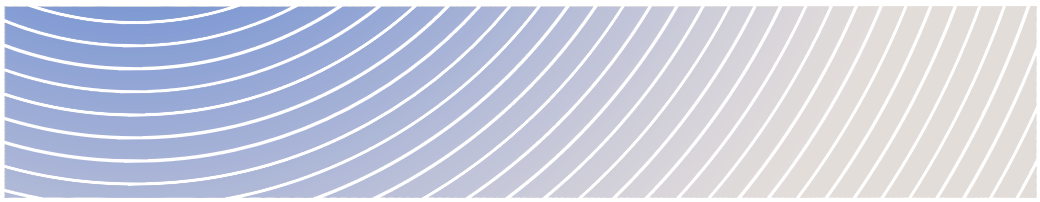
CNOOC INTERNATIONAL FLEMISH PASS EXPLORATION DRILLING PROJECT



ENVIRONMENTAL ASSESSMENT REPORT

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Executive Summary

CNOOC Petroleum North America ULC (the proponent) is proposing to conduct an offshore exploration drilling program within offshore exploration licences located in the Northwest Atlantic Ocean. The CNOOC International Flemish Pass Exploration Drilling Project (the Project) would involve drilling in two exploration licences (1144 and 1150) in the Flemish Pass. The closest licence is located approximately 400 kilometres east of St. John's, Newfoundland and Labrador. Between 2020 and 2028, the proponent could drill up to ten offshore wells.

A single mobile offshore drilling unit would be used, along with supply vessels and helicopters that would travel between the drilling areas and existing shore-based facilities on the island of Newfoundland and the airport in St. John's, Newfoundland and Labrador.

The Project would require authorization under the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*. Authorization under the *Fisheries Act* may also be required and a permit under the *Species at Risk Act* may be required for effects on species that are listed as endangered or threatened on Schedule 1 of that *Act*.

The Impact Assessment Agency (the Agency) conducted a federal environmental assessment (EA) of the Project under the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). The Project is subject to CEAA 2012 as it would involve activities that are described in item 10 of the Schedule to the *Regulations Designating Physical Activities* of CEAA 2012:

> ***The drilling, testing, and abandonment of offshore exploratory wells in the first drilling program in an area set out in one or more exploration licences issued in accordance with the Canada-Newfoundland and Labrador Atlantic Accord Implementation Act or the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act.***

On August 28, 2019, the *Impact Assessment Act* (IAA) came into force and CEAA 2012 was repealed. However, in accordance with the transitional provisions of the IAA, the EA of this Project is being continued under CEAA 2012 as if that Act had not been repealed.

This EA Report provides a summary and the main findings of the federal EA. The Agency prepared the report in consultation with the Canada-Newfoundland and Labrador Offshore Petroleum Board, Fisheries and Oceans Canada, Environment and Climate Change Canada, Health Canada, Natural Resources Canada and Transport Canada following a technical review of the proponent's Environmental Impact Statement and an evaluation of the potential environmental effects of the Project. The Agency also considered the views of Indigenous peoples and the general public.

The EA focused on features of the natural and human environment that may be adversely affected by the Project and that are within federal jurisdiction as described in subsection 5(1) of CEAA 2012 and on changes that may be caused in the environment that are directly linked or necessarily incidental to federal authorizations as described

in subsection 5(2) of CEAA 2012. These are referred to as valued components. The Agency selected the following valued components for this EA:

- fish and fish habitat (including marine plants);
- marine mammal and sea turtles;
- migratory birds;
- species at risk;
- special areas;
- commercial fisheries; and
- current use of lands and resources for traditional purposes and health socioeconomic conditions of Indigenous peoples.

During the EA, Indigenous groups and members of the public who submitted comments raised concerns about the Project's potential routine and accidental effects on the marine environment (e.g., marine mammals, fish, birds, special areas), commercial fishing and on related effects on Indigenous peoples and communities.

Notable potential environmental effects of the Project's routine operations include:

- effects on fish and fish habitat caused by the discharge of used drilling muds and cuttings to the marine environment;
- effects on marine mammals, fish and sea turtles caused by underwater sound from operation of the mobile offshore drilling unit and support vessels and from vertical seismic profiling surveys;
- effects on migratory birds caused by lights on the mobile offshore drilling unit and supply vessels and, if well testing is required, flaring; and
- interference with commercial fisheries, Indigenous or otherwise, including effects on fishing activity that may be caused by the need to avoid the safety exclusion zone around drilling operations.

The proponent's project planning and design incorporates measures to mitigate the adverse effects of the Project. These include adherence to existing guidelines and regulations and planning to identify, control and monitor environmental risks.

Accidents and malfunctions could occur during exploration drilling and cause adverse environmental effects. These accidents and malfunctions include batch fuel (diesel) spills, batch spills of synthetic-based drilling fluid (also referred to as drilling mud) and subsea hydrocarbon releases (blowouts). Oil spill fate and trajectory modelling and analyses were performed to help evaluate potential effects of accidental spills and to assist in spill response planning.

Historically, the incidence of large oil spills during exploration drilling is extremely low. The proponent proposed design measures, operational procedures and dedicated resources to prevent and respond to spills of any size from the Project. The proponent stated that in the unlikely event of a subsea hydrocarbon release, response measures would be undertaken in a safe, prompt and coordinated manner. These response measures could include containment, application of dispersants, mechanical recovery and shoreline protection operations, as applicable. To minimize response times, the Canada-Newfoundland and Labrador Offshore Petroleum Board would require submission of a Well Capping and Containment Plan that explores options to reduce response times.

The Agency identified key mitigation measures and follow-up program requirements for consideration by the Minister of Environment and Climate Change in establishing conditions as part of a CEAA 2012 decision

statement, in the event the Project is ultimately permitted to proceed. Given the current and potential expansion of activity of the offshore oil and gas sector in the Newfoundland and Labrador offshore area, the Agency is of the view that information gathered through the implementation of these conditions be presented and shared with industry, Indigenous groups, stakeholders and other interested parties. In addition to the Project, there are a number of other offshore exploration drilling projects and related activities being proposed for the Newfoundland and Labrador offshore area, including a regional assessment currently being led by the Agency.

The Project's possible effects on potential or established Aboriginal or treaty rights were also examined. One of the primary concerns raised by Indigenous groups during the EA for the Project, as well as previous offshore exploration drilling projects, is the potential effects of routine operations and accidental events on Atlantic Salmon. Atlantic Salmon have significant importance to Indigenous cultures and populations of salmon have experienced declines in recent decades, with some populations classified as endangered or threatened. Recognizing the data gaps in Atlantic Salmon migration, and by extension the potential effects on the species from offshore exploration drilling, in May 2019 the Environmental Studies Research Fund issued a call for proposals for studies related to Atlantic Salmon. The Environmental Studies Research Fund is funded through levies paid by interest holders such as oil and gas companies and is directed by a joint government/industry/public management board. Indigenous groups also raised concerns about the potential effects of large-scale spills on fishing for commercial or traditional purposes and associated socioeconomic and health effects. The Agency is of the opinion that the recommended measures to mitigate potential environmental effects on fish and fish habitat and commercial fisheries, and to prevent or reduce the effects of accidents and malfunctions, are appropriate measures to accommodate for potential impacts on rights.

The Agency concludes that the CNOOC International Flemish Pass Exploration Drilling Project is not likely to cause significant adverse environmental effects, taking into account the implementation of mitigation measures.

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List of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
Agency	Impact Assessment Agency of Canada
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EA Report	Environmental Assessment Report
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EIS Guidelines	Guidelines for the Preparation of an Environmental Impact Statement
ESRF	Environmental Studies Research Fund
IAA	*Impact Assessment Act*
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
MARPOL	International Convention for the Prevention of Pollution from Ships
MFN	Miawpukek First Nation
MMS	Mi'gmawei Mawiomi Secretariat
MODU	Mobile Offshore Drilling Unit
MTI	Mi'gmawe'l Tplu'taqnn Incorporated
NAFO	Northwest Atlantic Fisheries Organization
NRCan	Natural Resources Canada
Offshore Chemical Selection Guidelines	*Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands*
Project	CNOOC International Flemish Pass Exploration Drilling Project
Proponent	CNOOC Petroleum North America ULC
VSP	Vertical Seismic Profiling
WNNB	Wolastoqey Nation of New Brunswick

Glossary

Term	Definition
Abandonment	The process of securing a drilled well in a manner that allows it to be left indefinitely without further attention, and which prevents movement of petroleum (or potential petroleum) from its reservoir to another subsurface formation or to the environment.[1]
Blowout preventer	An apparatus affixed to the top of a wellhead during drilling operations that contains high-pressure wellhead valves designed to shut off the uncontrolled flow of reservoir fluids to the environment in a case where a loss of well control has been experienced.[1]
Cuttings	Chips and small fragments of rock produced by drilling that are circulated up from the drill bit to the surface by drilling mud.[1]
Delineation well	Well drilled after a discovery well to determine the areal extent of a reservoir.[1]
Exploratory well	A well in an area where petroleum has not been previously found or one targeted for formations above or below known reservoirs.[1]
Formation	The term for the primary unit in stratigraphy consisting of a succession of strata useful for mapping or description which possesses certain distinctive lithologic and other features.[1]
Mobile offshore drilling unit (MODU)	A drillship, semi-submersible drilling unit, jack-up drilling unit or other floating or fixed structure used in a drilling program and fitted with a drilling rig, and includes the drilling rig and other facilities and equipment necessary for drilling of wells for petroleum exploration or development.[1]
Produced water	Water associated with formation fluids in petroleum reservoirs that is produced along with oil and gas.[1]
Reservoir	A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids and which contains petroleum. [1,2]
Suspended well	A well in which drilling operations have temporarily ceased.[1]
Synthetic-based mud	A drilling mud in which the continuous phase is a synthetic fluid that should have a total polycyclic aromatic hydrocarbon concentration of less than 10 milligrams per kilogram, be relatively nontoxic in marine environments and have the potential to biodegrade under aerobic conditions.[1]
Water-based mud	A drilling fluid in which fresh or salt water is the continuous phase as well as the wetting (external) phase whether oil is present or not.[1,2]
Wellbore	The hole that would be drilled as part of the exploration drilling activities.[2]
Wellhead	During drilling, the location at the top of the surface casing where the blowout preventer connects to the well to provide fluid and pressure containment for drilling activities.[1]

