not likely to result in significant adverse cumulative environmental effects to any VC in combination with other projects and activities that have been or will be carried out. Moreover, the relative contribution of this Project to overall effects within the RSA will be low, and will not likely be perceptible. Mitigation and monitoring or follow-up programs identified as part of the Project-specific effects assessment (Chapter 8) would be applicable to cumulative effects, in that they are relevant to addressing the Project's potential contribution to cumulative effects in the region. No additional or revised mitigation, monitoring or follow-up is required or proposed related specifically to cumulative environmental effects.

6 MITIGATION MEASURES

Mitigation measures, as defined under CEAA 2012, refer to measures for the elimination, reduction or control of a project's potential adverse environmental effects. To help avoid or reduce the potential adverse effects of the Project, general and issue-specific mitigation measures are identified and proposed in the EIS, based upon current industry practice and standards, applicable regulatory requirements, those suggested through Nexen's engagement with regulatory authorities, stakeholders and Indigenous groups, and as defined through the professional judgment of the EIS team. A summary of the various mitigation measures and commitments set out in the EIS is provided in Table 6.1

The application of these mitigation measures was considered in fully integrated manner in the previously summarized environmental effects assessment. This includes technically and economically feasible measures that have been "built-in" to the Project through its planning and design, so as to avoid or reduce potential adverse environmental effects proactively, those required by applicable regulations and guidelines, as well as any other mitigation measures identified by Nexen as part of the effects analysis that is reported in the EIS and summarized herein.

Table 6.1 Summary of Proposed Mitigation and Their Relevance to each VC

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Special Areas	Indigenous Peoples	Fisheries and Other Ocean Uses	Atmospheric Environment
Planned Project Components and Activities							
The selection and screening of chemicals will be undertaken pursuant to the *Offshore Chemical Selection Guidelines*. Where technically feasible, lower toxicity drilling fluids and chemicals will preferentially be used.	●	●	●	●	●	●	
Treating operational discharges (such as sewage, deck drainage, bilge / cooling water, wash fluids, produced water, other waste) prior to release in compliance with the *Offshore Waste Treatment Guidelines,* MARPOL and other applicable regulations and standards.	●	●	●	●	●	●	
Oil-water separators will be used to treat contained oil-contaminated fluids, with collected oil properly stored and disposed of.	●	●	●	●	●	●	
Appropriate measures for the handling, storage, transportation and on-shore disposal of solid and hazardous wastes will be implemented throughout the Project.	●	●	●	●	●	●	
Complying with the *Canadian Environmental Protection Act,* the National Ambient Air Quality Objectives, the Newfoundland *Air Pollution Control*	●	●	●	●	●	●	●

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	**Marine and Migratory Birds**	**Marine Mammals and Sea Turtles**	**Special Areas**	**Indigenous Peoples**	**Fisheries and Other Ocean Uses**	**Atmospheric Environment**
Regulations, and MARPOL Regulations for criteria air contaminants in exhaust.							
During drilling activities that occur after the riser has been installed, SBM associated drill cuttings will be returned to the MODU and treated in accordance with the *Offshore Waste Treatment Guidelines* before being discharged to the marine environment. SBM drill cuttings are typically discharged below the sea surface in order to maximize their dispersion and thus, to help avoid or reduce any associated surface sheen and their accumulation on the seabed.	●	●	●	●	●	●	
Project-related artificial lighting will be minimized to the greatest extent possible without compromising safety.	●	●	●	●	●	●	
Local vessels, MODUs and equipment will be used where technically suitable and available to reduce the potential for introduction of aquatic invasive species. All foreign vessels used for the Project operating in Canadian jurisdiction will comply with the *Ballast Water Control and Management Regulations* of the *Canada Shipping Act, 2001* during any ballasting and de ballasting activities. This may include requiring all foreign vessels and MODUs to carry out ballast tank or system flushing prior to arriving in Canadian waters to mitigate the spread of alien invasive species.	●	●	●	●	●	●	
Prior to the start of drilling activity a seabed investigation will be undertaken with a drop camera / video system to investigate the potential presence of sensitive benthic organisms or habitats in the immediate area of the wellsite. Should coral colonies be observed within or in proximity to a planned wellsite location, a 100 m "set-back" from these organisms will be applied to avoid or reduce the potential for direct interaction with sensitive organisms or other potential effects (such as smothering or sedimentation from drill cuttings disposal or sedimentation). If moving the wellsite in this manner is not feasible, Nexen will consult with the C-NLOPB to determine an appropriate course of action.	●			●	●	●	
During any associated well testing, any produced hydrocarbons and small amounts of produced	●	●	●	●	●	●	

