Tilt Cove Exploration Drilling Program – EIS Summary

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Abbreviations

µg/L	microgram per litre
µPa	micropascal
Accord Acts	*Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* and *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act*
ADW	Approval to Drill a Well
bbl	barrel
BOP	blowout preventer
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CEA Agency	Canadian Environmental Assessment Agency
CH_4	methane
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DST	drill stem test
EA	environmental assessment
EBSA	Ecologically and Biologically Significant Area
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EL	Exploration Licence
EPP	Environmental Protection Plan
ESRF	Environmental Studies Research Fund
FSC	food, social and ceremonial
FTWT	Formation Testing While Tripping
g/m^2	gram per square metre
g/m^3	gram per cubic metre
GHG	greenhouse gas
GWP	Global Warming Potential
IAAC	Impact Assessment Agency of Canada
IBA	Important Bid Area
IUCN	International Union for Conservation of Nature
km	kilometre
km^2	square kilometre
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
kt	kilotonne
L	litre
LAA	Local Assessment Area
m	metre
m^3	cubic metre
MARPOL	Maritime Pollution under the International Convention for the Prevention of Pollution from Ships

MBCA	*Migratory Birds Convention Act, 1994*
MCPEI	Mi'kmaq Confederacy of Prince Edward Island
MDT	Modular Dynamic Testing
mg/L	milligram per litre
mm	millimetre
MMO	marine mammal observer
MMS	Mi'gmawei Mawiomi Secretariat
MODU	mobile offshore drilling unit
MTI	Mi'gmawe'l Tplu'tagnn Inc.
N_2O	nitrous oxide
NAFO	Northwest Atlantic Fisheries Organization
NB	New Brunswick
NHS	National Historic Site
NL	Newfoundland and Labrador
NL ESA	Newfoundland and Labrador *Endangered Species Act*
NM	nautical mile
NMCA	National Marine Conservation Area
NS	Nova Scotia
OA	Operations Authorization
OCSG	Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands
OSRP	Oil Spill Response Plan
OWTG	Offshore Waste Treatment Guidelines
PE	Prince Edward Island
The Project	Tilt Cove Exploration Drilling Project
PTS	permanent thresholds shift
QC	Quebec
RAA	Regional Assessment Area
RV	Research Vessel
SAR	species at risk
SARA	*Species at Risk Act*
SBA	Significant Benthic Area
SBM	synthetic-based [drilling] mud
SEA	Strategic Environmental Assessment
SIMA	Spill Impact Mitigation Assessment
SOCC	Species of Conservation Concern
SOCP	Statement of Canadian Practice (with Respect to the Mitigation of Seismic sound in the Marine Environment)
TTS	temporary thresholds shift
VC	Valued Component
VSP	vertical seismic profiling
WBM	water-based [drilling] mud
WNNB	Wolastoqey Nation of New Brunswick

1.0 INTRODUCTION

Suncor Energy Offshore Exploration Partnership (Suncor is proposing an exploration drilling program on Exploration Licence (EL) 1161 in the Jeanne d'Arc Basin, referred to as the Tilt Cove Exploration Drilling Project (the Project). The Project proposes the drilling of up to 12 to 16 wells over the term of the project.

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) has granted exploration rights for EL 1161, located approximately 300 kilometres (km) from St. John's, Newfoundland and Labrador (NL), located south of Hibernia and west of the Terra Nova and Hebron developments (Table 1.1; Figure 1-1). Sea depth ranges from 67 to approximately 90 m. Suncor is proposing an exploration drilling program to determine the presence, nature, and volume of potential oil and gas resources within EL 1161. Up to 12 to 16 wells may be drilled over the term of the EL (2019-2028), with drilling beginning as early as Q2 2024, pending regulatory approval. Additional wells will be considered based on the results of the first well. The proposed drilling program in EL 1611 is consistent with the work expenditure commitments made by Suncor when the licence was issued.

Table 1.1 Licence Size and Interests

EL	Size	Interest
1161	142,448 hectares (576.5 km²)	Suncor Energy Offshore Exploration Partnership(100%)

Offshore exploration drilling can be considered a designated physical activity subject to the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) if it falls under the definition provided in Section 10 of the *Regulations Designating Physical Activities.* This section applies to the drilling, testing, and decommissioning, suspension 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* and *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (Accord Acts). As the Project will constitute the first drilling, testing, and decommissioning, suspension and abandonment of offshore exploratory wells within EL 1161 issued to Suncor by the C-NLOPB, the Canadian Environmental Assessment Agency (CEA Agency) (now the Impact Assessment Agency of Canada [IAAC]) determined that the Project required a federal Environmental Impact Statement (EIS) under CEAA 2012 and issued EIS Guidelines (CEA Agency 2019) on June 28, 2019. Suncor submitted and received an extension from IAAC to continue the assessment of the currently proposed Project under CEAA 2012. An EIS has been completed to satisfy the CEAA 2012 requirements as well as the C-NLOPB requirements for an Environmental Assessment (EA) Report as part of the Operations Authorization (OA) review process under the Accord Acts. This document is a summary of the EIS, and has been prepared to facilitate public, stakeholder, and Indigenous review and engagement on the Project.

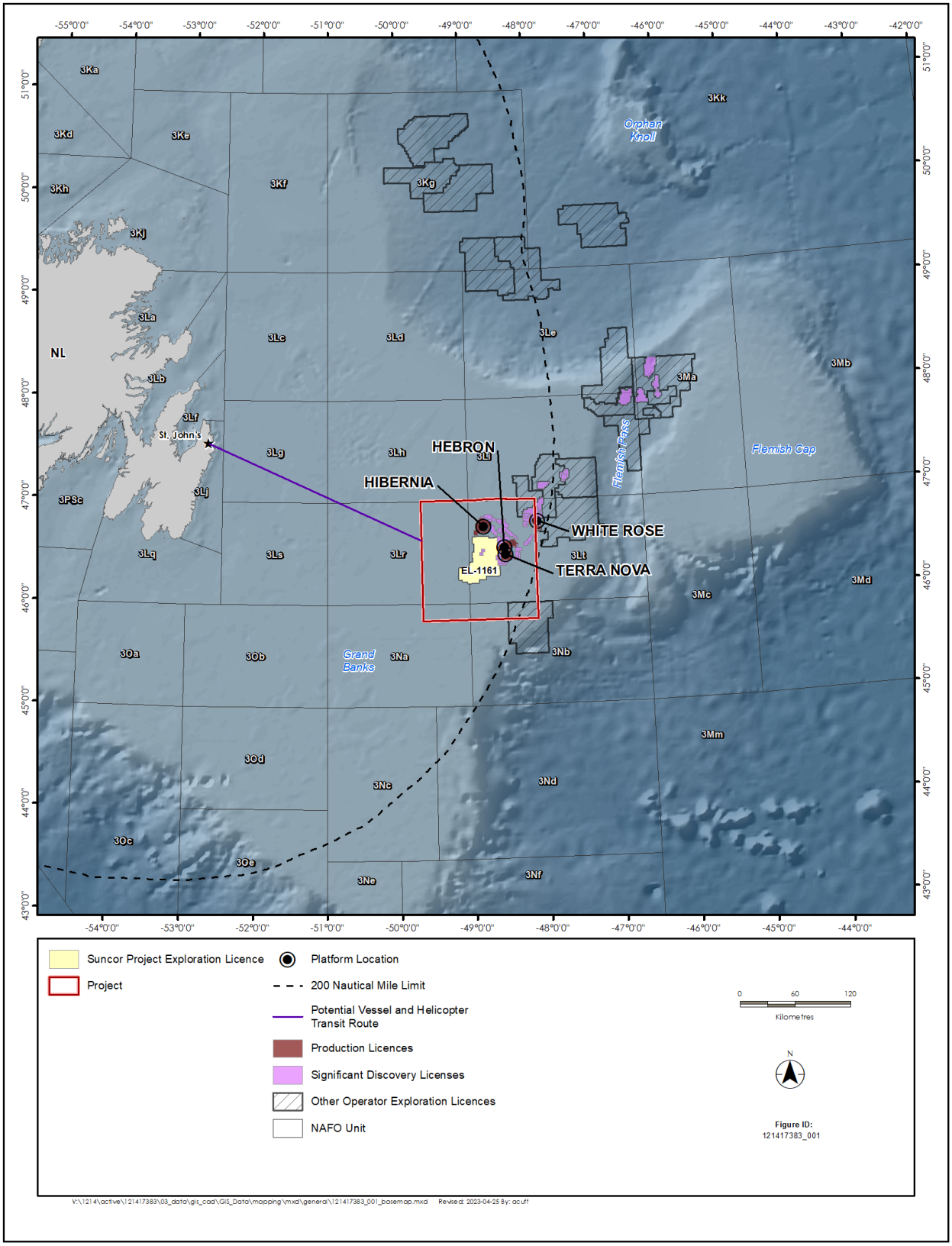

Figure 1-1 Project Location

2.0 PROJECT OVERVIEW

Suncor is proposing to drill up to 12 to 16 wells on EL 1161, which is located approximately 300 km east of St John's, NL. Specific well sites are not yet known but drilling operations will be conducted within the defined boundaries of EL 1161. Prospective areas will be selected to optimize the potential discovery of hydrocarbon reservoirs. Exploration drilling will be carried out in multiple phases, based on initial well results and rig availability.

As water depth in EL 1161 is relatively shallow, Suncor will complete the exploration drilling for this Project with a semi-submersible rig (referred to generically as a mobile offshore drilling unit, or MODU). Suncor will use several selection criteria to identify a MODU able to drill safe, compliant, and reliable wells. The criteria focus on regulatory compliance, meteorological and physical oceanographic conditions, and the technical capability of the MODU. The MODU is expected to be winterized to allow year-round drilling, if required. A drillship will not be considered by Suncor for use in the shallow waters of EL 1161 and is not considered part of the scope of the Project. Due to the potential for severe metocean conditions, the use of a jack up rig is also not considered within the scope of this Project.

Offshore drilling operations will be supported by logistical arrangements for supply and servicing activity. These arrangements will allow the transportation and movement of equipment and personnel between the MODU and land to allow sufficient stocks of equipment and supplies to be maintained for reliable, ongoing drilling operations. Supply vessels and helicopters will be used to provide logistic support such as transportation of personnel, equipment, and materials between the MODU and existing onshore facilities or an alternate location (e.g., supply base) in St. John's, NL. Activities at the onshore facilities are not included in the scope of the EIS.

2.1 Project Location

The Project is located offshore Newfoundland in EL 1161, approximately 300 km southeast of St John's, NL and covers 142,448 hectares (576.5 km^2). The nearest community is Blackhead (299 km from the EL). Water depths in the EL range from range from 67 to approximately 90 m.

2.2 Project Components and Activities

The main components of the Project include the drilling rig (the MODU) and offshore exploration wells. Supply and servicing components includes supply vessel operations (e.g., loading, transit, and unloading of vessels) to / from the a designated Port and the Project Area and helicopter support (e.g., crew transport and delivery of supplies and equipment) to / from St. John's International Airport and the Project Area. Activities associated with the Project include MODU mobilization and drilling, vertical seismic profiling (VSP), well evaluation and testing, well decommissioning, suspension and abandonment. These components and activities are described further below.

2.2.1 MODU Mobilization and Drilling

As water depth in EL 1161 is relatively shallow, Suncor will complete the exploration drilling for this Project with a semi-submersible rig operating in anchored mode. When a MODU has been identified, it will be

subject to Suncor's internal rig intake activities, which identify and effectively manage risks for rig start-ups and verify that contracted rigs conform to industry standards and Suncor's specific requirement. Pursuant to the Accord Acts and the requirements of an OA, a Certificate of Fitness for the MODU will be required. The Certificate of Fitness will be obtained for the MODU from a recognized independent third-party Certifying Authority prior to the commencement of drilling operations in accordance with the *Newfoundland Offshore Certificate of Fitness Regulations.*

The MODU will be moved to the drilling location, either by towing or by its own propulsion. Given the water depth the MODU will likely be moored using anchors. A safety zone (i.e., a 500-m radius from the anchor locations, approximately 7 km²) will be established around the MODU in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* to prevent collisions between the MODU and other vessels (e.g., fishing, research, or cargo vessels) operating in the area. The standby vessel at the MODU will monitor the safety zone. Suncor will communicate details of the safety zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Notice to Shipping and Notice to Mariners. Details of the safety zone will also be communicated during ongoing consultations with Indigenous and non-Indigenous fishers.

2.2.2 Offshore Exploration Wells

Suncor will drill up to 12 to 16 exploration wells within EL 1161 over the remaining term of the Project; the well design and location for the proposed wells have not yet been finalized. Well design will depend on several factors including the geology of the formations. As part of the OA and Approval to Drill a Well (ADW) applications, individual well designs will be designed and submitted for approval to the C-NLOPB.

Each section of the well will be drilled with an increasingly smaller drill bit and the borehole will then be secured with casing (liner installed within the wellbore). Casing is made up of a series of steel pipes that form a major structural component of the wellbore. It also serves several important functions, such as preventing the formation from caving into the wellbore, isolating the different formations to prevent flow or cross flow of formation fluids, and providing a means of maintaining control of formation fluids and pressure as the well is drilled. The drill bit is lubricated by drilling fluids, also known as drilling "muds" that are formulated according to the well design and the expected geological conditions. Several types of drilling fluids are available including water-based mud (WBM) and synthetic-based mud (SBM). Drilling fluids are pumped from the MODU through the drill string to the drill bit. As the drill bit rotates downward through the rock layers, it grinds the rock, breaking it up and generating rock fragments known as drill cuttings. The drill cuttings are circulated by the drilling fluid out of the wellbore. It is estimated that each well may take up to 120 days to drill.

Exploration wells are drilled in two phases: riserless drilling (i.e., an open water operation with no conduit for returns back to the MODU), and riser drilling (i.e., closed loop system that allows fluid returns back to the MODU). During riserless drilling, which occurs during the drilling of the initial sections of the well, there is no closed loop system in place to return drilling fluid and solids back to the MODU. Drilling fluids, excess cement, and cuttings are released directly to the seafloor in accordance with regulatory guidelines. After the initial phase of drilling, the riser is installed, which is the main conduit for remaining drilling activities at depth and allows drilling fluid and solids from the wellbore to be transported from the well to the MODU for treatment.

After cementing the surface casing, the blowout preventer (BOP) is installed. The BOP is a piece of safety equipment which prevents hydrocarbons from escaping the wellbore into the environment. It is put in place to protect the crew and the environment against unplanned fluid releases from the well. The BOP is put in place around the marine riser, which extends from the drill rig to the seabed and lowered to the seabed where it is latched onto the wellhead.

Drilling will then resume in a closed loop drilling mud circulation system. The mud will be pumped down the drilling string where it will cool and lubricate the bit and to transport cuttings and formation gas back to the rig for geological evaluation. The mud is then processed on the drill rig and then recirculated back into the well. The process of drilling, casing, and cementing is continued for the remaining hole sections. This sequence of events is repeated until the total depth of the well is reached. Drilling operations could be continuous until each well is completed or also completed in batches (riserless drilling sections, casing drilling sections, and completion operations).

2.2.3 Geophysical, Geological, Geotechnical and Environmental Surveys

Geophysical surveys, including VSP, is used to collect data from within the wellbore ahead of the drill bit to assist in further defining a petroleum resource by correlating the collected surface seismic data with the geological formations encountered in the wellbore. VSP places receivers (hydrophones) at different depths with within the wellbore and can deploy a number of different sound source positions, including zero-offset VSP and offset VSP (deployed over the side of the MODU to a depth of 3 to 5 m below the water surface). In a success case, Suncor will likely conduct zero offset VSP; however, the objectives of the VSP will determine the specific details of the program (e.g., type of VSP frequency, duration, air gun source array design). VSP typically takes one day or less to complete.

VSP uses a source array similar to that used in seismic operations but with a much smaller size and volume than a traditional surface seismic survey. As the VSP is focused around a wellbore, the sound effects will be localized to the MODU. As with any sound-generating activity, Suncor will apply the requirements of the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP) (Fisheries and Oceans Canada [DFO] 2007) when conducting VSP.

Environmental surveys may include coral and sponge pre-drill surveys, oceanography, meteorology, ice / iceberg surveys, and ROV-video or drop camera surveys, as well as collection of biota, water, and sediment samples. Geological and technical surveys collect sediment samples and conduct in-situ testing to measure the physical properties of the seabed and subsoil. Geological, geotechnical and environmental surveys are short-term, limited to the Project Area (EL 1161) and may occur throughout the Project life at any time of the year, using dedicated vessels provided by marine specialist suppliers.

2.2.4 Well Evaluation and Testing

If hydrocarbons are discovered during an exploration drilling program, well evaluation and possible testing would be conducted to help determine the commercial potential of the reservoir and the viability of a prospect. Well evaluation and testing include wireline logging and possible formation testing (i.e., well flow), which involves passing the well fluids through the MODU's test equipment.

While drilling, the well will be monitored and evaluated by a variety of means including “Measurement While Drilling and Logging While Drilling” techniques, mud logging, drilling parameters evaluation, and subsurface pressure evaluation activities. Wireline logging and well flow testing may also be performed after drilling activity has been completed based on the results of the primary evaluation tools. Well flow testing may take place on a subsequent appraisal well following a discovery, but likely not on an initial exploration well, unless it was suspended and the MODU returned at a later date to allow time for proper planning and safe execution of a well testing program.

Project appraisal wells may require well testing to gather information about subsurface characteristics such as potential productivity, connected volumes, fluid properties, composition, flow, pressure, and temperature. Well flow testing via drill stem testing (DST) may be required to convert an EL to a Significant Discovery Licence to demonstrate the potential for sustained production. Suncor will carefully consider the need for well flow testing via DST because it requires flaring to safely dispose of gases or other hydrocarbons that come to surface. A drill stem test, if needed, would be conducted over a one-month period (after drilling is complete) on an appraisal or delineation well, following an initial discovery, depending upon the hydrocarbons discovered. Flaring, if needed would only be required over a 36 hour period.

Alternative methods of flow testing that do not require flaring include wireline techniques of Modular Dynamic Testing (MDT) and Formation Testing While Tripping (FTWT) and are Suncor’s preferred methods. The MDT uses a downhole wireline tool with a pressure sensor and a sample chamber to sample reservoir fluids in situ, without free hydrocarbons coming to surface. FTWT employs a wireline tool with a pressure sensor and a downhole pump to deliver small amounts of hydrocarbons from the reservoir up the annulus and into a tank on the rig, and does not require flaring. Use of alternative MDT or FTWT methods will be considered first, before any decision to conduct a well test via well flow testing.

Suncor will relay plans for well test flaring to the C-NLOPB as part of the ADW process and will report on any flaring activity to the C-NLOPB, as required. Test wells will be suspended or abandoned in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.

2.2.5 Well Decommissioning, Suspension and Abandonment

Two possible scenarios exist for an exploratory well following drilling to Total Depth: suspension or abandonment. Operators are required to provide detailed plans to the C-NLOPB for monitoring suspended wells and are also required to provide information regarding the specific proposed methods of suspension of each well. For a suspended well, a suspension cap is installed to protect the wellhead connector. The suspension cap will protrude above the seabed. Proper notification via Notice to Shipping is made to identify the subsea obstruction until it is removed.

Well abandonment is the permanent decommissioning of a well and will be designed in compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, standard industry abandonment procedures and practices in accordance with C-NLOPB regulations, and Suncor’s applicable practices. As abandonment is intended to be permanent, there is no requirement for ongoing monitoring under the Regulations. Well abandonment could include plugging the well with a cement mixture to isolate the wellbore and removing the wellhead and any associated equipment to below the seafloor with mechanical cutters. In this scenario, the plugs would be placed at varying depths in the wellbore and the well casing would be typically cut just below the surface of the seal. Wellheads may be removed by the drill

rig or by ROV. The seabed is inspected using an ROV to confirm no equipment or obstructions remain. Suncor's removal strategy for wellheads will consider water depth and the likelihood of potential interactions with fishing activities. However, the abandonment program has not yet been defined. Final details about the well abandonment program will be confirmed with the C-NLOPB as well planning continues.

2.2.6 Supply and Servicing

An existing supply base facility in the St. John's, NL region will be used to support logistical requirements for offshore operations. Supply base activities will be conducted by an existing third-party contractor and are outside the scope of this EIS.

2.2.6.1 Support Vessel Operations

Supply vessels will support the MODU by re-supplying the drilling vessel with fuel, equipment, drilling mud, and other supplies, and by removing waste. Two to three supply vessels, or two full-time equivalent vessels, may be required, with one vessel on stand-by at the drill rig at all times for safety purposes. It is estimated that the supply vessels will make a total of two to three round-trips per week between the MODU and the supply base.

As supply vessels typically travel at approximately 22 km/hour (12 knots) at service speed, transit time between the Project Area and the onshore supply base would be approximately 18 to 24 hours. As the Project Area is near the development projects of Hibernia, Terra Nova, and Hebron, the long established shipping lanes will be used to access EL 1161. Once in the Project Area, the supply vessels will select the most appropriate route for reaching the destination.

When operating in near-shore or harbour areas, the supply vessels will follow applicable Port Authority requirements when in port and will be compliant with the Eastern Canadian Vessel Traffic Services Zone Regulations. Supply vessel transit has an existing regulatory regime and best management practices and is an ongoing, routine activity among all operators in the region.

2.2.6.2 Helicopter Traffic and Operations

Helicopters will be primarily used for regular crew changes, but also to support medical evacuation from the MODU and search and rescue activities in the area, if required. It is anticipated that approximately six helicopter trips per week would be required to transfer crew and any supplies not carried by the supply vessel to the MODU. The MODU will be equipped with a helideck for safe landings. Helicopter operations will be conducted out of St. John's International Airport.

Helicopter routings between the well locations and shore will typically take a straight-line course to the well location. The maximum flight time is expected to be approximately 1.5 hours as the maximum distance between St. John's International Airport and the farthest boundary of the EL is approximately 350 km.

The helicopters that will be used for this Project have not yet been contracted, however, it is expected that the helicopters used by the Project will have a capacity of approximately 12 to 15 passengers and a maximum range of approximately 540 nautical mile (NM) (1,000 km) without refuelling. Refuelling operations are expected to take place at St. John's International Airport. However, the MODU will be

equipped with fuel and refuelling equipment. The distance to the Project area and return will likely not require that auxiliary fuel tanks be installed on the helicopters.

2.2.7 Emissions, Discharges, and Waste Management

Key emission and waste streams from the Project have been classified into the following groups:

- Drilling waste
- Liquid discharges
- Hazardous and non-hazardous waste
- Sound emissions
- Light and thermal emissions

Some wastes will be managed, treated and discharged in accordance with the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010) from the MODU and the supply vessels, while others will be brought to shore for disposal. Offshore waste discharges and emissions associated with the Project (i.e., operational discharges and emissions from the MODU and supply vessels) will be managed in accordance with relevant regulations and municipal bylaws as applicable, including the OWTG and the *International Convention for the Prevention of Pollution from Ships* (MARPOL 73/78) that have been incorporated into provisions under various sections of the *Canada Shipping Act*. All waste not covered in this guidance will be brought to shore for disposal.

Waste management plans and procedures will be developed as part of the Environmental Protection Plan (EPP) for the Project and implemented to define waste storage, transfer, and transportation measures.

Information on the releases, wastes, and discharges will be reported as part of a regular compliance monitoring reporting program in accordance with regulatory requirements as described in the OWTG and in Suncor's EPP.

A summary of potential Project-related emissions and discharges is provided in Table 2.1.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
WBMs	WBMs will be used for the riserless sections of a well. WBMs are primarily composed of seawater, with other additives including bentonite (clay), barium sulphate (barite), and potassium chloride.	Excess WBM may be discharged to the marine environment as per the OWTG. The majority of WBMs discharged are classified under the Offshore Chemical Notification Scheme as substances that pose little or no risk to the environment.
SBM	SBMs may be used once the riser has been installed. SBM is a water-in-oil emulsion that contains non-aqueous (water insoluble) fluids manufactured through chemical processes.	SBM-associated drill cuttings will be returned to the MODU via the riser, treated and discharged at the drill site, meeting regulatory performance targets detailed within the OWTG. The concentration of SBM on cuttings will be monitored on the MODU for compliance with the regulations. In accordance with the OWTG, no surplus SBM is discharged to the sea; spent SBM that cannot be reused during drilling is brought to shore for disposal in an approved licensed facility.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Cement	Drilling cement is pumped into the casing / wellbore annuli after the casing is installed. Excess cement slurry and drilled (hard) cement may be discharged to the seabed during the initial phases of the well, which will be drilled without a riser. The volume of cement discharged to the seafloor during the riserless sections of the well is expected to be in the range of approximately 8 to 10 tonnes.	Prior to installation of the marine riser and BOP, excess cement is discharged on the seabed surrounding the wellhead. Cement returned to the drilling unit will be transported back to shore and disposed of at an appropriate facility. During commissioning and testing of a cement unit, small volumes of cement may be discharged into the sea.
Well treatment and testing fluids	Well testing may be required as part of the Project to gather information about the subsurface characteristics, and to convert an EL to an SDL. Depending on well success, formation fluids, including hydrocarbons and associated water are likely to be brought to surface during a well test.	Hydrocarbons, such as gas, oil or formation water that are brought to surface as part of well test activity will be flared for safe disposal. Flaring will be via one of two horizontal burner booms, to either a high efficiency burner head for liquids, or simple open-ended gas flare tips for gases to minimize fall out of un-combusted hydrocarbons. Flaring, if required, will be optimized to the amount necessary to characterize the well potential and as necessary for the safety of the operation.
Produced water	Produced water includes formation water encountered in a hydrocarbon bearing reservoir. Produced water would only be produced during well evaluation and testing processes when formation fluids are brought to surface.	Small amounts of produced water may be flared (although Suncor does not anticipate well test flaring for the initial wells). If volumes of produced water are large, some produced water may be brought onto the MODU for shipment to shore, unless the MODU can treat and discharge in accordance with the OWTG.
Bilge and deck drainage water	Deck drainage is water on deck surfaces of the MODU from precipitation, sea spray or MODU activities such as rig wash-down, or from fire control system or equipment testing. Bilge water is seawater that may seep or flow into parts of the MODU. Water may pass through pieces of equipment into other spaces of the MODU. As it may contact equipment and machinery, deck drainage and bilge water may be contaminated with oil and other chemicals.	Deck drainage and bilge water will be discharged according to the OWTG which state that deck drainage and bilge water can only be discharged if the residual oil concentration of the water does not exceed 15 mg/L.
Ballast water	Ballast water is used in MODU and supply vessels for stability and balance. It is taken up or discharged when the cargo is loaded or unloaded, or when extra stability is needed to manage weather conditions. The water typically does not contain hydrocarbons or chemicals as it is stored in dedicated tanks on the vessel.	Ballast water will be discharged according to International Maritime Organization *Ballast Water Management Regulations* and Transport Canada's *Ballast Water Control and Management Regulations*. The MODU will carry out ballast tank flushing prior to arriving in Canadian waters.
Grey and black water	Black and grey water will be generated from ablution, laundry and galley facilities onboard the MODU and supply vessels. Grey water will be generated from washing and laundry facilities, and black water includes sewage water generated from the accommodation areas.	Sewage will be macerated prior to discharge in accordance with MARPOL and OWTG.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Cooling water	Cooling water is seawater that is pumped onto the MODU and passed over or through equipment such as machinery engines using heat exchangers. Cooling water may be required on the MODU. However, volumes are likely to be negligible. Water may be treated through biocides or electrolysis prior to use.	Cooling water will be discharged according to the OWTG which states that any biocides used in cooling water are selected according to the Offshore Chemical Selection Guidelines (OCSG) (NEB et al. 2009). Cooling water is likely to be warmer than the ambient water temperature upon discharge but will be rapidly dispersed, reaching ambient temperatures.
BOP fluids	The BOP is regularly pressure and function tested. BOP fluids are released directly to the ocean during BOP installation and removal (approximately 23 m^3 per well, over 90 days, during BOP operations and testing activity approximately 1 m^3 per well in the event of non-routine BOP retrieval or riser unlatching (e.g., disconnect for weather – assumed once per well). BOP control fluid would also be discharged to the marine environment if the BOP is activated in response to an emergency event. BOP fluids are typically mixtures of ethylene glycol and water (typically a 30% ethylene glycol solution).	BOP fluids and other discharges from the subsea control equipment will be discharged according to OWTG and OCSG.
Putrescible solid waste	Includes food waste and domestic sewage generated offshore.	Food wastes and domestic sewage will be macerated in accordance with the OWTG and MARPOL prior to discharge at sea (below the water surface). There will be no discharge of macerated food waste within 3 nautical miles from land.
Non-hazardous waste	Non-hazardous wastes, includes packaging material, scrap metal, and other recyclables.	Will be stored in designated areas on board the MODU. At scheduled intervals, waste will be transferred to the supply vessels so that it can be transported to shore where it will be transferred to a third-party waste management contractor at an approved facility.
Hazardous waste	Hazardous waste includes oily wastes (e.g., filters, rags, and waste oil), waste chemicals and containers, batteries, biomedical waste, and spent drilling fluids.	Will be stored dedicated and appropriate waste receptacles in designated areas on the MODU and will be transferred to shore by supply vessel for disposal by a third-party licensed waste management contractor at an approved facility. Transfer of hazardous wastes will be conducted according to the *Transportation of Dangerous Goods Act*. Applicable approvals for the transportation, handling, and temporary storage of these hazardous wastes will be obtained as required.
Sound emissions	Underwater sound will be generated by the MODU and supply vessels, as well as by the air gun source array during VSP operations.	VSP activity will be planned and conducted in consideration of the SOCP with respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2007).

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Light and thermal emissions	Light and thermal emissions will be generated by various sources from the Project. Navigation and deck lighting will be operating on the MODU and supply vessel 24 hours a day throughout drilling and supply vessel operations for maritime safety and crew safety. Flaring activity during well flow testing, if carried out, will generate light and thermal emissions on the MODU.	Lighting will be reduced to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck. If Suncor intends to flare, it will notify the C-NLOPB in accordance with "Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-NL Offshore Area".

2.3 Accidental Events

Accidental events for the Project may include malfunctions, upset conditions or other unplanned events. Suncor recognizes that the most effective way to avoid damage to the environment from oil spills is to prevent the occurrence of releases. Suncor has a "zero tolerance" policy towards spills and has emphasized spill prevention in the design, operation and maintenance of the facilities and procedures to be employed offshore. Suncor has in place the personnel, policies, procedures, equipment, and training necessary to reduce the probability of incidents from occurring and to reduce the effects of spills, should they happen.

2.3.1 Potential Accidental Scenarios

The EIS focuses on credible worst-case accidents that could result during exploration drilling – a subsurface blowout, batch spill or SBM spill. Spill trajectory modelling has been conducted for a subsurface well blowout incident and a batch spill at a potential well location within EL 1161. Potential accidental event scenarios include:

- Well Blowout: Loss of primary and secondary well control can result in a blowout. Loss of primary well control could result from unexpected contact with high formation pressures, riser failure, downhole losses, emergency riser disconnect due to loss of MODU station-keeping or vessel collision with MODU, accidental riser failure, or loss of drilling fluid hydrostatic overbalance. Secondary well loss could result from a rig fire (or explosion), human error or equipment failure.
- Batch Spill: Batch spills are accidental one-time, bulk releases of finite amounts of hydrocarbons such as marine diesel. Batch spills can cover a range of spill events (size, location, weather conditions) and response measures to a release can be broad ranging. Batch spills can occur during bunkering operations or as a result of a vessel collision.
- SBM Spill: An unscheduled release of SBM could occur at the surface during transfer between the MODU and a supply vessel (via hose failure, incorrect valve alignment, of station-keeping failure) or subsurface, from the riser (via failure of the slip joint packer, riser failure or unlatching of the lower marine riser package). An unscheduled SBM release could also occur on the deck of the MODU, ending up in the marine environment via MODU drains.

The C-NLOPB OA requires submission of a Safety Plan to provide additional information about accidental risks that could occur during Project operations. Suncor has an existing Oil Spill Response Plan (OSRP) for its East Coast operations and will develop a Project-specific OSRP, which will be submitted to the

C-NLOPB as part of the OA process. Contingency planning and emergency response is discussed below in Section 2.3.4.