References

[1] Canada-Newfoundland and Labrador Offshore Petroleum Board

[2] Schlumberger Limited (https://www.glossary.oilfield.slb.com/)

1. Introduction

CNOOC Petroleum North America ULC (the proponent), formerly known as Nexen Energy ULC, is proposing to conduct an exploration drilling project within two offshore exploration licences, exploration licences 1144 and 1150, located in the Flemish Pass approximately 400 kilometres east of St. John's, Newfoundland and Labrador. The purpose of the CNOOC International Flemish Pass Exploration Drilling Project (the Project) is to determine the presence, nature and volume of potential hydrocarbon resources within the exploration licences.

The proponent has indicated that exploration drilling is a critical activity to enable continued oil and gas discoveries to maintain production and meet global demand for energy.

The proponent plans to drill up to ten wells throughout the life of the Project, which is anticipated to operate until 2028.

1.1. Purpose of the Environmental Assessment Report

The purpose of the Environmental Assessment (EA) Report is to provide a summary of the analysis conducted by the Impact Assessment Agency of Canada (the Agency) in reaching its conclusion on whether the Project is likely to cause significant adverse environmental effects after taking into account the proposed mitigation measures (Appendix A). The Minister of Environment and Climate Change will consider this report in making a decision on whether the Project is likely to cause significant adverse environmental effects, following which the Minister will issue an EA decision statement for the Project.

1.2. Scope of the Environmental Assessment

1.2.1. Environmental Assessment Requirements

On August 28, 2019, the *Impact Assessment Act* (IAA) came into force and the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) was repealed. However, in accordance with the transitional provisions of the IAA, the EA of this Project is being continued under CEAA 2012 as if that Act had not been repealed.

The Project is subject to CEAA 2012 as it would involve activities that are described in item 10 of the Schedule to the *Regulations Designating Physical Activities* of CEAA 2012:

> ***The drilling, testing, and abandonment of offshore exploratory wells in the first drilling program in an area set out in one or more exploration licences issued in accordance***

with the Canada-Newfoundland and Labrador Atlantic Accord Implementation Act or the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act.

The key dates for the EA of the Project, up to the release of this EA Report, are as follows:

- April 13, 2017: the proponent submitted a project description to the Agency
- June 9, 2017: the Agency determined that a federal EA was required
- June 12, 2017: the EA commenced
- July 25, 2017: the Agency issued the final Guidelines for the Preparation of an Environmental Impact Statement (EIS Guidelines) to the proponent
- February 21, 2018: the proponent submitted the Environmental Impact Statement (EIS) and EIS Summary

The Agency co-operated with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) during the EA of the Project. The C-NLOPB is an independent joint agency of the Governments of Canada and Newfoundland and Labrador and is responsible for regulation of petroleum activities in the Newfoundland and Labrador offshore area. The C-NLOPB also undertakes EAs of petroleum exploration and production works or activities proposed for the Newfoundland and Labrador offshore area. The EA conducted by the Agency is intended to also satisfy the C-NLOPB's EA requirements.

The Project is not subject to Newfoundland and Labrador provincial EA requirements.

1.2.2. Factors Considered in the Environmental Assessment

The Agency issued EIS Guidelines to the proponent that describe the information the proponent had to provide to support the EA process, including the environmental effects and the factors that must be considered. The EIS Guidelines for the Project can be found on the Canadian Impact Assessment Registry Internet site at the following link: https://www.ceaa-acee.gc.ca/050/evaluations /document/119511?culture=en-CA

The EIS Guidelines also focus the assessment by identifying components that have particular value or significance and may be affected by the Project. The valued components considered by the Agency and the corresponding valued components selected by the proponent are presented in Table 1.

Table 1: Valued Components Considered by the Agency

Environmental component	Included in Agency's analysis?	Agency rationale	Corresponding valued component selected by the proponent
Effects identified under subsection 5(1) of CEAA 2012			
Fish and Fish Habitat	Yes	Included due to the ecological importance and legislated protection of fish and fish habitat, as well as associated species at risk, and the socioeconomic importance of fisheries resources. There is also a high likelihood of project-valued component interactions. Includes corals and sponges.	Marine Fish and Fish Habitat (including Species at Risk)
Marine Plants	Yes	Potential effects on marine plants were included in the Agency's assessment of effects on fish habitat.	Marine Fish and Fish Habitat (including Species at Risk)
Marine Mammals and Sea Turtles	Yes	Included due to the ecological importance and legislated protection of marine mammals, as well as associated species at risk. There is also a high likelihood of project-valued component interactions.	Marine Mammals and Sea Turtles (including Species at Risk)
Migratory Birds	Yes	Included due to the ecological importance and legislated protection of migratory birds, as well as associated species at risk. There is also a high likelihood of project- valued component interactions.	Marine and Migratory Birds (including Species at Risk)
Current Use of Lands and Resources for Traditional Purposes and Health and Socioeconomic Conditions of Indigenous Peoples	Yes	Migratory species of importance to Indigenous communities (e.g., Atlantic Salmon, some species of migratory birds), may pass through the project area before moving to areas subject to traditional harvesting. Indigenous fisheries or harvesting could also be affected by an accident or malfunction associated with the Project. The contamination (or perception thereof) of fish and seafood in the event of a major spill could affect country food consumption in some Indigenous communities. Indigenous communal commercial fishing licences overlap with exploration licences included in the Project. These were considered in the Agency's assessment of effects on commercial fishing (below).	Indigenous Peoples

Environmental component	Included in Agency's analysis?	Agency rationale	Corresponding valued component selected by the proponent
Effects identified under subsection 5(1) of CEAA 2012 (continued)			
Physical or Cultural Heritage of Indigenous Peoples and Historical, Archaeological, Paleontological or Architectural Sites or Structures of Indigenous Peoples	No	The exploration licences would be located approximately 400 kilometres offshore. Project activities and components are not anticipated to result in any changes to the environment that would have an effect on physical and cultural heritage.	None
Special Areas (Marine)	Yes	There are several marine special areas that may be affected by the Project.	Special Areas
Air Quality and Greenhouse Gas Emissions	No	While there are direct emissions of greenhouse gases from the Project, there are no upstream emissions (i.e., emissions from other projects or industrial activities that could occur earlier in the lifecycle of a resource or other product). The Project would be short-term and routine activities would contribute a relatively small amount to provincial totals (i.e., 0.72 to 0.84 percent of Newfoundland and Labrador's average annual emissions). Additional information on greenhouse gases is provided in Section 2.4. The Project would adhere to applicable regulations and standards, including the *Newfoundland and Labrador Air Pollution Control Regulations*; the federal *National Ambient Air Quality Objectives* and the *Canadian Ambient Air Quality Standards*; and regulations and emission limits under the *International Convention for the Prevention of Pollution from Ships* (MARPOL). Given its location more than 400 kilometres offshore, the project area is not close to permanent receptors sensitive to atmospheric emissions.	Atmospheric Environment

Environmental component	Included in Agency's analysis?	Agency rationale	Corresponding valued component selected by the proponent
Effects identified under subsection 5(2) of CEAA 2012			
Commercial Fisheries	Yes	The project area overlaps with commercial fishing activity, including potential Indigenous communal commercial fishing, that could be affected by routine operations (e.g., safety exclusion zones) or by accidental events.	Fisheries and Other Ocean Uses
Recreational Fisheries	No	There is no known recreational fishing activity within the project area which is approximately 400 kilometres offshore from the island of Newfoundland. There are recreational fisheries in nearshore and coastal waters. Routine project activities and components are not expected to interfere with nearshore recreational fisheries beyond current levels because supply vessels would use existing routes and harbour approaches, avoiding interference with nearshore activities outside the approaches. Nearshore recreational fishing may be affected by accidental events associated with the Project. Measures proposed to mitigate effects on fish and fish habitat and commercial fisheries would mitigate similar environmental effects on recreational fisheries.	Fisheries and Other Ocean Uses
Special Areas (Coastal)	Yes	There are several coastal areas of importance in the regional study area. These may be affected by the Project in the event of an unmitigated subsea blowout.	Special Areas
Human Health	No	Other than human presence on mobile offshore drilling units (MODUs), there is intermittent human presence on fishing and other vessels in the exploration licences, which range from 400 to 650 kilometres from land. Therefore, routine project activities would not expose the general public to a health risk. Similarly, the distance from land and anticipated spill trajectories in the event of a large-scale spill offshore would have low potential for shoreline oiling and associated effects on coastal communities and human health.	None

Environmental component	Included in Agency's analysis?	Agency rationale	Corresponding valued component selected by the proponent
Effects identified under subsection 79(2) of the *Species at Risk Act*			
Federal Species at Risk	Yes	The *Species at Risk Act* requires consideration of listed species when conducting an EA under CEAA 2012. The Agency also examined effects on species assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered, threatened or of special concern.	The proponent assessed applicable species at risk within their analyses of effects on fish and fish habitat, marine mammals and sea turtles, and migratory birds.