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Special Areas	Indigenous Peoples	Fisheries and Other Ocean Uses	Atmospheric Environment
water will be flared using high-efficiency burners. If there is a significant amount of produced water encountered, it will be treated in accordance with the relevant regulatory requirements prior to ocean discharge.							
Nexen will operate in compliance with the relevant aspects of the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*. Seismic sound levels for VSP will be kept at the minimum level possible based on the associated technical requirements for the survey	●	●	●	●	●	●	
At the commencement of the VSP survey, a gradual "ramp-up" procedure of the seismic sound array will be implemented to allow any mobile marine animals to move away from the area if they are disturbed by it. There will also be a planned shut-down of the seismic sound arrays or reduction to the smallest, single source element during any required maintenance activities.	●	●	●	●	●	●	
Trained marine mammal observers (MMOs) will monitor and report on marine mammal and sea turtle sightings during VSP surveys. This will enable sound source array shutdown or delay actions to be implemented if marine mammal or sea turtle species listed on Schedule 1 of the SARA are detected within the monitored exclusion zone			●	●	●		
If removal of the wellhead is required as part of abandonment procedures, it will be done completed via mechanical separation (i.e., cutting, as opposed to the use of explosives). , which will limit underwater activity and introduced sound.	●		●	●	●	●	
Nexen will operate in accordance with the *Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area*.		●		●	●		
Where possible, known and observed bird colonies, other significant aggregations of avifauna, and other identified sensitive areas will be avoided in the conduct of Project-related exploration activities as per requirements of the *Seabird Ecological Reserve Regulations, 2015*.		●		●	●		

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	**Marine and Migratory Birds**	**Marine Mammals and Sea Turtles**	**Special Areas**	**Indigenous Peoples**	**Fisheries and Other Ocean Uses**	**Atmospheric Environment**
The frequency of vessel and aircraft traffic transits associated with the Project will be minimized to the extent possible.		●		●	●	●	●
Maceration of sewage and kitchen waste will be conducted in accordance with MARPOL and the *Offshore Waste Treatment Guidelines*.	●	●	●	●	●	●	
Flaring will be kept to the minimum amount necessary to characterize the hydrocarbon accumulation and as necessary for the safety of the operation. High efficiency burners will be used when flaring is required, and the Project will consider flare shields if technically and safely feasible. Nexen will notify the C-NLOPB of plans to flare so that the Board may consult with Environment and Climate Change Canada – Canadian Wildlife Service (ECCC-CWS) to determine a safe timeline to proceed to minimize effects on migratory birds.		●		●	●		●
Routine searches for stranded birds will be conducted on the MODUs and supply vessels, and appropriate programs and protocols for the collection and release of marine and migratory birds will be implemented for any birds that become stranded. Nexen will obtain the necessary Seabird Handling Permit from ECCC-CWS.		●		●	●		
Existing and common vessel travel routes will be used wherever practical, vessels will seek to maintain a steady course and vessel speed			●	●	●	●	
There will be continuing communications and regular information exchanges (FFAW-Unifor, DFO Science Branch, One Ocean, other stakeholders) about current fishing plans and current Project activities. It is also expected that regular updates will be submitted to the C-NLOPB before each year's operations commence, which will report on recent information exchanges, updates, any changes in the fisheries (including any new fisheries) and current-year Project plans and schedules and associated mitigations.						●	
At-sea monitoring of and direct communications with vessels (radar, automatic identification system (AIS), direct at-sea radio communications), and use of AIS by all sea-going Project vessels.						●	