2.3.2 Fate and Behaviour of Potential Spills

Oil spill trajectory and fate modelling was performed to support an EIS for the Suncor Energy Exploration Drilling Project in the Jeanne d'Arc Basin area. Hypothetical releases were modelled at one location approximately 325 km east-southeast of St. John's, NL, immediately west of the Terra Nova oil and gas field. Two hypothetical subsurface blowout scenarios were developed within the Project Area, which contains the block of interest, EL 1161. Hypothetical releases were modelled as unmitigated subsurface blowouts of Terra Nova crude oil. The subsurface blowouts were simulated as continuous 30- and 120-day releases, with a total simulation duration of 160 days.

Thresholds used to define areas and volumes exposed above levels of concern were conservative socio-economic thresholds for surface oil average thickness >0.04 µm; subsurface (within the water column) dissolved hydrocarbon concentrations >1.0 µg/L; and shore oil average concentration >1.0 g/m² and conservative ecological thresholds for oil surface thickness 10 g/m² (10 µm), water column concentration (1.0 µg/L dissolved polycyclic aromatic hydrocarbons or 100 µg/L total hydrogen), and shoreline oiling (100 g/m²). The thresholds used for the stochastic modelling were socio-economic.

Summaries of the stochastic analyses of potential surface oil and water column exposure by dissolved hydrocarbons depict areas to the east of the release site as having the highest potential likelihood (>90%) to exceed socio-economic thresholds. The >90% likelihood area typically extended up to 1,500 km to the east to the edge of the model domain for the surface and water column oil. This is the result of persistent fractions of the Terra Nova crude oil being on the surface (emulsified, tarballs, and when environmental conditions are below the pour point). The high probability for surface oil were much greater during winter months, when the temperature was lower than the pour point and surface oil remained thick, as it did not spread. As a result of this "freezing" behavior, also note that the water column exceedance footprints for winter were typically slightly smaller than that of summer, the result of the less entrainment and dissolution from surface oil because the oil was below the pour point during winter months. Predicted water column probability footprints were typically smaller than surface oil footprints, with the probability of threshold exceedance predicted to decrease more rapidly for water column results as distance from the release site increased.

In nearly all stochastic scenarios, lower probabilities of threshold exceedance are generally predicted for surface and/or water column oil contamination north of 60°N. However, higher probabilities of threshold exceedance (90% or above) are predicted for surface and/or water column oil contamination primarily to the east and in many cases to the south. In addition, <50% of the simulated 30-day releases were predicted to result in surface threshold exceedance >200 km to the west of the release location, while <50% of the 120-day releases were predicted to result in surface threshold exceedance >500 km west of the release location. Due to the weathering of the oil (i.e., evaporation, dissolution, biodegradation, emulsification, and formation of tarballs) that took place over the week or more required for oil to reach shorelines, the viscosity of the oil increased, resulting in greater predicted thicknesses of surface oil, and typically resulted in stranding oil on shorelines greater than the threshold of 1 g/m².

Due to the primarily eastward transport of oil from wind and currents, and the distance of the release location to the shoreline of Newfoundland, the maximum average annual probability of Canadian shoreline exposure above the 1 g/m² threshold was approximately 4% and 8% for the two subsurface blowouts, when one considers probabilities of all shorelines susceptible of oiling. However, maximum probabilities of shoreline oil contamination at specific points ranged from 18 to 45% depending on the release scenario and season, focused on the Avalon Peninsula. The minimum time to shorelines for threshold exceedance was 3.7 days in one winter scenario (but typically greater than a week for other scenarios), along the Avalon Peninsula and southeastern Newfoundland, >40 days along the northern shores of Newfoundland, southeastern Labrador, and the Azores.

Intuitively, the longer release durations led to larger spill volumes. The 30-day spill simulations released 555,012 m³, while 120-day simulations released 1,661,574 m³, respectively. Despite the larger spill volume for the 120-day releases (almost three times more), the size of the predicted stochastic footprints did not increase proportionally. This is due to the same underlying forcing (i.e., winds and currents) transporting different volumes of oil with the same speed and direction. While the overall footprint did not change markedly, the higher probability contours (e.g., 90%) extended much further for the 120-day releases. The annual stochastic 90% probability footprints of threshold exceedance for surface and water column oil increased by 156% and 62%, respectively, from the 30-day to the 120-day release. Nearly all expansion of footprints for long releases occurred to the east, northeast, and southeast of the release locations with very little expansion of lower probability footprints to the west. In other words, the longer spill duration mainly expanded probability footprints meridionally within the high probability areas east of the release site. Increased release duration also resulted in more predicted potential for shoreline oiling above the 1% probability of threshold exceedance (1,911 km 30-day vs 2,564 km 120-day). In addition, there were predicted increases (near doubling) in the overall probability of shoreline oiling for the 120-day releases.

Individual trajectories of interest were selected from the stochastic ensemble of results for the deterministic analysis. The deterministic trajectory and fate simulations provided an estimate of the transport of oil through the environment as well as its physical and chemical behavior for the specific set of modelled environmental conditions. Representative 95th percentile credible “worst-case” trajectories for surface oil exposure, water column contamination, and contact with shoreline were identified from the stochastic subsurface scenarios and release duration (i.e., 30 vs. 120 days). These highly conservative individual cases were selected based upon the size of the surface oil footprint, volume of oil in the water column, and the length of shoreline contacted with oil.

2.3.2.1 Surface Oil Exposure Case

The 95th percentile 30-day surface oil exposure case was predicted to result in shoreline oiling of generally 100 to >500 g/m² (exceeding the socio-economic threshold) along approximately 358 km of northeastern Newfoundland, the northern Avalon peninsula, and southeastern Labrador coastlines. The 95th percentile 120-day surface oil exposure case was not predicted to contact shorelines. Sediment oil contamination was predicted to the south of the release location on the Grand Banks for each representative scenario at concentrations generally <0.1 g/m².

2.3.2.2 Water-column Exposure Case

The 30-day representative case was predicted to contact shorelines, while the 120-day representative case was not predicted to reach the shore. The representative 30-day release was predicted to result in 87 km of Newfoundland shorelines, predominantly along the southern Avalon peninsula, to be contaminated above the socio-economic threshold.

2.3.2.3 Shoreline Exposure Case

The identified representative shoreline exposure cases were predicted to result in 1,461 to 1,452 km of contaminated shorelines. The releases resulted in similar lengths of shoreline oiling with the potential for contamination along the southern and southeastern coasts of Newfoundland (including the Avalon Peninsula), mostly in excess of 500 g/m². In general, the oil that was predicted to reach shorelines was expected to be relatively weathered, patchy, and discontinuous, as it would have degraded for well over a week (or more) before contacting shore. Limited sediment contamination of generally <0.01 g/m² was predicted in the immediate vicinity (within approximately 100 km) of the release location.

2.3.2.4 Surface Diesel Batch Spill

The batch spill release of 1,000 L marine diesel was predicted to result in silver or colorless sheens (<0.0001 mm) of oil floating on the water surface. Generally, oil within this representative scenario was predicted to be transported to the west and south, within 175 km of the release location. Note that total hydrocarbon and dissolved hydrocarbon concentrations in the water column were not predicted for the marine diesel batch spills modelled due to the relatively small volume of diesel oil released on the water surface and the large amount of natural dispersion from wind and waves that dispersed and diluted the marine diesel.

At the end of the 30-day marine diesel batch spill simulation, 44% was predicted to have evaporated into the atmosphere, 42% degraded, 15% remained entrained in the water column, while 0.1% of the released volume was predicted to remain floating on the water surface. No marine diesel was predicted to strand on shorelines or settle on sediments in this representative scenario.

2.3.3 Spill Risk and Probabilities

Over the last 22 years, offshore exploration and production facilities off NL have spilled a total of 2,759 bbl of oil in 478 incidents. Approximately 86% of the total volume of oil spillage occurred during development and production activities. A total of 33 incidents totaling 33 bbl occurred during exploration activities. Approximately 72% of these spills involved less than 1 bbl. Offshore exploration activities over the time period 1997 through 2018 also resulted in 11 SBM spills, for a total of 776 bbl. There has also been a significant trend of reduced spill numbers in exploration and production activities in offshore NL after 2005. Reducing the number of spills continues to be a focus area for both operators and the C-NLOPB. This reduction can be attributed to technological advances, lessons learned from investigations, an enhanced safety culture and improvements in the management systems and processes of operators in the basin.

Spill probabilities for individual wells depend on the release type. These probabilities do not indicate the release volume or imply the release would be a worst-case discharge. The overall mean probability of a

spill from each individual well is 0.00013 (1 in 7,700) for a subsurface blowout and 0.00011 (1 in 9,400) for a well release. The probabilities are for the duration of the exploration period.

Since there would be a maximum to 12 to 16 exploratory wells in the Project Area that will be in drilling phase over the course of 120 days each, approximately 5 years of potential time during which an exploration well blowout or release might occur.

In the event that a spill does occur, the spill will not necessarily involve the maximum outflow. In fact, most spills are relatively small and only very rarely does a spill result in a volume that would be classified as very large. If a spill does occur from the well, there is a distribution of potential spill volumes ranging from small to extremely large. The total volume is dependent on the duration of flow and flow rate, which for the Project would be as high as 125,796 per day. There are no data available to determine the potential volumes of blowouts after abandonment.

Blowouts involve flow at a certain rate for a few hours to a number of days, depending on the time to natural bridging or successful intervention by capping, relief well, or other means. When a blowout occurs, it is more likely to involve a relatively smaller volume than a very large volume. The vast majority (84%) of blowouts subside naturally within a few hours to days even in the absence of intervention or before an intervention can be implemented. However, the high flowrate for the Project–as high as 5,242 bbl per hour during the first day–means that even with a few hours of flow, there would be a spill in the tens of thousands of barrels. The chances of a blowout involving 1,000 bbl or more are 1 in 4,300 for the Project per well. Larger blowout volumes are even less likely. The chances of a blowout of 100,000 bbl are 1 in 5,000 per well.

Non-blowout releases tend to involve relatively small volumes of considerably <1 bbl to approximately 100 bbl, because they, by definition, do not involve uncontrolled flow. There are relatively rare instances in which the release is as much as 3,145 bbl (C-NLOPB 2022). If the number of wells increases, the overall probability increases in direct proportion to the number of wells. The probability of well releases of any volume is 1 in 9,100 and for volumes larger than 1,000 bbl is 1 in 910,000.

Based on analyses of the C-NLOPB exploration data for 1997 through 2021 for batch spills, the average per-well probability of batch spills for exploration activities was determined to be 0.42 per well-year. This equates to 0.00115 per day for each well. Most batch spills will be very small; 72% will involve less than one bbl. The Project Area is adjacent to producing assets at Hibernia, Hebron and Terra Nova, which provide an abundance of reservoir and pressure and temperature data that will be used by the Project in exploration well planning and drilling activities. Application of the knowledge and data from the adjacent assets can substantially reduce the likelihood of a well control incident.

2.3.4 Contingency Planning and Emergency Response

Oil spill trajectory modelling shows that there is only a remote probability of oil reaching the coastline prior to dispersion due to the prevailing wind and current conditions on the Grand Banks. In the unlikely event that conditions do allow oil spilled on the Grand Banks to approach shore, there will be no change to the management system described within the Suncor's OSRP; however, response techniques will change to coastal and shoreline applications.

Suncor has developed a four-layered escalation approach to respond, support and manage emergency situations both offshore and onshore for its worldwide operations. These layers consist of – i) Physical Response at the facility, ii) Response Support, iii) Response Management, and iv) Crisis Management (Figure 2-1). Four layers are identified with each having a corresponding team in place. While these teams coordinate with and support each other, they have a distinct mandate under which they operate. This approach is aligned across Suncor to ensure consistency across the organization and to provide the ability for up-scaling the response in the event of a large or sustained emergency response operation.

In the event of a well control emergency, the following documents will provide the basis of the Intervention Action Plan:

- Business Process for Emergency Management
- East Coast Oil Spill Response Plan (OSRP)
- Bridging Document for Suncor Energy and MODU
- MODU Emergency Response Bridging Document
- Blowout Contingency Plan

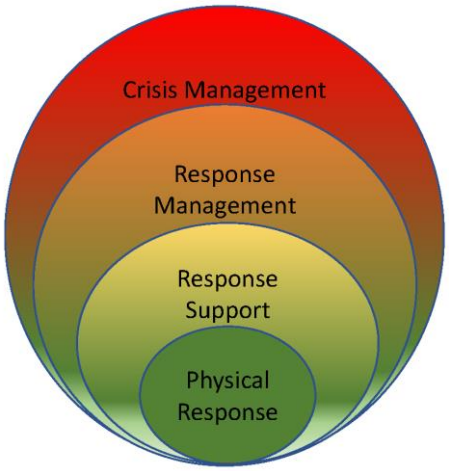

Figure 2-1 Suncor Emergency Response Structure

Suncor's MODU Blowout Contingency Plan provides an action plan based on a worst-case well control scenario. The described action plan is meant as supplementary to the above procedures in the event of a well control event. Response actions are to be initiated as quickly as possible, but they should never interfere with or take priority over the safety of rig site personnel affected by the well control incident.

Blowouts in floating drilling operations generally occur underground or in the wellhead / BOP area rather than at the surface. This section addresses responses to blowout situations, including damage to the rig. Response should be scaled to the consequence of a blowout event. The response to well control emergencies is grouped into the three categories

- Immediate Response (first 12 to 24 hours)
- Interim Actions (day 2 to completion)
- Extended-Term Response Planning

Suncor will have a suite of contingency and spill response plans, including:

- East Coast and Project-specific OSRP
- Tiered Response
- Blowout Contingency Plan (Source Control Plan)
- Relief Well Drilling
- Wildlife Monitoring and Response Plan
- Spill Impact Mitigation Assessment (SIMA)

Suncor has an existing OSRP, which will be used to develop a Project-specific OSRP for the exploration drilling program. The OSRP covers the management, countermeasures, and strategies that will be used in an oil spill response for Suncor's East Coast production and drilling operations. The OSRP describes the actions to be taken in the event of an oil spill and is specifically oriented to situations where Suncor has direct responsibility for the spill incident and its immediate and long-term impacts.

Spill contingency plans for Suncor's operations include:

- Provisions for spill surveillance and monitoring
- On-water response equipment
- Appropriate training for response personnel
- Bio-monitoring plans for large spills
- Mutual aid plans with other operators

The OSRP has been specifically developed to support East Coast drilling and production operations. The techniques, procedures and policies outlined in the OSRP are also sufficiently flexible to allow Suncor to respond to a spill as it escalates and moves away from its point of origin.

Suncor will prepare a SIMA, an evaluation applied to an oil spill to aid in the selection of the appropriate spill response(s) that results in the best overall recovery of resources of concern (either ecological, socio-economic and/or cultural). Reduction of environmental impacts often required multiple response options. A SIMA:

- Compiles and evaluates data for relevant oil spill scenarios
- Predicts outcomes / impacts for the relevant spill scenarios (including a "No Intervention" [or "natural attenuation" option)
- Balance trade-offs of the benefits and drawbacks of each feasible response scenario, including No Intervention
- Selects the best response option(s) to develop the strategy for each scenario

Suncor will develop their SIMA as per the Guidelines on Implementing Spill Impact Mitigation Assessment (IPIECA-API-IOGP 2017). Suncor will consider the feasible response options that would be potentially effective in the Project Area and will develop their SIMA in consultation with Environment and Climate Change Canada (ECCC), the Canadian Science Table, and the C-NLOPB.

2.4 Project Schedule

Suncor proposes to commence exploration drilling activities as early as Q2 2024 pending regulatory approval, and potentially continue intermittently until end of 2029 with proper authorizations in place. Up to 12 to 16 wells could be drilled over the term of the Project. The length of drilling associated activities may be up to 120 days for each well with the potential to occur year-round. Drilling activities will not be continuous over the term and will be in part determined by rig availability and results.

The EIS assumes year-round drilling using a semi-submersible rig for the purposes of the assessment. VSP operations will take approximately one day per well, and the various components of well testing, where required, would occur over a one-month period annually. Geological, geotechnical and environmental surveys may take place any time during the Project (e.g., including coral and sponge pre-drill surveys could be conducted anytime prior to the onset of drilling). Well decommissioning, suspension and abandonment will be conducted following drilling and/or well testing. Wells may be designed for suspension and re-entry, but this will be determined through further prospect evaluation.

3.0 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

Every EA of a designated project must consider alternative means of carrying out the Project that are technically and economically feasible and consider the environmental effects of such alternative means, as required under section 19(1)(g) of CEAA 2012.

Consistent with the CEA Agency's (2015) Operational Policy Statement for Addressing “Purpose of” and “Alternative Means” under the *Canadian Environmental Assessment Act, 2012*, the process for consideration of alternative means of carrying out the Project includes the following steps:

- Consideration of legal compliance, technical feasibility, and economic feasibility of alternative means of carrying out the Project
- Description of each identified alternative to the extent needed to identify and compare potential environmental effects
- Consideration of the environmental (including socio-economic) effects of the identified technically and economically feasible alternatives of carrying out the Project; this includes potential adverse effects on potential or established Aboriginal and Treaty rights and related interests (where this information has been provided)
- Selection of the preferred alternative means of carrying out the Project, based on the relative consideration of effects

The EIS Guidelines for the Project (CEA Agency 2019) identify several components for consideration in the alternative means analysis including:

- Drilling fluid selection (e.g., WBM or SBM)
- Drilling unit selection
- Drilling waste management
- Water management and effluent discharge

- Alternative platform lighting options (including flaring) to reduce attraction and associated mortality of birds

Each option for the alternative means identified above is summarized in a tabular format. The preferred alternative means form the basis for the Project to be assessed (i.e., assumed to be the base case that is assessed for environmental effects in Chapters 8 to 14 of the EIS).

Table 3.1 Summary of Alternative Analysis

Option	Legally Acceptable?	Technically Feasible?	Economically Feasible?	Environmental Issues	Preferred Option
Drilling Fluid					
SBM only	No	Yes	Yes	SBM is not permitted for ocean discharge without treatment; therefore, SBM cannot be used for riserless drilling where the cuttings are disposed directly on the seafloor	Not preferred
WBM only	Yes	Yes – although potential challenges with borehole stability	Yes – although potential increased cost from non-productive time and losses	No substantial difference between options. Both are considered acceptable provided that appropriate controls are in place and chemicals are selected in accordance with OCSG (EIS considers both WBM and SBM in effects assessment)	Not preferred
WBM / SBM hybrid for different sections	Yes	Yes	Yes		Preferred
MODU					
Semi-submersible Rig	Yes	Yes	Yes	Both options are considered to be environmentally acceptable and would have comparable environmental effects in terms of lighting, emissions and discharges, and underwater sound	Preferred
Jack-up Rig	Yes	No	Yes		Not Preferred
Drilling Waste Management					
Discharge to water column (following treatment of SBM on cuttings)	Yes	Yes	Yes	Some localized effects are expected on the seafloor from discharge of cuttings (assessed in Chapter 9)	Preferred

Table 3.1 Summary of Alternative Analysis

Option	Legally Acceptable?	Technically Feasible?	Economically Feasible?	Environmental Issues	Preferred Option
Offshore Reinjection	Yes	No	Not considered as option because not technically feasible		Not preferred
Ship-to-shore (SBM-associated cuttings)	Yes	Yes	Yes – but increased costs from increased transportation and operational delays	Some limited offshore effects are expected from increased transportation, and some onshore effects from transportation and onshore disposal of waste including increased health, safety and environment risks associated with truck and vessel traffic and exposure and handling of waste material	Not preferred
Lighting					
Standard MODU lighting	Yes	Yes	Yes	Some localized visual effect is expected which could affect migratory birds (assessed in Section 9)	Preferred
Reduced Lighting (i.e., during nighttime or inclement weather)	Yes	Yes	Yes	Options to reduce lighting on the MODU as far as practicable will be considered. However, it will be maintained at a level that will not introduce safety risks for the workforce or drilling operations	Preferred
Spectral modified lighting	Yes	No – currently limited capabilities in extreme weather; safety concerns with helicopter approach and landing	No – not considered as commercially viable yet	Not considered as option because not feasible	Not preferred
Flaring					
No flaring during DST	No	Not considered as option due to regulatory and safety requirements; Industry continues to advocate for alternative methods, which in some cases have been deemed acceptable to obtain an SDL..			Preferred

Table 3.1 Summary of Alternative Analysis

Option	Legally Acceptable?	Technically Feasible?	Economically Feasible?	Environmental Issues	Preferred Option
Formation testing while tripping / Interval Pressure Transient Testing and MDT	Yes	Yes, although technically inferior as may not fulfill C-NLOPB data requirements in all cases	Yes, although economically superior, associated with inferior data collection	No flaring and therefore reduced atmospheric emissions and light, resulting in reduced risk of bird attraction and mortality	Preferred
DST Flaring as required with flare shield (water curtain)	Yes	Yes	Yes	Some limited offshore effects are expected from the light and atmospheric emissions generated during flaring. These are expected to be intermittent and brief in duration over a temporary period at the end of drilling (assessed in Section 9)	Preferred (if flaring is required)
Reduced flaring (i.e., no flaring during nighttime DST or inclement weather)	Yes	Yes – although activity could give result to compromised data	Yes – but increased MODU costs and risk of delays	Reduced flaring would still result in some measure of light and atmospheric emissions	Not Preferred

There are several components of the Project that remain to be finalized. Some options under review will be confirmed to C-NLOPB as part of the OA and ADW process (e.g., wellsite location).

4.0 CONSULTATION AND ENGAGEMENT

Suncor recognizes the importance of early and ongoing engagement with Indigenous groups and other stakeholders that continues over the life of the Project. Suncor is committed to this ongoing engagement to build mutually beneficial, long-term trusting relationships developed on the principles of respect, inclusion, transparency, and accountability.

4.1 Government Departments and Agencies

Regulatory stakeholders are typically engaged to confirm specific regulatory requirements / processes and/or data requests. Key regulatory stakeholders for the Project are:

- C-NLOPB
- Government of Canada
  - IAAC
  - DFO
  - ECCC, including Canadian Wildlife Services (CWS)

- Natural Resources Canada
- Department of National Defence
- Transport Canada

A log of Project-related consultation with government departments and agencies is provided in Chapter 3 of the EIS.

4.2 Indigenous Groups

Suncor recognizes the potential for the Project to interact with Indigenous interests and acknowledges the importance of engaging Indigenous organizations to provide Project information and obtain feedback on potential issues and concerns.

Suncor recognizes that there are several Indigenous organizations in Atlantic Canada that hold commercial-communal fishing licences for Northwest Atlantic Fisheries Organization (NAFO) Divisions that overlap the Project Area. However, none of the Indigenous organizations that hold the licences have confirmed current fishing activity in the area. There are currently no documented food, social and ceremonial (FSC) licences within or near the Project Area. However, Suncor acknowledges that species harvested for commercial or FSC purposes outside the Project Area may potentially interact with Project activities (planned or unplanned) during migration to traditional fishing grounds. These species may include species at risk and/or of cultural importance to Indigenous groups (e.g., Atlantic salmon). The list of Indigenous groups that may have a potential interest in the Project include groups and communities in Newfoundland and Labrador (NL), New Brunswick (NB), Prince Edward Island (PE). Nova Scotia (NS), and Québec (QC).

The EIS Guidelines (Section 5.1) specify that Suncor engage the following Indigenous groups:

Newfoundland and Labrador

- Labrador Inuit (Nunatsiavut Government)
- Labrador Innu (Innu Nation)
- NunatuKavut Community Council
- Qalipu Mi’kmaq First Nation Band
- Miawpukek Mi'kmamawey Mawi'omi (Miawpukek First Nation)

New Brunswick

- Mi’gmawe’l Tplu’taqnn Inc. (MTI), which represents the following Mi’kmaq First Nation groups:
  - Amlamgog (Fort Folly) First Nation
  - Natoaganeg (Eel Ground) First Nation
  - Oinpegitjoig (Pabineau) First Nation
  - Esgenoôpetitj First Nation
  - Tjipõgtõtjg (Buctouche) First Nation
  - L’nui Menikuk (Indian Island) First Nation
  - Ugpi’ganjig (Eel River Bar) First Nation
  - Metepnagiag Mi’kmaq Nation
  - Elsipogtog First Nation (represented by MTI in 2023)

- Wolastoqey Nation of New Brunswick (WNNB), which coordinates consultation with the following five Maliseet First Nations (letters were sent to individual communities; follow up occurred with the WNNB):
  - Kingsclear First Nation
  - Madawaska Maliseet First Nation
  - Oromocto First Nation
  - St. Mary's First Nation
  - Tobique First Nation
  - Woodstock First Nation
- Peskotomuhkati Nation at Skutik (Passamaquoddy)

Prince Edward Island

- L'Nuey, (formerly the Mi'kmaq Confederacy of PEI [MCPEI]) represents the following Mi'kmaq First Nations in consultation (letters were sent to individual communities; follow-up occurred with L'Nuey / MCPEI):
  - Abegweit First Nation
  - Lennox Island First Nation

Nova Scotia

- Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), which represents the following 11 Mi'kmaq First Nations in Nova Scotia in consultation and engagement (letters were sent to individual communities; follow-up occurred with the KMKNO):
  - Acadia First Nation
  - Annapolis Valley First Nation
  - Bear River First Nation
  - Eskasoni First Nation
  - Glooscap First Nation
  - Paqtnkek Mi'kmaw Nation
  - Pictou Landing First Nation
  - Potlotek First Nation
  - Wagmatcook First Nation
  - We'koqmaq First Nation
- Sipekne'katik First Nation
- Membertou First Nation
- Millbrook First Nation

Quebec

- Mi'gmawei Mawiomi Secretariat (MMS), which represents the following Mi'gmaq First Nation groups:
  - Micmas of Gesgapegiag
  - La Nation Micmac de Gespeg
  - Listuguj Mi'gmaq Government
- Première Nation de Ekuanitshit
- Première Nation de Nutashkuan

Suncor uses a variety of engagement methods to inform and involve identified Indigenous groups, such as:

- Written and visual communications (letters, emails)
- Phone calls
- Information updates and bulletins
- Meetings and workshops

Suncor has notified, and will continue to notify, each of the identified Indigenous groups about key steps in the EIS development process and of opportunities to provide comments. Suncor initiated engagement with Indigenous groups in May 2019 to introduce the Project and inquire about potential interests and concerns as well as preferred methods of engagement. In July 2019, Suncor followed up on their initial request with a letter acknowledging and outlining the Indigenous interests and concerns that had been brought forward to date through various recent environmental assessments. Indigenous groups were invited to attend a series of workshops in September 2019 to discuss their interests and concerns. The workshop proceedings were sent to all Indigenous groups following the workshops for comment.

Suncor was aware at the start of the project that they are one of several similar offshore exploration drilling projects at various stages in the environmental assessment process under CEAA 2012. Therefore, Suncor joined with other operators to collaborate on engagement to help reduce multiple engagement requests on Indigenous groups in 2019 and 2020.

A summary of key issues and concerns raised by Indigenous groups in engagement workshops with Suncor is provided in Table 4.1.

Table 4.1 Concerns Expressed by Indigenous Groups

Atlantic Salmon (and other culturally important species):

- Salmon are a cornerstone species for Indigenous communities in Atlantic Canada. Indigenous groups are concerned about potential impacts of exploration drilling (both operations and potential accidents) on Atlantic Salmon populations that may migrate and over-winter in the Project Area. These populations return to their natal rivers and streams where they could be harvested for traditional (FSC) purposes, although many Indigenous communities do not harvest for FSC purposes due to ecological concerns. Some of these populations are listed under SARA.
- Other culturally important species of concern to Indigenous groups include American eel, swordfish, tuna, ground fish, lobster, crab, sea turtles, sharks and marine mammals.

Action / Mitigation:

- Suncor recognizes the social and cultural significance of salmon to Indigenous groups in Atlantic Canada, as well as the uncertainty associated with the known presence and activities of Atlantic salmon in the project areas. Suncor, along with other oil and gas companies, provide funding to the Environmental Studies Research Fund (ESRF) for studies related to environmental and social issues that support decision-making for oil and gas projects. The ESRF is currently funding an Atlantic salmon research project to answer the questions of concern to Indigenous groups and others. The research project has involvement from Atlantic Indigenous communities and organizations. A summary of the study is below.
- The ESRF Atlantic salmon project is a large collaborative effort with the goal of understanding the potential interactions of Atlantic Salmon with offshore oil and gas activities in Eastern Canada. Indigenous partners include members of DFO's Aboriginal Aquatic Resources and Oceans Management programs (AAROM) as well as the Nunatsiavut Government. Funding is provided to each group annually to support project related activities. The Unama'ki Institute of Natural Resources (UINR) coordinates Indigenous partner training, field sampling and has created a forum for sharing sampling strategies and challenges. Indigenous knowledge is used for selecting priority rivers and capturing salmon for tagging while respecting the vulnerability of Atlantic salmon populations. Dr. Shelley Denny is a member of the ESRF Atlantic salmon Steering Committee and the project lead for UINR. Levi Denny (UINR) is the Indigenous Research and Partnership Project Coordinator. A project update was given by Levi Denny at the AAROM science symposium (March 2, 2022) and the AAROM directors meeting (March 23, 2022).

Table 4.1 Concerns Expressed by Indigenous Groups

• ESRF hosted an Animal Care and Fish Surgical Tagging Course in October 2021 at the University of PEI (UPEI). Participants from nine Indigenous partner groups attended the course. The UPEI training course in combination with hands-on field training has significantly enhanced the capacity for telemetry fieldwork in Eastern Canada. The ESRF Atlantic salmon project tagged a total of 556 kelt and 2314 smolt from 38 rivers in 2021 and 2022. There is another field season planned for 2023 and publication will be in late 2024/ early 2025.
Potential Impacts to Indigenous Fisheries: • Impacts from operations and potential incidents or spills that may result in adverse environmental effects on traditional, commercial and commercial-communal fisheries. Questions were raised regarding the potential for operations to impact behaviours of Atlantic salmon and other species in the area -- related to underwater noise, light, vibration and changes to water quality. *Action / Mitigation:* • Suncor will continue to engage with Indigenous groups throughout the exploration drilling program and provide information related to operational activity and environmental monitoring. Suncor will develop a Fisheries Communication Plan with Indigenous groups prior to operations to ensure ongoing communication and opportunities for feedback during operations, and to inform Indigenous groups in the event of an emergency. • Suncor will continue to work with Indigenous fishers to reduce any potential impact on their ability to exercise their fishing rights.
Cumulative Effects: • There is a perceived lack of a comprehensive approach to analyzing, understanding and addressing the potential for cumulative impacts of so many proposed projects in the same region on the environment, and on Indigenous communities. It is anticipated that the current Regional Assessment in Atlantic Canada will attempt to address cumulative effects on a broader level. *Action / Mitigation:* • Suncor participated in the recent federal government Regional Assessment where a more regional and multi-faceted approach was taken to examining cumulative effects of multiple projects and interactions with other ocean users. Suncor has applied any applicable new learnings from the regional assessment to their exploration drilling project.
Indigenous Knowledge: • The EIS and Project implementation should consider and integrate Indigenous traditional and ecological knowledge regarding aquatic, nearshore and offshore environments. • Indigenous groups recognize the complexity and sensitivity of gathering and applying or integrating Indigenous Knowledge in EIS and further, to operations – particularly in an area as geographically and culturally diverse as the Atlantic region. Many issues must be considered, for example, confidentiality and protection of information, where that information is managed and maintained, and by whom. *Action / Mitigation:* • Suncor recognizes the importance of considering Indigenous Knowledge in its operations. Suncor is supporting an Atlantic-wide Indigenous Knowledge study through the ESRF. The first phase of this project was completed and there is another phase in the planning stages. The report titled, “Laying the Groundwork: Enhancing Cross Cultural Understanding Through Two-Eyed Seeing.” This can be found on the ESRF website: (https://www.esrfunds.org/sites/esrfunds/files/pdf/ESRF222_Denny_et_al.pdf) • Suncor will continue to monitor the status of this project and other developments in Indigenous knowledge to incorporate into operations.
Environmental Impacts: • In addition to concerns regarding potential impacts to fishing and fishing rights, Indigenous groups have concerns regarding effects of exploration drilling operations on the marine environment, including changes to water quality, fish and fish habitat, marine plants, migratory birds and marine mammals and increased contributions to atmospheric emissions contributing to climate change. *Actions / Mitigations:* • Suncor will share the results of a follow up program, which would be developed if it is determined that sensitive environmental features are found during the pre-drilling survey.