1.2.3. Methods and Approach

In its EIS and EIS Summary, the proponent assessed the Project's effects based on a structured approach that is consistent with accepted practices for conducting EAs and with the Agency's *Operational Policy Statement: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012*. The application of mitigation measures was considered in the analysis (see Appendix B for a full list of the proponent's proposed mitigation and follow-up measures) and the predicted residual environmental effects were characterized based on the following assessment criteria:

- nature/direction of the effect: whether the effect was predicted to be positive, adverse or neutral;
- magnitude: the degree of change from baseline conditions in the affected area;
- geographic extent: the spatial area within which the environmental effect would likely occur;
- duration: the period of time over which the environmental effect would likely be evident;
- frequency: how often the environmental effect would likely occur; and
- reversibility: the ability of an environmental component to return to an equal or improved condition once the disturbance(s) has ended.

The proponent also considered the current condition of each environmental component as a result of natural and/or anthropogenic factors, and its resulting resiliency or sensitivity to further change (i.e., ecological/socioeconomic context). The proponent then determined the significance of residual project-related environmental effects based on pre-defined standards or thresholds (i.e., significance rating criteria). It also considered the level of confidence in its environmental effects predictions and proposed mitigation, along with sources of uncertainty, data gaps, issues of reliability, sensitivity and approaches to conservativeness.

The Agency reviewed various sources of information in conducting its analysis, including:

- the proponent's EIS and EIS Summary;
- additional information received from the proponent in response to the information requirements issued by the Agency following its review of the EIS;
- advice from expert departments and agencies, including the C-NLOPB;
- comments received from the public; and

- comments received from Indigenous peoples.

The Agency determined the significance of residual effects of routine project operations (Section 6) by taking into account the mitigation measures that it considered necessary. The Agency also considered the effects of accidents and malfunctions that may occur in connection with the Project (Section 7.1), as well as the effects of the environment on the Project (Section 7.2) and cumulative environmental effects (Section 7.3).

The Agency's analysis, including how the Agency incorporated views expressed by Indigenous peoples, the public and expert departments and agencies, is provided throughout this report.

2. Project Overview

2.1. Project Location and Spatial Boundaries of the Environmental Assessment

The Project is located in the Flemish Pass of the Northwest Atlantic Ocean, within exploration licences 1144 and 1150, approximately 400 kilometres east of the island of Newfoundland in water depths varying from 330 to 1,200 metres (Figure 1). The exploration licences have a combined area of 3,326 square kilometres. Both exploration licences are located on the extended continental shelf outside Canada's 200 nautical mile exclusive economic zone. Exact drilling locations within the exploration licences have not yet been finalized.

Spatial boundaries of an EA are established to define the area within which a project may interact with the environment and cause environmental effects and may vary among valued components. The proponent defined three types of spatial boundaries for the EA: project area, local study area and regional study area.

Proponent's Project Area

The immediate area within which project activities and components may occur (i.e., the exploration licences) plus a 20-kilometre buffer. The project area has a total area of approximately 10,634 square kilometres. Water depth in the project area ranges from 250 to 1,200 metres.

Note: References to the project area throughout this report are consistent with the proponent's definition. However, project activities for the designated project subject to federal EA would be limited to the exploration licences within which exploration drilling could occur as well as the route to and from these exploration licences to the supply base and airport on the island of Newfoundland.

Proponent's Local Study Area

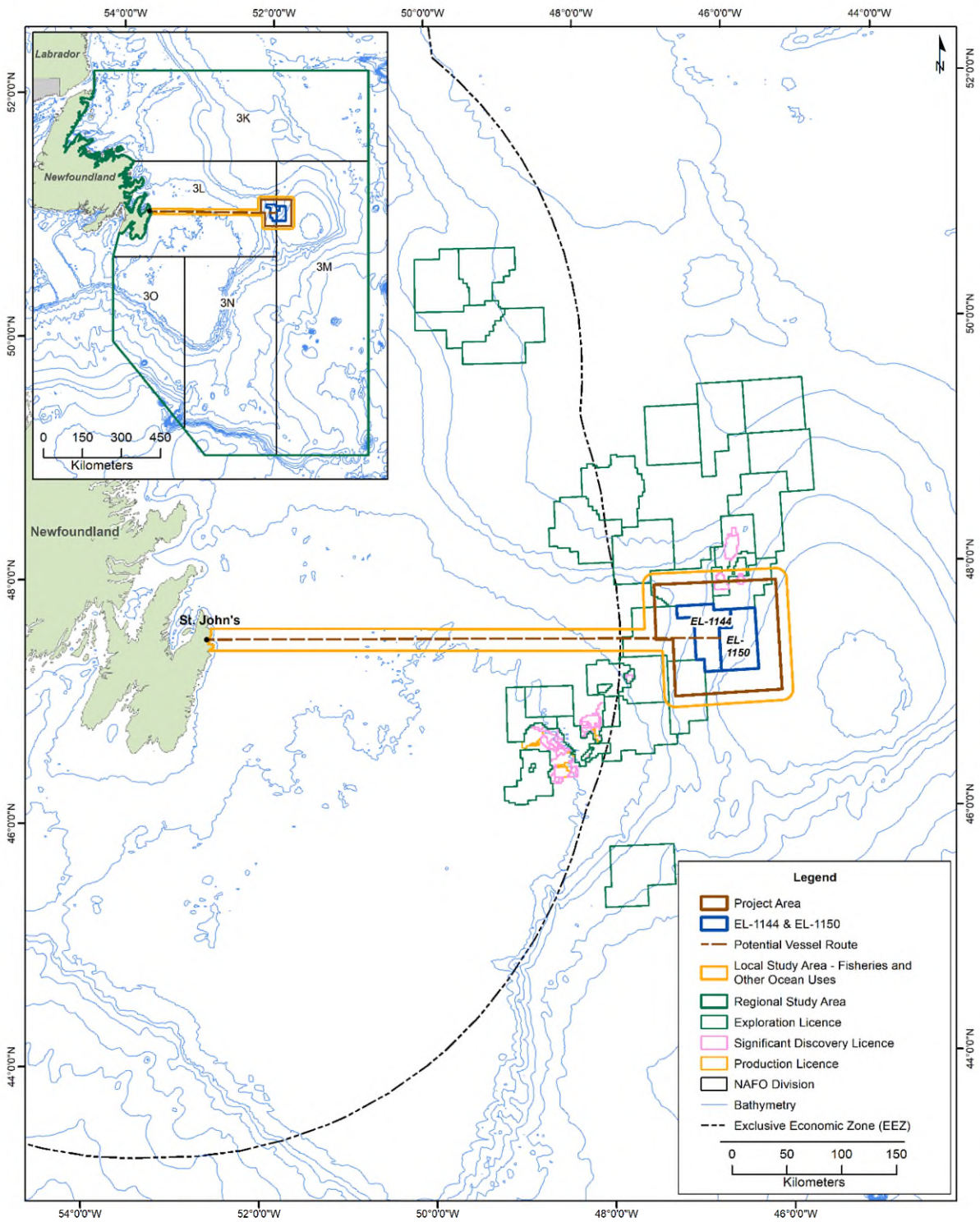
Local study areas were defined for each valued component. The local study areas for marine fish and fish habitat, marine and migratory birds, special areas, Indigenous communities and activities and commercial fisheries and other ocean uses include the project area, the associated support vessel and air transit route and a ten-kilometre buffer around this transit route. The local study area for marine mammals and sea turtles includes the project area and a 150-kilometer buffer around it, and the support vessel and air transit route and a ten-kilometre buffer around this transit route.

Proponent's Regional Study Area

The regional study area considers the possible movement patterns of marine fish, birds, mammals and sea turtles over the time periods and durations for which they may be affected by planned project activities, as well as the distribution and geographic extent of fishing and other human activities surrounding the project area/local study area for regional context purposes. In addition, the regional study area encompasses the predicted zone of influence of a potential oil spill event. The regional study area is consistent for all valued components except for Indigenous peoples and fisheries and other ocean uses. For Indigenous peoples, the regional study area includes an overall region of eastern Canada that generally encompasses each of the Indigenous communities and their activities throughout Newfoundland and Labrador, the Maritime Provinces and Quebec. For fisheries and other

ocean uses, the regional study area captures the marine waters offshore eastern Newfoundland, namely Northwest Atlantic Fisheries Organization (NAFO) Divisions 3K, 3L, 3M, 3N and 3O.

Figure 1: Project Area and Associated Licences



Source: CNOOC Petroleum North America ULC

2.2. Project Components and Activities

The Project would include the drilling, testing and abandonment or suspension of up to ten offshore wells within exploration licences 1144 and 1150 and associated incidental activities. The key components and activities that comprise the Project include MODU mobilization, offshore drilling (both exploration drilling and possible delineation drilling), vertical seismic profiling (VSP) surveys, well testing, well abandonment or suspension and associated supply and service activities. The ten wells represent surface (seabed) wellhead locations and not subsurface bottom hole locations which may be associated with sidetracking from the main wellbore.