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Special Areas	Indigenous Peoples	Fisheries and Other Ocean Uses	Atmospheric Environment
The establishment and communication of identified safety zones (with ship hailing protocols and other measures) to protect the safety of personnel and equipment and eliminate the risk of fishing gear or vessel damage near the MODU.						●	
The establishment, implementation and communication of a *Fishing Gear Damage or Loss Compensation Program*, in accordance with applicable C-NLOPB requirements, to address any unplanned interactions between Project components and commercial fishing equipment.						●	
The use of a Fisheries Liaison Officer (FLO) on board vessels and during MODU movements as appropriate; the requirement for this to be determined in discussion with regulatory authorities and the FFAW-Unifor in accordance with the Risk Management Matrix Guidelines developed by One Ocean.						●	
The designation and use of a Single Point of Contact (SPOC) during marine operations to facilitate project-fishing industry communications in real time, and to respond to gear / vessel damage claims.						●	
Notices to Shipping / Notices to Mariners for planned Project activities (including activity, safety zones, installation locations and timing), and information about contacting Project representatives (e.g. the SPOC).						●	
The communication of the locations of any wellheads left in place to harvesters and other marine users and appropriate authorities for inclusion on nautical charts for the information of commercial fishers and other mariners as applicable.						●	
Surveying drill locations for the presence of UXOs and shipwrecks before equipment is placed and drilling begins; treatment of suspected UXO according to Notices to Mariners Annual Edition (2017) Section 37, and reporting to DND.						●	
Avoiding existing subsea cables within the ELs when deciding on drilling locations.						●	
Identification and avoidance of other offshore petroleum installations and their safety zones.						●	

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Special Areas	Indigenous Peoples	Fisheries and Other Ocean Uses	Atmospheric Environment
Identifying a specific point of contact for MARLANT queries and concerns, and to ensure engagement of CPF 84, through Director General Naval Strategic Readiness (DGNSR), to ensure de-confliction with possible Allied submarine activities.						●	
Awareness of and adherence to relevant sections of Section F (National Defense – Military Notices) of Notices to Mariners Annual Edition (2017) with respect to possible military activities.						●	
Overall adherence to the *Canada Shipping Act, 2001* (and *Collision Regulations*).						●	
Engines will be operated and maintained according to manufacturer's recommendations.							●
Emission sources will comply with applicable limits set out in Canada's *Vessel Pollution and Dangerous Chemicals Regulations*.							●
Sulphur content in diesel fuel used for the Project will meet current regulatory requirements (as per Regulation SOR/2002-254).							●
Accidental Events							
Adherence to all applicable regulations, authorizations / approvals and guidelines related to spill prevention and response	●	●	●	●	●	●	●
Spill prevention plans and procedures as required by the C-NLOPB, will be developed and submitted for approval to the C-NLOPB as a requirement of the OA and will include, at a minimum, the following: • Training of project personnel • Spill Response equipment for containment (e.g., booms) and/or removal • Implementation of measures to deter birds from contacting spilled oil (e.g., bird scaring devices) • Shoreline response measures, if oil is predicted to contact shoreline • Shoreline clean-up measures, if in the event oil contacts shoreline • Measure to be implemented for the rehabilitation and recovery of oiled seabirds • Overview of monitoring that could be conducted in relation to various spill events	●	●	●	●	●	●	●