Table 4.1 Concerns Expressed by Indigenous Groups

Lack of Original and Recent Baseline Studies:

- Indigenous groups are concerned that the various EIS submitted for offshore exploration to date have relied solely on existing data and studies – some of them outdated.

Actions / Mitigation:

- Suncor has incorporated the most recent data available and studies published for the effects assessment into the EIS. Suncor has also incorporated results from their environmental effects monitoring program at the Terra Nova Project.

Compensation:

- Indigenous groups understand that there are C-NLOPB guidelines in place for loss or damage to fishing gear and vessels, or in the case of an emergency. However, specific compensation concerns of Indigenous groups relate to the following:
  - Potential impacts on commercial - communal fisheries. The impacts on commercial-communal fisheries would be different than a "regular" commercial licence because the licences are "owned" by the Band (community) itself, they are not transferrable, cannot be sold, and the profits are often used to sustain employment, programs and services, and community infrastructure
  - Potential impacts on Food, Social and Cultural (FSC) fisheries, which may cause deeper social and cultural impacts within communities.

Actions / Mitigations:

- Suncor would consider any damages to Indigenous fishing activity resulting from Suncor's proposed offshore activities on a case-by-case basis and in consultation with Indigenous groups. Suncor follows the CNLOPB Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2017).

Oil Spill Response:

- A number of concerns have been expressed by Indigenous groups regarding the adequacy of oil spill response, including:
  - Concerns about oil reaching shoreline, impacting fisheries and traditional territories.
  - Companies need to demonstrate the accuracy of probability calculation and trajectories of oil spills.
  - Capping stacks – a capping stack should be located and maintained in Atlantic Canada.
  - How can Indigenous groups/communities be involved in oil spill response?
  - Concerns expressed regarding contamination or fish taint from an oil spill and how this impacts not only consumption, but also perception and cultural norms.

Actions / Mitigations:

- Suncor is building upon the previous efforts of the oil and gas industry to create capacity and awareness of industry and company standards to prevent and respond to an emergency. Suncor participated in three workshops with Indigenous groups where emergency preparedness and oil spill response was discussed in detail, including – management practices, oil spill modelling, capping stacks and other technology, and the oil spill response Incident Command System (ICS).
- Suncor will have a comprehensive oil spill response plan in advance of any project activities.
- To ensure Indigenous groups are informed of key milestones in operational activity during exploratory drilling, Suncor will develop a Fisheries Communications Plan in consultation with Indigenous groups that includes a protocol for communicating with Indigenous groups during operations, in the event of an emergency.

Environmental Monitoring:

- Indigenous groups want to see monitoring and follow-up programs, including research and data collection related to impacts on Indigenous groups – e.g., fish and fish habitat, birds and marine mammals.
- Indigenous groups would like to be involved with environmental monitoring; and, to be kept informed of results of environmental monitoring programs throughout the exploration drilling program, and in the event of an incident or spill that may result in adverse environmental effects.

Action / Mitigation:

- Suncor will share the results of a follow up program, which would be developed if it is determined that sensitive environmental features are found during the pre-drilling survey.

Table 4.1 Concerns Expressed by Indigenous Groups

Ongoing Communication and Engagement with Indigenous Groups: • Indigenous groups want to continue to be actively informed of key milestones and outcomes in the Project, and in the event of an incident or spill that may result in adverse environmental effects. *Action / Mitigation:* • Suncor will develop a Fisheries Communication Plan in consultation with Indigenous groups prior to operations to outline a process and content for updates on key operational and other milestones during the drilling campaign, as well as outreach to Indigenous groups in the unlikely event of an emergency.

Suncor will continue to engage with identified Indigenous groups during the EA process, pending authorization of the Project, and throughout the operations phase of the Project as outlined. Suncor will continue to provide project information and has expressed willingness to meet with interested Indigenous groups to discuss anything related to the Project. Suncor will develop a Fisheries Communication Plan in consultation with Indigenous groups prior to the drilling program, which will provide a framework for communicating updates on key operational and other milestones as well as a process for emergency notifications.

4.3 Fisheries Stakeholders

Early and ongoing consultation with the fishing industry is a key form of mitigation of potential effects of the Project on the commercial fisheries. Suncor recognizes the importance of location and timing of fishing activities when scheduling meetings with identified potential fisheries stakeholders. The following is a list of initial fisheries stakeholders engaged, or to be engaged, for the Project:

- One Ocean
- Fish, Food and Allied Workers-Unifor
- Ocean Choice International
- Association of Seafood Producers
- Canadian Association of Prawn Producers
- Atlantic Groundfish Council

One Ocean, which acts as a liaison between the oil and gas and fishing industries, has developed a protocol that provides guidance on consultation approach. Following the initial reach out to fisheries stakeholders on the Project in May of 2019, updates were provided at One Ocean working group meetings.

4.4 Other Public Stakeholder Groups

Other public stakeholders include industry associations and non-governmental organizations. Suncor will monitor activities and communications generated by these groups and participate in local industry events as appropriate including supplier information sessions, seminars, and conferences.

5.0 ENVIRONMENTAL ASSESSMENT APPROACH

5.1 Scope of the Assessment

The scope of the Project is defined in the Project Description submitted by Suncor on May 23, 2019, and is further discussed in Chapter 2 of this EIS. Suncor proposes to drill up to 12 to 16 exploration wells on EL 1161 during the term of the EL.

The scope of the Project to be assessed under CEAA 2012 and pursuant to the Accord Acts includes the following Project activities and components:

- Geophysical (including VSP), geological, geotechnical and environmental surveys
- MODU mobilization and drilling
  - mobilization, operation (i.e., drilling), and demobilization of the MODU
  - establishment of a safety zone associated with MODU presence and operation
  - light and sound (atmospheric and underwater) emissions associated with MODU presence and operation
  - waste and water management, including discharge of drill muds and cuttings and other discharges and emissions
- Well evaluation and testing
- Well decommissioning, suspension and abandonment
- Supply and servicing operations
  - loading, refueling, and operation of supply vessels (for re-supply and transfer of materials, fuel, and equipment; on-site safety during drilling activities; and transit between the onshore supply base and the MODU)
  - helicopter support (for crew transport and delivery of supplies and equipment)

The assessment focuses on the potential environment effects associated with these activities and components, which reflect the scope of the Project as described in the EIS Guidelines (CEA Agency 2019) that will take place throughout the life of the Project and are considered routine activities. Potential environmental effects that could occur in the event of an accidental event or malfunction (non-routine events) are also identified and considered within the scope of the Project. This includes blowouts (uncontrolled release of hydrocarbons during drilling), and platform and vessel batch spills and releases (e.g., hydraulic fluid, diesel), which have the potential to occur in the offshore (e.g., during drilling) or nearshore (e.g., during supply vessel transit) environment.

5.2 Overview of Approach

The importance of EA as a planning and decision-making tool is emphasized in the guiding principles, with an emphasis on the early identification of mitigation and follow-up programs. In addition to what is already well known about the potential environmental effects of offshore exploration activities, the EIS identifies Project-specific sensitivities mitigation strategies, including environmental design features.

The method used to conduct the EA for the Project is based on a structured approach consistent with international best practices and with the method used by Stantec for EAs of projects assessed by IAAC. Projects assessed using the same method include Flemish Pass Exploration Drilling Project Environmental Impact Statement (Statoil 2017), Eastern Newfoundland Offshore Exploration Drilling Project Environmental Impact Statement (ExxonMobil Canada Properties 2017), Husky Energy Exploration Drilling Project 2018-2025 Environmental Impact Statement (Husky Oil Operations Limited 2018), and Newfoundland Orphan Basin Exploration Drilling Program Environmental Impact Statement (BP 2018), West Flemish Pass Exploration Drilling Project 2021-2030: Environmental Assessment (Chevron 2020), and BHP Canada Exploration Drilling Project (2019-2028) Environmental Assessment (BHP 2020).

The EA method is structured to:

- Identify the issues and potential effects that are likely to be important
- Consider key issues raised by Indigenous communities, stakeholders, and the public
- Incorporate engineering design and programs for mitigation and follow-up into a comprehensive environmental planning process.

5.2.1 Identification and Selection of Valued Components

Valued components (VCs) are environmental attributes associated with the Project that are of value or interest because they have been identified to be of concern to Indigenous peoples, regulatory agencies, Suncor, resource managers, scientists, key stakeholders, and/or the public. The identification and assessment of potential adverse environmental effects of the Project on VCs is the focus of this method.

To facilitate a focused and effective environmental effects assessment the following VCs were selected:

- Atmospheric Environment (Greenhouse Gas [GHG])
- Marine Fish and Fish Habitat
- Marine and Migratory Birds
- Marine Mammals and Sea Turtles
- Special Areas
- Indigenous Peoples
- Commercial Fisheries and Other Ocean Users

5.2.2 Spatial and Temporal Boundaries

Spatial and temporal boundaries are defined to evaluate environmental effects. The geographic range over which the Project's potential environmental effects may occur are reflected in the spatial boundaries, recognizing that some environmental effects may extend beyond the Project Area (Figure 5-1). The temporal boundaries identify when an environmental effect may occur and are based on the timing and duration of Project activities and the nature of the interactions with each individual VC.

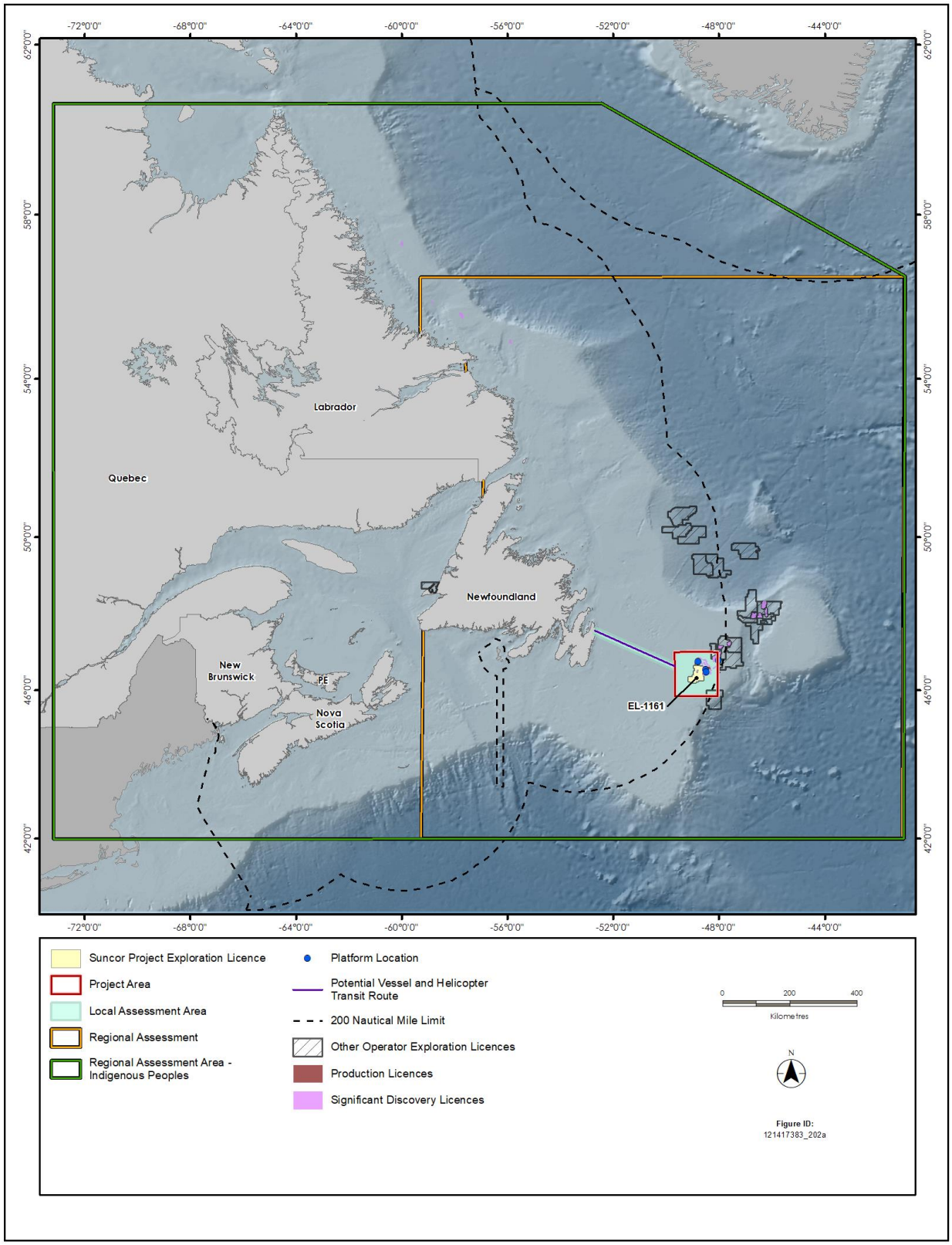

Figure 5-1 Project Area, Local Assessment Area and Regional Assessment Areas

With respect to Project activities and components, the spatial boundaries for the Project to be assessed are:

- **Project Area:** The Project Area (Figure 5-1) encompasses the immediate area o the EL within which Project drilling activities will occur. Specific well locations have not been identified but will occur within the EL. A 40 km buffer around the perimeter of EL 1161 defines the Project Area. The Project Area applies to all VCs.
- **Local Assessment Area (LAA):** The LAA (Figure 5-1) is the maximum area within which environmental effects from routine Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. It consists of the Project Area and the transit routes to and from the Project Area.
- **Regional Assessment Area (RAA):** The RAA (Figure 5-1) is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (i.e., certain or reasonably foreseeable) physical activities as well as to account for the larger movements and distributions of the various biological and socio-economic components. Although the RAA is intended to be much broader than the LAA, which focuses on the extent of potential effects associated with routine Project activities for each VC, it is possible that effects from larger scale unplanned events (e.g., blowout) could extend beyond the RAA. The RAA is consistent for all VCs, except for the Indigenous Peoples VC. The Regional Assessment Area – Indigenous Communities and Activities has a larger area to encompass the various Indigenous communities and activities that have the potential to be affected by Project-related activities.
- **Global (GHGs only):** Because GHGs are long-lived in the atmosphere and the environmental effects related to GHGs are global and cumulative in nature, the spatial boundary for purposes of assessment is the global area under the Earth's atmosphere.

All Project phases, including well drilling, testing, and decommissioning, suspension and abandonment are included in the temporal boundaries for the Project. Based on the current schedule, the temporal boundaries for assessment are:

- Suncor proposes to commence exploration drilling with an initial well as early as Q2 2024, pending regulatory approval. Up to 12 to 16 wells could be drilled over the term of the Project, contingent on the drilling results of the initial well; the temporal scope of the EIS extends to the end of 2029 to allow Project activities to properly and safely conclude.
- It is anticipated that the length of drilling associated activities may be up to 120 days for each well with the potential to occur year-round. Drilling may occur year-round if conducted using an anchored semi-submersible rig
- VSP operations will take approximately one day per well
- Well testing (if required, dependent on drilling results) could also occur at any time during the temporal scope of this EIS. Well testing, if necessary, would occur over a one-month period annually. Geological, geotechnical and environmental surveys are also short-term and could occur any time during the Project
- Well decommissioning, suspension and abandonment will be conducted following drilling and/or well testing. Wells may be designed for suspension and re-entry, but this will be determined through further prospect evaluation

6.0 SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT

The following sections provide a summary of the environmental effects assessment of the EIS. To reduce or eliminate potential adverse effects, the implementation of mitigation measures is fully integrated into the effects assessment. Mitigation measures are detailed in Table 7.1.

6.1 Atmospheric Environment

The atmospheric environment is considered a VC as it represents a physical environment that could be impacted by the Project. The constituents of the atmospheric environment are essential to sustain life and maintain the health and well-being of humans, marine ecosystems, wildlife, vegetation and other biota. The atmospheric environment is also a pathway for the transport of air contaminants to marine, freshwater, terrestrial and human environments. The Atmospheric Environment VC includes consideration of potential environmental effects on air quality, greenhouse gases (GHGs), noise and lighting.

The potential environmental effects on air quality, ambient sound quality, and lighting during Project activities have been acknowledged. The existing atmospheric environment within the Project Area can be generally categorized as good, with occasional human exposure to exhaust contaminants from existing offshore oil production facilities (i.e., Hebron, Hibernia, Terra Nova, and *SeaRose*), supply ships, and other vessels in the area. This region also receives long-range air contaminants from the industrial mid-west and northeastern seaboard of the United States. Ambient sound quality and lighting components of the atmospheric environment are typically assessed based on the effects on sensitive human-based receptors using quantitative measures such as percent highly annoyed (as per Health Canada (2017) Guidelines) for sound quality, and light trespass, glare and sky glow (as per the International Commission on Illumination) for artificial lighting. However, due to the remote nature and marine setting of the proposed Project, the Project is not anticipated to cause a substantive change in sound quality or lighting as it relates to human receptors. As a result, potential changes in the acoustic environment and lighting are not considered further in this chapter. The potential effects of sound and lighting on other receptors (e.g., marine fish and marine birds) are addressed elsewhere in the EIS, in the relevant VC sections. Information on air contaminant emissions from Project activities are presented in the EIS.

Given the importance of climate change, GHGs have been included as a VC due to release of GHGs and their accumulation in the atmosphere. GHGs influence global climate and may affect Canada's and NL's ability to meet emission reduction targets for GHGs that have been set or are being developed federally and provincially.

6.1.1 Existing Environment

The Newfoundland Grand Banks are among the harshest and most variable environmental operating areas in the world. This is an area that is affected by numerous climatic factors that vary from year to year, seasonally, and, at times, from storm to storm. The Grand Banks are located near the boundary of the maritime and continental air masses, and hence can be affected from storms that originate from the ocean or from the North American continent. Continental and maritime storms have different characteristics and each vary in their predictability. There are also situations in the winter when the cold Arctic air mass spills

over the Grand Banks in “cold outbreaks,” causing gales and a rapid build-up of high sea state conditions. In the late summer and fall, the Maritime Tropical air mass to the south of the region can cause the formation of tropical storms that eventually track across the region, bringing high winds and seas. Warm air masses moving from the Gulf Stream over the colder Labrador Current waters produce heavy fog, especially in spring and summer, when the air-sea temperature differences are greatest. The confluence of the Labrador Current and the Gulf Stream produce temperature contrasts that frequently cause migrating low pressure systems to develop as they cross the Grand Banks, sometimes explosively. Severe storms occur most frequently in the fall, due to hurricanes or other tropical systems, and in the months of January through March as large winter storms transit the area from the southwest to the northeast.

There are no site-specific ambient air quality data for the Project Area. The existing air quality within the Project Area can be generally categorized as good, with occasional human exposure to exhaust contaminants from existing offshore oil production facilities (i.e., Terra Nova, Hebron, Hibernia, and White Rose), supply ships, and other vessels in the area. This region also receives long-range air contaminants from the industrial mid-west and northeastern seaboard of the United States.

6.1.2 Potential Interactions with the Environment

Routine Project activities will result in the release of GHGs including:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrogen dioxide (N_2O)

In consideration of these potential pathways, the assessment of Project-related effects on atmospheric environment focuses on the following potential effects:

- Change in greenhouse gases

6.1.3 Potential Effects from Routine Operations

6.1.3.1 Change in GHG

Emissions of GHGs (CO_2, CH_4, and N_2O) would be released regularly during each phase of the Project from the operation of vessels and associated equipment. Emissions were estimated for the following key Project activities that may cause GHGs to be released to the atmosphere:

- Presence and Operation of the MODU
- Vertical Seismic Profiling
- Well Testing and Flaring
- Supply and Servicing

Emissions of GHGs (CO_2, CH_4, and N_2O) from diesel and gas combustion in Project equipment and vessels were estimated considering approximate equipment and vessel working hours per year for each Project scenario, fuel consumption rate, and GHG emission factors from the National Inventory Report (ECCC 2022a). The equipment and vessel working hours were used with the fuel consumption rate to determine

the total volume of diesel or gas combusted. Volume-based diesel combustion factors were then applied to estimate emissions of CO_2, CH_4, and N_2O.

The carbon dioxide equivalent, or CO_2e, is determined by weighting each of the GHGs by its associated global warming potential (GWP), relative to CO_2. The GWP for a gas is used to compare its global warming impact with another gas. The GWP compares how much heat would be trapped in the atmosphere compared to a similar mass of CO_2 (reference gas). Therefore, the higher the GWP, the more warming to the atmosphere would result from that gas.

The total estimated GHG emissions from the Project activities are presented below in Table 6.1.

Table 6.1 Estimated GHG Emissions for the MODU, Support Vessels, Helicopter and Well Testing (Flaring)

Source	MODU	Vessels	Helicopters	Well Testing	Total Emissions
CO_2 (tonnes CO_2e per year)	43,295	17,803	1,196	282	62,576
CH_4 (tonnes CO_2e per year)	102	41.8	0.34	18.1	162
N_2O (tonnes CO_2e per year)	346	142	9.90	2.03	501
Total Annual GHG Emissions (tonnes CO_2e per year)	43,744	17,987	1,206	303	63,239

Over the term of the EL, there could be between zero and four wells drilled per year. This EIS assumes only one-third of the drilled wells will be tested, or approximately one per year for the purposes of the effects assessment. With those assumptions, the annual GHG emissions resulting from Project activities (drilling, vessel traffic, helicopter traffic, and well testing) could range from 0 to approximately 63 kt CO_2e per year; approximately 44 kt CO_2e are attributed to the MODU and the rest are from vessels, helicopters, and flaring. Because GHG emissions from vessels, and helicopters, are not included in the National Inventory Report totals, only emissions from the MODU are considered for comparison to the provincial and federal emissions. The emissions from the MODU represent approximately 0% to 0.46% of the total reported provincial GHG emissions for 2020 (9,500,000 tonnes CO_2e) and approximately 0% to 0.01% of the 2020 national emissions (672,000,000 tonnes CO_2e) (ECCC 2022b).

The GHG emissions from the MODU operations are compared to provincial and federal GHG targets in Table 6.2.

Table 6.2 GHG Emissions in Comparison to Provincial and Federal Targets

	Predicted Annual Project Emissions	2030 GHG Targets	
		Provincial[a]	Federal[b]
	44 kt	6.9 MT	513 MT
Project Contribution to GHG Targets	—	0.63%	0.01%
Notes: [a] Gov NL 2019; [b] ECCC 2022b			

The total GHG emissions from Project activities are estimated to be approximately 63 kt CO_2e per year. This estimate is in the “medium” magnitude category using the CEA Agency criteria. To stay consistent with

the magnitude definitions in the other VC chapters, the CEA Agency's definition of "medium" magnitude will be referred to herein as "moderate" in magnitude.

GHG emissions to the atmosphere are considered to be irreversible, as effects related to the release of GHG emissions from Project operation would not be reversible for at least 100 years.

Suncor will adhere to federal and provincial compliance and reporting requirements for emissions as applicable.

6.2 Marine Fish and Fish Habitat

Exploration drilling activities are planned to occur within the marine environment, therefore, marine fish and fish habitat are considered a VC as per section 7.1.3 of the EIS Guidelines due to their potential interactions with routine project operations and components (CEA Agency 2019). Marine fish and fish habitat are also of ecological (e.g., ecosystem functioning, food web interactions) and socio-economic importance (e.g., commercial, recreational and Indigenous fisheries) and therefore linked through these pathways to other VCs considered in the EIS.

Project activities and components may influence the biological and physical aspects of the marine ecosystem through infrastructure presence, discharges and emissions from vessels and the MODU, vertical seismic profiling activities, and well decommissioning, suspension and abandonment. The Project Area encompasses shelf areas (approximately 60 to 140 m water depth) of the Grand Banks and a variety of plankton, fish and invertebrates occur in the area. For the purposes of this assessment, marine fish and fish habitat are considered as defined under the *Fisheries Act*:

- "Fish" includes any parts of and life history stages of fish, shellfish, crustaceans and marine animals
- "Fish habitat" includes water frequented by fish and other areas (e.g., spawning, nursery, rearing, food supply, and migration areas) that fish depend upon directly or indirectly to carry out life processes
- "Marine plants" include algae, marine flowering plants, and phytoplankton

6.2.1 Existing Environment

The marine biological environment includes a wide variety of biological organisms, ranging from plankton and bacterial communities to large fish and whales. Each portion of the biological environment present within the Project Area is further described within this chapter, including fish and fish habitat, marine birds, marine mammals and sea turtles, and special areas. Species of conservation concern within each biological unit is discussed, as well as species outlined as being of Indigenous concern.

The Grand Banks of Newfoundland are a highly productive ecosystem. The two major currents, the Gulf Stream and the Labrador Current, cause mixing and upwelling that result in high productivity and diversity on the Grand Banks. Localized gyres, such as around the Flemish Cap, are particularly productive and result in important feeding and spawning grounds for fish, marine mammals, and sea birds. Many species migrate to this area specifically to feed before returning to spawning grounds. Although they are presented separately, each portion of this chapter is related by a complex web of trophic linkages and predator-prey interactions.

Plankton are small, typically microscopic, organisms that move passively in the aquatic environment (IAAC 2021). Taxa typically assigned as plankton include bacteria, viruses, fungi, phytoplankton, a variety of small invertebrates (zooplankton), and pelagic fish eggs and larvae (ichthyoplankton). Plankton are an extremely diverse and ecologically important group, often forming the base and lower levels of the marine food web. They provide important biological links to processes such as nitrogen fixation, carbon absorption, and CO_2 regulation (Petrou et al. 2019). Many species may spend only a portion of their life cycle as plankton and may play very different roles as adults.

Most microbes (bacteria, viruses, and fungi) are secondary consumers, and their presence is heavily dictated by the presence of phytoplankton as a food source. Phytoplankton are microscopic algae which convert sunlight into energy, and the base of the marine food web. The location of peaks in phytoplankton bloom is driven by areas of upwelling and mixing, in addition to thermal fronts between different bodies of water. On the Grand Banks, these are typically the edges of the continental shelf and Flemish Cap, and the mixing front of the Gulf Stream and Labrador Current (Anderson and Gardner 1986; Templeman 2007 in Husky 2018). The density and distribution of zooplankton mirrors that of their prey.

Spring and fall phytoplankton blooms result in high abundances of zooplankton and many species time reproduction so that their larval forms are present during these blooms. The majority of zooplankton biomass on the Grand Banks is composed of three copepod species: *Calanus glacialis, C. finmarchicus,* and *C. hyperboreus* (Greenan et al. 2010). Many fish species in the waters off Newfoundland exist as ichthyoplankton (eggs and larvae of fish species) for a portion of their life cycles, including Atlantic cod, sand lance, capelin, redfish, white hake, and Greenland halibut (Dalley et al. 2000 in Husky 2018).

Corals and sponges are long-lived, sessile, marine benthic invertebrates that provide biogenic habitat, can form dense aggregations, and are sensitive to physical and chemical damage (Hogg et al. 2010, Baker et al. 2012; Beazley et al. 2013; Buhl-Mortensen et al. 2017). Deep-sea coral and sponge taxa documented on the Grand Banks of Newfoundland include soft corals, sea pens, black corals, gorgonians, stony corals, glass sponges, *Geodia* sponges, and stalked sponges (Wareham and Edinger 2007, Kenchington et al. 2009, 2015, Fuller 2011, Beazley et al. 2013, Guijarro et al. 2016). DFO has identified specific areas along the eastern Canadian shelf as Significant Benthic Areas (SBAs) for deep-sea corals and sponges (DFO 2017a). There are no SBAs within EL1161; the closest SBAs are approximately 15 km to the west of the western most edge of the Project Area and are designated for large and small gorgonian corals. A sponge SBA is to the south of the Project Area along the southeastern shelf-edge of the Grand Banks. Other SBAs for corals (sea pens and gorgonians) in the area are located along the southeastern Newfoundland Shelf. The Northwest Atlantic Fisheries Organization (NAFO) has established several coral and sponge closures along the southern and eastern edges of the Grand Banks, within the Flemish Pass, and the slopes of the Flemish Cap but none occur within the project area (DFO 2015). Within the Project Area, several Canadian Research Vessel (RV) trawls have occurred between 2002 to 2015. Of the RV trawls conducted within the Project Area, few had documented occurrences of corals and sponges and these were all below the NAFO thresholds for significant concentrations of corals and sponges. Of the research trawls conducted within EL1161, there were no recorded recoveries of sea pens or small gorgonians. One trawl recovered large gorgonians, ten trawls recovered soft corals, and two recovered sponges.

A wide variety of demersal, benthic, and pelagic fish and invertebrate species occur within the Project Area. These species play important roles in the ecosystem ranging from zooplankton (mainly larvae), planktivores (e.g., capelin), and as large predators (e.g., white shark), with many playing different roles at different points

in their life histories. Between 2014 and 2018, 140 Canadian RV trawls took place in the Project Area in water depths from 59 m to 139 m. Forty species of finfish were caught within the boundary of the Project Area, the majority of which were demersal species. These species belong to 17 families and six functional groups and include commercial species such as common lumpfish, witch flounder, yellowtail flounder, roughhead grenadier, American plaice, thorny skate, Atlantic cod, Greenland halibut, deepwater / Acadian redfish, Atlantic herring, and capelin. Though trawling is not a representative method of collecting data on pelagic species, several pelagic species are present in Canadian RV trawl data (e.g., capelin and Atlantic herring), which are deemed likely to be present in the Project Area. Other non-migratory pelagic species include Atlantic mackerel, lanternfish, and alewife (or gaspereau). Though not observed in RV trawls, these species are occasionally reported in the area and may be present (IAAC 2021). Migratory species include Atlantic salmon and the American eel, both of which are species at risk.

Several fish species at risk (SAR) or other species of conservation concern (SOCC) are known to occur, or likely to occur, in the RAA (Table 6.3). This includes species that are formally designated by the *Species at Risk Act* (SARA) or the Newfoundland and Labrador *Endangered Species Act* (NL ESA), or those identified as being of conservation concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The NL ESA gives the following three categories of protection designation:

- Endangered: A species that is facing imminent extirpation or extinction
- Threatened: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- Vulnerable: A species that has characteristics which make it sensitive to human activities or natural event

Table 6.3 Fish Species of Conservation Concern Potentially Occurring in the RAA

Species		Status/Designation[1, 2]			Relevant Population (Where Applicable)
Common Name	Scientific Name	NL ESA	SARA	COSEWIC	
Acadian redfish	*Sebastes fasciatus*			T	Atlantic (COSEWIC)
American eel	*Anguilla rostrata*	V		T	
American plaice	*Hippoglossoides platessoides*			T	Newfoundland and Labrador (COSEWIC)
Atlantic bluefin tuna	*Thunnus thynnus*			E	
Atlantic cod	*Gadus morhua*			E	Newfoundland and Labrador (COSEWIC)

Table 6.3 Fish Species of Conservation Concern Potentially Occurring in the RAA

Species		Status/Designation[1, 2]			Relevant Population (Where Applicable)
Common Name	Scientific Name	NL ESA	SARA	COSEWIC	
Atlantic salmon	*Salmo salar*			T	South Newfoundland
				SC	Quebec Eastern North Shore
				SC	Quebec Western North Shore
				E	Anticosti Island
				SC	Inner St. Lawrence
				SC	Gaspe-Southern Gulf of St. Lawrence
				E	Eastern Cape Breton
				E	Nova Scotia Southern Upland
				E	Outer Bay of Fundy Population
Atlantic wolffish	*Anarhichas lupus*		SC	SC	
Basking shark	*Cetorhinus maximus*			SC	Atlantic (COSEWIC)
Blue shark	*Prionace glauca*			NR	Atlantic (COSEWIC)
Common lumpfish	*Cyclopterus lumpus*			T	Atlantic (COSEWIC)
Cusk	*Brosme brosme*			E	
Deepwater redfish	*Sebastes mentella*			T	Northern (COSEWIC)
Northern wolffish	*Anarhichas denticulatus*		T	T	
Porbeagle	*Lamna nasus*			E	
Roundnose grenadier	*Coryphaenoides rupestris*			E	Atlantic and Arctic (COSEWIC)
Shortfin mako	*Isurus oxyrinchus*			E	Atlantic (COSEWIC)
Smooth skate	*Malacoraja senta*			E	Funk Island Deep (COSEWIC)
Spiny dogfish	*Squalus acanthias*			SC	Atlantic (COSEWIC)
Spotted wolffish	*Anarhichas minor*		T	T	
Thorny skate	*Amblyraja radiata*			SC	Canada (COSEWIC)
White hake	*Urophycis tenuis*			T	Atlantic and Northern Gulf of St. Lawrence (COSEWIC)
White shark	*Carcharodon carcharias*		E	E	Atlantic (COSEWIC/SARA)
Winter skate	*Leucoraja ocellata*			E	Eastern Scotian Shelf – Newfoundland (COSEWIC)

Notes:
[1] Not at Risk (NR), Least Concern (LC), Vulnerable (V), Near Threatened (NT), Special Concern (SC), Threatened (T), Endangered (E), Critically Endangered (CE)
[2] Multiple designations refer to multiple populations or sub-populations.