Logistical support required for the Project, including the MODU, supply vessels and helicopters would be owned by third-party service providers and contracted for use by the proponent. The only new components developed for the Project would be the offshore exploration wells.

2.2.1. Mobile Offshore Drilling Unit Mobilization

Once the well site is selected, the MODU, either a semi-submersible or drill ship, would be towed or self-propelled to the well site and held in position by either a dynamic positioning system or by anchors. With the MODU in place a safety exclusion zone would be defined, maintained and monitored by a standby support vessel and publicized through Notice to Mariners. The safety exclusion zone is usually the greater of either the area within a 500-metre radius of the MODU or, if anchored, a zone of 50 metres from the anchor pattern. Prior to the start of drilling, a visual well site seabed investigation survey would be conducted using a remotely operated vehicle, sonar (multi-beam or side scan) or other equipment deployed from the MODU or support vessel.

2.2.2. Offshore Well Drilling

Each exploration or delineation well would be drilled over several months in sections that gradually reduce in size. After each section is drilled, steel pipe or casing is installed and cemented into place to stabilize the well bore, isolate pressure/fluids and prevent drilling fluid losses prior to drilling the next hole section. For the first two to three hole sections there is no closed-loop circulating system in place (riserless drilling). During this portion of drilling, the drilling fluids and cuttings are deposited onto the seabed. Typically, seawater and/or water-based mud is used during the drilling of these riserless hole sections.

Once the riser is installed, the remainder of the hole sections may be drilled with water-based mud or synthetic-based mud. The riser creates a conduit for the circulation of these drilling fluids down the drill string and then for the fluids and associated drill cuttings to be transpored back up to the MODU for treatment. Treatment typically involves separating the drill cuttings from the drilling fluid. The majority of the drilling fluid would be reconditioned and reused, while any spent synthetic-based mud would be returned to shore for disposal or recycling. Following treatment, a small and permitable portion of the synthetic-based mud may remain in the drill cuttings and be discharged.

The proponent may completely drill one well at a time or if the plan involves drilling multiple close proximity wells with similar well designs, it may consider “batch drilling.” For batch drilling, the riserless sections for multiple wells are initially and consecutively drilled and then the MODU returns to these sites to complete the remaining portions of the wells. Based on early well information and spatial considerations, the predicted minimum estimated distance between potential wells would be six kilometres.

The proponent has indicated that it is not planning to conduct simultaneous drilling with more than one MODU given the regulatory requirements for individual MODU certification and the planned scope of the exploratory drilling program.

2.2.3. Vertical Seismic Profiling

VSP is used to get higher levels of accuracy in defining the geological features and potential petroleum reserves by obtaining high resolution images of the target. VSP surveys are conducted by placing a string of receivers (geophones) down the well at pre-determined depths, with a seismic source (usually mid-sized sound source arrays) suspended from the MODU or on a vessel. VSP surveys are typically short-term activities (one to two days duration), with seismic source activation often limited to just a few hours. VSP surveys are quieter and more localized than a surface seismic survey, as they are conducted using hydrophones inside a vertical wellbore and a smaller sound source near the surface at or near the well.

2.2.4. Well Testing

Wireline logging would be used to characterize the reservoir properties to understand the composition and heterogeneity of the reservoir and predict the distribution of the porosity, permeability and saturation. Wireline logging would be conducted with wireline logging tools provided by a third-party contractor.

If there is an indication of commercial hydrocarbons at an exploration well, a well flow test may be conducted (also sometimes referred to as a formation flow test). A well flow test involves the flowing of well fluids from the reservoir to gather additional information on the potential reservoir properties, such as productivity, volumes, fluid composition, flow rate, pressure and temperature. Well flow testing is required by the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, prior to obtaining a Significant Discovery Licence from the C-NLOPB. The duration of well flow testing is typically in the order of several days.

During well flow testing, produced fluid is flowed back to the MODU, where hydrocarbons are separated from any produced water and samples are analyzed. Produced hydrocarbons are flared using high-efficiency burners supplied by a third-party. If technically feasible, produced water would be flared with the hydrocarbons. If the volume of produced water exceeds the technical capabilities of selected flare burners, produced water would be treated in accordance with the relevant regulatory requirements prior to ocean discharge. Any flaring activities would be kept to a minimum.

A well flow test may also be carried out using alternative technologies such as a drill pipe conveyed test assembly. In such cases, the hydrocarbons are circulated to surface and recovered with no requirement to flare oil or produced water (see Section 3 for a discussion of alternative means of carrying out the Project).

2.2.5. Well Abandonment or Suspension

Once drilling and any associated well testing is completed, offshore exploration and delineation wells are typically permanently abandoned, or in some cases, temporarily suspended. The well abandonment approach for the Project has not been finalized but would adhere to the requirements set out under the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, as well as the proponent's internal governance.

Abandonment or suspension involves the isolation of the well bore by placing cement plugs, in combination with mechanical devices, at various depths. Wells would be abandoned or suspended with a minimum of two barriers in place. In the event that the well is suspended, the casing/wellhead would be left in place for future use. Alternatively, the wellhead may be abandoned and would remain in place on the seabed, in which case the wellhead position would be reported to Canadian Hydrographic Services so nautical charts could be updated. The lifespan of abandonment measures is intended to be infinite. If a wellhead were to be cut and abandoned above the seafloor, the planned maximum height of wellhead remaining above the seafloor would be 0.85 metres. Removal of sections of the casing or wellhead would be completed via mechanical separation (i.e., cutting), as opposed to with the use of explosives. A remotely operated vehicle or other equipment would be used to inspect the seabed to ensure that no equipment or obstructions remain in place. Abandoned or suspended wells would be monitored and inspected in accordance with applicable regulatory requirements.

2.2.6. Supply and Servicing

Offshore drilling activities would be supported by a number of logistical and supporting activities.

Onshore Supply Base

One or more existing facilities in eastern Newfoundland would provide re-fueling, temporary storage, staging and loading of materials and supplies to support offshore exploration activities. The onshore supply base for most previous and existing offshore operations has been located in St. John's, and although no final decision has been made, at this time for the purposes of the EA, the proponent has proposed using these existing facilities. The existing shore-based facilities are owned and operated by independent third-party service providers.

Supply Vessels

Marine vessels are used to transport personnel, equipment and other materials to and from the MODU during an offshore exploration program. As well, a dedicated stand-by vessel would attend to the MODU throughout the drilling. These services would be procured from existing, established third-party suppliers.

Unless they are avoiding other activities or ice, supply vessels would travel directly between an established port facility in St. John's and the MODU. It is anticipated that with a single operating MODU there would be two to three return transits per week by supply vessels during the course of the Project.

Aircraft

Helicopters would be used for the transportation of personnel and key materials to and from the MODU as required throughout the course of the Project. Aircraft support would be supplied by a third-party licensed operator under contract to the proponent at St. John's International Airport. It is estimated that there would be one to three helicopter transits per day to the MODU.

2.3. Emissions and Waste Management

Potential environmental emissions and discharges associated with offshore exploration drilling programs include noise, light and other atmospheric emissions as well as discharges of waste such as drilling fluids, drill cuttings,

cement, blowout preventer fluid, produced water, bilge/deck water, ballast water, grey/black water, cooling water, other non-routine operational liquid discharges, solid and hazardous wastes associated with the MODU, supply vessels and aircraft.

Any chemicals used would adhere to the C-NLOPB requirements under the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (the *Offshore Chemical Selection Guidelines*). The proponent would prepare a chemical screening and management plan in accordance with those guidelines, which would be developed as part of the supporting documentation for the Operations Authorization application to the C-NLOPB. Furthermore, any discharges to the environment would adhere to the C-NLOPB requirements under the *Offshore Waste Treatment Guidelines*, which may involve treatment of discharges prior to release. In addition to these two guidelines, there are other existing regulations and guidelines that pertain to environmental emissions and waste materials associated with offshore exploration activities, including:

- *Newfoundland and Labrador Management of Greenhouse Gas Act;*
- *International Convention for the Prevention of Pollution from Ships* (MARPOL);
- *Environmental Protection Plan Guidelines*;
- *Drilling and Production Guidelines*;
- *Fisheries Act*;
- *Canadian Environmental Protection Act;*
- *Oceans Act*; and
- *Canada Shipping Act, 2001*.

Greenhouse Gas Emissions

During offshore exploration drilling, routine and non-routine activities would result in emissions of greenhouse gases. Routine activities contributing to greenhouse gas emissions include exhaust from the MODU, supply vessels and aircraft and their associated equipment (such as on-board power generators), as well as emissions from the flaring of hydrocarbons associated with well testing as required. Greenhouse gas emissions, including emissions associated with potential flaring during formation flow testing, are estimated in Table 2.