Mitigation Measures	VCs *						
	Marine Fish and Fish Habitat	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Special Areas	Indigenous Peoples	Fisheries and Other Ocean Uses	Atmospheric Environment
Effects of the Environment on the Project							
MODU selection and applicable certifications / authorizations to address local environmental conditions	●	●	●	●	●	●	●
Physical environment data observations, weather forecasting, and reporting will be conducted in accordance with the *Offshore Physical Environmental Guidelines.* Physical environmental conditions will influence on-going operational planning and decision-making	●	●	●	●	●	●	●
Implementation of an Ice Management Plan. Options to be investigated for ice management include: ice detecting radar on drilling installations, use of satellite data to monitor for presence of ice	●	●	●	●	●	●	●
Ability to quickly and safely disconnect riser in event of emergency.	●	●	●	●	●	●	●
* Table includes where the mitigation measure is directly and/or indirectly relevant to addressing potential adverse effects on each VC							

7 SIGNIFICANCE OF RESIDUAL ENVIRONMENTAL EFFECTS

A summary of the predicted residual environmental effects on each VC are summarized in Table 7.1, including those that may result from planned Project activities, potential accidental events, and cumulative environmental effects.

Table 7.1 Summary of Predicted Residual Environmental Effects for Planned Project Activities, Possible Accidental Events, and Cumulative Effects

VC	Planned Project Activities	Potential Accidental Events		Cumulative Effects
	Significance of Residual Environmental Effects	*Significance of Residual Environmental Effects*	*Likelihood of Significant Effects*	*Significance of Residual Environmental Effects*
Marine Fish and Fish Habitat	N	N	n/a	N
Marine and Migratory Birds	N	S	Low	N
Marine Mammals and Sea Turtles	N	N	n/a	N
Special Areas	N	N	n/a	N
Indigenous Peoples	N	N	n/a	N
Fisheries and Other Ocean Uses	N	N	n/a	N
Atmospheric Environment	N	N	n/a	N

Key:
N : Not significant residual environmental effect (adverse)
S: Significant residual environmental effect (adverse)
n/a: Not applicable
Note: See environmental effect significance definitions provided for each VC in Chapters 8-14 of the EIS.

As illustrated throughout the EIS, each of the potential environmental interactions, resulting environmental changes and predicted environmental effects that may be associated with the Project can be avoided or otherwise mitigated through the use of good planning and proven operational practices, which are industry standard and/or are well established and outlined in relevant regulation and guidelines, and which have been identified and committed by Nexen as part of the EIS. Additional, Project and VC-specific mitigation measures have also been identified and committed to by Nexen, as required and applicable (Table 6.1).

Overall, the planned components and activities that will be associated with the Project will entail localized, transient disturbances in the marine environment at any one location within an EL and time throughout the operational life of this exploration program, the potential effects of which will be effectively avoided or minimized through the various regulated or otherwise implemented mitigations referenced above. The Project is therefore not anticipated to disturb, displace, or otherwise affect marine fish, birds, mammals, sea turtles, Indigenous peoples, fisheries or other human components

and activities in such a way that causes adverse, sustained and detectable effects to populations, species at risk or human activities in any location.

Nexen recognizes that of particular concern to government regulators, Indigenous groups, stakeholder organizations and the general public is the potential for an accidental event to occur during offshore drilling activities, and the potential environmental consequences of any such incident. Although each of the potential accidental events that have been assessed herein (batch spills and blowouts) have the potential to adversely affect any biophysical and socioeconomic components that come into contact with them, clearly the potential for, and possible magnitude of, any such effects will depend on the specific probability, nature, degree and other characteristics of the event, including the type and amount of material spilled, its eventual geographic extent, oceanographic conditions and the persistence of these materials in the environment.

As noted through the oil spill probability analysis completed for this EIS, a blowout event is an extremely unlikely occurrence, which would be avoided through Nexen's planned spill prevention measures. If such an event were to occur, it would be acted upon quickly and effectively with Nexen's planned response measures. In addition, the subsequent (post-EA) regulatory approvals process that apply to the Project are amongst the most rigorous and stringent in the world. Through those regulatory processes, operators are required to demonstrate that they have the ability and capacity to undertake such activities in a safe and environmentally responsible manner through various project design measures, operational procedures, and response mechanisms. These mitigations will help to ensure that such an accidental event does not occur, and in the very unlikely event that one did, will allow Nexen to respond in a timely and effective manner, thereby reducing any potential environmental effects.