The waters off NL contain a variety of species commercially harvested or used for FSC purposes by Indigenous groups. Indigenous engagement has highlighted several species as being of Indigenous concern due to their importance and their status as species at risk. These include the American eel, Atlantic

salmon, swordfish, and tuna. These species are migratory, do not spawn within the Project Area, and only the American eel is likely to have juveniles present in these waters. Additional details on these species as they relate to Indigenous groups can be found in Section 6.6. The American eel is a catadromous species that migrates from freshwater to saltwater to breed. They are present in nearly all freshwater rivers in Canada that have access to the Atlantic Ocean as far north as Labrador (COSEWIC 2012). These migrations occur in the summer and fall (June to November, varies by population) in Canada, with eels travelling along the continental shelf before swimming over deeper waters to reach the Sargasso Sea (Béguer-Pon et al. 2015). Anadromous Atlantic salmon typically leave their natal rivers during May / June as smolt where they spend from one to four years in the marine environment before returning to spawn as adults (Gardner 1976, COSEWIC 2010a). Fish that are successful at spawning typically overwinter in freshwater and return to the ocean the following spring. Thus, at any given time there are multiple age classes of salmon expected to be using ocean environments.

6.2.2 Potential Interactions with the Environment

The potential direct and indirect effects and associated pathways of planned offshore oil and gas exploration activities on marine fish and fish habitat have been described as part of the Eastern Newfoundland Regional Assessment study area that overlaps with the Project Area (IAAC 2021). Potential effects and pathways (adapted from Amec 2014) include:

- Destruction, contamination, or alteration of marine habitats and benthic organisms due to discharge and deposition of drill cuttings and/or fluids as well as the deployment and use of Project equipment
- Contamination of fish / invertebrates and their habitats due to other Project discharges in the environment during planned oil and gas exploration drilling and other associated survey and support activities
- The attraction of marine fish to MODUs and vessels, with increased potential for injury, mortality, contamination, and other interactions
- Temporary avoidance of areas by marine fish due to exposure to underwater sound or other disturbances, that may alter their presence and abundance as well as disturbing movements / migrations, feeding, or other activities
- Changes in the availability, distribution, or quality of food sources and/or habitats for fish and invertebrates as a result of planned activities and their associated environmental emissions
- Injury, mortality, or other disturbances to marine fish as a result of exposure to sound within the water column during VSP survey activity

As a result of these considerations, the assessment of Project-related effects on marine fish and fish habitat is focused on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat availability, quality, and use

These effects reflect *Fisheries Act* prohibitions against causing death of fish or habitat alteration, disruption and destruction and allow for consideration of effects on fish SAR.

6.2.3 Potential Effects from Routine Operations

6.2.3.1 Change in Risk of Mortality, Injury or Health

A change in risk of mortality, injury, or health for individual marine fishes and invertebrates may result from potential interactions with the presence and operation of a MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, and discharges. Well testing and flaring, well decommissioning, suspension and abandonment, and supply and servicing operations are not predicted to result in changes in risk of mortality, injury or health.

Potential effects associated with increased turbidity and suspended sediment resulting from anchor placement would have a small spatial footprint, affecting individuals of sessile, suspension feeding invertebrates (e.g., corals, sponges, brittle stars) and not have an effect on populations. Effects would be recoverable due to the dissipation and short-term nature of turbidity and suspended sediment effects. It is unlikely that exposure to MODU sound would result in either physical injury or mortality to fishes and invertebrates, based on available scientific literature. Artificial lighting emissions from the MODU may increase predation and foraging opportunities for fish but will be localized from hundreds of metres to less than 1.5 km from the light source depending on structure design and activities (i.e., increased illumination with flaring) (Keenan et al. 2007; Simonsen 2013; Foss 2016). The potential spread of invasive species via the MODU and supply vessels is low with the application of standard mitigation measures (e.g., ballast water regulations for prevention and mitigation of spread of invasive species).

Changes in mortality or injury may occur from acute changes in sound pressure and/or particle motion for fishes and invertebrates exposed to high sound levels in close proximity to the VSP array. As per regulatory guidance and standard practices, a ramp-up period for the VSP source will be conducted during onset of the survey. A gradual increase in emitted sound levels is anticipated to provide an opportunity for mobile organisms to move away before potentially injury-inducing sound levels are achieved close to the sound source. VSP sound sources are stationary and the overall duration is low; therefore, mobile fishes and invertebrates are not likely to be subjected to cumulative exposures. However, low-mobility fishes and sessile invertebrates occurring in the immediate area of a VSP source would be exposed numerous times to relatively consistent levels of sound during a VSP survey. A mitigating factor is that while all fishes and invertebrates are able to detect the particle motion component of underwater sound, only some fishes and no invertebrates can detect the sound pressure component of sound. Marine planktonic organisms could be affected physically by sound emitted during VSP activities but effects are typically localized to areas adjacent (<5 m) to the sound source (Kostyuchenko 1973; Booman et al. 1996; Østby et al. 2003; Boertmann and Mosbech 2011; Fields et al. 2019). Planktonic mortality rates from airgun exposure are considered low relative to natural mortality (Saetre and Ona 1996, in Popper et al. 2014) and therefore not likely to have population level effects.

Drill cuttings discharges that settle on the seafloor may bury and smother low mobility benthic organisms. Benthic invertebrates that are sessile or have low mobility, are more likely to be subject to burial or suspended sediment effects relative to mobile organisms that can avoid deposition areas. As indicated from laboratory exposure studies, the toxicity and bioaccumulation effects from WBM and SBM cuttings are generally low. However, the physical (e.g., smothering, burial) and indirect effects (i.e., creation of anoxic environments) associated with drill cuttings deposition may affect fish mortality, injury, and health.

Drill cuttings and fluids dispersion modelling was performed for the Project and in consideration of initial burial effects from drill cuttings, the 6.5 mm predicted no-effect threshold (Kjeilen-Eilertsen et al. 2004; Smit et al. 2006; Statoil Canada Ltd. 2017; Nexen 2018) is exceeded in the near field (within 0.11 km of the wellhead) in the summer scenario (maximum predicted thickness is 7.28 mm covering a maximum area of 0.003 km^2) but not in the fall. The conservative 1.5 mm predicted no-effect threshold is exceeded in the summer up to 0.47 km from the wellhead, and in the fall up to 0.55 km from the wellhead. However, in field experimental studies of benthic community responses show that recolonization of sediments, capped with 10 mm of WBM drill cuttings sediment, was not different in overall diversity relative to native sediments after 1 year (Bakke et al. 1986, in Bakke et al. 2013). Since the 10 mm recoverable threshold is not exceeded in any modelled scenario, non-recoverable burial effects on benthic organisms is not predicted within EL 1161. Benthic mortality rates as a result of these discharges are not predicted to result in irreversible changes to local populations due to the negligible to low magnitude and spatial extent of potential effects. Additionally, coral and sponge densities within the Project Area are relatively low; therefore, the Project is not predicted to result in population level effects on coral and sponge resources. Furthermore, an imagery-based, pre-drilling seabed survey will be conducted at the proposed wellsite(s) to assess the presence of environmentally sensitive features such as habitat-forming corals and sponges.

6.2.3.2 Change in Habitat Availability, Quality and Use

A change in habitat availability, quality and use for marine fishes and invertebrates may result from the operation and presence of the MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, Project-related discharges, well decommissioning, suspension and abandonment, and supply and servicing operations.

Underwater sound emitted during MODU operations may affect the quality of the underwater acoustic environment for marine fishes and invertebrates (Cordes et al. 2016). The principal potential effects would be behavioural with a change in habitat availability from avoidance responses of mobile fishes and invertebrates, albeit in a localized area. Continuous sounds may result in behavioural effects of avoidance, attraction, or startle responses by individual fish (Clark et al. 2016). Fishes and invertebrates remaining in the area will likely habituate to the continuous sound and avoidance and startle responses will decrease over time during drilling activities. Given the localized and temporary nature of the drilling activity, displacement of fish from habitats and population level disturbances are unlikely.

Marine fish and invertebrates may aggregate toward or avoid the illuminated areas and attributed to artificial lights on the MODU, resulting in potential changes in habitat quality and use. Marine fish behaviours (e.g., feeding, schooling, predator avoidance, and migration) may be altered by sharp light contrasts created by over-water structures due to shading during the day and artificial lighting at night (Nightingale and Simenstad 2002; Hanson et al. 2003, in BP 2018). Potential effects of artificial lighting from the MODU are generally localized to hundreds of metres to less than 1.5 km from the light source (Keenan et al. 2007; Simonsen 2013; Foss 2016).

The placement of anchors may result in avoidance of the area during initial placement with colonization of the hard structures over Project activities. However, considering the short-term nature of drilling activities and low spatial footprint of anchors, the potential effects on fish habitat are negligible. Aquatic invasive species may compete with local species for resources (e.g., colonizing habitat) and may result in a change to fish habitat availability and quality. However, the potential spread of invasive species is low with the

application of standard mitigation measures (e.g., ballast water regulations for prevention and mitigation of spread of invasive species).

The received sound pressure levels from VSP activities are predicted to have effects on marine fish and fish habitat with a short-term change in habitat quality and use. While mobile fishes could exhibit a variety of behavioural responses when exposed to sound from the VSP sound source, this seismic airgun source will have a lower source SPL than airgun arrays used during full mobile 2D and 3D seismic surveys and is much shorter in duration than mobile seismic surveys. Localized and temporary avoidance by a variety of fish species including salmonids, herring, and flatfish have resulted from exposure to impulsive underwater sounds, such as those generated during VSP (Feist et al. 1996; McCauley et al. 2000a, 2000b, in BP 2018). Other observed behavioural responses include a short duration “startle” response (flexion of body followed by a burst of faster swimming), and an “alarm” response with intense variable movements (Schwarz and Greer 1984; Feist et al. 1996; McCauley et al. 2000a, 2000b, in BP 2018).

The discharge of drill mud and cuttings are predicted to result in changes in habitat availability and quality from physical and chemical changes to the water column and sediments. Drilling mud and cuttings discharges are the primary discharges expected to have effects on marine fish and fish habitat. The potential effects in the water column are generally considered non-persistent and temporary with the rapid dilution and dispersal of drill cuttings. Drilling mud and cuttings discharges may have effects on benthic invertebrates such as habitat-forming corals and sponges and therefore result in changes to habitat availability (Allers et al. 2013; Cordes et al. 2016; DFO 2019). Coral and sponge densities within the Project Area are relatively low and the Project Area does not overlap with significant benthic areas (SBAs) for corals and sponges. With mitigation measures, such as imagery-based, pre-drilling seabed survey, effects to biogenic habitat are expected to be limited.

Well decommissioning, suspension and abandonment activities are predicted to result in a temporary, localized disturbance that may result in avoidance of the area and change in habitat availability for the duration of the activity. Depending on the decommissioning strategy, the duration of potential effects may be short-term to permanent (if wellhead is left in place). Due to the small spatial extent of the wellhead infrastructure, permanent effects would be low in magnitude with a localized nature of potential positive effects.

Supply and servicing operations are expected to increase vessel traffic within the Project Area for the duration of Project activities. There may be localized, transient effects to fish habitat quality and use around the supply vessel traffic route due to increased vessel sound. Changes to habitat availability, quality and use from supply vessel traffic is predicted to represent a small increment over similar effects from existing levels of marine traffic in the RAA.

6.2.4 Potential Effects from Accidental Events

Accidental events that result in the release of oil or SBM into the marine environment have the potential to affect marine fish and fish habitat depending on the nature, scale and duration of an offshore spill. The availability and quality of fish habitats may change from accidental events, with potential effects on water and sediment quality, and effects on biogenic habitats (e.g., eelgrass, macroalgae, corals, sponges). Change in habitat quality may also result in changes of habitat use (e.g., avoidance of these areas by marine fishes). Direct exposure to released substances by fish and invertebrates within these habitats may

also result in changes in risk of mortality, injury or health depending on toxicity of released substances, mitigation measures employed (e.g., dispersants, in-situ burning), exposed life history stage, and uptake pathways. Marine fish may also migrate to other areas if there are potential declines in prey species from accidental release exposures.

Potential effects from a subsurface blowout accidental event will depend on the extent and duration of the spill, spill trajectory, and overlaps in space and time with marine fish and fish habitat. If a subsurface blowout were to occur, it would potentially have effects on marine fish and fish habitat through changes in risk of mortality, injury or health of fishes, and changes in habitat availability, quality and use.

The potential surface water and water column effects of a subsurface blowout on fish and invertebrates would depend upon the timing of the event and how it coincides with seasonal migrations and timing of particular life history stages. Oil exposure of early life history stages would likely result in lethal and sublethal developmental effects in fish and invertebrates. A mitigative factor would be that fish and invertebrate species spawn over large spatial scales and it is unlikely that the spill would encompass the full geographic extent of spawning range for any species. Therefore, the effects from a subsurface blowout are not predicted to affect natural recruitment such that organisms may not re-establish populations to levels prior to an accidental event. Mobile fish and invertebrates may also be able to avoid hydrocarbon exposure or contaminated food sources through temporary migration. Lethal and sublethal effects are predicted for slow moving or sedentary fish and invertebrates near an accidental release site. Oil transported away from the release site during an unmitigated spill would be highly weathered, patchy and discontinuous resulting from natural degradation processes occurring over a week or more. Fish and invertebrate populations occupying the water column and surface areas are estimated to recover within a few years after the spill has subsided.

Cold-water corals and sponges occupy slope and bottom areas of the Grand Banks, Flemish Pass, and Flemish Cap. Potential effects and associated recovery times from a subsea hydrocarbon release by corals and sponges is highly dependent on the nature and extent of initial exposure. Although few directed studies have been conducted on local coral and sponge species, information from other regions indicate recovery may be on the scale of decades. However, oil transported to the sediment was not a major fate pathway in the deterministic modelled scenarios (surface oil, water column, shoreline exposure), with <0.1% predicted to settle on the sediments and exposure levels of <1 g/m^2. Sediment exposure was also to occur near the release site with modelled footprints within 100 km. Therefore, with limited initial exposure, potential adverse effects to corals and sponges and special areas established for benthic features would be limited. With limited benthic effects, there would also be limited exposure to other benthic organisms and wolffish critical habitat (DFO 2020) within the region.

A surface marine diesel spill (1,000 L) was modelled from the drilling installation and was predicted to result in oil floating on the water surface with silver or colourless sheens whose thickness would be below 0.0001 mm (RPS Group 2020). The predicted transport of this spill indicated it could be within 175 km of the release location to the south and west. The oil thickness, in addition to the small quantity of spilled diesel released, was below the socio-economic and ecological thresholds. Mass balance estimations after the 30-day diesel batch spill simulation suggested that more than 85% was predicted to be evaporated to the atmosphere or degraded.

Accidental releases from vessels travelling to shore from the drilling installation were modelled as part of BHP's EIS for the exploration licence in EL 1157 and EL 1158. A batch spill was modelled of 3,200 L of

marine diesel from a vessel along the planned vessel transit route from the Orphan Basin to the Avalon Peninsula of Newfoundland (RPS Group 2019). The model predicted a spill of this volume would result in patchy distributions of silver or colourless sheens whose thickness would be below 0.0001 mm (RPS Group 2019). Some model simulations predicted diesel would extend from the spill site and wrap around the southern portion of the Avalon peninsula. Spilled diesel would not exceed the ecological threshold in either stochastic modelling or worst-case deterministic scenarios for surface oiling and water column. Approximately 9 km of shoreline exceeded the ecological threshold in the 95th percentile worst-case scenarios.

Batch spills of these volumes would likely have limited impacts on marine fish and fish habitat. Effects from a diesel spill would be similar to those described for other hydrocarbon releases. Early life history stages (eggs, larvae, and juveniles) are typically more vulnerable to spills, as they have limited or no capacity to avoid the spill. As many fish species in the northwest Atlantic have eggs and larvae living near the sea surface, they are more likely to be exposed to a surface spill and may experience lethal or sublethal effects. If the spill reaches shore, nearshore habitats including spawning and rearing areas may be affected. Spilled oil can have immediate toxic effects on intertidal and subtidal organisms, such as sea grasses and macroalgae (Stepaniyan 2008; Fonseca et al. 2017). These effects from spilled diesel would likely be short-term in nature as volatiles would evaporate, and the oil would breakdown. The effect on pelagic species would be low, due to the small spatial extent of a spill and limited exposure below the surface. If the spill reaches shore, recovery would likely be within months to years after the spill has subsided. The potential effects would be similar for SAR and secure species. Mitigation measures would be implemented if a spill took place, and would reduce the magnitude, duration, and extent of a spill and reduce effects on marine fish and fish habitat.

Two scenarios for accidental SBM release were modelled as part of Nexen Energy's Flemish Pass Exploration Drilling Project (Amec Foster Wheeler 2018; Nexen Energy 2018) at a shallow-water site on the eastern slope of the Flemish Pass (EL 1150; 378 m depth). These models were used to inform the potential effects of an SBM spill for the Tilt Cove Project Area. As modelled results for EL 1150 are not specifically representative of conditions at EL 1161, even doubling the maximum distance for the surface release scenario results in effects to marine fish and fish habitat being limited to 1 km from the release site. Potential changes to risk of mortality, injury, and health on fish and fish habitat would be limited to sessile benthic species unable to avoid burial. Changes to water and benthic habitats in the area would be temporary and reversible. SBMs biodegrade rapidly and acute toxicity is considered to be relatively low. Depending on the nature and extent of the spill, the duration of the effect may range from short- to long-term. Partial recovery is on the order of weeks to months, with total recovery within three to five years. Potential pathways of effects from SBM releases would be similar for SAR and secure species. However, SAR species may be more vulnerable to adverse effects on individuals or habitat. Mitigative measures employed to protect secure species from accidental releases would also be protective of SAR species.

Although accidental events may result in adverse effects on marine fish and fish habitat through lethal and sublethal effects, these residual effects are predicted to be reversible at the population level. Fish habitat contaminated by hydrocarbon or SBM exposure would also recover through natural degradation processes and employed mitigative measures. Fish species within the RAA spawn over large geographic areas, and a spill is not predicted to encompass all of these areas to a degree that organisms may not re-establish to affected areas given the low probability for large spill events and associated mitigative response measures. These potential effects would be similar for species at risk and secure species.

SUNCOR ENERGY

6.3 Marine and Migratory Birds

Marine and migratory birds were chosen as a VC because of their role in pelagic and coastal ecosystems, the cultural and economic importance of subsistence and recreational hunts, predisposition to attraction to artificial lighting at night, the adverse effects of oil, regulatory considerations, and requirements in the EIS Guidelines. The Marine and Migratory Birds VC includes oceanic (i.e., beyond the continental shelf), neritic (continental shelf), and littoral zone (intertidal, splash, and spray zones) alcids (auks), fulmars, shearwaters, storm-petrels, gannets, skuas, terns, gulls, phalaropes, waterfowl, loons, grebes, and shorebirds (plovers, sandpipers) that are protected under the *Migratory Birds Convention Act*, *1994* (MBCA) and additional marine-associated birds not protected under the MBCA but protected by the *Newfoundland and Labrador Wild Life Act* (i.e., cormorants). The term “migratory” in this context means protected under the MBCA regardless of whether a listed species under consideration undertakes migrations of any kind. This VC also includes the marine and migratory birds listed under Schedule 1 of SARA, COSEWIC, the NL ESA, or the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.

6.3.1 Existing Environment

The marine waters off eastern Newfoundland provide a vast area of important breeding, migrating, and wintering habitat for marine-associated birds. The upwelling of the cold Labrador Current meeting the Grand Banks, the Flemish Cap and the North Atlantic Drift brings vital mineral nutrients from the ocean depths to the surface. The phytoplankton nourished by this upwelling form the basis for substantial biomass production, culminating in globally important numbers of seabirds in parts of the region in each season (Brown 1986; Lock et al. 1994; Fifield et al. 2009).

Marine bird habitats in the RAA are comprised of coastal waters, continental shelf, slope, and deep waters. Concentrations of these birds sometimes occur at the upwellings at oceanographic features. Spawning capelin attract large concentrations of marine birds to coastal waters for a few weeks in summer. Millions of marine birds breed at nesting colonies in coastal southeastern Labrador and eastern Newfoundland, and forage for their young on the Grand Banks and other shelf areas during summer. Thousands of non-breeding seabirds occur in the RAA during the summer months. For example, most of the world’s population of great shearwater and large numbers of sooty shearwater migrate to Newfoundland waters to moult and feed upon completion of their breeding period in the Southern Hemisphere. Thousands of sub-adult seabirds of species that nest north of the RAA remain in the RAA during the summer, especially northern fulmar and black-legged kittiwake. In the fall, migration of marine birds that have bred in the Arctic and subarctic regions of eastern Canada and Greenland brings them to the RAA to spend the winter. Other marine and migratory species also pass through the RAA during spring and fall migration.

Waterfowl nest in coastal Newfoundland in relatively small numbers but winter in large numbers (Lock et al. 1994). They are rarely observed beyond coastal waters. Some species of loons and grebes also winter in coastal Newfoundland waters. Some shorebird (plovers, turnstones, and sandpipers) species nesting in the Arctic make trans-oceanic flights during fall migration from eastern North America to South America (Williams and Williams 1978; Richardson 1979). As a result, small numbers are observed in offshore areas of the RAA. Waterfowl (ducks, geese and swans), loons, and grebes are susceptible to oil pollution because, like alcids, they spend most of their time feeding or resting on or under the sea. These species are rarely out of sight of the coastline. A total of 32 species have been recorded in Newfoundland (Statoil

Canada Ltd. 2017), but only 24 species regularly occur in the marine waters of the RAA. Two of these are species of conservation concern (harlequin duck and Barrow's goldeneye).

In total, 26 species of plovers, turnstones, and sandpipers use Newfoundland during breeding, passage migrants, or in winter (Mactavish et al. 2016). Of these species, piping plover, spotted sandpiper, and willet nest along marine coastlines. Piping plover is assessed as Endangered by COSEWIC and also designated Endangered on Schedule 1 of SARA and under the provincial ESA. Piping plover and willet nest only at sites in southwestern and western Newfoundland, including Stephenville Crossing, Cheeseman Provincial Park and Burgeo, well outside the RAA (Statoil Canada Ltd. 2017), although there is a historical nesting record of piping plover from the Cape Freels coastline (Bird Studies Canada 2016). Several species use coastlines in the RAA during fall migration and a small number of ruddy turnstones have overwintered at Mistaken Point, the northernmost site in this species' usual wintering range (Bird Studies Canada 2016).

Landbirds such as raptors and songbirds associated with coastal habitats may be encountered in coastal areas of the RAA (Statoil Canada Ltd. 2017). Landbird species nesting in eastern Canada occasionally drift out to sea during migration and land on vessels in the RAA; several species have been recorded on offshore platforms and vessels (Thomas et al. 2014; Statoil Canada Ltd. 2015a, 2015b, unpublished migratory bird salvage reports provided by Statoil). Nocturnally migrating species are often attracted to artificial lighting on vessels, especially when fog or rain sets in after the night's nocturnal migration has begun (Gauthreaux and Belser 2006). These species are most often seen during spring migration (April to June) and fall migration (August-November).

In total, nine species designated at risk provincially or federally, or of conservation concern as assessed by COSEWIC, have the potential to occur in the RAA or the Project Area (Table 6.4). These species include two coastal waterfowl species, three shorebird species, one phalarope species, two gull species, and one raptor species. An additional six species, while not designated provincially or federally, occur on IUCN's Red List of Threatened Species. Other shorebird and landbird species at risk in Newfoundland are not likely to occur in the RAA or Project Area.

Table 6.4 Marine and Migratory Bird Species of Conservation Interest Likely to Occur in the RAA

Species	NL ESA Status	Federal Status		IUCN Red List
		SARA Listing	COSEWIC Assessment	
Harlequin duck (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Long-tailed duck	None	None	None	Vulnerable
Barrow's goldeneye (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Piping plover (*melodus* ssp.)	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Red knot (*rufa* ssp.)	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Buff-breasted sandpiper	None	Special Concern (Schedule 1)	Special Concern	Near threatened
Red-necked phalarope	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Black-legged kittiwake	None	None	None	Vulnerable

Table 6.4 Marine and Migratory Bird Species of Conservation Interest Likely to Occur in the RAA

Species	NL ESA Status	Federal Status		IUCN Red List
		SARA Listing	COSEWIC Assessment	
Ivory gull	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Ross's gull	None	Threatened (Schedule 1)	Threatened	None
Peregrine galcon *anatum / tundrius*	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Leach's storm-petrel	None	None	Threatened	Vulnerable
Bermuda petrel	None	None	None	Endangered
Desertas petrel	None	None	None	Vulnerable
Zino's petrel	None	None	None	Endangered

6.3.2 Potential Interactions with the Environment

Routine Project activities and components have potential to interact with migratory birds and their associated habitat as a result of the attraction by nocturnally active birds to the artificial light emitted by the MODU and supply vessels, operational discharges during well drilling, underwater sound emissions from VSP operations, emissions during well testing operations, and interactions with supply vessels and helicopter activities during supply and servicing.

Direct and indirect adverse effects on migratory birds could be caused by Project activities through the following effects pathways:

- Nocturnal disturbance (e.g., increased opportunities for predators, attraction to the MODU or supply vessels and subsequent collision or stranding resulting in mortality) due to artificial light levels different weather conditions and seasons
- Physical displacement because of vessel presence (e.g., disruption of foraging activities)
- Exposure to operational discharges (e.g., drilling waste, deck drainage, gray water, black water)
- Attraction of predator species near the MODU or supply vessels
- Collision risk with Project infrastructure (e.g., the MODU or supply vessels)
- Physical or behavioural effects due to increased underwater sound from VSP surveys

In consideration of these potential pathways, the assessment of Project-related effects on marine and migratory birds focuses on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat quality and use

6.3.3 Potential Effects from Routine Operations

6.3.3.1 Change in Risk of Mortality or Physical Injury

The most important potential interactions between marine and migratory birds and the presence and operation of a MODU result from the attraction of nocturnally active birds to artificial lighting on platforms. This phenomenon can result in mortality in some species as a result of stranding, collisions, predation and exposure to other vessel-based threats. Marine and migratory bird attraction to coastal and offshore lighting has been widely reported, but the underlying mechanisms are poorly known (Imber 1975; Wiese et al. 2001; Gauthreaux and Belser 2006; Montevecchi 2006; Montevecchi et al. 2009; Bruinzeel and van Belle 2010; Rodríguez et al. 2015; Ronconi et al. 2015; Adams et al. 2019). Attraction of nocturnally active birds may result in direct mortality or injury through collisions with facility infrastructure, predation, or through stranding on the platform (i.e., birds are unable to regain flight and die from dehydration, starvation or hypothermia) (Baird 1990; Montevecchi et al. 1999; Wiese et al. 2000; LGL 2017). Attraction to artificial lighting and related stranding in marine birds has been documented in more than 40 species representing most families of procellariform birds (i.e., fulmarine and gadfly petrels, shearwaters, and prions [Procellariidae], storm-petrels [Hydrobatidae], and diving-petrels [Pelecanoididae]) (Imber 1975; Reed et al. 1985; Telfer et al. 1987; Le Corre et al. 2002; Black 2005; Montevecchi 2006; Rodríguez and Rodríguez 2009; Miles et al. 2010; Rodríguez et al. 2015). With the implementation of appropriate mitigation measures (See Table 7.1), the overall magnitude of the effect of the presence and operation of a MODU on marine and migratory birds is anticipated to be low. There may be a slight increase in mortality / injury levels due to collisions, disorientation, and potential predation, although, based on previous monitoring, the mortality rate is anticipated to be low as most stranded birds encountered on platforms and vessels are found alive and released successfully.

Permanent physiological damage, i.e., hearing loss (permanent acoustic threshold shift), is unlikely to result from a VSP survey. Temporary auditory impairment from exposure to loud impulse sound may last days (Hashino et al. 1988), which may impede a bird's ability to find their kin at nest sites, for example. Deep-diving birds such as alcids (common and thick-billed murre, razorbill, dovekie, Atlantic puffin) may be at somewhat higher risk of injury (or disturbance) due to exposure to underwater sound from geophysical sound sources than shallow-diving species (northern fulmar, shearwaters). No mortality or injuries of marine bird from the underwater sound energy from VSP surveys have been reported. To mitigate potential effects from VSP activities, air source operations will incorporate a ramp-up in consideration of the SOCP (DFO 2007). The gradual increase in emitted underwater sound levels will provide an opportunity for diving marine birds to move away from the sound source before associated underwater sound reaches levels that are potentially physically damaging to marine birds diving near the source. Above the water, atmospheric sound from the air source array is substantially reduced or muffled such that it is expected to have little or no effect on birds that have their heads above water or are in flight.

Cement, WBM and cuttings released at the seafloor will be at depths below the maximum diving range of most seabird species expected in the Project Area, except the razorbill and common and thick-billed murre. Water depths in EL 1161 range from approximately 61 m to 87 m. The deepest-diving seabird species found in the Project Area, thick-billed murre, can reach depths up to 200 m (Gaston and Hipfner 2000, in ExxonMobil Canada Properties 2017). However, alcids such as the two murre species generally avoid platforms, which reduces the potential for murres interacting with mud and cuttings (Amec 2011; Baird 1990; Bramford et al. 1990). SBM has a synthetic base fluid as a component, but SBM cuttings are treated

prior to discharge, and have only a small (and permitted) fraction of residual SBM when discharged. Discharging the SBM-related drill cuttings below the water's surface further mitigates the potential for marine and migratory birds to encounter the chemical components of SBM. The treated discharge of some operational wastes may cause surface sheening, typically under calm conditions; however, the potential for sheen formation is very unlikely with proper treatment and management of operational discharges. With the proper implementation of mitigation measures (See Table 7.1), the overall magnitude of the effect of drilling and other marine discharges on marine and migratory birds is anticipated to be low. These effects will be prevented or reduced through the waste management and discharge treatment measures in compliance with OCSG and OWTG, and adherence to associated MARPOL requirements.

It is Suncor's preference to use other methods and to avoid flaring (see Section 2.2.4). However, if flaring is required nocturnal migrants, and nocturnally active seabirds such as Leach's storm-petrel are the marine and migratory birds most at risk of attraction to flares. Although the potential mortality resulting from such interactions is poorly understood. While accurate assessment of mortality at offshore facilities may be difficult, no mass mortality events due to incineration in flares have ever been reported at oil and gas operations in offshore NL. Mitigation measures regarding flaring will be adhered to throughout the Project, including the use of high efficiency burners. If flaring is required, Suncor will discuss flaring plans with the C-NLOPB including steps to reduce adverse effects on migratory birds. This may involve restricting flaring to the minimum required to characterize the wells' hydrocarbon potential and as necessary for the safety of the operation, limiting flaring during periods of migratory bird vulnerability, and the use of a water curtain to deter birds from the general vicinity of the flare. The effects of flaring on marine and migratory birds are therefore anticipated to be low.

The various bird species that occupy the Project Area will not likely be affected by supply vessel activity, associated aircraft use, or vessels used for well decommissioning, suspension and abandonment activities due to its transitory nature and thus, its short term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years, including that associated with existing oil production and exploratory drilling platforms in the RAA.