Table 2: Estimated Project Total Greenhouse Gas Emissions by Activity

Project Component/Activity	Greenhouse Gas Emissions (tonnes)			
	Carbon Dioxide	Methane	Nitrous Oxide	Total carbon dioxide equivalent emissions
MODU*	467 415 (SS) 582 032 (DS)	23 (SS) 29 (DS)	70 (SS) 92 (DS)	486 670 (SS) 607 236 (DS)
Supply Vessel	164 244	8	25	171 093
Helicopter	8727	0	1	8944
Well Testing	31 889	5	5	33 254
Total	672 275 (SS) 786 892 (DS)	37 (SS) 43 (DS)	101 (SS) 122 (DS)	699 961 (SS) 820 527 (DS)

*SS = semi-submersible, DS = drillship

The overall greenhouse gas emissions over the Project are estimated to be between approximately 700 000 and 820 000 tonnes of total carbon dioxide equivalent (annual average between approximately 77 780 and 91 180 tonnes of total carbon dioxide equivalent annually). This would represent between approximately 0.72 and 0.84 percent of Newfoundland and Labrador's average annual greenhouse gas emissions, based on 2016 emissions in that province, and approximately 0.01 percent of Canada's annual emissions, based on 2016 emissions nationally. Industrial facilities that emit more than 10 000 tonnes of carbon dioxide equivalent per year are required to quantify and report greenhouse gas emissions to Environment and Climate Change Canada (ECCC, 2018).

2.4. Schedule

The proponent's planned temporal scope for the Project is from 2020 to 2028 but drilling activities would not be continuous over this period. Project activities would be aligned with the exploration licence periods and would end once regulatory obligations and commitments have been met and a licence has either reverted back to the C-NLOPB or been converted to a Significant Discovery Licence. In-field project activity could commence as early as 2020.

It is expected that each well would require approximately 45 to 160 days for drilling, evaluation and well abandonment or suspension. The specific nature and timing of each project phase and activity within each year of the program would continue to evolve and become further defined as planning and implementation progress.

3. Alternative Means of Carrying out the Project

CEAA 2012 requires that EAs of designated projects take into account alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means. The proponent identified and evaluated alternatives for the following aspects of the Project: drilling fluids selection, MODU selection, drilling waste management, offshore lighting and well testing and flaring.

Drilling Fluids Selection

Water-based muds and synthetic-based muds were both identified as technically and economically feasible at different project stages, and acceptable under current regulatory regimes. The proponent indicated water-based mud would be used during initial drilling when the riser is not in place, as it is technically inferior in deeper sections of the well; synthetic-based mud is likely to be used at deeper well sections, when the riser is installed as it is technically superior for deeper well sections where it offers better drilling performance, stability and well control.

Mobile Offshore Drilling Unit Selection

Three types of MODUs are typically used in drilling offshore wells in Atlantic Canada: semi-submersibles, drill ships and jack-up rigs. Feasibility and selection of the MODU is well-specific and based on physical environmental conditions, including water depth, required drilling depth and expected weather and ice conditions and associated mobility requirements. Based on water depth and environmental conditions, the proponent stated that a jack-up MODU is not considered technically feasible for this Project. The Project would be conducted using either a semi-submersible or drill ship MODU and selection would be based on an evaluation of specific well site conditions and proponent requirements.

Drilling Waste Management

Three potential options were considered related to the management of drilling waste: disposal at sea, shipping waste to shore and reinjection. Reinjection of drilling waste into a dedicated well is not considered economically or technically feasible for exploration drilling activities in Atlantic Canada. For the disposal of synthetic-based mud associated drill cuttings, while shipping to shore is considered technically feasible, due to increased transportation cost, operational delays, health and safety considerations, as well as the lack of a treatment facility in Newfoundland, ship-to-shore is not a preferred option. Discharge to the water column following treatment, as per existing applicable guidelines and regulatory requirements, was identified as the preferred option because it is considered non-toxic but with some localized seabed effects and is technically and economically feasible.

Offshore Lighting

Three potential options were considered related to lighting: no lighting or limited lighting, standard lighting and spectral modified lighting. No or limited lighting were considered unfeasible alternatives due to operational and safety concerns. Spectral modified lighting has not been proven to be technically or economically feasible, and there are safety concerns with some types of spectral lighting in certain conditions. In addition, use is restricted by commercial availability and cost. As such, standard lighting was identified as the preferred option. The proponent indicated that lighting would be minimized to the greatest extent possible, without compromising safe operations.

Well Testing and Flaring

Flaring is generally required during well flow testing to safely and efficiently dispose of hydrocarbons that may come to the surface and as such, not flaring is not considered to be a feasible option if such tests are required. During standard well flow tests, flaring may last one to three days per flow testing period. Once well testing begins, it is impossible to avoid nighttime flaring and it is necessary to complete the test in order to avoid negatively affecting the test results.

There are alternative well flow testing technologies with the potential for improved safety and environmental performance that could be implemented for the Project. The proponent may use alternative testing technologies that meet the C-NLOPB's requirements as they become available, such as using a drill pipe conveyed test assembly. In such cases, the hydrocarbons are circulated to surface and recovered without the requirement to flare oil or produced water. There are several factors that would need to be considered to determine if a proposed alternative testing technology is suitable for a specific well, including:

- the properties of the reservoir, the data to be collected, any C-NLOPB requirements, and the suitability of the alternative technology to complete the test and meet any requirements;
- the availability of the technology within the project timeline;
- the economic viability, technical feasibility, and benefits and limitations of using the alternative technology; and
- proposed proprietary technologies (e.g., formation flow testing while tripping), including the logistical, technical, economic and time requirements for use.

Ultimately, the C-NLOPB would determine the required methods of well testing to validate the presence of hydrocarbons. Additional measures to minimize potential effects of flaring can be found in Section 6.3.

3.1. Views Expressed

Views expressed by federal authorities, Indigenous groups or the public related to alternative means of carrying out the Project were directly linked to potential effects on valued components of the identified alternatives and differences between these predicted effects. These views are outlined in Section 6, as appropriate.

3.2. Agency Analysis and Conclusion

The Agency is satisfied that the proponent adequately assessed alternative means of carrying out the Project.

4. Consultation Activities

4.1. Crown Consultation with Indigenous Peoples

The Crown has a duty to consult Indigenous peoples in Canada, and to accommodate where appropriate, when its proposed conduct might adversely impact a potential or established Aboriginal or treaty right. Indigenous consultation is also undertaken more broadly to aid good governance, sound policy development and decision-making. For example, in certain instances there may not be a constitutional duty to consult but the Agency may decide to engage with Indigenous groups for policy reasons.

4.1.1. Indigenous Consultation Led by the Agency

The Agency served as Crown Consultation Coordinator for a whole-of-government approach to consultation. The Agency consulted communities and groups that hold communal commercial fishing licences in NAFO areas that overlap the project area, local study area and regional study area, or portions of them, or hold licences for species that migrate through the project area such as swordfish. In addition, the Agency consulted communities that fish for and have an interest in certain Atlantic Salmon populations, a species which could potentially be affected by the Project. The following communities were consulted:

- **Labrador Inuit:** Nunatsiavut Government, NunatuKavut Community Council
- **Labrador Innu:** Innu Nation
- **Nova Scotia Mi'kmaq First Nations**: Acadia, Annapolis Valley, Bear River, Eskasoni, Glooscap, Membertou, Millbrook, Paqtnkek (Afton), Pictou Landing, Potlotek (Chapel Island), Sipekne'katik, Wagmatcook, and We'kmoqma'q (Waycobah)
- **New Brunswick Wolastoqiyik (Maliseet) First Nations**: Kingsclear, Madawaska Maliseet, Oromocto, St. Mary's, Tobique, and Woodstock
- **New Brunswick Mi'gmaq First Nations**: Buctouche, Eel River Bar, Fort Folly, Esgenoopetitj, Indian Island, Pabineau, Eel Ground, Metepenagiag, and Elsipogtog
- **New Brunswick Peskotomuhkati Nation at Skutik (Passamaquoddy)**
- **Prince Edward Island Mi'kmaq First Nations:** Abegweit and Lennox Island
- **Quebec Mi'gmaq**: Micmacs of Gespapegiag, Nation Micmac de Gespeg, and Listuguj Mi'gmaq Government
- **Quebec Innu**: Innus de Ekuanitshit and Première Nation de Nutashkuan

Several groups are represented in consultation by aggregate organizations including:

- Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) represents the Nova Scotia Mi'kmaq First Nations in consultation with the exception of Millbrook and Sipekne'katik First Nations.
- Wolastoqey Nation of New Brunswick (WNNB) represents the New Brunswick Wolastoqiyik (Maliseet) First Nations in consultation. Woodstock First Nation was being consulted separately until the community joined WNNB in March 2019.
- Mi'gmawe'l Tplu'taqnn Incorporated (MTI) represents the New Brunswick Mi'gmaq First Nations in consultation with the exception of Elsipogtog First Nation.

- Mi'kmaq Confederacy of Prince Edward Island represents the Prince Edward Island Mi'kmaq First Nations in consultation.
- Mi'gmawei Mawiomi Secretariat (MMS) represents the Quebec Mi'gmaq in consultation.

The Agency made a determination that the depth of consultation with these Indigenous groups would be low on the consultation spectrum based on an analysis of Section 35 Rights and the potential for adverse effects on these rights from the Project.[1] It provided this analysis to Indigenous groups, along with draft consultation plans, and requested feedback on the plans. Comments were received on the plan and the determination of depth of the consultation.

The Agency also contacted the Qalipu First Nation and Miawpukek First Nation (MFN), which were being engaged for the purposes of good governance, and provided them with information on the Project and opportunities to submit comments.

The Agency integrated the Crown's consultation and engagement activities into the EA and invited Indigenous groups to review and comment on the documents listed in Table 3.