The Project is not likely to result in significant adverse environmental effects.

8 ENVIRONMENTAL MONITORING AND FOLLOW-UP

The EIS also identifies and describes proposed environmental monitoring and/or follow-up activities which may be required or proposed for the Project.

8.1 Follow-up

Based on the information presented in the EIS, and the findings and conclusions of the environmental effects assessment, a follow-up program will be undertaken in consideration of sensitive benthic habitat in the following circumstances:

- When a planned well site is located within an identified FCA, or
- In an area where the results of the pre-drill seabed investigation and subsequent review by DFO and C-NLOPB indicate that monitoring is required.

The purpose of the program would be to determine the effectiveness of mitigation measures in protecting the sensitive benthic habitat. It may include parameters such as:

- Post-drilling seabed core samples or sediment traps to measure drill cuttings deposition; and/or
- Post-drilling visual assessment using high-definition images / video.

If exploration wells are planned to be drilled under the circumstances identified above, a follow-up monitoring plan will be developed and submitted for DFO and the C-NLOPB for review prior to commencement of drilling.

As illustrated throughout the EIS, the Project does not require or propose the use of new or different equipment, methods or other technologies during its planned components and activities. It uses standard and proven exploration components and methods, for which potential environmental issues are well understood and fully manageable through existing and effective mitigation measures. This has allowed for an overall high level of confidence in the environmental effects predictions made as part of the EIS. Therefore, follow-up is not proposed for any of the other VCs considered in the EIS, including species at risk. Moreover, the results of Nexen's regulatory, Indigenous and stakeholder engagement program to date have not identified concerns that require or could be addressed through any such follow-up.

In the event of a spill, an EEM program may be required, depending on the nature and magnitude of the spill. This program will be developed in consultation with the C-NLOPB and other relevant regulatory authorities.

8.2 Future Environmental Monitoring, Observations and Communications

8.2.1 Environmental Monitoring and Observations

Monitoring is often undertaken to help assure the regulator and the public that environmental regulations and requirements are being followed. Requirements for compliance monitoring are outlined in the *Offshore Waste Treatment Guidelines* and the *Environmental Protection Plan Guidelines*. Nexen's Project-related plans detail the environmental compliance monitoring plans, procedures, and reporting requirements that it will follow, and must be reviewed and accepted by the C-NLOPB in order to obtain an OA.

In addition to reporting requirements outlined in Nexen's own plans and procedures, Nexen will be responsible for reporting to the C-NLOPB in accordance with the *Drilling and Production Regulations* and *Data Acquisition and Reporting Guidelines*. The *Drilling and Production Guidelines* and *Data Acquisition and Reporting Guidelines* describe the operational testing, measurement, monitoring, and reporting requirements to be conducted during an exploration well drilling program. These are primarily related to engineering and technical aspects of the operations. Any incidents will be reported in accordance with the *Incident Reporting and Investigation Guidelines*.

Nexen will develop and implement an operational monitoring program for marine birds throughout the course of the Project. This monitoring program will be designed in consultation with applicable regulatory authorities, and will include the following:

- A trained Environmental Observer will be onboard the MODU to record marine bird sightings during Project operations, which will be undertaken in accordance with the ECCC-CWS's pelagic seabird monitoring protocol, and will utilize other available information and sources, including the guide for pelagic seabirds of Atlantic Canada.
- A report of the seabird monitoring program, together with any recommended changes, will be submitted to the C-NLOPB and ECCC-CWS on a yearly basis in the format recommended by the regulator.
- During Project operations offshore, regular searches of vessel decks will be undertaken and accepted protocols for the collection and release of any birds that become stranded will be implemented by qualified and experienced personnel, in accordance with applicable regulatory guidance and requirements and the ECCC-CWS bird handling permit.