6.3.3.2 Change in Habitat Quality and Use

A change in habitat quality and use for marine and migratory birds could potentially occur as a result of Project activities, particularly due to the influence of artificial lighting, discharges and atmospheric and underwater sound associated with the MODU and supply vessels. These changes in the marine habitat could potentially influence bird behaviour, most likely resulting in attraction. Helicopter traffic also has the potential to affect habitat quality and use by marine and migratory birds.

Attraction of nocturnally active marine and migratory birds to artificial lighting is discussed in detail above (change in risk of mortality or injury). Daytime densities of some species of marine bird within 500 m of offshore platforms are often many times higher than before the installation of the platforms or some distance farther away from platforms, suggesting that the birds are attracted to foraging opportunities or to the shelter found downwind of platforms (Tasker et al. 1986; Baird 1990; Wiese and Montevecchi 1999).

The presence of offshore platforms can also provide new habitats for birds (Russell 2005). Structures may be used as roosting and resting habitat by gulls (Burke et al. 2012), as stopover locations for migrating landbirds who may forage around the platforms (Russell 2005; Bruinzeel and van Belle 2010), or even

potentially as hunting grounds for predatory species such as large gull species and peregrine falcons in passage migration that take advantage of concentrations of birds around the structures (Russell 2005).

Some marine bird species, especially alcids, may be displaced from the area around the active MODU during drilling operations and along supply vessel routes through general avoidance responses. However, the effect of habitat displacement on marine-associated birds is likely to be minor due to its small footprint (Hedd et al. 2011; Ronconi et al. 2015). Because the MODU will not be situated in one location for an extended time, disturbance will be short-term and transient in nature.

Some localized and short-term behavioural effects (change in presence and abundance) are likely to occur, with some species displaced from the Project Area / LAA and others attracted by lighting, including artificial light resulting from nocturnal flaring, which will reduce the degree to which foraging opportunities are enhanced by the presence and operation of a drilling installation. The localized, transient, and short-term nature of these disturbances at one location and time during the Project considerably reduces the potential for adverse effects upon marine and migratory birds (individuals or populations). It is therefore unlikely that individuals will be attracted or displaced over extended areas or timeframes. Given that the likely zone of influence of the Project, conservatively set at 16 km diameter, at one time or location will represent a small proportion of the feeding, breeding or migration area of species, birds will not be displaced from key habitats or during important activities or be otherwise affected in a manner that causes detectable adverse effects to overall populations in the region.

Vessel traffic may interact with seabirds through lighting, atmospheric and underwater sound, and other associated environmental emissions and discharges. The various bird species that occupy the Project Area will not likely be affected by supply vessel activity due to its transitory nature and thus, its short-term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years.

Helicopters may interact with the marine and migratory birds through aircraft overflights and potential disturbance of normal nesting, foraging or resting activities. The various bird species that occupy the Project Area and transit route will not likely be affected by helicopter activity due to its transitory nature and thus, its short-term presence at any one location, and because of mitigation measures in place (see Table 7.1).

6.3.4 Potential Effects from Accidental Events

Accidental spill scenarios have potential to result in a change in risk of mortality or physical injury and/or a change in habitat quality and use for marine and migratory birds. The extent of the potential effects will depend on how the spill trajectory and the VC overlap in space and time. The assessment is conservative (i.e., geographic and temporal overlap are assumed to occur, and modelling results assume no implementation of mitigation measures).

A subsea well blowout's potential effects will be determined by the spill's characteristics, its trajectory, and how the spill trajectory coincides in time and space with marine and migratory birds. Such a blowout is unlikely to occur, but it has potential to change both the risk of mortality or physical injury and the habitat quality and use for marine and migratory birds. Two oil exposure thresholds were used to assess whether the oil would have effects on marine and migratory birds. These thresholds are based on the habitats of seabirds (open water) and shorebirds (the intertidal zone of shorelines). There is potential for direct effects

from oil from a blowout on the nesting habitat of a subset of marine-associated species, but most seabird species nest well above the high tide mark. As a result, there much is greater potential for direct effects on habitat at sea (i.e., those used for foraging, loafing, and roosting). The greatest potential risk of mortality or injury from oil for seabirds at-sea is from exposure to oil on the sea surface. Surface oil causes lethal effects to seabirds above a threshold thickness of 10 µm (>10 g/m²) (French et al. 1996; French McCay and Rowe 2004; French McCay 2009). For shorebirds (and other wildlife) on or along the shore, and for nesting seabirds resting on the water near their coastal nesting colonies, an oil exposure index consisting of the length of shoreline oiled by the potential ecological effects on shoreline fauna and flora of 100 g/m² (100 µm thick) was used. The threshold has typically been >100 g/m² (100 µm thick) (French McCay 2009).

The modelling results suggest that the areas most likely to be affected by an unmitigated, subsurface, well blowout are Jeanne d'Arc Basin, the Newfoundland Basin, Flemish Pass, the areas to the east, and, in the 120 day simulations, the Southeast Shoal. As a result, a blowout during summer would have the potential to interact primarily with the relatively high concentration of summering great shearwaters, Leach's storm-petrels foraging for their nestlings, and smaller concentrations of northern fulmars and sooty shearwaters. Of these species, the shearwaters and fulmars would be most vulnerable to interaction with oil due to their moulting of flight feathers and the resulting greater amount of time on the sea surface. Low average wind speeds during summer also increase the amount of time these species spend on the sea surface because dynamic soaring species depend heavily on wind for lift rather than powered flight, as in other seabird species. A blowout during winter would have the potential to interact with large concentrations of thick-billed murres, dovekies, kittiwakes, and fulmars, and smaller concentrations common murres. Of these species, the murres and dovekies would be most vulnerable due to the large proportion of time that alcids spend on the sea surface. A blowout during spring or fall has the potential to interact with the above species, with murres and dovekies as the most vulnerable species. However, higher average wind speeds and sea states during winter and fall would decrease the length of time that contiguous areas of oil would persist on the surface. The magnitude and extent of potential effects would be reduced with the application of spill response measures, therefore the risk of adverse effects on secure and at-risk to marine and migratory birds would be reduced.

In the even less likely event of shoreline oiling, particularly at or near the seabird colonies of the Avalon Peninsula and for coastal SERs on the Avalon, such as Cape St. Mary's, Witless Bay Islands, and Baccalieu Island, there is potential for marine and migratory birds present and nesting in these areas to interact with surface oil. It is probable that only a small proportion of local populations would be affected. As stated above, by the time oil made contact with the shoreline, it would be patchy, discontinuous and weathered. As with surface oil, the potential effects would be reduced with mitigation measures, therefore the risk of adverse effects on shoreline and coastal marine and migratory birds would be reduced.

A batch diesel spill or vessel spill has the potential to result in a change in risk of mortality or physical injury and change in habitat quality and use for marine and migratory birds. A threshold concentration for lethal effects to seabirds is the open water area covered by an oil plume greater than 10 µm thick (>10 g/m²). For shorebirds (and other wildlife) on or along the shore, an exposure index is length of shoreline oiled by a slick >100 g/m² in thickness.

Based on the modelling results, a batch spill could result in a temporary and reversible degradation in habitat quality. Depending on the location and extent of the spill, it could directly and indirectly reduce the amount of habitat available to marine and migratory birds at sea. However, the model predicts surface

hydrocarbon thickness well below the ecological threshold and no probability of shoreline contact. A batch spill of diesel is therefore not expected to create permanent or irreversible changes to habitat quality and use. A batch spill of hydrocarbons has the potential to cause a change in risk of mortality or physical injury for marine and migratory birds through direct contact. However, since the modelled sheen's predicted thickness is well below the ecological threshold it is predicted that birds coming into contact with the sheen would not suffer mortality or sublethal effects. The number of birds affected would also be limited due to the short time and small area where the diesel would be on the water's surface.

A Project supply vessel spill of fuel has the potential to result in a change in risk of mortality or physical injury and change in habitat quality and use for marine and migratory birds. A batch spill of hydrocarbons has the potential to cause a change in risk of mortality or physical injury for marine and migratory birds through direct contact. However, it is predicted that birds coming into contact with the sheen would not suffer mortality or sublethal effects. The number of birds affected would also be limited due to the short time and small area where the diesel would be on the water's surface. If the spill occurred during the breeding season nesting species would be most vulnerable. Among those species, the most vulnerable would be those spending the greatest amount of time on the water such as common murre and Atlantic puffin, which nest in the Witless Bay SER in large numbers, along with smaller numbers of equally vulnerable thick-billed murre and razorbill. However, the surface thickness would still be below the ecological threshold and the diesel would rapidly evaporate and degrade. As a result, birds nesting on the islands in the SER would not suffer mortality or sublethal effects.

Such a spill could result in a temporary and reversible degradation in habitat quality. Depending on the location and extent of the spill, it could directly and indirectly reduce the amount of suitable habitat available to marine and migratory birds at sea. Affected habitat could potentially include shoreline. When a diesel spill interacts with the shoreline, it tends to penetrate porous sediments quickly and washes off quickly by waves and tidal flushing (National Oceanic and Atmospheric Administration 2016). These effects would be short-term in duration, lasting until the slick disperses and the diesel content in the area reaches background levels. A batch spill of diesel is therefore not expected to create permanent or irreversible changes to habitat quality and use, including habitat within the Witless Bay Islands SER. Given the modelling predictions of a low probability of the diesel on the water's surface or on the shorelines on the nesting islands approaching the thickness of the respective ecological thresholds, and given the rapid evaporation, degradation and entrainment of the slick, the effects on habitat quality and use in the SER would be short-term and reversible.

An SBM spill has the potential to result in a surface sheen which in turn could cause a change in risk of mortality or physical injury or change in habitat quality and use for seabirds present in the immediate vicinity of the MODU (Morandin and O'Hara 2016). However, a sheen would be limited in size, temporary, and moderate wind and wave conditions would quickly break it up. Given that the low surface oil thickness required to result in a sheen (0.04 µm) is well below the ecological threshold surface oil thickness, it is expected that effects would be minor and unlikely to result in seabird mortality.

6.4 Marine Mammals and Sea Turtles

The Marine Mammals and Sea Turtles VC includes baleen whales, large-toothed whales, delphinids, porpoises, seals, and sea turtles, focusing in particular on those species that are listed under Schedule 1 of the SARA and considered at risk by the COSEWIC. Marine Mammals and Sea Turtles was selected as a VC in recognition of the important habitat for these species in NL waters, their potential vulnerability to effects from Project components and activities (particularly underwater sound emissions), and the cultural and recreational value they hold for Indigenous groups and the general public. The EIS Guidelines also require the assessment of potential Project effects on marine mammals and sea turtles.

6.4.1 Existing Environment

A total of 32 species of marine mammals could potentially occur in the Project Area and RAA, including 26 species of cetaceans (whales, dolphins, and porpoises) and six species of seals. However, seven of the cetacean species are extralimital in the region. The region likely offers important foraging habitat for many species, and most marine mammals use the area seasonally. Four sea turtle species could also occur within or near the Project Area. The seasonal occurrence and conservation status of marine mammals and sea turtles that could occur within or near the Project Area are summarized in Tables 6.7 and 6.8, respectively.

Although most cetaceans occur in the RAA throughout the year, they are most commonly seen in the Project Area between June and September. Summer is an important season for cetaceans and sea turtles in the waters of Newfoundland. During this time, migratory species come to forage in the region before heading to southerly latitudes for the winter. Pinnipeds are most common during winter and spring. Concentrations of marine mammals and sea turtles in certain areas at certain times may be an artifact of the survey effort that has taken place in these locations. Similarly, low sightings in other regions may be attributable to reduced survey effort. Several EBSAs, MPA, and Marine Refuges in the RAA provide important ecological functions for marine mammals and sea turtles, including important habitat for overwintering, refuge, and foraging.

Five species/populations of marine mammals and two sea turtle species that could occur in the Project Area are listed under Schedule 1 of SARA: (1) blue whale (Atlantic population); (2) fin whale; (3) North Atlantic right whale; (4) northern bottlenose whale (Scotian Shelf population); (5) Sowerby's beaked whale; (6) leatherback sea turtle; and (7) loggerhead sea turtle (Tables 6.5 and 6.6).

Table 6.5 Marine Mammals that May Occur in the Project Area and Surrounding Marine Environment

Common Name	Scientific Name	SARA Schedule 1 Status [1]	COSEWIC Designation [2,3]	Potential Timing of Presence	Sources
Mysticetes (Baleen Whales)					
Blue whale (Atlantic population)	*Balaenoptera musculus*	Endangered	Endangered	Year-round (highest numbers from early spring through winter)	COSEWIC (2002); Waring et al. (2011); Lesage et al. (2016)
Fin whale (Atlantic population)	*B. physalus*	Special Concern	Special Concern	Year-round	COSEWIC (2005); DFO (2017a); Hayes et al. (2018)
Sei whale (Atlantic population)	*B. borealis*	Not Listed	Endangered	Seasonal (summer)	COSEWIC (2003); Hayes et al. (2017)
Humpback whale (Western North Atlantic population)	*Megaptera novaeangliae*	Not Listed (Special Concern on Schedule 3)	Not at Risk	Year-round (highest concentration from spring through winter)	Lawson and Gosselin (2009); Bettridge et al. (2015)
Common minke whale (North Atlantic subspecies)	*B. acutorostrata*	Not Listed	Not at Risk	Year-round (highest concentration spring through fall)	Risch et al. (2014); Hayes et al. (2018)
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Endangered	Summer	COSEWIC (2013); Hayes et al. (2018)
Bowhead whale [4] (Eastern Canada-West Greenland population)	*Balaena mysticetus*	Not Listed	Special Concern	Unknown	Ledwell et al. (2007); COSEWIC (2009a); CBC (2014)
Odontocetes (Toothed Whales)					
Sperm whale	*Physeter macrocephalus*	Not Listed	Not at Risk; Mid-priority Candidate	Year-round	Waring et al. (2015)
Pygmy sperm whale [4,5]	*Kogia breviceps*	Not Listed	Not at Risk	Unknown	Hayes et al. (2017)
Northern bottlenose whale (1: Scotian Shelf population/ 2: Davis Strait-Baffin Bay-Labrador Sea population)	*Hyperoodon ampullatus*	• Endangered • Not Listed	Endangered Special Concern	Year-round	COSEWIC (2011); DFO (2016)
Sowerby's beaked whale	*Mesoplodon bidens*	Special Concern	Special Concern	Unknown	COSEWIC (2006a); DFO (2017b)
Cuvier's beaked whale [4,5]	*Ziphius cavirostris*	Not Listed	Not at Risk; High-priority Candidate	Unknown	Waring et al. (2014)

Table 6.5 Marine Mammals that May Occur in the Project Area and Surrounding Marine Environment

Common Name	Scientific Name	SARA Schedule 1 Status [1]	COSEWIC Designation [2,3]	Potential Timing of Presence	Sources
Blainville's beaked whale [4]	*Mesoplodon densirostris*	Not Listed	Not at Risk	Unknown	Waring et al. (2014)
Orca / Killer whale (Northwest Atlantic/Eastern Arctic population)	*Orcinus orca*	Not Listed	Special Concern	Year-round	COSEWIC (2009b); Waring et al. (2015)
False killer whale [4]	*Pseudorca crassidens*	Not Listed	Not Listed	Unknown	Waring et al. (2015)
Long-finned pilot whale	*Globicephala melas*	Not Listed	Not at Risk	Year-round	Fullard et al. (2000); Hayes et al. (2017)
White-beaked dolphin	*Lagenorhynchus albirostris*	Not Listed	Not at Risk	Year-round	Waring et al. (2007)
Atlantic white-sided dolphin	*L. acutus*	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Common dolphin (short-beaked)	*Delphinus delphis*	Not Listed	Not at Risk	Seasonal (summer through fall)	Hayes et al. (2018)
Risso's dolphin	*Grampus griseus*	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Common bottlenose dolphin	*Tursiops truncatus*	Not Listed	Not at Risk	Seasonal (May to September)	Hayes et al. (2017)
Atlantic spotted dolphin	*Stenella frontalis*	Not Listed	Not Listed	Unknown	Waring et al. (2014)
Spinner dolphin [4]	*S. longirostris*	Not Listed	Not Listed	Unknown	Waring et al. (2014)
Striped dolphin	*S. coeruleoalba*	Not Listed	Not at Risk	Seasonal (summer)	Waring et al. (2014)
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Not Listed (Threatened on Schedule 2)	Special Concern	Year-round	COSEWIC (2006b)
Beluga whale [4] (St. Lawrence Estuary population)	*Delphinapterus leucas*	Endangered	Endangered	Unknown	COSEWIC (2014)
Narwhal [4]	*Monodon monoceros*	Not Listed	Special Concern	Unknown	COSEWIC (2004)

Table 6.5 Marine Mammals that May Occur in the Project Area and Surrounding Marine Environment

Common Name	Scientific Name	SARA Schedule 1 Status [1]	COSEWIC Designation [2,3]	Potential Timing of Presence	Sources
Phocids (Seals)					
Harbour seal (Atlantic and Eastern Arctic subspecies)	*Phoca vitulina concolor*	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Harp seal	*Pagophilus groenlandicus*	Not Listed	Not Listed; Low-priority Candidate	Year-round (highest concentrations in winter)	DFO (2012); Waring et al. (2014); IAAC (2021)
Hooded seal	*Cystophora cristata*	Not Listed	Not at Risk; Mid-priority Candidate	Seasonal (highest concentrations in winter)	Waring et al. (2007); Andersen et al. (2009, 2012, 2013, 2014)
Grey seal	*Halichoerus grypus*	Not Listed	Not at Risk	Year-round	Lesage and Hammill (2001); Hayes et al. (2018)
Ringed seal	*Pusa hispida*	Not Listed	Not at Risk	Year-round	Aivek Stantec Limited Partnership (2021)
Bearded seal	*Erignathus barbatus*	Not Listed	Data Deficient; Mid-priority Candidate	Year-round	Aivek Stantec Limited Partnership (2021)

Notes:
[1] SARA = Canadian *Species at Risk Act.*
[2] COSEWIC = Committee on the Status of Endangered Wildlife in Canada.
[3] None of these marine mammal or sea turtle species are currently listed under the NL ESA.
[4] These species are considered extralimital in the RAA and are not considered further.
[5] Although no confirmed visual detections have been made near the Project Area, sightings have been made within the RAA, and these species were detected acoustically along the edges of the Grand Banks during the ESRF acoustic study (Delarue et al. 2018).
Additional Sources: Husky Energy (2012); BP (2016); IAAC (2021).

Table 6.6 Sea Turtle Species that May Occur in the Project Area and Surrounding Marine Environment

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential Timing of Presence	Sources
Leatherback sea turtle (Atlantic population)	*Dermochelys coriacea*	Endangered	Endangered	Seasonal (spring through fall)	COSEWIC (2012a)
Loggerhead sea turtle	*Caretta caretta*	Endangered	Endangered	Seasonal (spring through fall)	Brazner and McMilan (2008); COSEWIC (2010b)
Green sea turtle	*Chelonia mydas*	Not Listed	Not Listed	Seasonal (summer and fall)	James et al. (2004)
Kemp's ridley sea turtle [1]	*Lepidochelys kempii*	Not Listed	Not Listed	Seasonal	National Marine Fisheries Service et al. (2011)

Notes:
[1] This species is considered extralimital in the RAA.
Additional Sources: Husky Energy (2012); BP (2016); IAAC (2021).

6.4.2 Potential Interactions with the Environment

Routine Project activities and components have the potential to interact with marine mammal and sea turtle species due to underwater sound produced by operation of the MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, supply vessels, and helicopter overflights. These potential sources of disturbance, as well as operational discharges, could result in direct or indirect (e.g., changes in habitat quality) effects on marine mammals and sea turtles. There is also the risk of mortality or physical injury as a result of vessel collisions. The Project could also change the availability, distribution, or quality of prey. The assessment of Project-related effects on marine mammals and sea turtles focuses on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat quality and use

6.4.3 Potential Effects from Routine Operations

6.4.3.1 Change in Risk of Mortality or Physical Injury

There are two primary pathways from Project activities that may result in change in the risk of mortality or physical injury for marine mammals and sea turtles: vessel strikes and underwater sound generated by Project activities. The supply vessels transiting to and from the Project Area have the potential to collide with marine mammals or turtles, resulting in injury or mortality. The pathway of effect in the case of a vessel strike is the physical contact with a supply vessel. Underwater sound generated by VSP operations and other Project activities has the potential to cause temporary hearing changes in marine mammals or sea turtles (temporary threshold shift or TTS), and there is the possibility of permanent hearing damage (permanent threshold shift or PTS).

With the implementation of mitigation measures (Table 7.1), it is unlikely that auditory injury from MODU operations, including support vessels and VSP surveys, will result in injuries (PTS) for marine mammals or sea turtles. There have been no reported cases of marine mammal or sea turtle mortalities that have been causally linked to sounds generated during oil and gas exploration activities. To mitigate potential effects from VSP operations, a ramp-up procedure for the air gun array will be implemented in consideration of the SOCP (DFO 2007). Ramp-up will be delayed if a marine mammal or sea turtle is detected within 500 m of the air gun array. Air gun(s) will be shut down if a marine mammal or sea turtle listed as endangered or threatened on SARA Schedule 1 as well as a beaked whale is detected within the 500-m zone around the array. Overall, the risk for marine mammals and sea turtles incurring hearing impairment (injury) is considered low.

Mortality or injury of marine mammals and sea turtles can occur as a result of a vessel strike. Although there are no known marine mammal concentration areas along the transit route, it is possible that groups of foraging marine mammals may be encountered, especially during summer months. Sea turtles are considered rare along the transit route as well as in the Project Area. Supply vessels will use existing shipping lanes as practicable; where these do not exist, supply vessels will follow a straight-line approach to and from the Project Area. Supply vessels will travel at lower speeds (not exceeding 22 km/hour or 12 knots) than those generally associated with lethal ship strikes to marine mammals, except as needed in the case of an emergency. Supply vessels will be required to reduce speed to a maximum of 13 km/hour (7 knots) when a marine mammal or sea turtle is observed or reported within 400 m of the supply vessel (except if not feasible for safety reasons). Vessels may also alter course if practicable to avoid collision with a marine mammal (or sea turtle). Overall, the risk of marine mammals and sea turtles incurring injury or mortality is considered quite low; the risk is lower for SAR given the rare occurrence of these species, with the exception of fin whales (Schedule 1, special concern).

6.4.3.2 Change in Habitat Quality and Use

A change in habitat quality and use for marine mammals and sea turtles may occur from Project activities, particularly due to the underwater sound generated by the MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, and supply vessels. Marine mammals detect and produce sounds both passively and actively to communicate, locate prey and predators, navigate, and gather information about their surroundings (Richardson et al. 1995; Nowacek et al. 2007; Tyack 2008; Shannon et al. 2016). It is unknown how important underwater sound is to sea turtles, but it is likely less important than for marine mammals. Anthropogenic sound from vessel traffic and other offshore exploration activities has the potential to cause adverse effects on marine mammals and sea turtles. This assessment focuses on disturbance or the potential changes in behaviour and distribution of animals that could be of sufficient magnitude to be “biologically important”. Communication masking of marine mammals is also considered, where a sound of interest is obscured by interfering sounds at a similar frequency.

Changes in habitat quality and use due to the presence and operation of a MODU, geophysical (including VSP), geological, geotechnical and environmental surveys operations, and supply vessels are mainly associated with sound emissions, which can lead to behavioural changes in marine mammals and sea turtles. Underwater sound, whether of anthropogenic or natural origin, may interfere with the abilities of marine mammals to communicate by masking sounds that are important to them. The overall magnitude of the effect of the presence and operation of a MODU and/or supply vessels, and the short-term and localized nature of VSP, on marine mammals and sea turtles is anticipated to be low. Some localized and short-term

behavioural effects (change in presence and abundance) are likely to occur, with some species potentially being displaced from the immediate area around the MODU, supply vessels, and/or VSP air gun array. The localized, transient, and short-term nature of these disturbances at one location and time during Project activities considerably reduces the potential for adverse effects on individual marine mammals and sea turtles and their populations. It is thus unlikely that individuals will be displaced over extended areas or periods of time. Given that the zone of influence of the Project at one time or location will likely be a small proportion of the feeding, breeding, or migration area of species, marine mammals and sea turtles will not be displaced from important habitats or during important activities or be affected in a manner that causes adverse effects to overall populations in the region.

Project-related supply vessel traffic represents a negligible contribution to the overall vessel traffic off eastern Newfoundland. Supply vessels will use existing shipping lanes as practicable; where these do not exist, supply vessels will follow a straight-line approach to and from the Project Area. Whenever possible, vessels will maintain a steady course and constant speed. Additionally, during transit to/from the Project Area, supply vessels will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. In the event that a marine mammal or sea turtle is detected near the vessel, vessel speed will be reduced.

Discharges from Project supply vessels and the MODU will be in accordance with the OWTG and MARPOL, as applicable. Discharges are expected to be temporary, localized, non-toxic, and subject to dilution in the open ocean. There is little potential for marine mammals and sea turtles to interact with well decommissioning, suspension and abandonment activities. There is some potential that marine mammals may temporarily avoid a localized area around a wellhead during mechanical separation of the wellhead from the seabed due to underwater sound and other disturbance. Residual effects associated with drilling and other marine discharges, as well as well decommissioning, suspension and abandonment activities, on marine mammals and sea turtle habitat quality and use is predicted to be negligible.

6.4.4 Potential Effects from Accidental Events

An accidental release of oil or SBM can affect marine mammals and sea turtles through two primary pathways: direct exposure resulting in a change in risk of mortality or physical “injury” (i.e., health effects) and/or a change in habitat quality and use which can lead to behavioural responses (e.g., avoidance) and/or the ability of marine mammals and sea turtles to successfully perform life functions (e.g., foraging). The extent of potential effects will depend on how the spill trajectory and the VC overlap in both time and space (Frasier et al. 2020).

A well blowout may result in a change in risk of mortality or physical injury and a change in habitat quality and use for marine mammals and sea turtles. Given that marine mammals and sea turtles are known or expected to occur throughout most, if not all of the RAA, the magnitude of effects will likely be higher for subsea releases of larger scale and extended duration, as was observed during the Deepwater Horizon spill in the Gulf of Mexico (e.g., Takeshita et al. 2017). Marine mammals and sea turtles may be exposed to oil via a combination of pathways (i.e., inhalation, ingestion, aspiration, surface exposure, and absorption). Marine mammals and sea turtles that are closer to the site of the blowout are most likely to be exposed to a more constant flow and higher concentrations of recently released oil, as compared to species that are more prevalent in the nearshore.

For the purposes of this assessment, a surface oil thickness of 10 µm is the threshold at which it is assumed that a change in risk of mortality or physical injury may occur for marine mammals and sea turtles. A 10 µm thick layer of oil on-water has been identified with sub-lethal effects to marine mammals and sea turtles (French et al. 1996; French-McCay and Rowe 2004; French-McCay 2009). Fresh oil at this thickness corresponds to a dark brown or metallic sheen. A surface oil thickness of 0.04 µm is used in this assessment as a conservative threshold for a change in habitat quality and use for marine mammals and sea turtles. For wildlife (e.g., seals) on or along the shore, an oil exposure index consisting of the length of shoreline oiled by a threshold for the potential ecological effects on shoreline fauna and flora of 100 g/m² (100 µm thick) was used.

The modelling results suggest that areas most likely to be affected by an unmitigated, subsea well blowout are Jeanne d'Arc Basin, Newfoundland Basin, Flemish Pass and the areas to the east; in the 120 day simulations, the Southeast Shoal would also be affected. As a result, a blowout would have potential to interact with marine mammals that inhabit both the shallower waters of the Grand Banks and adjacent deeper waters. Sea turtles are expected to be rare in Jeanne d'Arc Basin, Flemish Pass and the areas to the east. It is possible that marine mammals and sea turtles that do occur in offshore areas where predicted concentrations of hydrocarbons occur above the ecological threshold levels from an unmitigated subsurface blowout could experience adverse changes in habitat quality and use, health, and in extreme cases, increases in injury and mortality levels. As reviewed above, while some marine mammals seem to avoid oil spills, other marine mammals have been observed swimming through, and feeding in, large slicks (see Helm et al. 2015; Wilkin et al. 2017). Sea turtles may be more susceptible to the effects of exposure to hydrocarbons than marine mammals because they do not respond with avoidance behaviour, exhibit indiscriminate feeding, and take large pre-dive inhalations (see Milton et al. 2003; Vander Zanden et al. 2016). The magnitude and extent of potential effects would be reduced with the application of spill response measures; therefore, the risk of adverse effects on marine mammals and sea turtles would be reduced.

Oil was predicted to strand on shorelines in several simulations. Harbour and grey seals that are known to haul-out in small numbers and use coastal areas, particularly on the Avalon and Burin peninsulas, could potentially interact with oiled shoreline. As with surface oil, the potential effects would be reduced with mitigation measures, therefore the risk of adverse effects on shoreline and coastal marine mammals would be reduced. Small numbers of seals which may interact with hydrocarbons (albeit highly weathered oil that is patchy and discontinuous), could conceivably experience a change in mortality or injury or a change in health; however, it is probable that only a small proportion of local populations would be affected. The magnitude and extent of potential effects would be reduced with the application of spill response measures, therefore the risk of adverse effects to coastal marine mammals would be reduced.

There are seven marine mammal and two sea turtle SAR that are known or expected to occur in the in the LAA and/or RAA. In the extremely unlikely event of a subsurface blowout to the marine environment, these species have the potential to be adversely affected, if the spill occurs when the SAR is in the area. The likelihood, however, of a subsurface blowout occurring is extremely low. In an actual event, emergency response measures would likely reduce the magnitude, duration and geographic extent of the spill, and therefore reduce the potential impacts on marine mammals and sea turtles.

A batch spill of marine diesel could directly and indirectly reduce the amount and quality of habitat available to marine mammals and sea turtles. If the vessel spill of diesel occurred in the nearshore area, there is the potential for shoreline to be affected. When diesel spills interact with the shoreline, it tends to penetrate

porous sediments quickly and washes off quickly by waves and tidal flushing (National Oceanic and Atmospheric Administration 2016). These effects would be short-term in duration until the slick disperses and the diesel content in the area reaches background levels. A batch spill of diesel is therefore not expected to create permanent or irreversible changes to habitat quality and use. Likewise, there is limited potential for a batch spill of diesel to change the risk in mortality or physical injury for marine mammals and sea turtles.

There is potential for an SBM spill to result in a surface sheen which in turn could potentially cause a change in habitat quality and use and possibly a change in the risk of mortality or physical injury for marine mammals and sea turtles present in the immediate area. If the wind and wave conditions were such that a sheen formed, it would be temporary and limited in size, such that only individuals in the immediate area of the spill would likely be affected. Furthermore, given the low surface oil thickness required to result in a sheen (0.04 µm), it is expected that effects would be minor and unlikely to result in marine mammal or sea turtle mortality or injury. Likewise, reductions in habitat quality and use would be temporary, reversible and localized.

6.5 Special Areas

The Special Areas VC addresses potential effects upon areas of the marine environment that have been identified due to biological and ecological importance or sensitivity. These areas may be identified and / or protected by legislation or other applicable processes by international, Canadian, and NL agencies. Special areas have been selected as a VC due to these designations, their presence within and near the Project Area, and concerns regarding Project activities that may potentially affect these areas.

6.5.1 Existing Environment

The EIS Guidelines indicate that the EIS is to provide “the distances between the edge of the Project Area (i.e., drill sites and marine transportation routes) and special areas”. Several special areas intersect with EL 1161, the Project Area or LAA, including the supply vessel route where marine vessels and aircraft are anticipated to transit. Summaries of the defining features of special areas in the LAA along with the distance between Project components and these special areas are included in Table 6.7.

EL 1161 intersects with the Snow Crab Stewardship Exclusion Zone in Crab Fishing Area 8Bx. The Project Area intersects with the same crab fishing closure and two SBAs. Thus, those special areas intersecting the Project in the offshore are identified for marine fish and fish habitat. The LAA also encompasses an Important Bird Area (IBA), two Ecologically or Biologically Significant Areas (EBSAs), a Candidate National Marine Conservation Area (NMCA), another Snow Crab Stewardship Exclusion Zone, and two National Historic Sites (NHS). These special areas are primarily designated for marine and marine fish and fish habitat, migratory bird habitat, and / or marine mammal and sea turtle habitat. The two NHS (Signal Hill NHS and Cape Spear NHS) are within the transit route LAA near the entrance to the Port of St. John’s.