Table 3: Comment Opportunities during the Environmental Assessment

Document or Subject of Consultation	Dates
Summary of the Project Description	April 25, 2017 – May 17, 2017 (20 days)
Draft EIS Guidelines	June 12, 2017 – July 12, 2017 (30 days)
EIS Summary	April 4, 2018 – May 4, 2018 (30 days)
Draft EA Report and Potential Conditions	September 25, 2019 – October 25, 2019 (30 days)

The Agency considered comments received from Indigenous groups following their reviews of the EIS and associated summary and asked the proponent to provide additional information on a number of topics. Indigenous groups were provided an opportunity to review and comment on the additional information, as applicable.

In addition to opportunities to review and comment on the documents listed above, the Agency organized four information sessions in October 2017 that provided information about the Agency and four proposed offshore exploration drilling projects subject to federal EA, including this Project. The Agency invited feedback on how the Agency could help facilitate participation in the EA, and on the potential environmental effects of the Project and potential impacts to Section 35 Rights.

The Agency also organized three workshops in April 2018 to build relationships between Indigenous groups, proponents and government; provide an overview of offshore drilling projects; and identify and address concerns from Indigenous groups. Proponents were invited to participate in the Agency's April 2018 workshops so they could provide information and answer questions about their projects.

[1] In describing the preliminary determination regarding the depth of consultation, the Agency contacted the above-listed Indigenous groups, with the exception of Qalipu First Nation and MFN, as the latter groups were being engaged for the purpose of good governance and were contacted separately with a description of engagement opportunities.

The Agency maintained contact with Indigenous groups throughout the EA with general meetings with Indigenous Consultation Coordinators and periodic emails to verify that participants were aware of the EA process as it advanced, respond to questions and discuss comments.

The main areas of concern raised by Indigenous peoples included:

- salmon and potential interactions with the Project;
- effects on fish and fish habitat;
- effects on fishing for communal commercial and food, social or ceremonial purposes, including related socioeconomic and health effects;
- effects of accidents and malfunctions, including the use of dispersants in oil spill response;
- effects on migratory birds;
- compensation in the event of damages from normal operation or due to accidents and malfunctions; and
- cumulative effects.

Appendix C contains a summary of comments provided to date by Indigenous peoples, along with the proponent's and Agency's responses. A subset of comments are also discussed in the context of individual valued components throughout Sections 6 and 7.

The Agency supported the participation and consultation of Indigenous groups during the EA through its Participant Funding Program. Funding was made available to assist in reviewing and providing comments on the EIS summary, the draft EA Report and potential EA conditions. In total, the Agency allocated $206,525 to 11 Indigenous communities and aggregate organizations.

4.1.2. The Proponent's Indigenous Engagement Activities

The proponent engaged with 41 Indigenous groups located in Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Quebec. Early engagement began in March 2017 with the Nunatsiavut Government, the Labrador Innu Nation, the NunatuKavut Community Council, Qalipu Mi'kmaq Nation Band and MFN. Based on direction from the Agency, in July 2017, the proponent began engaging an additional 36 Indigenous groups in the Maritime Provinces and Quebec. Engagement methods included phone calls, emails and reports. The proponent also participated in the three workshops organized by the Agency in April 2018 and organized additional workshops in October 2018, in which the Agency and proponents of other offshore exploratory drilling projects also participated. The proponent stated that they would continue to communicate with Indigenous groups as required and requested.

4.2. Public Participation

4.2.1. Public Participation Led by the Agency

The Agency provided four opportunities for the public to participate in the EA (these were the same as those listed in Table 3 above). These opportunities were publicised through print, radio, and online advertisements and notifications, and included instruction on how to contact the Agency. Documents were made available online and were also available in hard copy upon request.

In response to the public notice during the comment period on the EIS Summary, submissions were received from the Fish, Food and Allied Workers' Union and the Newfoundland and Labrador Oil & Gas Industries Association.

The Fish, Food and Allied Workers' Union provided information on the nature and importance of the fishing industry and traditional knowledge, and raised concerns related to potential effects of the Project on commercial fisheries, including related socioeconomic effects, oil spills, marine conservation and cumulative effects. The Newfoundland and Labrador Oil & Gas Industries Association indicated its support for the Project, suggested consideration of the Eastern Newfoundland Strategic Environmental Assessment Report, provided information on the availability of data, commented on the spatial extent and location of the Project and highlighted the economic importance of the offshore oil and gas sector.

The Agency made funding available through its Participant Funding Program to support the public in reviewing and providing comments. Through this program, $12,300 was allocated to one public organization to reimburse eligible expenses related to their participation in the EA.

4.2.2. Public Participation Activities by the Proponent

The proponent engaged with groups representing various stakeholders that have historically been engaged in or have an interest in offshore oil and gas operations in Newfoundland and Labrador. This included representatives from the oil and gas industry, fishing industry, Indigenous communities, environmental non-government organizations and other oil and gas operators participating in exploration or production activities in offshore Newfoundland and Labrador.

The proponent conducted engagement efforts for the EIS from May 2016 until January 2018. The proponent used a variety of engagement methods including face-to-face meetings, telephone conversations and written correspondence.

4.3. Participation of Federal Government Experts

Federal departments and agencies with specialist information and expert knowledge relevant to the Project supported the Agency throughout the EA.

The Agency requested specialist and expert information and knowledge from the C-NLOPB, Department of National Defense, Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Health Canada, Transport Canada, Natural Resources Canada (NRCan), Indigenous Services Canada and the Parks Canada Agency. Their advice and expertise has been incorporated into the sections that follow.

4.4. Consultation on the Draft Environmental Assessment Report

The Agency invited the public and Indigenous groups to comment on a draft version of this EA Report and on the potential EA conditions. The Agency received five submissions from Indigenous groups. Comments, issues, and recommendations were consistent with the areas of concern identified in earlier phases of the EA, and that have

been summarized in section 4.1.1 and Appendix C, including effects on fish marine mammals and birds (including species of particular concern to Indigenous groups such as Atlantic salmon); effects from an accident or malfunction; and cumulative effects. Consultation with Indigenous groups, impacts to Rights, and the role of Indigenous groups during oil spill response were also highlighted in the submissions. The Agency also received three submissions from the public and the proponent, which included recommended modifications to the conditions, expressed support for the Project, and identified concerns regarding the potential effects on fish and fish habitat and international commercial fishing activity.

The Agency considered the submissions and is of the view that the analysis of environmental effects and conclusions presented in the draft EA Report remain appropriate. Based on its review of specific comments received, the Agency edited the EA Report for further clarity. The Agency determined that the proposed key mitigations remained appropriate, with the addition of the following items:

- requiring the proponent to control project lighting, including the direction, timing, intensity and glare of light fixtures, while meeting operational, health and safety requirements;
- requiring the proponent to include in its Fisheries Communications Plan procedures to engage in two-way communication with Indigenous groups in the event of a spill requiring a tier 2 or tier 3 response[2]; and
- requiring the proponent to provide Indigenous group with an opportunity to review and provide feedback on a draft version of the Spill Response Plan.

[2] Tier 2 and tier 3 responses are defined in the International Association of Oil & Gas Producers' document *Tiered Preparedness and Response* (International Association of Oil & Gas Producers, 2015).

5. Existing Marine Ecosystem

CEAA 2012 defines the environment as the components of the Earth, including the land, water, and air, all organic and inorganic matter and living organisms, and the interacting natural systems that include these components. Similarly, marine ecosystems include the physical and chemical environment along with varied, complex and naturally dynamic organisms. Human activities can cause changes that affect the health of marine ecosystems.

This section summarizes information on the existing marine ecosystem presented by the proponent and available online in DFO's report Canada's Oceans Now: Atlantic Ecosystems, 2018 (DFO, 2018a).

5.1. Physical and Chemical Environment

5.1.1. Physical Environment

The Project would be located in the Flemish Pass of the Northwest Atlantic Ocean. The Flemish Pass is a north-east – south-west trending, mid-slope basin located between the Grand Banks and the Flemish Cap. It reaches a depth of approximately 1300 metres and is dominated by sandy mud substrate with some areas of rocks. The physical components of the marine ecosystem in the Flemish Pass are influenced by seasonal changes in currents, water temperature, sea ice, oxygen levels, acidification, and nutrient levels. Changes in the physical environment may have important impacts on biological systems at different scales, including changes in species growth rates or changes in food webs.

The predominant ocean current in the project area is the Labrador Current which brings cool Arctic water to the area. The Labrador Current mixes with the Gulf Stream to create an area of high productivity along the tail of the Grand Banks which is located southwest of the project area within the regional study area.

The North Atlantic is temperate with ocean temperatures changing with the season. The surface water temperatures in the project area vary with air temperatures ranging from -1.8 degrees Celsius in February to 15.7 degrees Celsius in August. For depths greater than 200 metres, sea temperature varies only slightly by depth with monthly mean temperatures ranging from 3.3 to 4.0 degrees Celsius. An important interaction is the mixing of cooler, fresher water from the Labrador Current with the warmer, saltier waters of the Gulf Stream. Temperature influences both physical processes such as sea ice formation and mixing in the water column and the condition and behaviour of the species inhabiting the area.

Seasonal changes in sea ice and the layers in the water column play important roles in the way the ecosystem in the project area functions. An important feature in the project area is the cold intermediate layer that forms when a cold water layer is trapped by warm spring surface water, along with freshwater from sea ice melt and runoff from land, forming a less dense layer at the top of the water column. The cold intermediate layer influences mixing within the water column which affects how nutrients are distributed and has an impact on the productivity of the ecosystem. Seasonal changes in sea ice influence freshwater input and the timing of phytoplankton blooms. Sea ice also provides habitat for organisms that live under and on the ice. The project area generally has sea ice from mid-January until late April with the highest ice extent and presence of first year ice in early April. Icebergs are observed in the project area from January to August. The number of icebergs

reported (first sightings) annually for the project area varies and has historically ranged from zero in numerous years, to a maximum of 217 and has averaged 55 icebergs per year.