Nexen will develop and implement an operational monitoring program for marine mammals during VSP surveys for the Project. Nexen will consult with applicable regulatory authorities in the design of the program, which will involve: the following:

- A trained MMO will be onboard to record marine mammal and sea turtle sightings during VSP survey operations.
- Visual monitoring for the presence of marine mammals and sea turtles within a pre-determined exclusion zone will take place during VSP operations where a seismic source array is used.

- Observational / shutdown procedures will follow the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*. for marine mammals and sea turtles.
- A report of the observational program will be submitted annually to the C-NLOPB and DFO, including documentation of marine mammal and sea turtle sightings.
- Any vessel strikes involving marine mammals or sea turtles will be reported to DFO within 24 hours.

8.2.2 Engagement and Communications

Nexen will continue to communicate with Indigenous groups throughout the operational life of the Project, as required or requested, through established and/or additional engagement processes. The specific nature, frequency, subject matter and format of such future engagement will be determined in discussion with the Indigenous groups. Nexen will also continue to review these inputs and perspectives as the Project progresses, and will consider them in its Project-related planning and decision-making as applicable. These on-going engagement processes are intended to allow for continued discussion of Project related activities and issues as they may arise, as well as to collaboratively plan any revised management measures throughout the life of the Project.

Nexen will develop and implement an Indigenous Communities Fisheries Communication Plan (ICFC Plan). Indigenous communities will be invited to provide comments on the ICFC Plan. The ICFC Plan will be designed to:

- Identify communication objectives;
- Identify a list of participants and key contacts;
- Provide instructions for updating participants during the operational activities;
- Provide opportunities for feedback and further exchange of information; and
- Serve as a reference for expected communication during the unlikely event of a major incident such as a spill.

Nexen has committed to on-going communication and information exchange mechanisms with fishers and other ocean uses throughout the Project. These are intended to allow for the on-going consideration of Project related activities and any issues that might arise during the Project, and to work collaboratively to assess, plan and implement any further mitigation measures that might be required during the life of the Project. These mechanisms will provide continuing opportunities for consultation and evaluation and to understand and address any changes in the fisheries environment or science survey plans. In years when exploration activities are planned, Nexen will provide an annual update of planned activities to fishers and fish processors that will include timing of exploration activities and locations of planned wells

These include on-going communication and cooperation mechanisms throughout the operational life of this Project, which are intended to allow for continued discussion of Project related activities and issues as they may arise during Project implementation, as well as to cooperatively and collaboratively plan and implement adaptive management measures throughout the life of the Project.

9 EIS SUMMARY AND CONCLUSIONS

Nexen is committed to obtaining all required permits, approvals and authorizations for the Project, and the company and its contractors will adhere to these and all relevant regulations and guidelines in planning and implementing the Project that is the subject of this EIS. This includes the various mitigations identified and committed to in the preceding sections, the implementation and effectiveness of which will be directed, managed, and monitored in accordance with Nexen's applicable policies and procedures. Nexen will also prepare and submit EA Updates to the C-NLOPB in relation to this multi-year exploration program, that will describe the previous year's Project activities, any recent and on-going engagement activities and their outcomes, as well as outlining the proposed exploration work for the coming year and evaluating the continued applicability and validity of the EIS predictions and associated mitigations.

In conclusion, the Project represents an environmentally and socially responsible, technically feasible and economically beneficial means of conducting offshore exploration drilling and other associated activities within Nexen's existing ELs in the Flemish Pass region. It will allow Nexen to meet its exploration and expenditure obligations under the terms of these licences, while at the same time providing important direct and indirect socioeconomic benefits to the province as well as contributing information and experience to help advance the future development of the Newfoundland and Labrador offshore oil and gas industry and the overall economy of the Atlantic region and Canada.