Table 6.7 Special Areas in the LAA

Special Area	Defining Features	Nearest Distance (km)		
		EL 1161	Project Area	LAA (50 / 10 km)*
Quidi Vidi Lake IBA	Winter daytime resting site for herring, great black-backed, Iceland, glaucous and common black-headed gulls. Locally rare ring-billed gull, mew gull, lesser black-backed gull and waterfowl (e.g., American black ducks, mallards and northern pintails) also common in winter.	300	235	Overlap**
Virgin Rocks EBSA	Identified for unique geomorphological features and habitat that hosts aggregations of sand lance, American plaice, capelin, sooty shearwater, thick-billed murre and killer whales.	69	29	Overlap
Eastern Avalon Canadian EBSA	Feeding area for seabirds (e.g., Atlantic puffin, common murre, thick-billed murre, razorbill, northern fulmar), cetaceans, leatherback turtles and seals from spring to fall.	234	177	Overlap
Small Gorgonian Coral SBA	DFO modelling shows high predicted presence probability of indicated species.	14	Overlap	Overlap
Large Gorgonian Coral SBA		22	Overlap	Overlap
East Avalon / Grand Banks Candidate National Marine Conservation Area (NMCA)	Detailed description not available. Intersects Eastern Avalon EBSA, Witless Bay Ecological Reserve and Witless Bay Islands IBA. Assumed to be an important area for cetaceans and seabirds (likely Atlantic puffin, Leach's storm petrel, common murre, thick-billed murre, northern fulmar, razorbill, black-legged kittiwake, herring gull, great black-backed gull, black guillemot, sea ducks) based on other special areas.	219	219	Overlap
8Bx Snow Crab Stewardship Exclusion Zone	Areas closed to crab fishing.	Overlap	Overlap	Overlap
Near Shore Snow Crab Stewardship Exclusion Zone		250	185	Overlap
Signal Hill NHS	Cultural history.	301	236	Overlap
Cape Spear NHS		295	230	Overlap

Distances are calculated in NAD83 UTM Zone 23N Projection
* The LAA is a 50 km buffer around the Project Area and 10 km on either side of the support vessel route.
** The Project component (i.e., EL 1161, Project Area or LAA) overlaps spatially with the special area.

6.5.2 Potential Interactions with the Environment

Special areas within the RAA have been identified as special mainly due to biological and/or ecological characteristics. Though most of these special areas have no associated legislated conservation measures, some have provincial, federal or other regulatory mandates to protect natural features and/or cultural assets, or to permit scientific research, education, or recreation.

The Guidelines indicates that the EIS is to discuss potential effects on special areas including “use of dispersants; change to habitat quality (e.g., noise, light, water, sediment quality); and change to the environmental features that define the special area (e.g., physical features, species assemblages, species abundance)”. The assessment of routine Project-related effects on special areas is focused on change in habitat quality.

Project activities with the potential to result in residual environmental effects include presence and operation of a MODU, discharges, well decommissioning, suspension and abandonment, and supply and servicing. These potential residual effects are discussed in the following sections as relevant to special areas within the LAA. Effects on species including SAR and SOCC that occur within these special areas are assessed within the biological VC sections: Section 6.2 (Marine Fish and Fish Habitat); Section 6.3 (Marine and Migratory Birds); and Section 6.4 (Marine Mammals and Sea Turtles). These sections are referenced throughout as relevant.

6.5.3 Potential Effects from Routine Operations

6.5.3.1 Special Areas Identified for Marine Fish and Fish Habitat

The Project Area and EL 1161 intersect the 8Bx Snow Crab Exclusion Zone (closed to crab fishing). The Project Area intersects two SBAs, one identified for large gorgonian corals and one for small gorgonian corals, but neither of these special areas intersects EL 1161. Lighting from a MODU is expected to be mainly detected near the surface (<10 m water depth) and to a distance of less than 1.5 km from the light source (Keenan et al. 2007; Simonsen 2013; Foss 2016). Thus, light is not anticipated to reach subsea habitat such as that found in the Snow Crab Exclusion Zone. As sound from the MODU could result in disturbance to fish species up to an estimated 522 m from the source (Alavizadeh and Deveau 2020), the effects of such sound emissions could be realized by fish species in Snow Crab Exclusion Zone. Continuous sounds may result in behavioural effects such as avoidance, attraction, or startle responses by individual fish, but such responses are dependent upon motivational state (e.g., foraging, reproduction, migration, predator avoidance) (Marchesan et al. 2005; Stoner et al. 2008; de Robertis and Handegard 2013). Fishes and invertebrates remaining in the area will likely habituate to continuous sound such that avoidance and startle responses decrease over time during drilling activities. Short-term localized turbidity from placement of MODU anchors could cause disturbance to gorgonian corals within tens of metres of the anchor site (Heery et al. 2017) but special areas identified for benthic species are at least 14 km from EL 1161.

A variety of fish species are known to exhibit localized and temporary avoidance behaviours from exposure to impulsive underwater sounds, such as those generated during VSP. Scientific modelling has shown that sound levels from VSP could result in behavioural responses up to 19.2 km from a source for sensitive fish species (Alavizadeh and Deveau 2020). Field studies on the Grand Banks with seismic sound from a 2D seismic array did not result in changes to catch rates of snow crab over days or weeks. Other special areas

identified for marine fish species are a minimum of 29 km from the Project Area. The received sound pressure levels from VSP activities are predicted to have effects on the special areas in the Project Area with a short-term change in habitat quality.

Drilling mud and cuttings discharges may result in a temporary increase in suspended particulate matter and turbidity in the water column. These changes are anticipated to last from minutes to days and return to background levels within hours after cessation of discharges (Smit et al. 2006; Koh and Teh 2011; IOGP 2016). Most marine fish species are anticipated to experience effects of drill cutting deposition within tens of metres and within 550 m for sensitive species such as corals and sponges (Norsk Olje og Gass 2013). Thus, effects could be experienced in the Snow Crab Exclusion Zone but not by corals and sponges in the SBAs that are a minimum of 14 km from EL 1161.

Removal of wellheads could result in temporary localized disturbances (e.g., sound and turbidity) as discussed under presence and operation of a MODU. If wellheads are left in place, they will provide hard substrate for colonization by benthic communities with potential beneficial effects (Cordes et al. 2016; Lacey and Hayes 2019).

Mobile fishes would potentially respond to sound and move away from a vessel within 10s of metres though behavioural responses. This may vary due to inter- and intraspecific differences in sound detection and associated effects, and motivational state (e.g., foraging, reproduction, migration, predator avoidance) (Marchesan et al. 2005; Stoner et al. 2008; de Robertis and Handegard 2013). Changes to habitat quality from supply vessel traffic are predicted to represent a small increment over similar effects from existing levels of marine traffic in the RAA.

6.5.3.2 Special Areas Identified for Marine and Migratory Birds

The nearest special area identified for marine and migratory birds is the Virgin Rocks EBSA located 29 km from the Project Area. Data on the distance at which birds can be affected by light from a MODU or vessel are limited. The zone of influence varies with factors such as weather, intensity and position (height) of the light source, and ambient light conditions (Montevecchi 2006). Bruinzeel and van Belle (2010) found that the distance at which birds become disoriented ranges from 200 m in dense fog to 1,000 to 1,400 m in lighter fog to light rain, to up to 4.5 km in overcast skies with no celestial cues and otherwise good visibility. Poot et al. (2008) showed that 30 kW of electric lighting affects migrating land birds out to at least 5 km, but greater distances cannot be ruled out (Poot et al. 2008; Hedd et al. 2011; Ronconi et al. 2015). Large numbers of fledgling short-tailed shearwaters were attracted to intense, temporary artificial lighting separated by 15 km of sea from the nearest nesting colony (Rodríguez et al. 2014). Thus, the zone of influence for attraction of birds found in this EBSA (i.e., murres and shearwaters) is not well understood, but in the available literature does not support likely effects on the Virgin Rocks EBSA.

Most field studies of the effects of underwater sound on bird behaviour have found no substantial effects (see LGL 1998; Minerals Management Service 2004). Moulting long-tailed ducks in the Beaufort Sea show no changes in movements or diving behaviour during geophysical surveys, although the authors noted that smaller-scale behavioural changes could not be ruled out (Flint et al. 2003; Lacroix et al. 2003). In the Davis Strait, Stemp (1985) found no evidence of effects of geophysical surveys on thick-billed murre, northern fulmar, or black-legged kittiwake distribution or mortality in the offshore. Stemp (1985), citing a personal communication with another researcher, reported that shearwaters show no behavioural response close to

a geophysical sound array even with their heads underwater. Evans et al. (1993) observed no evidence that marine birds are attracted to or repelled by offshore seismic survey activity in the Irish Sea. However, a five-year study (2009-2013) using Global Positioning System tracking reported avoidance of a 2-D seismic survey by African penguins when foraging close to breeding colonies that were located less than 100 km from the seismic survey (Pichegru et al. 2017). It could not be determined whether the penguins (flightless birds that dive to depths of 30 m on average) were responding directly to air source sound or to potential changes in the distribution of their prey. The birds reverted to normal behaviour when the seismic source array was shut down. Thus, VSP for this Project is not anticipated to result in effects on marine and migratory birds in the Virgin Rocks EBSA.

The presence of sheens from routine discharges would be unusual given adherence to the OWTG and MARPOL requirements for waste management. However, if they do occur, this could result in avoidance and/or attraction of marine birds. Northern fulmar, shearwater species and storm-petrel species are attracted to sheens. The visual appearance of a hydrocarbon sheen would resemble a sheen of biological origin and may occasionally attract such species (Nevitt 1999). However, these species also search for food by olfaction, relying on the smell of chemicals found in their foods, such as dimethyl sulfide (e.g., Leach's storm-petrel; Nevitt and Haberman 2003). Such species distinguish between sheen of oils derived from animals and sheen of petroleum oils by their odours (Hutchison and Wenzel 1980). As a result, these birds would be unlikely to encounter a sheen during foraging. Other birds may not be attracted and may temporarily avoid the localized affected area. The release of discharges from operations could result in changes to habitat quality for birds (with avoidance or attraction behaviours) but with appropriate management and adherence to regulations and guidelines, such effects on birds are considered to be temporary and localized. Thus, discharges are not likely to affect seabirds in the Virgin Rocks EBSA.

Seabird species (i.e., sooty shearwaters and thick-billed murres) are identified as present in the Virgin Rocks EBSA. The potential for marine and migratory birds to interact with well decommissioning, suspension and abandonment activities is low because the activities will take place within the Project Area and below the diving depths of seabird species that are likely to be present, except the razorbill and common and thick-billed murres. However, movement and presence of vessels supporting well decommissioning, suspension and abandonment activities have the potential to displace murres and other alcids from the localized area due to alcids' avoidance of vessel traffic (Ronconi and St. Clair 2002; Bellefleur et al. 2009). Thus, the effects of well decommissioning, suspension and abandonment are not likely to reach the Virgin Rocks EBSA.

Four special areas identified for the presence of marine and migratory bird species intersect the supply vessel route within the LAA. These include the Virgin Rocks EBSA, Eastern Avalon EBSA, the East Avalon / Grand Banks Candidate NMCA, and Quidi Vidi Lake IBA. Vessel traffic may interact with seabirds through lighting, atmospheric and underwater sound, and other associated environmental emissions and discharges. The various bird species that occupy the LAA will not likely be affected by supply vessel activity due to its transitory nature and thus, its short-term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years.

Helicopters may interact with the marine and migratory birds through aircraft overflights and potential disturbance of normal nesting, foraging or resting activities. Possible disturbance effects include increased energy expenditure of birds due to escape reactions, increased heart rate, decreased food intake due to interruptions, and temporary loss of suitable habitat (Ellis et al. 1991; Trimper et al. 2003; Komenda-

Zehnder et al. 2003). The various bird species that occupy special areas in the LAA will not likely be affected by supply vessel activity or associated aircraft use, due to its transitory nature and thus, its short-term presence at any one location. The potential effects due to nocturnal artificial lighting sources on the supply vessels are anticipated to be similar, but lower magnitude, to those discussed under presence and operation of a MODU, as discussed above. In addition, vessel traffic for this Project is anticipated to be a minor contribution to overall marine traffic that has occurred throughout the region for many years.

6.5.3.3 Special Areas Identified for Marine Mammals and Sea Turtles

The nearest special area identified for marine mammals is the Virgin Rocks EBSA (noted for killer whales) located 29 km from the Project Area. There have been few studies of marine mammal behaviour in relation to drilling activity. However, available information suggests that effects are localized and temporary. Kapel (1979) reported several different species of baleen whales – mainly fin, minke, and humpback whales – within sight of active drill ships off West Greenland. Offshore California, grey whales responded when closer than 1 km around a semi-submersible drilling unit (Malme et al. 1983, 1984). Marine mammals are frequently sighted around oil and gas installations in the North and Irish seas (Todd et al. 2016; Delefoss et al. 2018). Based on available scientific modelling and observations, some localized and short-term behavioural effects (change in presence and abundance) are likely to occur, with some species potentially being displaced from the immediate area around the MODU. Marine mammals (i.e., humpback and minke whales) have been observed within hundreds of metres of the operating platforms on the Grand Banks. Thus, disturbances from presence and operation of the MODU are not anticipated to extend to the Virgin Rocks EBSA.

Little systematic information is available on reactions of cetaceans to impulsive sound sources. However, there are systematic studies on sperm whales, and an increasing amount of information about responses of various odontocetes to seismic surveys from monitoring studies. Seismic operators and MMOs on seismic vessels regularly see dolphins and other delphinids near operating air gun arrays, but generally most individuals show some avoidance of seismic vessels with an operating source array. The avoidance radii for delphinids appear to be small, on the order of 1 km or less, and some individuals show no apparent avoidance. Belugas, at times, show avoidance of seismic vessels at greater distances (tens of kilometres) (Miller et al. 2005). Preliminary data from the Gulf of Mexico show a correlation between reduced sperm whale acoustic activity and periods with air gun operations (Sidorovskaia et al. 2014). Thompson et al. (2013) reported reduced densities and acoustic detections of harbour porpoise in response to the presence of a seismic survey in Moray Firth, Scotland, at ranges of 5 to 10 km; however, animals returned to the area within a few hours (Thompson et al. 2013). Van Beest et al. (2018) exposed five harbour porpoises to a single 10 in^3 air gun for 1 minute at 2 to 3 second intervals at ranges of 420 to 690 m; one porpoise moved away from the sound source but returned to natural movement patters within 8 hours, and two porpoises had shorter and shallower dives but returned to natural behaviours within 24 hours. Some localized and short-term behavioural effects (change in presence and abundance) are likely to occur for marine mammals, with some species potentially being displaced from the immediate area around the VSP air gun array. Thus, due to distance VSP is not likely to result in effects on marine mammals in the Virgin Rocks EBSA.

Drilling wastes such as cement, WBM, and cuttings released at the seafloor are unlikely to affect marine mammals and sea turtles. Water depths in the EL where exploration drilling would occur range from approximately 61 to 87 m. Drilling activities are unlikely to produce concentrations of heavy metals in muds

and cuttings that could be harmful to marine mammals (Neff et al. 1980, in Hinwood et al. 1994). These activities are expected to have limited effects on marine mammals and sea turtles. With screening and selection of chemicals (including use of non-toxic drilling fluids) in accordance with the OCSG, and proper disposal of drill muds and cuttings in accordance with the OWTG, potential effects on marine mammals and sea turtles due to disposal of drill muds and cuttings and associated waste materials are considered unlikely. Thus, discharges are not anticipated to result in effects on the Virgin Rocks EBSA.

Three special areas identified for the presence of marine mammals and sea turtles intersect the supply vessel route within the LAA. These include the Virgin Rocks EBSA, Eastern Avalon EBSA, and the East Avalon / Grand Banks Candidate NMCA. Marine mammal responses to vessels are variable and range from avoidance at long distances to little or no response or approach (Richardson et al. 1995). Seals often show limited or no response to vessels but have also shown signs of displacement in response to vessel traffic. Odontocetes sometimes show no avoidance reactions and occasionally approach vessels. However, some species, such as the harbour porpoise, are displaced by vessels or otherwise change their behaviour in response to vessel sounds (e.g., Wisniewska et al. 2018; Roberts et al. 2019). While baleen whales often swim rapidly away from vessels that have strong or changing sound emission characteristics, stationary vessels or slow-moving vessels generally elicit little response from baleen whales.

There are few systematic studies on sea turtle responses to vessels. Hazel et al. (2007) examined behavioural responses of green sea turtles to a research vessel approaching at slow, moderate, or fast speeds. Fewer sea turtles fled from an approaching vessel as speed increased; turtles that fled from moderate to fast approaches did so at significantly shorter distances from the vessel than those that fled from slow approaches. Hazel et al. (2007) concluded that sea turtles may not be able to avoid vessels with speeds greater than 4 km/h. Tyson et al. (2017) reported that a juvenile green sea turtles dove during vessel passes and remained still near the sea floor. Lester et al. (2013) reported that behavioural responses of semi-aquatic turtles to boat sounds are variable.

The potential for masking of marine mammal calls or important environmental cues is considered low from supply vessels given the relatively low source level. Harbour seals have been reported to increase the minimum frequency and amplitude of their calls in response to vessel noise (Matthews 2017). However, harp seals may not increase the frequencies of their calls in areas with increased low-frequency sounds (Terhune and Bosker 2016).

Routine transportation activities associated with helicopter support have potential to cause changes in habitat quality or use for marine mammals and sea turtles due to disturbance. Available information indicates that single or occasional aircraft overflights will cause no more than brief behavioural responses in cetaceans and pinnipeds (summarized in Richardson et al. 1995). The majority of behavioural responses elicited in beluga and bowhead whales by an overhead helicopter traveling over the Beaufort Sea occurred when the aircraft flew at altitudes and lateral distances less than 150 m and 250 m, respectively (Patenaude et al. 2002). As with other underwater sound sources, the degree of sensitivity of cetaceans to sounds produced by aircrafts depend on their activity state at the time of exposure; individuals in a resting state appear to have the highest sensitivity to such disturbances (Würsig et al. 1998; Luksenburg and Parsons 2009). Cetaceans most commonly react to sounds from overhead aircrafts by diving (Luksenburg and Parsons 2009). Other reported behavioural responses include decreased surfacing periods, changes in activity state, and breaching (Luksenburg and Parsons 2009). It is uncertain how sea turtles would respond, but single or occasional overflights by helicopters would likely elicit only brief behavioural responses. Some

localized and short-term behavioural effects are likely to occur, with some species possibly being displaced from the immediate area around a supply vessel or helicopter. The localized, transient, and short-term nature of these disturbances at one location and time during the Project considerably reduces the potential for adverse effects on marine mammals and sea turtles.

6.5.4 Potential Effects from Accidental Events

Special areas and their important characteristics may be vulnerable to an accidental event, as such incidents may affect habitats for which they have been identified and/or protected. Change in habitat quality is also the focus for the assessment of accidental events on special areas, though the pathways for effects may be different. The effects assessment for special areas is closely linked to the assessment of accidental effects upon marine fish and fish habitat (Section 6.2.4), marine and migratory birds (Section 6.3.4) and marine mammals and sea turtles (Section 6.4.4).

Accidental releases of oil or SBM fluids have the potential to result in a change in habitat quality in special areas through potential effects on the sea surface, in the water column, or on the seabed. Effects on special areas, in the unlikely event of an accidental release of hydrocarbons or other substances, include potential degradation of the integrity of the special area so that it is not capable of providing the same biological or ecological function, or use, for which it was designated. The extent of potential effects is dependent upon the nature, scale, and duration of a spill, how the spill trajectory and special areas overlap, and the types of special areas that occur in affected locations. The assessment of these effects is conservative (i.e., overlap is assumed to occur, and modelling results assume mitigation measures are not implemented). However, in the event of an accidental release, appropriate responses to avoid or reduce harm would be implemented.

Given the potentially large amount of oil that could be associated with an unmitigated subsurface well blowout, and the possibility for a spill to extend over a large geographic range, a blowout is the accidental event of greatest concern. A blowout, though extremely unlikely, has the potential to result in a change in habitat quality of special areas in the RAA. Although hydrocarbon spills could result in adverse effects on special areas, these residual effects would not be permanent or result in a change in habitat that would not be reversible at the population level for marine fish and fish habitat, marine and migratory birds and marine mammals and sea turtles. However, the environmental effects could be significant for migratory birds if the consequences carried over more than one generation according to the significance threshold used in this EA or self-sustaining population objectives or recovery goals for listed species are jeopardized. This is considered unlikely given the low probability of a large spill event to occur and the response that would be in place to reduce the consequences of such an event.

6.6 Indigenous Peoples and Communities

Indigenous peoples is identified as a VC in the EIS in recognition of the cultural, social, and economic importance of marine life and fishing to Indigenous peoples, and in consideration of potential or established Aboriginal and treaty rights. As prescribed in the EIS Guidelines and in CEAA 2012, the VC considers the following:

- Health and socio-economic conditions
- Physical and cultural heritage

- Current use of lands and resources for traditional purposes
- Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

The key interaction between the Project and these Indigenous groups is related to the potential effects to commercial-communal and FSC fishing through a change in access to and/or availability of harvested species. Several Indigenous communities hold commercial-communal or FSC licences for fishing areas in the RAA or for species that may migrate through the RAA. Although there is no documented FSC licences within the Project Area, some species targeted in FSC fisheries are anadromous or catadromous and can potentially migrate through the Project Area. This VC also considers the indirect effects on socio-economic conditions that may subsequently occur as a result of impacts to the commercial-communal and FSC fisheries.

6.6.1 Existing Environment

There were 41 Indigenous groups identified in the EIS Guidelines that may be influenced by routine Project activities and which should be considered in the scope of the EA. This included five groups in NL, 13 groups in NS, 16 groups in NB, two groups in PE, and five groups in QC.

Within the offshore waters of NL, the Project Area and RAA, there are several species that are fished commercially, including species that Indigenous groups may hold commercial-communal licences to harvest. Species harvested for commercial-communal purposes within the RAA include capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. While species such as capelin, herring and mackerel are typically harvested in coastal areas, key species which are potentially commercially fished in and near the Project Area, include shrimp, snow crab, and groundfish. Most harvesting occurs between April and August, with some activity occurring year-round. The type of commercial fishing gear used in offshore NL generally depends on the species that is being harvested and can include a combination of stern otter trawls, mobile or fixed gillnets, and longlines (e.g., baited hooks). Snow crab are fished using crab pots and northern shrimp, using shrimp trawls.

There are various species harvested by Indigenous groups for FSC purposes, many of which are harvested inshore and/or in freshwater systems, and unlikely to interact with Project activities. Some of the species listed above include, but are not limited to gaspereau, trout, Atlantic salmon, bass, mackerel, eel, shad, groundfish (e.g., flounder, halibut, pollock), Arctic char, smelt, blue shark, herring, mussel, clams, periwinkle, soft-shell clams, squid, tomcod, quahaug, razor clams, lobster, crab and scallops. Some species harvested for FSC purposes are anadromous / catadromous and can potentially migrate through the RAA and/or Project Area. Of particular concern, in regard to potential interaction with Project activities are American eel and Atlantic salmon.

6.6.2 Potential Interactions with the Environment

The Project could affect commercial-communal fisheries resources by direct or indirect effects on fished species or through effects on fishing activity (e.g., displacement from fishing areas, gear loss or damage, availability of fisheries resources). To date, no Indigenous community has indicated that they actively fish in the Project Area or LAA, although this does not necessarily mean they will not do so in the future. Although there is no known FSC fishing or harvesting taking place in the Project Area, routine Project

activities could interact with migratory fish, bird, or mammal species that may be harvested by Indigenous communities from onshore / nearshore harvesting sites. Adverse effects on fishing or harvesting activities could indirectly lead to changes in health, socio-economic, and well-being conditions or cultural heritage of affected Indigenous communities.

The nearest Indigenous community to the Project Area is the Qalipu Mi'kmaq First Nation located approximately 445 km away, on the island of Newfoundland. There are no known physical and cultural sites, including structures, sites, or things of historical, archaeological, paleontological, or architectural significance within the Project Area or the LAA, and therefore, there are no pathways of effects from routine Project activities to these areas.

As a result of these considerations, the assessment of Project-related effects on Indigenous peoples is focused on the following potential effect:

- Change in commercial-communal fisheries
- Change in current use of lands and resources for traditional purposes

6.6.3 Potential Effects from Routine Operations

6.6.3.1 Change in Commercial-Communal Fisheries

A change in commercial-communal fisheries could occur as a result of Project activities affecting the marine environment, including drilling (underwater sound effects on commercial-communal fisheries species), geophysical (including VSP), geological, geotechnical and environmental surveys (underwater sound effects on commercial-communal fisheries species), discharges (effects on water and sediment quality for commercial-communal fisheries), well decommissioning, suspension and abandonment (potential interference with commercial-communal fishing) and supply and servicing (supply vessels disturbing marine fish or damaging fisheries gear or equipment).

There is potential for a disruption of commercial-communal fishing activities if drilling activities displace fishing in the areas around drill sites. A 500-m radius safety (exclusion) zone will be maintained around the MODU, when it is present and operating, within which non-Project vessels will be prohibited. Commercial-communal fishing will be excluded from an area of approximately 7 km² for up to approximately 120 days for each well drilled (up to 12 to 16 wells over the term of the EL). Although fishing effort may be prevented within this safety zone, it is anticipated to be a temporary and localized fishing exclusion and is not likely to have a substantial effect on commercial-communal fishing activities and fisheries resources. The temporary exclusion of fishing from the safety zone (for up to 120 days per well) is not predicted to affect commercial-communal fisheries to the extent that it would substantively affect revenue for Indigenous communities and affect community health and socio-economic conditions.

Biophysical and behavioural effects associated with underwater sound on fish species, including commercial-communal species, are discussed in Section 6.2.3. These effects are predicted to be localized and temporary, particularly as the fish may become habituated to the continuous underwater sound emissions (Chapman and Hawkins 1969; McCauley et al. 2000a, 2000b; Fewtrel and McCauley 2012). Given the temporary and localized nature of this effect, it is not expected that fishery species (or prey upon

which they may depend) would experience a measurable change in availability to the extent that commercial-communal fisheries resources would be adversely affected.

VSP operations will produce underwater sound that may potentially affect commercial-communal fish species (or prey species upon which fishery species may depend). Underwater sound could startle fish, causing them to avoid the area and thereby reduce catchability. Physical and behavioral changes in marine fish (including fisheries species) would be temporary (VSP surveys are expected to take one day per well) and reversible (e.g., baseline conditions resume after VSP surveys are completed). Fish species, including commercial-communal species, may move away from an area due to the presence of underwater sound. Effects on fisheries species, however, would not be likely to affect the availability of fisheries resources such that there would be a measurable change in catch rates or mortality of commercially species.

The discharge of drilling waste and other discharges and emissions may result in temporary and localized effects on water quality and/or sediment quality and therefore potentially affect commercial-communal fisheries species within a localized area. Discharges from the MODU will be in accordance with Suncor's EPP and the OWTG (NEB et al. 2010). The availability of fisheries resources is not expected to be affected by discharges.

Wells drilled during the Project life span will be plugged and abandoned following completion of well evaluation activities, although the abandonment program has not yet been defined. Abandonment activities will be conducted according to Suncor's practices and requirements set by the C-NLOPB. If the wellhead is left in place, it would result in a permanent piece of infrastructure on the seafloor, which would have to potential to interact with fishing and/or research equipment and may potentially cause damage. It is estimated that there would not be a large amount of interaction with commercial fishing activities in the LAA, as most harvesting takes place along the shelf edge at shallower depths. Suncor's well suspension and abandonment strategy will be designed in compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, standard industry abandonment procedures and practices in accordance with C-NLOPB regulations, and Suncor's applicable practices and decisions regarding wellhead removal will consider water depth and the likelihood of potential interactions with fishing activities.

The operation of supply vessels will increase vessel traffic in the Project Area and the LAA and therefore potentially interact with commercial-communal fishing activity (e.g., interfere with fishing gear or fishing vessel navigation) or disrupt fishery species due to underwater sound emissions. Common shipping routes will be used by supply vessels, as practicable, and supply vessels will adhere to standard navigation procedures to reduce incremental marine disturbance and potential conflict with fishing vessels.

6.6.3.2 Change in Current Use of Lands and Resources for Traditional Purposes

Current use of lands and resources for traditional purposes includes harvesting activities to collect resources that provide nourishment, or for use in traditional ceremonies and social events. Indigenous peoples have historically relied on harvesting a variety of species (e.g., fish, birds, marine mammals, wildlife, plants) for sustenance, medicine, spiritual and cultural practices, and for trade. Although, Suncor is not aware of FSC fishing occurring in the Project Area, migratory fish, bird and/or mammal species that may be traditionally harvested by Indigenous communities (or species linked to these harvested species [e.g., prey species]) elsewhere, may migrate through the Project Area and interact with the Project. This

may therefore affect the quality or availability of these resources upon which Indigenous communities may depend and potentially result in a change in current use of resources for traditional purposes.

Fish can be affected by underwater sound emissions from the MODU, which may cause migratory species to avoid the area around the MODU, particularly during the start-up of drilling. These emissions may cause fish to avoid the area around the MODU, although these effects are expected to temporary as the fish become habituated to the continuous sound levels. Given the temporary nature of this effect, it is not expected that migratory fish would be affected to the extent that FSC fisheries would experience a change in availability of fisheries resources (through species mortality or dispersion of stocks) and therefore would not indirectly result in associated social and cultural impacts to the Indigenous communities.

The presence and operation of the MODU could interact with traditional bird harvesting activities indirectly through nocturnal attraction of the harvested bird species to artificial lighting when these birds are in the vicinity of the MODU. Species commonly harvested by Indigenous communities include geese, ducks, loons, gulls, murres, mergansers, and scoters. Section 6.3.3 describes Project effects on marine and migratory birds. The magnitude of the effect of MODU operation on marine and migratory birds is expected to be low in consideration of the implementation of mitigation including following the Best Practices for Stranded Birds Encountered Offshore Atlantic Canada (ECCC 2016).

Seals are harvested by Indigenous communities for FSC purposes. The harp seal and hooded seal are expected to be common in the Project Area. Potential effects from drilling on marine mammals (including seals) is discussed in Section 6.4.3. Residual effects on marine mammals are predicted to be low in magnitude; therefore, potential impacts to harvested seal species are similarly predicted to be low in magnitude.

Underwater sound associated with VSP could cause physiological or behavioral effects (including startle and alarm responses) on migratory fish. Mobile fish are anticipated to avoid underwater sound at thresholds which could result in injury or mortality, particularly with the implementation of ramp-up procedures (implemented primarily for the protection of marine mammals and sea turtles). Similarly, it is unlikely that VSP surveys will result in injuries (e.g., PTS) for marine mammals or sea turtles. Residual effects from VSP on FSC fisheries species are not anticipated since the VSP operation would be localized and short term, with negligible environmental effects on FSC fisheries species that may be migrating through the area. Potential impacts to social and cultural values are also anticipated to be low.

Sound produced by VSP surveys could also potentially interact with migratory birds, particularly diving birds, who may hear a sound pulse if they are underwater when the VSP sound source is activated. Murres are diving species which could be present in the Project Area and which are traditionally harvested by Indigenous communities in the RAA. Common murres may dive to a depth of 180 m or deeper (Piatt and Nettleship 1985). However, given the ramp-up period, it is likely that the gradual increase in underwater sound levels would deter these birds from feeding underwater in the affected area when the seismic source is activated. As discussed in Section 6.3.3, residual effects from these surveys are likewise not anticipated because the activity will be extremely localized and short-term (approximately one day per well), with negligible environmental effects on birds.

The discharge of drilling waste and other emissions may result in temporary and localized effects on water quality and/or sediment quality and therefore could affect FSC species within a localized area. Discharges

and emissions will be in accordance with Suncor's EPP and the OWTG (NEB et al. 2010), thereby reducing the potential for adverse environmental effects on marine fish (refer to Section 6.2.3). Localized effects on the marine benthos from drill waste deposition is not predicted to affect FSC fisheries species.