The climate of the project area is governed by the passage of high- and low-pressure circulation systems. This results in periods with high winds, large wave heights, low visibility and severe weather. The highest average wind speeds of 11.7 metres per second occur in winter, with maximum wind speeds recorded of 34.3 metres per second in January. Minimum and maximum recorded air temperatures are -12 degrees Celsius in February and 24 degrees Celsius in August. Precipitation occurs within the project area approximately 14.6 percent of the time. The highest precipitation, 22.8 percent of the time, is in February occurring approximately equally as rain/drizzle and snow and the lowest precipitation, 9.8 percent of the time, is in July with the majority occurring as rain/drizzle. Fog frequently reduces visibility in the project area with the majority of the fog occurring from May to August.

Underwater sound is an important factor when assessing the potential effects of exploration drilling offshore on certain species, especially marine mammals that rely on sound to communicate, locate food and detect threats. Underwater sound is influenced by natural conditions, such as weather and wave action and marine mammals (e.g., whale songs), as well as human activities, such as petroleum production and exploration activities, fishing and marine transportation.

5.1.2. Chemical Environment

The chemical environment includes components such as dissolved oxygen, ocean acidity and nutrient availability. The amount of dissolved oxygen in seawater is important for the health of marine organisms. In deep water, as in the project area, mixing from surface waters can replace oxygen. When there is little mixing, dissolved oxygen can be depleted by the respiration of organisms and the breakdown of organic matter. If oxygen levels are too low, there may be serious effects on ecosystems such as slower growth, reduced reproductive success and effects on the way species are distributed since most species will leave an area before hypoxia can cause potential adverse effects.

Ocean acidity is increasing as the ocean absorbs atmospheric carbon dioxide. An increase in acidity makes the water more corrosive to calcium carbonate, the main element in the skeletons and shells of many organisms including plankton and corals, and can also cause increased physiological stress for these organisms. These changes can have implications for food webs and ecosystems as a whole.

Like plants on land, phytoplankton require light and nutrients to grow. The most important nutrients include nitrogen, phosphorous and silica. Nitrogen is usually the limiting nutrient for the growth of phytoplankton in the ocean. As a result, nitrogen cycling within the water column is very important.

5.2. Biological Environment

The biological components of the marine ecosystem include phytoplankton, zooplankton, corals and sponges, fish and invertebrate communities, marine mammals, sea turtles and seabirds. The biological environment is changing with species distributions shifting and causing changes to the food web.

Phytoplankton are microscopic plants that produce oxygen and organic matter from sunlight, carbon dioxide and inorganic nutrients. They support many marine food webs as the key food source for zooplankton, which are in

turn food for many fish and marine mammals. Phytoplankton abundance is an indicator of the productivity of an ecosystem. Changes in the timing of the spring bloom can have consequences for many other organisms in the ecosystem. In most areas of the North Atlantic, phytoplankton biomasses have been well below average since 2015.

Zooplankton are small animals that drift in the water column, feeding on phytoplankton, bacteria and fungi. They are the critical link between phytoplankton and larger marine animals and changes in zooplankton abundance have important consequences for animals that rely on them as their primary food source. In general, zooplankton have been experiencing a shift in community structure with a lower abundance of energy-rich copepod *C. finmarchicus* and a higher abundance of small and warm-water copepods as well as non-copepods.

Corals grow mainly on boulders and bedrock but can also anchor in soft sediments. The distribution of deep-water corals is patchy, influenced by the condition of the seabed, temperature, salinity and currents. Sponges are found along continental shelves, slopes, canyons and deep fjords at depths down to 3,000 metres. Both deep-sea corals and sponges are vulnerable to human activities such as fishing and resource extraction. Corals and sponges may be the only complex habitat-forming features on the seafloor. Their structure provides areas for other species to rest, feed, spawn, avoid predators and provide protection for eggs and juveniles of various species. Sponges contribute significantly to the nitrogen, carbon and silicon cycles in the ocean. This results from their large filter-feeding capacity, a diet mainly composed of dissolved organic matter and a silicified skeleton.

Marine fish and invertebrates within pelagic, demersal and benthic communities are part of a complex ecological network. These communities are closely connected to the physical, chemical and biological environment in which they live. An example of this is how physical conditions affect the capelin population. A key factor is the timing of melting sea ice in spring that generates ocean conditions that are favourable to the spring bloom of phytoplankton. If blooms occur too early, due to early ice retreat, zooplankton may miss the maximum peak of phytoplankton production. This creates a mismatch in energy flow and reduces zooplankton productivity. The result is lower forage fish production. Capelin and herring production are linked directly with the abundance of their zooplankton prey and capelin growth and spawning may be directly impacted by poor zooplankton production. In turn, capelin availability has been shown to be an important driver of the abundance of northern Atlantic Cod stocks and reproductive rates in Harp Seals.

Marine fish and fish habitat components that are relevant to the project area include plankton, benthos and finfish. The presence, abundance and distribution of particular species varies considerably based on habitat characteristics and variability across this rather large and diverse marine environment. The Project would take place in the vicinity of the Grand Banks, Flemish Cap and the Flemish Pass, each of which are unique functional units with specific oceanographic characteristics and species assemblages:

- the relatively shallow Grand Banks Shelf is dominated by echinoderms (e.g., sand dollars), bivalves (e.g., Icelandic Scallop), shrimp, Snow Crab, lanternfish and redfish.
- the Flemish Cap supports benthic invertebrates characteristic of shelf and slope assemblages, including sea stars and sea anemones. Redfish species and Atlantic Cod are found in shallow slope areas, with deeper slopes dominated by Greenland Halibut, Longnose Eel, Blue Hake, grenadiers and dogfish.
- the Flemish Pass supports benthic invertebrate species characteristic of middle slope assemblages, predominately corals, sponges and echinoderms. Deeper areas of the slope are dominated by sea pens, sponges and echinoderms. Finfish species typical at middle slope depths include Longnose Eel, Blue Hake and halibut. Dominant species in deeper areas include lanternfish, dragonfish and viperfish.

The continental slope acts as a transition zone between these functional units and supports important fish habitat.

Many of the marine mammals present in the project area are summer migrants which come to the Northwest Atlantic to feed mainly on capelin, Atlantic Herring, and krill. The role of marine mammals in the Atlantic food web varies widely, from fish-eating Grey Seals to slow-moving copepod and fish-eating Northern Atlantic Right Whales. Because many marine mammal species are highly mobile and migratory, their movements can reflect changes in prey or in environmental conditions.

The eastern and southern coastlines and the offshore waters of Newfoundland and Labrador provide important habitat for marine-associated bird species. Offshore islands and mainland cliffs provide nesting grounds for tens of millions of seabirds representing some 20 species, including some of the largest seabird colonies in eastern North America south of the Hudson Strait (e.g., the largest colony of Leach's Storm-petrels in the world is located on Baccalieu Island, approximately 64 kilometres north of St. John's). The abundance and distribution of species in the region varies considerably based on the time of year.

Seabirds are top predators and can be effective indicators of overall health of marine ecosystems. Some populations of seabirds have been increasing such as Common Murres and Atlantic Puffins while others have stabilized after a period of increased abundance such as Northern Gannets; however, certain surface-feeding species such as Black-legged Kittiwakes, Leach's Storm-petrel and Herring Gulls have experienced population declines. Abundance of seabirds can be indirectly affected by changes in oceanographic conditions or by human activities such as commercial fishing and oil and gas exploration and production. For example, Leach's Storm-petrels are vulnerable to light effects from the Project as they hunt at night for species such as lanternfish. Lanternfish vertically migrate during the day, spending the daytime in deep water and rising to the surface at nighttime. Thus, the effect of the Project's lighting on Leach's Storm-petrel is two-fold; attraction and disorientation of birds to the light and potential effects to the availability of food sources.

5.3. Human Activities

The project area and larger eastern Newfoundland and Labrador offshore area is known to be used for a variety of human activities. These include marine research activities, marine shipping, commercial fisheries, other offshore oil and gas activity, military operations and marine subsea cables.

Fisheries are an important component of the human environment of Newfoundland and Labrador, especially for communities and regions along the eastern coastline of Newfoundland. Prior to 1992, for decades the primary harvesting activities taking place targeted groundfish species. With the collapse of groundfish stocks in the early 1990s, a moratorium was declared and commercial harvest of groundfish dropped drastically. Although some groundfish and pelagic fish harvesting are still conducted, Snow Crab and shrimp are now the primary species harvested by fishers in offshore Newfoundland and Labrador by both weight and value.

6. Predicted Effects on Valued Components

Section 6 discusses the potential effects of the Project on the valued components considered by the Agency. Potential effects on special areas and species at risk are considered in Section 6.4 and 6.5, respectively but also in other sections where the valued component may include relevant special areas or species at risk. The potential effects of an accident or malfunction on these valued components are discussed in Section 7.1.

A summary of the proponent's proposed mitigation measures, monitoring and follow-up is provided in Appendix B.

As described in the analysis below and taking into account the implementation of key mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on fish and fish habitat, marine mammals and sea turtles, migratory birds, special areas, species at risk, commercial fisheries or the current use, health and socioeconomic conditions of Indigenous peoples.