Marine and migratory birds that may be harvested for FSC purposes may interact with discharges resulting in attraction to the MODU and/or oiling of feathers if there is a sheen present. However, a sheen is unlikely to occur as a result of routine discharges given compliance with regulatory requirements for waste discharges and therefore adverse effects to marine and migratory birds from discharges is not anticipated. With the implementation of standard environmental protection measures for waste management, the overall magnitude of the effect of discharges and emissions is predicted to be low. It is therefore unlikely that discharges and emissions would reduce the availability of species to be harvested for FSC purposes.

If well testing involves flaring, there is potential for marine and migratory birds to be attracted to the flare where they may become stranded on the MODU and/or experience physical injury or death. Flaring, if conducted, would be brief and bird attraction would be limited to within several kilometres of the MODU. Mitigation measures would be implemented to reduce adverse effects on marine and migratory birds (refer to Section 6.3.3). The effects of formation flow testing with flaring (if conducted) on marine associated birds, and therefore traditional harvesting, are therefore anticipated to be negligible.

The operation of supply vessels will increase vessel traffic in the Project Area and LAA and may therefore locally affect migratory species habitat quality and use around the supply vessel. The operation of supply vessels and helicopters, particularly in the nearshore area, may result in sensory disturbances to nesting marine and migratory birds, and supply vessels may interact with FSC fisheries species or nearshore FSC fishing.

Supply and servicing activities are not predicted to affect access to traditional fishing areas or interfere with fishing activities. Supply vessels and helicopters would represent an incremental increase of existing high levels of traffic in the nearshore and would abide by standard navigation practices to reduce or avoid adverse interactions with fishing activities. With respect to migratory bird colonies, buffer zones would be observed to reduce potential for sensory disturbance of breeding birds (refer to Section 6.3.3).

6.6.4 Potential Effects from Accidental Events

An accidental spill has the potential to affect fisheries resources, both directly and indirectly through effects to harvested species, displacement from traditional fishing areas, gear loss or damage, as well as reducing the marketability of commercial fish products and associated economic losses, resulting in changes to commercial-communal fisheries. A change in current use of lands and resources for traditional purposes could occur through effects to migratory species harvested for FSC purposes elsewhere. An accidental event may also indirectly affect socio-economic conditions, quality of life and well-being of Indigenous peoples. The extent of potential effects depends on the type and volume of a spill, the oceanographic conditions and how the spill trajectory and the VC overlap in both space and in time.

Due to the large spatial and temporal scale associated with a subsurface blowout, there is a potential for effects on the availability of fisheries resources (e.g., effects on fisheries species), fouling of fishing gear, and access to fisheries resources. These effects may potentially result in changes to commercial-communal fisheries, as well as adverse effects on socio-economic conditions for Indigenous peoples, such as food

insecurity and/or economic loss. Many Indigenous communities rely on revenue generated from commercial-communal fishing to fund community ventures, social programs and benefits, and therefore, may also result in indirect socio-economic effects.

There is also potential for adverse effects to FSC species harvested elsewhere that may migrate through the LAA. These effects have the potential to result in lasting outcomes on the quality of life of the Indigenous peoples, lasting longer than the physical effects of the spill itself.

Affected areas in the event of a subsurface blowout would be closed to fishing to reduce human contact and consumption of potentially contaminated food sources. Reduced marketability is more likely to occur following a spill due to reduced consumer confidence of seafood (ITOPF 2011). A fish can absorb oil-derived substances into its tissues, causing petroleum tastes and odors following exposure to low hydrocarbon concentrations. Although tainting is reversible, there is perceived contamination concerns that may linger after seafood has been determined safe for consumption, further leading to potential economic losses and reduced marketability (Yender et al. 2002; ITOPF 2011). This can have adverse health and socio-economic effects on affected Indigenous communities.

Given the eastward transport of oil, it is unlikely that in the event of a subsurface blowout, oil will intersect areas traditionally harvested and areas harvested for commercial-communal fisheries. There is, however, a potential for interaction with commercial-communal or FSC harvested species (e.g., fish, murres, seals) that may migrate through a spill area before the species is harvested in a non-affected area. Effects on marine fish are assessed in Section 6.2.4, effects on marine and migratory birds are assessed in Section 6.3.4, and effects on marine mammals are assessed in Section 6.4.4. Through the implementation of an Indigenous Fisheries Communication Plan, Indigenous groups will be informed of an accidental event thereby giving fishers the opportunity to haul out fishing gear from the affected areas and reducing the potential for fouling of gear. Actual loss or damage, which includes income, including future income, and, with respect to Aboriginal peoples of Canada, loss of hunting, fishing and gathering opportunities will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017).

Effects of a marine diesel spill on marine fish and fish habitat are limited (see Section 6.2.4), with temporary and reversible degradation in habitat quality at the water surface and localized, patchy distributions of oil. Similarly, effects on marine and migratory birds (see Section 6.3.4), and marine mammals (see Section 6.4.4) are also not likely to occur over a large area. Therefore, adverse effects to commercial-communal and FSC fisheries are anticipated to be low.

A surface batch spill is a silver or colourless sheen on the water surface, which is predicted to evaporate quickly. There is a limited potential that the biophysical effects of a diesel spill will have an adverse effect on the presence of abundance, distribution, quality or overall availability of resources for harvesting activities by Indigenous groups within their traditional harvesting areas. Therefore, there are limited effects on the quality or cultural value of these traditional activities by Indigenous groups. It is also unlikely that these effects will extend or affect the physical (e.g., through ingestion of toxic materials) or social health and well-being of Indigenous people or communities.

As with a batch spill of marine diesel within the Project Area, effects of a marine diesel spill on marine fish and fish habitat are limited, with temporary and reversible degradation in habitat quality at the water surface and localized, patchy distributions of oil. Effects on marine and migratory birds and marine mammals are also not likely to occur over a large area. Therefore, adverse effects to commercial-communal and FSC fisheries are anticipated to be low.

It is anticipated that in the event of an SBM spill from the MODU, SBM will rapidly sink to the seafloor and be localized to the area surrounding the MODU, therefore resulting in temporary degradation to the benthic habitat and potential smothering of benthic fauna. There is a potential for an effect to occur to marine fish and fish habitat from a localized deposition area within 1 km from the Project site. Studies have shown that there is little or no risk of the bioaccumulation of drilling based chemicals occurring in the tissues of benthic animals or transfer through marine food webs to fishery species (Neff et al. 2000). The residual effects from SBM spills are therefore predicted to result in low magnitude adverse effects that are localized to the Project Area and reversible. The effects on FSC and commercial-communal fisheries are expected to be negligible given the localized extent of benthic interaction.

6.7 Commercial Fisheries and Other Ocean Uses

Commercial Fisheries and Other Ocean Users are included in the EIS due to the economic and cultural importance they hold for the province of NL as well as other jurisdictions that participate in these activities within the RAA (i.e., other NAFO nations and Saint Pierre and Miquelon). Commercial fisheries refer to harvesting of fish species for commercial purposes by domestic and foreign fleets. Recreational fishing and aquaculture are also considered under the scope of commercial fisheries. There is very little commercial fishing activity within EL 1161 and the Project Area. However, the RAA encompasses important fishing grounds for commercially fished stocks managed by DFO and NAFO.

Other ocean users that participate in activities offshore NL within the RAA include domestic and foreign vessels conducting marine research, military exercises, shipping or other offshore oil and gas activities. The presence of existing marine infrastructure (e.g., subsea cables, shipwrecks, and legacy sites) is also considered.

6.7.1 Existing Environment

The Project Area is located within portions of NAFO Divisions 3L and 3N, specifically, Unit Areas 3Lr, 3Lt, 3Na, and 3Nb. The Project Area is mostly contained within the Canadian Exclusive Economic Zone, with just 4% overlapping with the NAFO Fishing Footprint. The RAA Overlaps with all or portions of the following NAFO divisions and subdivisions: 1F; 2H; 2J; 3K; 3L; 3M; 3N; 3O; 3Ps; 3Pn; 4Vn; 4Vs; 4W; and 4R.

Fishing effort in the RAA is dominantly by domestic fleets; however, due to the geography of the RAA, foreign fleets from St. Pierre and Miquelon and other NAFO nations also participate in commercial fishing activities. Quota sharing agreements are in place between Canada and St. Pierre and Miquelon for stocks managed by DFO, as well as between NAFO and Canada, for NAFO managed stocks.

To date, there is limited commercial fishing in the Project Area and EL 1161, although this does not necessarily mean there will be none in the future. The Project Area is situated near a known fishing area for snow crab on the Grand Banks and commercial fishing activity for snow crab has occurred continuously

within the southeast corner of the Project Area from 2013 to 2017. There has been no commercial fishing activity for groundfish within the Project Area since 2013; however, groundfish are harvested within the RAA, mainly along the slopes of the NL shelves and on the Tail of the Grand Banks. The main active groundfish fisheries are for Greenland halibut, redfish and yellowtail flounder, while cod and American plaice are harvested as bycatch only.

Species harvested by international commercial fisheries outside the Canadian Exclusive Economic Zone, within the NAFO Fishing Footprint, include groundfish species managed by NAFO within Divisions 3L and 3N, and include redfish, Greenland halibut, thorny skate, and white hake. American plaice, Atlantic cod, and Witch flounder are caught and harvested as bycatch only.

The Project Area is located in Shrimp Fishing Area 7, which is currently closed to harvesting of northern shrimp fishing for both domestic and foreign fleets.

Atlantic cod, smelt, Atlantic salmon, and trout are fished recreationally in near-shore and mid-shore areas off the coast of NL. Aquaculture operations on the east coast of NL, within the RAA, and in the Atlantic Ocean include blue mussels, Atlantic cod, trout, and oysters.

In addition to commercial and recreational fishing activity and aquaculture, portions of the Project Area and RAA may be subject to other human-related activities that take place within offshore NL, which include marine research, marine transportation, other offshore oil and gas activity, military operations, and subsea infrastructure. Post-season crab surveys and DFO RV trawls have historically occurred within EL 1161 and the Project Area. Marine shipping activity and activity related to offshore oil exploration and extraction are commonplace within offshore NL and activities overlap with the EL 1161 and the Project Area. There are no known shipwrecks or legacy sites within the Project Area. Known subsea cables include fibre-optic lines from the Hibernia Canada Express cable to the Hibernia and Terra Nova platforms, neither of which overlaps with EL1161 where Project related drilling activity will take place.

6.7.2 Potential Interactions with the Environment

To date, there is limited commercial fishing in the Project Area or LAA, although this does not necessarily mean there will be none in the future. Routine Project activities have the potential to interact directly with commercial fisheries and other ocean users. These interactions can include displacement from fishing grounds and loss or damage to gear (which would be compensated as per the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2017). Indirect interactions include those that may result in physical or behavioural effects on commercially fished species, such as changes in fish health or quality, fish avoiding popular fishing grounds due to underwater sound, or changes in water quality (as discussed in Section 6.3). These direct and/or indirect effects have the potential to result in measurable changes for commercial fisheries. For other human components and activities, behavioural effects on fish could indirectly affect research activities, and Project activities may also limit certain areas for research or military exercises, which may result in changes in schedules, or relocation of vessels to alternate areas. Damage to vessels or research equipment may also occur.

As a result of these considerations, the assessment of Project-related effects on commercial fisheries and other ocean users is focused on the following potential effect:

- Change in access to or availability of resources

6.7.3 Potential Effects from Routine Operations

Commercial fishing activity involves setting and retrieving gear in designated fishing grounds, as well as travel to and from those fishing grounds. Other ocean uses can include shipping and planned military activities, ocean research activities, and the presence of existing infrastructure on the seabed. Project interactions that might interrupt or prevent these activities include the presence of the safety zone around the MODU, sound emissions from the MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, and supply vessels, and the presence of a suspension cap or abandoned wellhead on the sea floor. Adverse effects on marine fish, including commercial species, are discussed in Section 6.2 (Marine Fish and Fish Habitat VC).

Mobilization and operation of the MODU can affect the availability of or access to resources for commercial fisheries and other ocean uses by direct interference through the establishment a safety zone (which will restrict access to certain areas for commercial fisheries and other ocean activities) and through effects from underwater sound on fish species which could affect their distribution. The designated safety zone (500 m radius from the well location or 50 m beyond an anchor point, whichever is larger) is established around the MODU in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* to prevent collisions between the MODU and other vessels. It will result in an area of approximately 7 km² being inaccessible to fishing and other vessels for a period of up to 120 days per well. The MODU (and corresponding safety zone) will be in place at the wellsite for approximately 120 days for each well drilled. Mobilization and operation of the MODU may also interact with other ocean users by requiring them to reroute, relocate or reschedule their activities due to transit operations and/or establishment of the safety zone.

Sediment and seawater quality could be affected by discharges from the MODU (including drill muds and cuttings) and supply vessels, by indirectly affecting the quality (or perceived quality) of commercial fish species, as well as the potential conditions during research activities. As per the assessment of discharges on marine fish and fish habitat (Section 6.2.3), the effects from discharges (including grey or black water, bilge water, deck drainage, BOP fluid, and cement) are expected to be low in magnitude and localized to the Project Area.

Underwater sound associated with a VSP survey could disturb fish, causing them to temporarily avoid the affected area. This may lead to a reduction in landings for certain commercially fished species, particularly groundfish species, as underwater sound has been found to cause behavioural responses to air gun source array exposure. Studies have shown effects on fisheries catch rates of groundfish species were short term in nature and no effect was noted after seismic surveys ceased (Engås et al. 1996; Løkkeborg et al. 2012; Streever al. 2016). Studies conducted on shrimp and crab indicate that invertebrate species do not exhibit the same avoidance response as groundfish species and that natural spatial and temporal influence are more important factors in determining the catch rate (Christian et al. 2003; Morris et al. 2018).

Wells drilled during the Project life span will be plugged and abandoned upon completion of well evaluation activities, although the abandonment program has not yet been defined. Abandonment activities will be conducted according to Suncor's practices and requirements set by the C-NLOPB. Suncor's wellhead removal strategy considers water depth and the likelihood of potential interactions with fishing activities. As discussed in Section 2.2.5, two possible scenarios exist for an exploratory well: suspension or abandonment. An exposed suspension cap may cause temporary disturbance to the area immediately surrounding the well but is not expected to have a substantial effect on fish populations. If the wellhead is left in place after well decommissioning, suspension and abandonment, it would result in a permanent piece of infrastructure on the seafloor, which would have to potential to affect access to commercial fisheries resources (i.e., vessels may have to deviate from a straight line transit to avoid charted wellheads). It is estimated that there would not be a large amount of interaction with commercial fishing activities in the LAA, as most harvesting takes place along the shelf edge at shallower depths. It is unlikely that wellhead abandonment will result in an interaction with commercial fishing and offshore research activity in a way that would result in a substantial change to availability of resource.

The addition of supply vessel traffic to and from the area will provide a small increase to existing marine traffic levels. Commercial fishers are aware of supply vessels moving throughout offshore NL and are accustomed to operating around supply vessels. The implementation of standard industry measures and operation of vessels will reduce the likelihood of an interaction. Supply vessels will follow established vessel traffic routes and communication protocols when transiting to and from the Project Area. Once near the Project Area, the supply vessel will select the route most appropriate for reaching the MODU. Supply vessels will adhere to standard at-sea protocol and procedures, reducing potential conflicts with commercial fisheries and other ocean users.

Given the irregular schedule and short-term duration of drilling activities, the localized nature of Project interactions with commercial fishing activity, and the implementation of mitigation, such as communication with commercial fishers and other ocean users, and environmental protection measures, it is not expected that local fishers will experience a change in availability of fishing resources such that they cannot be used at current levels within the RAA for more than one fishing season. Likewise, for other ocean users, it is not expected they will be displaced or unable to use substantial portions of the areas currently used for one or more years.

6.7.4 Potential Effects from Accidental Events

An accidental event can interact directly and indirectly with commercial fisheries and other ocean users by causing a change in availability of resources. For commercial fishers, the resource would be commercially harvested fish species. For other ocean users, the resource would be marine species of interest, in the case of research vessel surveys, or access to ocean areas (surface, subsurface or sea floor) for research and other purposes (i.e., marine transportation or military training). Direct interactions can include displacement from fishing grounds and damage to gear, vessels or instruments. Changes in fish health or quality, and fish avoiding fishing grounds due to changes in water quality, are considered as indirect effects. Indirect effects on commercially fished species and species targeted during research activities due to change in abundance, distribution and quality are discussed in the assessment of accidental events on Marine Fish and Fish Habitat (Section 6.2.4).

If an accidental even were to occur, it may affect commercial fisheries and other ocean users through:

- Loss of access to marine areas
- Damage to or fouling of gear, vessel, or equipment
- Reduced marketability of resources

A subsea blowout scenario has the potential to cause a change in the availability of resources for commercial fisheries and other ocean user, depending on the spatial and temporal scale of the spill and overlap with known uses of the marine areas. Key mitigation, aside from spill response, includes early and effective communication and compensation for actual loss or damage. Fishery closures may be imposed after a spill to prevent gear from being contaminated and to protect or reassure seafood consumers during spill remediation. Closures areas are also implemented to reduce interferences of other vessels with those associated with spill remediation and clean up. The implementation of a fishery closure would prevent harvesting of fish in the affected area. While this may ease concerns about marketing of tainted product, it also means that harvesting activities are stalled or displaced to another location for a period of time. Closures typically remain in place until there is no visible sheen, there is low risk of future exposure based on predicted trajectory modelling, and seafood has passed a chemical analysis for oil contamination as well as a sensory test (e.g., smell and taste) (National Commission on the BP DWH Oil Spill and Offshore Drilling 2011).

A marine diesel spill is not likely to result in effects over a large area. Based on modelled results, oil was predicted to be transported to the west and south, within 175 km of the release location within EL 1161. At the end of the 30-day marine diesel batch spill simulation, 44% was predicted to be evaporated into the atmosphere, 42% degraded, 15% remained entrained in the water column, while 0.1% of the released volume was predicted to remain floating on the water surface. No marine diesel was predicted to strand on shorelines or settle on sediments in the modelled scenario.

It is anticipated that in the event of an SBM spill from the MODU, SBM will rapidly sink to the seafloor and be localized to the area surrounding the MODU, resulting in temporary degradation to the benthic habitat and potential smothering of benthic fauna. Studies have shown that there is little or no risk of the bioaccumulation of drilling based chemicals occurring in the tissues of benthic animals or transfer through marine food webs to fishery species (Neff et al. 2000). Although unlikely to occur, an SBM spill may potentially result in a surface sheen. However, it is unlikely that a sheen at this scale within the Project Area would result in a fisheries closure or pose risk to gear fouling.

For other human components and activities, behavioural and physical effects on fish could indirectly affect research activities, and Project activities may also limit certain areas for research or military exercises, which may result in changes in schedules, or relocation of vessels to alternate areas. Damage to vessels or research equipment may also occur.

6.8 Cumulative Effects

Section 19(1)(a) of CEAA 2012 requires that the EA of a designated project consider "any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out". Scoping the assessment of cumulative environmental effects involved:

- Selecting VCs for the cumulative effects assessment
- Defining the spatial and temporal boundaries of the assessment
- Identifying other past, present, and future (i.e., certain or reasonably foreseeable) physical activities in the Study Area where residual environmental effects have potential to overlap spatially and temporally with those of the Project

The assessment of cumulative environmental effects considers all seven of the VCs for which Project-related environmental effects were assessed, as residual environmental effects were predicted for each VC. These seven VCs are:

- Atmospheric Environment
- Marine Fish and Fish Habitat
- Marine and Migratory Birds
- Marine Mammals and Sea Turtles
- Special Areas
- Indigenous Peoples
- Commercial Fisheries and Other Ocean Users

The following list identifies the past, present, and future (i.e., certain or reasonably foreseeable) physical activities within the RAA that have potential to cause residual environmental effects that overlap spatially and temporally with the residual environmental effects of the Project:

- Geophysical survey programs
- Offshore exploration drilling and production projects
- Commercial and Indigenous fisheries
- Hunting activity
- Other ocean uses, such as shipping, scientific research, and military activities

6.8.1 Atmospheric Environment

Project-related GHG emissions have the potential to cumulatively increase GHG emissions from the area when combined with the GHG emissions from existing offshore development projects in and surrounding the Project Area and along with other exploration drilling projects. The Project will contribute 0.63% of the provincial 2030 GHG target and 0.01% to the Federal 2030 GHG target. The Project emissions contributes a small fraction to the provincial and national targets and may marginally affect NL's and Canada's abilities to meet their targets.

The cumulative environmental effects on the atmospheric environment resulting from planned Project activities combined with GHG emission sources located within the Project Area are predicted to be moderate in magnitude, global, of short-term duration, and occurring regularly but reversible.

6.8.2 Marine Fish and Fish Habitat

Residual environmental effects from the Project may potentially combine with residual effects from one or more other physical activities potentially resulting in cumulative environmental effects on fish and fish habitat. The potential cumulative environmental effects include a cumulative change in risk of mortality or physical injury and/or a change in habitat quality and use.

A change in risk of mortality, injury, or health may result from potential interactions with the presence and operation of a MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, and discharges. In general, offshore exploration drilling projects, production projects, geophysical surveys, commercial fishing and other ocean uses may result in physical injury or mortality to fish and the residual effects from these activities have the potential to combine with residual effects from the Project, resulting in cumulative adverse environmental effects. Migratory species (particularly those whose ranges cover a large extent of the RAA) may be sequentially exposed to the residual effects of the Project and the residual effects of one or more other physical activities throughout their life cycle. Project emissions will contribute to an already disturbed soundscape in the marine environment, however, the underwater sound emissions from the Project will be relatively short-term and reversible.

A change in habitat availability, quality, and use for marine fishes and invertebrates may result from the operation and presence of the MODU, geophysical (including VSP), geological, geotechnical and environmental surveys, Project-related discharges, well decommissioning, suspension and abandonment, and supply and servicing operations. The cumulative environmental effects of the Project in combination with other physical activities may therefore include a temporary reduction in the amount of habitat available within the RAA (i.e., due to temporary avoidance of multiple areas at once). This cumulative change in habitat availability, quality, and use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviours. In general, the presence of Project and non-Project vessels in any particular area is anticipated to be medium-term and transient in nature, thus limiting water quality and sound effects (and associated cumulative changes in habitat quality and use) at any given location, including areas of importance for reproduction, feeding, and migration of fish.

6.8.3 Marine and Migratory Birds

Marine and migratory birds have been and continue to be subject to numerous threats throughout their sometimes extensive ranges that may affect their distribution, abundance, and health. These threats include vessel traffic, (including residual hydrocarbons and other contaminants in routine operational discharges from vessels), hunting, fishing activity (including fisheries bycatch (entanglement in gear)), offshore petroleum exploration and production activities, and associated effluents and emissions, pesticides, and other pollution. Cumulative effects pathways associated with the Project include discharges and emissions, artificial lighting, sound disturbances and helicopter strikes, which could result in cumulative changes in risk of mortality or physical injury and/or habitat quality and use.

The presence and operation of a MODU and supply vessels has the greatest potential to result in changes to risk of mortality or physical injury for marine and migratory birds. Some of these species are known to concentrate around drilling and production platforms as a result of artificial lighting at night, food, and other visual cues. Artificial night lighting currently in the Project Area include nearby production platforms, fishing, and shipping vessels transiting in proximity. The presence of the MODU would be a new source of night

lighting in the region in addition to the artificial lighting currently present from other projects, thereby increasing risk of mortality or physical injury and/or change in habitat quality and use for marine and migratory birds. Project-related effects are anticipated to be a localized, transient, and short-term cumulative effect to the current projects and physical activities in the area and unlikely to result in adverse effects to marine and migratory birds at the population level.

Atmospheric sound emissions generated from other physical activities in the Project Area may locally displace marine and migratory birds for short durations through general avoidance responses. The cumulative environmental effects of the Project in combination with other physical activities will therefore include a temporary reduction in the amount of marine and migratory bird habitat available within the RAA (i.e., due to temporary avoidance of multiple areas at once). This cumulative change in habitat quality and use has potential to disrupt foraging and/or migratory behaviour; however, effects of in-air sound would be localized and temporary.

6.8.4 Marine Mammals and Sea Turtles

Marine mammals and sea turtles are commonly highly mobile, with broad ranges and large movements across annual migration routes. The generally widespread migratory nature of some species (including in many cases beyond the RAA) increases the potential for individuals and populations to be affected by multiple perturbations throughout their ranges.

There are two primary pathways from Project activities that may cumulatively interact with other activities resulting in change in the risk of mortality or physical injury for marine mammals and sea turtles: vessel strikes and underwater sound generated by Project activities. Underwater sound emissions from Project-related operations will contribute to the wider area soundscape, which includes underwater sound emissions of other physical activities and may, therefore, potentially result in a cumulative change in risk of mortality or physical injury. To mitigate potential effects from VSP operations for the Project, a ramp-up procedure for the air gun array will be implemented in consideration of the SOCP (DFO 2007).

A cumulative change in risk of mortality or physical injury for marine mammals and sea turtles may also occur due to increased potential for strikes with vessels conducting various physical activities within the RAA (including Project activities). Marine mammals and sea turtles are also at risk of mortality due to entanglement in fishing gear. Project activities, offshore petroleum exploration and production drilling projects, geophysical survey programs, and the activities of fisheries and other ocean users have potential to occur in different parts of the RAA, thereby cumulatively potentially increasing risk of mortality or physical injury.

Cumulative effects to change in habitat quality and use may occur as a result of underwater sound and/or marine discharges from human activities. The PTS / TTS thresholds for high-frequency cetaceans do not extend beyond the Project Area. The Project and other physical activities may temporarily reduce habitat availability within the RAA resulting from the potential for temporary avoidance of multiple areas at once.

6.8.5 Special Areas

Pathways for cumulative environmental effects on fish and fish habitat, marine and migratory birds, and marine mammals and sea turtles are also applicable to special areas. Several special areas intersect with EL 1161, the Project Area or LAA including the supply vessel route where marine vessels and aircraft are anticipated to transit. Potential cumulative interactions associated with the presence and operation of the MODU, including discharge of drill muds and cuttings as well as other discharges and emissions, geophysical (including VSP), geological, geotechnical and environmental surveys, and well decommissioning, suspension and abandonment activities, would be limited, for the most part, to localized portions of these special areas, whose boundaries overlap with the Project Area. Many of these special areas also overlap with areas for current production platforms as well as proposed future exploration drilling programs, which would be predicted to have similar environmental effects as this Project. However, the extent of disturbance would be localized per well site and, like Suncor, other operators proposing exploration drilling activities in these areas, have committed to conducting seabed surveys prior to drilling to confirm the absence of sensitive environmental features, such as habitat-forming corals or SAR and implementing an appropriate course of action in consultation with regulatory authorities to avoid or reduce adverse effects on these features.

Special areas, whose boundaries overlap with the LAA due to proposed supply vessel routes, may also experience effects on habitat quality associated with marine discharges, sound, and light emissions. The supply vessel and helicopter transport routes proposed for this Project would be similar to those used by existing oil and gas development projects on the Jeanne d'Arc Basin (given commencement at an existing onshore port) and proposed future exploration drilling projects. Therefore, there is potential for cumulative environmental effects on these special areas due to increased marine traffic. However, the incremental changes to existing traffic volumes due to supply and servicing from the Project will be minor and temporary with effects being short-term and transitory in any one location.

6.8.6 Indigenous Peoples

The safety (exclusion) zones associated with other offshore petroleum exploration and production drilling projects will increase the cumulative area that will be temporarily unavailable to Indigenous fishers and harvesters at any given time during Project activities. It is assumed, for the purpose of this assessment, that each of these exploration projects would institute a 500-m radius safety (exclusion) zone (approximately 0.8 km²) from which fisheries would be temporarily excluded. These safety (exclusion) zones would be in addition to the approximately 380 km² footprint of safety (exclusion) zones associated with existing production projects in the RAA. Ongoing communication will be required to avoid adverse effects on commercial-communal fisheries that may occur in the RAA and associated health and socio-economic conditions in Indigenous communities.

Indigenous fishers that experience a change in access to their customary fishing areas as a result of the Project in combination with other physical activities in the RAA may be required to temporarily relocate their fishing effort, thereby adversely affecting the competition for remaining fishing areas in the RAA. Fishing effort within and surrounding the Project Area is relatively low and does not include unique fishing grounds or concentrated fishing effort that occurs exclusively within the Project Area.

Physical activities within the RAA may unintentionally result in damage to fishing gear which has the potential to cumulatively interact with the Project to result in a change in commercial-communal fisheries within the RAA. Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (Canadian Association of Petroleum Producers 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017). Similar compensation plans would be implemented in the event of gear loss or damage by other operators.

While there are no known FSC fisheries in the Project Area, the assessment of cumulative effects on current use of lands and resources considers cumulative effects on migratory fish, bird, and marine mammal species that have the potential to migrate through the Project Area. Potential cumulative environmental effects on Indigenous peoples may result in changes to current use of lands and resources for traditional purposes through environmental effects on marine fish, marine and migratory birds, and marine mammals and sea turtles due to the generation of underwater sound and water quality effects associated with discharges. Cumulative adverse effects on marine species that could be considered important from an FSC perspective, are not predicted to cause a change in quantity, quality or availability of these resources that could result in a change in health and socio-economic conditions or a change in current use of lands and resources for traditional purposes.

6.8.7 Commercial Fisheries and Other Ocean Users

Fishing effort near the Project Area is relatively low and does not include unique fishing grounds or concentrated fishing effort that occurs exclusively within the Project Area. Drilling activities will require a 500-m radius safety (exclusion) zone around the MODU which could cumulatively contribute to restricted fishing areas; however, given the lack of commercial fishing in the Project Area / LAA, cumulative effects from Project related activities is anticipated to be negligible. Underwater sound, drill cuttings deposition, and light emissions will not extend beyond the Project Area. The potential for temporary loss of access to preferred fishing areas as a result of the Project is therefore anticipated to be negligible and is unlikely to have a discernable effect on the overall distribution of fishing effort within the RAA.

Physical activities within the RAA may unintentionally result in damage to fishing gear, which has the potential to cumulatively interact with the Project to result in a change in fisheries within the RAA. Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material.

Standard practices for communication among marine users, including the communication of details of the safety (exclusion) zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Notice to Shipping and Notice to Mariners systems, is expected to mitigate potential conflicts with fisheries as well as other ocean users. During the drilling program, a Fisheries Communication Plan will be implemented to facilitate coordinated communication with fishers. Suncor will share Project details, as applicable, and determine the need for a fisheries liaison officer during project operations.

6.9 Effects of the Environment on the Project

As required under section 19(1)(h) of CEAA 2012 and as specified in the EIS Guidelines (Part 2, section 7.6.2), the EIS assesses and evaluates how local environmental conditions and natural hazards could adversely affect the Project, resulting in potential effects on the environment.

Key environmental factors that could potentially affect the Project include:

- Marine geology (sediment and seafloor instability; landslides)
- Climatology, weather, and oceanographic conditions
- Marine icing, sea ice and icebergs

Appropriate understanding and careful consideration of environmental characteristics including winds, waves, currents, ice, precipitation, and other factors, such as seismicity, is required for offshore oil and gas exploration and production activities. Understanding these environmental characteristics enables offshore operations that are safe for workers, while also protecting the environment, equipment, and infrastructure. This includes avoiding or reducing the potential for incidents and accidents that may occur as a result of unplanned interactions between oil and gas operations and the physical environment of the applicable marine area.

Key environmental factors that may affect the Project include severe and/or extreme weather conditions, sea ice, icebergs, superstructure icing, and oceanographic conditions. Seismicity and geological stability are also considerations, although such events have a low probability of occurrence. Engineering design, operational procedures, and mitigation measures will reduce potential adverse effects to the Project. Based on the application of risk mitigation including adherence to the *Newfoundland Offshore Certificate of Fitness Regulations*, *Newfoundland Offshore Petroleum Installations Regulations*, and the Offshore Physical Environmental Guidelines, substantial adverse residual effects of the environment on the Project are not likely to occur.

7.0 MITIGATION MEASURES AND COMMITMENTS

The implementation of mitigation measures is proposed to reduce or eliminate potential adverse effects. Mitigation may include documented practices and measures proven effective in the past, as well as measures developed specifically for the Project. In some cases (e.g., fishing gear loss, major spills), compensation measures may be warranted. Each VC assessment indicates how the mitigation measures will reduce or eliminate potential adverse effects on the VC. A summary of standard mitigation measures and Project-specific commitments to be implemented is provided in Table 7.1.

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
General	
1	Contractors and subcontractors will be required to demonstrate conformance with the requirements that have been established, including environment, health and safety standards and performance requirements.
2	A Certificate of Fitness will be obtained for the MODU from an independent third-party Certifying Authority prior to the commencement of drilling operations in accordance with the *Newfoundland Offshore Certificate of Fitness Regulations*.
3	The observation, forecasting and reporting of physical environment data will be conducted in accordance with the *Offshore Physical Environment Guidelines* (NEB et al. 2008).
4	Suncor and contractors working on the Project will regularly monitor weather forecasts to forewarn supply vessels, helicopters and the MODU of inclement weather or heavy fog before it poses a risk to their activities and operations. Extreme weather conditions that are outside the operating limits of supply vessels or helicopters will be avoided, if possible. Captains / Pilots will have the authority and obligation to suspend or modify operations in case of adverse weather or poor visibility that compromises the safety of supply vessel, helicopter, or MODU operations.
5	Suncor will prepare and submit an Ice Management Plan as part of the application for Drilling Program Authorization as per the *Offshore Physical Environment Guidelines* (NEB et al. 2008). This Plan, which will form part of the Safety Plan submission and will include details on sea ice / iceberg monitoring and detection, and risk assessment, mitigation, and contingency procedures.
6	Safe work practices will be implemented to reduce exposure of personnel to lightning risk (e.g., restriction of access to external areas on the MODU or supply vessel during thunder and lightning events).
7	Prior to any drilling activity, Suncor will conduct a geohazard assessment for wellsites.
8	Project-related damage to fishing gear, if any, will be compensated in accordance with the *Compensation Guidelines with Respecting Damages Relating to Offshore Petroleum Activity* (C-NLOPB and CNSOPB 2017).
9	The Project will operate in accordance with applicable regulations.
10	Suncor will continue to engage with Indigenous communities to share Project details and facilitate information sharing. This will be accomplished through the development and implementation of a Fisheries Communication Plan.
11	A Fisheries Communication Plan will be implemented to facilitate coordinated communication with fishers (commercial fishers and Indigenous groups). Suncor will share Project details, as applicable, and determine the need for a fisheries liaison officer during certain operations of the MODU. This engagement will be coordinated through One Ocean, Fish, Food and Allied Workers-Unifor, Ocean Choice International, Association of Seafood Producers, and Atlantic Groundfish Council.
12	Suncor will maintain ongoing communications with the NAFO Secretariat, through DFO as the Canadian representative, regarding planned Project activities, including timely communication of drilling locations, safety zone, and well decommissioning, suspension and abandonment
13	Suncor will contact DFO regarding timing and locations of planned DFO research (spring and fall RV surveys, longline halibut survey, and post-season crab survey).
14	Suncor will contact DND regarding timing of planned offshore military exercises.
15	Suncor will conduct a pre-drill survey at each wellsite to confirm the presence / absence of potential hazardous subsea infrastructure (e.g., cables, unexploded ordinance, shipwrecks), the presence / absence of natural geohazards (e.g., shallow gas pockets), and the presence / absence of habitat-forming corals or sponges.
16	An up-to-date version of information (such as Fisheries Communication Plan, results of follow-up and marine mammal and sea turtle monitoring, pre-drill survey results, SIMA, OSRP, well control strategies, and decommissioning, suspension and abandonment plans) will be posted via the Internet and Indigenous groups will be notified of the postings.

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
Presence and Operation of the MODU	
17	A safety zone will be established around the MODU in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* SOR/2009-316.
18	Suncor will provide details of the safety zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Notices to Shipping and Notices to Mariners. Details of the safety zone will also be communicated during ongoing engagement with commercial and Indigenous fishers.
19	To maintain navigational safety at all times during the Project, obstruction lights, navigation lights and foghorns will be kept in working condition on board the MODU and supply vessels. Radio communication systems will be in place and in working order for contacting other marine vessels as necessary.
20	The MODU will be equipped with local communication equipment to enable radio communication between the supply vessels and the MODU's bridge. Communication channels will also be put in place for internet access and enable communication between the MODU and shore.
21	Suncor will conduct an imagery-based seabed survey at the proposed wellsite(s) to confirm the absence of shipwrecks, debris on the seafloor, unexploded ordnance, and sensitive environmental features, such as habitat-forming corals or sponges. The survey will be carried out prior to drilling and will encompass an area within a 500-m radius from the wellsite. If any environmental or anthropogenic sensitivities are identified during the survey, Suncor will notify the C-NLOPB immediately to discuss an appropriate course of action. This may involve further investigation and/or moving the wellsite if it is feasible to do so.
22	Variable speed drive equipment with high power consumption (e.g., gas compressors, water injection pumps) will be used to optimize energy efficiency
23	High-efficiency equipment will be used for power generation, if available
24	Sulphur content in diesel fuel used for the Project will meet the *Sulphur in Diesel Fuel Regulations* and will comply with the sulphur limits in fuels for large marine diesel engines, per the *Vessel Pollution and Dangerous Chemicals Regulations*
25	The Project will use ultra-low sulphur diesel fuel wherever practicable and available as it will reduce the potential for adverse local air quality effects
26	Artificial lighting will be reduced, where possible with consideration of safety and associated operational requirements. Lighting reductions may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck
27	To reduce the potential spread of invasive species, ballast water will be managed in consideration of applicable Canadian and international ballast water management requirements (e.g., Canada's *Ballast Water Regulations*)
28	Suncor will develop a protocol for systematic, daily searches for seabirds stranded on the MODU and supply vessels, which will include the documentation of search effort. Seabirds found will be recovered, rehabilitated, released and documented in accordance with the methods in Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2017a). Suncor will provide training in these protocols and procedures. A Seabird Handling Permit will be obtained from ECCC-CWS annually. In accordance with ECCC requirements, an annual report and all occurrence data that summarizes stranded and/or seabird handling occurrences will be submitted to ECCC.
Geophysical (including VSP), Geological, Geotechnical and Environmental Surveys	
29	VSP activities will be planned and conducted in consideration of relevant regulations and guidance including the SOCP (DFO 2007) and C-NLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019).
30	Passive acoustic monitoring will be implemented, or equivalent technology, and visual monitoring by marine mammal and sea turtle observers during vertical seismic surveys.

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
31	A ramp-up procedure for VSP surveys will be carried out where seismic source elements are gradually increased over a period of approximately 30 minutes until the operating level is achieved. This measure, as outlined in the SOCP (DFO 2007) and C-NLOPB (2019) guideline, is intended to reduce potential change in risk of injury to marine animals (including fishes and invertebrates, marine mammals, and marine birds) in close proximity to the sound source at the start of the activity. A gradual increase in emitted sound levels is intended to provide an opportunity for mobile organisms to move away before potentially injury-inducing sound levels are achieved close to the sound source.
32	VSP activities will be planned to avoid dispersing aggregations of fish from known spawning areas and diverting fish from known migration corridors as detailed in Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019).
33	Marine Mammal Observers (MMOs) will monitor and report on marine mammal and sea turtle sightings during surveys and will implement shutdown and ramp-up procedures during VSP surveys.
34	MMOs will implement a pre-ramp up watch of 60 minutes prior to ramp-up for a VSP survey. The longer 60-minute pre-ramp up watch versus the minimum 30-minute period required in the SOCP will be used to account for the longer dive times of beaked whales (and other deep-diving marine mammals) expected to occur in the Project Area. This period is recommended by DFO (Moors-Murphy and Theriault 2017) in a recent review of the SOCP.
35	Shut down procedures (i.e., shutdown of source array) will be implemented during VSP surveys if a marine mammal or sea turtle listed as endangered or threatened on Schedule 1 of SARA, as well as any beaked whale species, is observed within 500 m of the air gun array.
Well Testing and Flaring	
36	High-efficiency burners (flare tip) will be used if flaring is conducted, if available
37	Well testing, if carried out, will be subject to Suncor's well test assurance process, which is designed to promote safe and efficient well test operations
38	If flaring is required for well testing, Suncor will discuss flaring plans with the C-NLOPB including steps to reduce adverse effects on migratory birds. This may involve restricting flaring to the minimum required to characterize the wells' hydrocarbon potential and as necessary for the safety of the operation, reducing flaring during periods of migratory bird vulnerability, and the use of a water curtain to deter birds from the general vicinity of the flare. Alternative testing methods that do not require flaring are preferred by Suncor, and their applicability will be fully evaluated prior to flaring taking place.
Discharges	
30	Air emissions from the Project will adhere to applicable regulations and standards.
40	Offshore waste discharges and emissions associated with the Project (i.e., operational discharges and emissions from the MODU and supply vessels) will be managed in accordance with relevant regulations and municipal bylaws as applicable, such as the OWTG (NEB et al. 2010) and MARPOL, of which Canada has incorporated provisions under various sections of the *Canada Shipping Act*. Waste discharges not meeting legal requirements will not be discharged to the ocean and will be brought to shore for disposal. Furthermore, a Project-specific EPP and waste management plan will be developed to prevent unauthorized waste discharges (refer to Section 2.10 for details on waste discharges and management).
41	Selection and screening of chemicals to be discharged, including drill fluids, will be in accordance with the OCSG (NEB et al. 2009). Where feasible, lower toxicity drilling muds and biodegradable and environmentally friendly muds and cements will be used. The chemical components of drilling fluids, where feasible, will be those that have been rated as less hazardous under the OCNS and/or Pose Little or No Risk to the Environment by the Convention for the Protection of the Marine Environment of the North-East Atlantic.
42	SBM drill cuttings will be returned to the MODU and treated in accordance with the OWTG before being discharged into the marine environment. The concentration of SBM on cuttings will be monitored onboard the MODU, and in accordance with OWTG. No excess or spent SBM will be discharged, and any of this excess or spent SBM that cannot be reused will be brought back to shore for disposal. WBM drill cuttings will be discharged without treatment.

SUNCOR ENERGY

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
43	Excess cement may be discharged to the seabed during the initial phases of the well, which will be drilled without a riser. Unused cement bulks and additives will be transported to shore for future re-use or disposed at an approved facility.
44	Small amounts of produced water may be flared. If volumes of produced water are large, some produced water may be brought onto the MODU for treatment and shipped to shore for disposal.
45	Deck drainage and bilge water will be discharged according to the OWTG which state that deck drainage and bilge water can only be discharged if the residual oil concentration of the water does not exceed 15 mg/L.
46	Ballast water will be discharged according to IMO *Ballast Water Management Regulations* and Transport Canada's *Ballast Water Control and Management Regulations.* The MODU will carry out ballast tank flushing prior to arriving in Canadian waters.
47	Putrescible solid waste, specifically food waste generated offshore on the MODU and supply vessels, will be disposed of according to OWTG and MARPOL requirements. Management of kitchen waste will be conducted in accordance with MARPOL and OWTG. There will be no discharge of macerated food waste within 3 NM from land.
48	Waste discharges that do not meet regulatory requirements will be delivered to the shore base for appropriate disposal at approved facilities. Project-specific EPP and WMP will be designed to prevent unauthorized waste discharges (Section 2.7 provides additional information on waste discharges and management).
49	Sewage will be managed in accordance with MARPOL and in line with the OWTG prior to discharge.
50	Cooling water will be discharged in line with the OWTG, which states that any biocides used in cooling water are selected in line with a chemical management system developed in line with the OCSG.
51	BOP fluids and any other discharges from the subsea control equipment will be discharged according to OWTG and OCSG.
52	Liquid wastes, not approved for discharge in OWTG such as waste chemicals, cooking oils or lubricating oils, will be transported onshore for transfer to an approved disposal facility.
53	Biomedical waste will be collected onboard by the doctor or medic and stored in special containers before being transported onshore for incineration.
54	Transfer of hazardous wastes will be conducted according to the *Transportation of Dangerous Goods Act.* Any applicable approvals for the transportation, handling, and temporary storage of these hazardous wastes will be obtained as required.
Supply and Servicing Operations	
55	Supply vessels will undergo Suncor's internal verification process and where required, additional external inspections / audits (e.g., C-NLOPB pre-authorization inspections) in preparation for the Project.
56	Supply vessels will use existing shipping lanes as practicable; where these do not exist, supply vessels will follow a straight-line approach to and from the Project Area.
57	During transit to and from the Project Area, supply vessels will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. If marine mammals or sea turtles are observed by vessel crews, they will reduce speed and/or alter course if practicable to avoid a collision. More specifically, supply vessels will reduce speed to a maximum of 13 km/hour (7 knots) when a marine mammal or sea turtle is observed or reported within 400 m of a supply vessel, except if not feasible for safety reasons.
58	Lighting on supply vessels will be reduced to an extent that will not compromise safety of operations. This may include avoiding use of unnecessary lighting, shading lights, and directing lights towards the deck.
59	Air emission sources associated with vessels will adhere to applicable limits set out in Canada's V*essel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act, 2001.*

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
60	The regional CWS office will be contacted for separation distances and altitudes between helicopters transiting to and from the MODU and migratory bird nesting colonies, as per CWS guidelines (Government of Canada 2018) and routes will comply with provincial *Seabird Ecological Reserve Regulations*, 2015. Specific details will be provided in the Project EPP.
61	Supply vessel routes transiting to and from the MODU will be planned to avoid passing within 300 m of migratory bird nesting colonies during the nesting period and will comply with provincial *Seabird Ecological Reserve Regulations*, 2015 and federal guidelines in order to minimize disturbance to colonies (ECCC 2017b). Specific details will be provided in the Project EPP.
Well Decommissioning, Suspension and Abandonment	
62	A seabed survey will be conducted at the end of a drilling program using an ROV to inspect the seabed for debris.
63	Well decommissioning, suspension and abandonment for this Project will be carried out as per applicable industry practice and in compliance with relevant regulatory requirements. Once wells have been drilled to total depth and well evaluation programs completed (if applicable), the well will be plugged and abandoned in line with applicable Suncor practices and C-NLOPB requirements. The final well decommissioning, suspension and abandonment program has not yet been finalized. However, these details will be confirmed to the C-NLOPB as planning for the Project continues.
64	Suncor's well decommissioning, suspension and abandonment plan, including a wellhead abandonment strategy, is on file with the C-NLOPB. If it is proposed that a specific wellhead be abandoned on the seafloor in a manner that could potentially interfere with commercial fishing, the strategy will be developed in consultation with Indigenous groups and commercial fishers.
65	Suncor will communicate the locations of abandoned wellheads (if applicable) to Indigenous and non-Indigenous fishers and the Canadian Hydrographic Services for future nautical charts.
Accidental Events	
66	Suncor will implement multiple preventative and response barriers to manage risk of incidents occurring and mitigate potential consequences. See Section 2.5 and 16.4.3 for specific information on well control and blowout prevention, and Section 16.4 for a description of Suncor's contingency planning and emergency response measures.
67	As noted in Section 16.4.1, the Project will operate under Project-specific OSRP, which will be submitted to the C-NLOPB prior to the start of drilling activity as part of the OA process. The OSRP will specify tactical response methods, procedures and strategies for safely responding to different spill scenarios. Tactical response methods that will be considered following a spill incident include but are not limited to: surveillance and monitoring, mechanical dispersion, containment and recovery; chemical dispersion; in-situ burning; and wildlife measures. See Section 16.4 for details on emergency management and spill response.
68	Suncor will prepare a SIMA, an evaluation applied to an oil spill to aid in the selection of the appropriate spill response(s) that results in the best overall recovery of resources of concern (either ecological, socio-economic and/or cultural). Suncor will develop their SIMA as per the Guidelines on Implementing Spill Impact Mitigation Assessment (IPIECA-API-IOGP 2017). Suncor will consider all feasible response options that would be potentially effective in the Project Area and will develop their SIMA in consultation with ECCC, the Canadian Science Table, and the C-NLOPB.
69	Suncor will develop a Wildlife Monitoring Plan and, for incidents where wildlife is threatened, engage specialized expertise to implement the Plan, including the recovery and rehabilitation of wildlife species as needed (refer to Section 16.4.5 for Suncor's wildlife monitoring response approach).
70	A Fisheries Communication Plan will be used to facilitate coordinated communication, including procedures for informing commercial fishers of an accidental event and planned response. Emphasis will be on timely communication, allowing fishers to haul out gear from affected areas, reducing potential of fouling of fishing gear. This engagement will be coordinated through One Ocean, FFAW-Unifor, OCI, ASP, and Atlantic Groundfish Council.

Table 7.1 Summary of Standard and Project Specific Mitigation Measures

No.	Proponent Commitments
71	Actual loss or damage, which includes income, will be compensated in accordance with industry best practices in the NL offshore and relevant guidance material including the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017) (applicable if a spill results in gear loss or damage), Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2017), and the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the latter of which indicates that operators should implement a gear and/or vessel damage compensation program.
72	Communication with fishers, including procedures for informing Indigenous groups of an accidental event. Timely communication will be important, thereby providing fishers with the opportunity to remove gear from the affected areas and reducing the potential for fouling of fishing gear. In the event of Project-related damage to fishing gear, fishers will be compensated in accordance with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2017).
73	Suncor will maintain ongoing communications with the NAFO Secretariat, through DFO as the Canadian representative, regarding the occurrence of an accidental event, including timely communication on restricted access zones and applicable buffers.

8.0 SIGNIFICANCE OF RESIDUAL EFFECTS

Table 8.1 summarizes the residual effect findings for each VC and indicates the significance of these effects for routine operations. Table 8.2 summarizes the residual effect findings for each VC and indicates the significance of these effects for accidental events. Where an effect is predicted to be significant, the likelihood of that effect occurring is also presented.

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 18.2)	Residual Effect Characterization					Ecological / Socio Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Atmospheric Environment		Change in GHG Levels	Presence and Operation of a MODU	Refer to Section 8.4	M	G	MT	C	IR	D	N	N/A
			Geophysical (including VSP) Surveys		M	G	ST	IR	IR	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		M	G	ST	IR	IR	D	N	N/A
			Discharge		-	-	-	-	-	-		-
			Well Testing and Flaring		M	G	ST	IR	IR	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		M	G	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		M	G	MT	R	IR	D	N	N/A
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury	Presence and Operation of a MODU	Refer to Section 9.3	L	PA	MT	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		L	PA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
		Change in Habitat Availability, Quality, and Use	Presence and Operation of a MODU		L	PA	MT	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		L	PA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		L	PA	ST	IR	R	D	N	N/A
			Discharges		M	PA	MT	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		L	PA	ST-P	IR	R	D	N	N/A
			Supply and Servicing		L	PA	ST-MT	IR	R	D	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury	Presence and Operation of a MODU	Refer to Section 10.3	L	LAA	ST	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		N-L	PA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
			Well Testing and Flaring		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		N	PA	ST	IR	R	D	N	N/A
			Supply and Servicing		L	LAA	ST	IR	R	D	N	N/A

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 18.2)	Residual Effect Characterization					Ecological / Socio Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in Habitat Quality and Use	Presence and Operation of a MODU	Refer to Section 10.3	L	LAA	ST	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		N	PA	ST	UL	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		L	PA	ST	IR	R	D	N	N/A
			Discharges		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Well Testing and Flaring		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		N	PA	ST	IR	R	D	N	N/A
			Supply and Servicing		L	LAA	ST	IR	R	D	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Injury	Presence and Operation of a MODU	Refer to Section 11.3	N	PA	ST-MT	UL	R	D	N	N/A
			Geophysical (including VSP) Surveys		N-L	PA-LAA	ST-MT	UL	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		N-L	PA	ST-MT	UL	R	D	N	N/A
			Supply and Servicing		N-L	LAA	ST-MT	UL	R	D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of a MODU		L	PA-LAA	ST-MT	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		L	PA-LAA	ST-MT	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		L	PA	ST-MT	IR	R	D	N	N/A
			Discharges		N	PA	ST	UL	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		N	PA	ST	UL	R	D	N	N/A
			Supply and Servicing		L	LAA	ST-MT	IR	R	D	N	N/A
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	Presence and Operation of a MODU	Refer to Section 12.4	L	PA	MT	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		L	PA-LAA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	MT	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		L	PA	ST	IR	R-I	D	N	N/A
			Supply and Servicing		L	LAA	ST-MT	IR	R	D	N	N/A

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 18.2)	Residual Effect Characterization					Ecological / Socio Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Indigenous Peoples	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Commercial-communal Fisheries	Presence and Operation of a MODU	Refer to Section 13.3	N-L	RAA	ST	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		N-L	RAA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		N-L	PA	ST	IR	R	D	N	N/A
			Discharges		N-L	RAA	MT	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		N-L	PA	ST-P	IR	R-I	D	N	N/A
			Supply and Servicing		N-L	RAA	ST	IR	R	D	N	N/A
	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Current Use of Lands and Resources for Traditional Purposes	Presence and Operation of a MODU		N-L	RAA	ST	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		N-L	RAA	ST	IR	R	D	N	N/A
			Geological, Geological, Geotechnical and Environmental Surveys		N-L	PA	ST	IR	R	D	N	N/A
			Discharges		N-L	RAA	ST	IR	R	D	N	N/A
			Well Testing and Flaring		N	RAA	ST	IR	R	D	N	N/A
			Supply and Servicing		N-L	RAA	ST	IR	R	D	N	N/A
Commercial Fisheries and Other Ocean Users	s. 5(2)(b)(i)	Change in Availability of Resources	Presence and Operation of a MODU	Refer to Section 14.3	L	PA	ST	IR	R	D	N	N/A
			Geophysical (including VSP) Surveys		L	PA	ST	IR	R	D	N	N/A
			Geological, Geological Geotechnical and Environmental Surveys		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning, Suspension and Abandonment		L	PA	ST-P	IR	R-I	D	N	N/A
			Supply and Servicing		L	LAA	ST	R	R	D	N	N/A
Key:					**Magnitude:** N: Negligible L: Low M: Moderate H: High	**Geographic Extent:** PA: Project Area LAA: Local Assessment Area RAA: Regional Assessment Area G; Global (GHGs only)	**Duration:** ST: Short-term MT: Medium-term LT: Long-term P: Permanent	**Frequency:** UL: Unlikely S: Single event IR: Irregular event R: Regular event C: Continuous	**Reversibility:** R: Reversible I: Irreversible	**Ecological/Socio-Economic Context:** D: Disturbed U: Undisturbed	**Significance:** S: Significant N: Not Significant	**Likelihood:** U: Unlikely L: Likely N/A: Not applicable

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 18.2)	Residual Effect Characterization					Ecological / Socio Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			

Notes:

VC-specific definitions included for each VC in Chapters 8 to 14.

Environmental Effects under CEAA 2012:

5(1)

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:

- (i) fish as defined in section 2 of the *Fisheries Act*,
- (ii) aquatic species as defined in subsection 2(1) of the *Species at Risk Act*,
- (iii) migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act*, 1994, and
- (iv) any other component of the environment that is set out in Schedule 2 of [CEAA 2012];

(b) a change that may be caused to the environment that would occur

- (i) on federal lands,
- (ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or
- (iii) outside Canada; and

(c) with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on

- (i) health and socio-economic conditions,
- (ii) physical and cultural heritage,
- (iii) the current use of lands and resources for traditional purposes, or
- (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Certain additional environmental effects must be considered under section 5(2) of CEAA 2012 where the carrying out of the physical activity, the designated project, or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than CEAA 2012.

5(2)

(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and

(b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on

- (i) health and socio-economic conditions,
- (ii) physical and cultural heritage, or
- (iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Table 8.2 Summary of Residual Effects for Accidental Events

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Accidental Event Scenario	Mitigation Reference (refer to Table 18.2)	Residual Effect Characterization					Ecological / Socio Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury / Change in Habitat Availability, Quality, and Use	Well Blowout Incident	Section 16.6.1	M-H	RAA*	LT	UL	R	D	N	N/A
			Marine Diesel Spill		L	RAA	ST-MT	UL	R	D	N	N/A
			Vessel Spill on Transit		L	RAA	ST-MT	UL	R	D	N	N/A
			SBM Spill		L	PA	ST-LT	UL	R	D	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	Well Blowout Incident	Section 16.6.2	H	RAA*	ST-MT	UL	R	D	S	U
			Marine Diesel Spill		L	LAA	ST	UL	R	D	S	U
			Vessel Spill on Transit		L	LAA	ST	UL	R	D	S	U
			SBM Spill		L	LAA	ST	UL	R	D	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	Well Blowout Incident	Section 16.6.3	M	RAA	MT-LT	UL	R	D	N	N/A
			Marine Diesel Spill		L	LAA	ST	UL	R	D	N	N/A
			Vessel Spill on Transit		L	LAA	ST	UL	R	D	N	N/A
			SBM Spill		L	PA	ST	UL	R	D	N	N/A
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	Well Blowout Incident	Section 16.6.4	H	RAA	ST-MT	UL	R	D	S	U
			Marine Diesel Spill		L	LAA	ST	UL	R	D	N	N/A
			Vessel Spill on Transit		L	LAA	ST	UL	R	D	N	N/A
			SBM Spill		L	PA	ST-LT	UL	R	D	N	N/A
Indigenous Peoples	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Commercial-communal Fisheries / Change in Current Use of Lands and Resources for Traditional Purposes	Well Blowout Incident	Section 16.6.5	M-H	RAA	MT-LT	UL	R	D	S	U
			Marine Diesel Spill		L	LAA	ST	UL	R	D	N	N/A
			Vessel Spill on Transit		L	LAA	ST	UL	R	D	N	N/A
			SBM Spill		N-L	PA	ST	UL	R	D	N	N/A
Commercial Fisheries and Other Ocean Users	s. 5(2)(b)(i)	Change in Availability of Resources	Well Blowout Incident	Section 15.6.6	M-H	RAA*	MT-LT	UL	R	D	N	N/A
			Marine Diesel Spill		L	RAA	ST-MT	UL	R	D	N	N/A
			Vessel Spill on Transit		L	RAA	ST-MT	UL	R	D	N	N/A
			SBM Spill		L	PA	ST	UL	R	D	N	N/A

Notes:

* In certain scenarios, effects may extend beyond the RAA.

See Table 8.2 for key.

The environmental effects assessment for each VC examines the degree and nature of change to, and resulting effects on, the existing environment that may occur as a result of planned Project activities. In each case, a conservative indication of effects is provided, as it is based on the reasonable worst-case scenario of the characterized range of magnitude (range of natural variability). Mitigation measures, summarized in Table 7.1, have been proposed to reduce or eliminate adverse environmental effects for components of the Project scope. They include general Project mitigation measures, best management practices, and VC-specific mitigation measures. Residual adverse environmental effects of routine Project activities and components are predicted to be not significant for all VCs with the implementation of these proposed mitigation measures.

In the unlikely event of a Project-related accidental event resulting in the large-scale release of oil into the marine environment, a significant adverse effect is predicted for marine and migratory birds, special areas and Indigenous peoples and communities. In the event of a well blowout, Suncor would attempt direct intervention measures where appropriate and in consultation with regulators (e.g., capping stack, dispersants). The magnitude and extent of potential effects would be reduced with the application of spill response measures; therefore, the risk of adverse effects would be reduced.

9.0 FOLLOW-UP AND MONITORING PROGRAMS

As per CEAA 2012, a follow-up program is a program for “verifying the accuracy of the EA of a designated project” and “determining the effectiveness of any mitigation measures.” Given offshore NL has a long history of oil and gas exploration and well-established oil production operations, most potential environmental interactions are well understood, and standard mitigation is well known. Proposed monitoring and follow-up programs are described below.

9.1 Atmospheric Environment

Based on the information presented in the EIS, and the conclusion of the effects assessment, no specific follow-up or monitoring related to the atmospheric environment is considered necessary in relation to the Project.

9.2 Marine Fish and Fish Habitat

Suncor will conduct a pre-drilling visual seabed survey at proposed drilling locations to confirm the presence / absence of sensitive biological communities (e.g., corals and sponges). The visual surveys will also be used to confirm the absence of shipwrecks, debris on the seafloor, and unexploded ordnance. If any environmental sensitivities are identified during the survey, Suncor will notify the C-NLOPB to discuss an appropriate course of action. This may involve further investigation and/or moving the wellsite if feasible. If sensitive environmental features are found during the pre-drill survey, a follow-up program will be determined in consultation with the C-NLOPB and DFO. Results will be posted on the internet and indigenous groups informed of the posting.

9.3 Marine and Migratory Birds

For the duration of the drilling program for each well:

- Systematic searches for stranded birds will be carried out daily on the MODU and supply vessels, per Guidance for Developing Systematic Stranded Bird Survey Protocols for Vessels and Platforms (ECCC-CWS 2021).This effort will be documented by trained personnel according to search protocols designed specifically for each facility as per Standard for Observers Conducting Seabird Surveys at Sea, and for Trainers Providing Instruction on Seabird Survey Methods (ECCC 2020)
- Retrieval, rehabilitation, release and documentation of stranded birds will be conducted according to *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (ECCC 2017a) and associated permit conditions under the MBCA authorizing the capture and handling of migratory birds;

Results of the monitoring program will be submitted to CWS.

9.4 Marine Mammals and Sea Turtles

Suncor will develop a marine mammal and sea turtle monitoring plan to be implemented during geophysical (including VSP), geological, geotechnical and environmental surveys where it is appropriate as outlined in Section 11.3.2. The Plan will include MMO requirements, shutdown, and ramp-up procedures and reporting requirements. The following monitoring and mitigation measures will be implemented:

- MMOs will monitor and report on marine mammal and sea turtle sightings during geophysical (including VSP), geological, geotechnical and environmental surveys to implement shutdown and ramp-up procedures.
- A ramp-up procedure will be implemented before VSP activity begins.
- MMOs will implement a pre-ramp up watch of 60 minutes prior to ramp-up. Ramp-up will be delayed if any marine mammal or sea turtle is detected within 500 m of the air gun array.
- Shut-down procedures will be implemented if a marine mammal or sea turtle listed as endangered or threatened on Schedule 1 of SARA, as well as any beaked whale species, is observed within 500 m of the air gun array.
- Supply vessels will use existing shipping lanes as practicable; where these do not exist, supply vessels will follow a straight-line approach to and from the Project Area.
- During transit to and from the Project Area, supply vessels will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency.
- If marine mammals or sea turtles are observed by vessel crews, they will reduce speed and/or alter course if practicable to avoid a collision.
- Supply vessels will be required to reduce speed to a maximum of 13 km/hour (7 knots) when a marine mammal or sea turtle is observed or reported within 400 m of the supply vessel (except if not feasible for safety reasons). Vessels may also alter course if practicable to avoid collision with a marine mammal (or sea turtle).

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. Results of the marine mammal and sea turtle monitoring plan will be shared via the Internet. In the unlikely event of a Project vessel collision with a marine mammal or sea turtle, Suncor will contact DFO through their 24-hour emergency contact number (1-888-895-3003). Results will be posted on the Internet and Indigenous groups informed of the posting.

9.5 Special Areas

Suncor will conduct an imagery-based seabed survey at the proposed wellsite(s) to identify sensitive environmental features, such as habitat-forming corals or sponges, prior to drilling. If any environmental sensitivities are identified during the survey, Suncor will notify the C-NLOPB to discuss an appropriate course of action. This may involve further investigation and/or moving the wellsite if feasible. If sensitive environmental features are found during the pre-drill survey, a follow-up program will be determined in consultation with the C-NLOPB and DFO. Results will be posted on the internet and indigenous groups informed of the posting.

9.6 Indigenous Peoples

No follow-up and monitoring are proposed for routine Project activities. This is based on several factors, including the high level of confidence for a prediction of no significant adverse environmental effects on Indigenous communities and activities, the implementation of standard mitigation, and ongoing engagement with Indigenous communities, including the development and implementation of a Fisheries Communication Plan. Results of follow-up and marine mammal and sea turtles monitoring will be made available to Indigenous groups.

9.7 Commercial Fisheries and Other Ocean Users

Given the high level of confidence for a prediction of no significant adverse environmental effects on commercial fisheries and other ocean users, and the implementation of standard mitigation, including ongoing engagement with fisheries stakeholders and other ocean users and the implementation of a Fisheries Communication Plan, no follow-up and monitoring are proposed for routine Project activities.

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