6.1. Fish and Fish Habitat

6.1.1. Proponent's Assessment of Environmental Effects

Existing Environment

The project area and surrounding marine environments are used by fish and invertebrate species of commercial, cultural and/or ecological importance and support regionally important areas of biodiversity and marine productivity. Species distributions fluctuate as species migrate on daily or seasonal cycles. For example, on an annual cycle, the regional study area is visited by large pelagics (e.g., tunas, swordfish) during the warm water season, while other occupants (e.g., capelin, Atlantic Cod) may leave the area at certain times of the year as they migrate inshore to spawn or feed. Other species (e.g., redfish, Greenland Halibut and Snow Crab) are more resident in nature.

Structure forming sponges and corals provide habitat, refuge and foraging areas for a variety of species. There are at least 56 species of corals and sea pens distributed on the Flemish Cap, Flemish Pass and the Grand Banks and at least 60 species of sponges in the region. Regionally, areas with relatively high sponge biomass are located in the southern Flemish Pass and eastern slope of the Grand Banks. Within the project area and adjacent environments, sponge densities are considered low on the seabed and medium on the slopes.

There are multiple fish species at risk that may occur in the project area or have ranges overlapping the regional study area. These include the following three species which have been highlighted by Indigenous groups as being of particular concern:

- **American Eel** travel from freshwater environments during the fall to the Sargasso Sea to spawn and have the potential to occur seasonally at shallow depths in the project area;
- **Atlantic Bluefin Tuna** migrate to the waters of the Northwest Atlantic Ocean, including the Grand Banks, Flemish Pass, Flemish Cap, and areas off the continental shelf, in search of food during the summer before leaving the area in the fall; and

- **Atlantic Salmon** could pass through the project area on route to and from their maturation and winter feeding grounds in the Labrador Sea and off Greenland.

Atlantic Salmon populations, including those not currently considered at risk, have shown declines in recent years, particularly in the number of adults returning to spawn. Hypotheses for this decline include predation, fishing pressure and changes in the physical and biological environments, with top-ranked hypotheses associated with the marine phase of a salmon's life cycle. Higher mortality is occurring after salmon leave their natal rivers and this appears to be common to all North American Atlantic Salmon spawning populations.

Little research is available on the routes used by Atlantic Salmon to access suitable marine habitat, particularly since the close of the commercial salmon fishery and reduction in tagging experiments in the 1970s and 1980s. Labrador and Nunavik populations are unlikely to migrate through the project area but individuals from the island of Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick and the Gulf of St. Lawrence could pass through the project area. Prior to their spring spawning migration to their natal rivers, adult salmon have been found congregating in two general offshore locations: the western edge of Labrador Sea and the eastern edge of the Grand Banks. In terms of habitat preferences, avoidance of lower water temperatures, particularly below 3°C, can play a predictive role in habitat use near the Grand Banks and Flemish Pass. Although favourable temperatures for salmon exist in January and April, there is little to no data to support the project area being used by Atlantic Salmon as overwintering habitat or as a major feeding area.

Predicted Effects

The proponent predicted the following potential interactions between the Project and fish and fish habitat:

- destruction, contamination or alteration of marine habitats, fish and benthic organisms from deposition of drill cuttings and/or fluids, other environmental discharges, deployment and use of project equipment, and the introduction and spread of aquatic invasive species;
- attraction of fish to the MODU and vessels, resulting in increased potential for injury or mortality;
- behavioural effects and temporary avoidance of areas from underwater sound;
- changes in the availability, distribution or quality of feed sources and/or habitats; and
- injury, mortality or disturbance to marine fish as a result of exposure to sound.

Key potential effects on fish and fish habitat that may result from the above interactions are described below.

Risk of Mortality or Physical Injury or Changes in Health

Fish mortality, injury or health effects could result from discharge of drill cuttings and drilling fluids or from sound emissions during drilling or VSP surveys.

The planned release of drilling waste materials is a key potential interaction with marine fish and fish habitat during offshore drilling programs, with potential effects on fish and benthos via smothering, chemical toxicity and bioaccumulation. Studies and monitoring programs have shown that the nature and magnitude of smothering of benthic invertebrates and creation of oxygen-depleted environments (from degradation of synthetic-based mud organic components) are linked to the thickness and extent of the associated cuttings layers that may accumulate on the seabed following discharge. Drill cutting deposition modelling predicted that the formed cuttings layer would be limited in size and distribution in this deep offshore environment, and that cuttings layer thicknesses would exceed established thresholds for creation of anoxic areas and smothering of benthic species

in a limited area surrounding each well. Any cutting accumulations on the seabed would eventually be recolonized following the completion of each of the up to ten wells that may be drilled as part of this Project.

The Project would use both water-based and synthetic-based drilling muds for drilling, with treatment and disposal of muds and cuttings in accordance with the *Offshore Waste Treatment Guidelines*. Water-based muds and associated cuttings would be discharged directly to the seabed. Water-based muds are not likely to result in contamination as these materials are non-toxic, have low bioaccumulation potential and only localized biological effects.

Species that have limited ability to migrate away from the well site (e.g., corals) are considered sensitive to suspended sediments, with increased larval mortality and changes in feeding behaviour resulting from exposure to water-based muds. Environmental effects monitoring data for offshore Newfoundland have indicated that the area of water-based mud effects where there was an increase in metal levels is generally limited to within 250-500 metres of the well site.

Synthetic-based mud-associated cuttings would be treated to limit the amount of synthetic mud retained on the cuttings discharge. Acute toxicity of synthetic-based muds is considered to be relatively low based on laboratory experiments and field evaluations of synthetic-based mud-associated drill cuttings piles; however, toxicity experiments showed that there are potential health effects with chronic exposure to synthetic-based mud-associated cuttings. Very small quantities (less than four percent) of synthetic-based mud-associated cuttings were predicted to disperse beyond one to two kilometres from the deepwater well site, with accumulations (less than 0.1 millimetre) well below the most conservative no-effect threshold value of 1.5 millimetres. Due to the relatively low quantities, dispersed synthetic-based mud-associated cuttings would be expected to have very low potential for interactions with organisms in the water column and benthic areas more than one to two kilometres from the well site. Any potential effects are likely to be localized and temporary in nature, as synthetic-based muds biodegrade within a few years.

Operation of the MODU and support vessels as well as VSP surveys would produce sound that may result in impacts to fish and invertebrates. Effects vary given the spectrum of hearing capabilities of fish and invertebrates and may include changes in fish mortality, injury (e.g., hearing sensory structures) and fish health (including changes to food availability and abundance). Although it is recognized that marine invertebrates can be quite sensitive to sound, recent field-based studies on adult populations of scallops, clams and lobster revealed no evidence of increased mortality after prolonged exposure. Some species may also become habituated to underwater noise levels. During seismic surveys, little direct physical damage to fish occurs at distances greater than a few metres from the seismic sound source and due to avoidance behaviour by free-swimming fish, they typically do not suffer physical damage from these surveys. Furthermore, seismic emissions from VSP surveys are mainly directed downwards into the well, with limited horizontal range, and sound levels are lower than those for standard geophysical surveys.

Based on previous modelling, the proponent estimated that source pressure levels would range from 189 to 197 dB re 1 µPa[3] for operation of the MODU and support vessels and from 245.6 to 248.2 dB re 1 µPa for VSP surveys. At the source, these values exceed published guidelines for injury and/or mortality of some species and life stages;[4] however, the proponent noted that sound levels would decrease rapidly with increasing distance

[3] Decibels relative to a fixed reference pressure of 1 micropascal root mean square sound pressure level

[4] For impulsive sounds, the US Fisheries Hydroacoustic Working Group proposed dual criteria of peak sound pressure level of 206 dB re 1 µPa and cumulative sound exposure (energy) level of 187 dB re 1 µPa2s for fish 2 grams or heavier. For

from the source. For example, exceedance of thresholds for temporary threshold shift and recoverable injuries was predicted to be limited to within 330 metres and 150 metres from the centre of the drilling platform, respectively. Given the transient nature of fish and demonstrated avoidance behaviours of fish to sound, the proponent stated it would be unlikely that fish would remain in the immediate area long enough (i.e., 12 to 48 hours) to be continuously exposed to these levels. Furthermore, even in the unexpected event that an individual elected to remain in the exposure area, the result would still be temporary in nature, as both temporary hearing threshold shift and recoverable injuries are by definition short-term and reversible outcomes. The proponent concluded that underwater noise emitted during VSP surveys may result in temporary displacement of some fish species but is not anticipated to result in injury or mortality of fish and invertebrates.

In addition to drilling muds and cuttings and sound emissions, the Project would also result in other discharges to the marine environment (e.g., cement, bilge and deck drainage, ballast water, sewage, cooling water). Waste discharges would be treated as required and discharged in accordance with applicable requirements, thereby reducing any potential effects on the marine environment. Additionally, any foreign vessels used for the Project operating in Canadian jurisdiction would comply with requirements to carry out ballast tank or system flushing prior to arriving in Canadian waters to mitigate the spread of alien invasive species.

Change in Habitat Availability or Quality

Drilling and associated cuttings discharges affect fish habitat via seabed disturbance, sediment deposition and change of substrate composition.

To determine the potential extent of these effects, drill cuttings dispersion modelling was conducted for two sites in the project area. The sites were located on either side of the Flemish Pass, one in deep water (1137 metres) and one in shallower water (378 metres). A burial depth of 6.5 millimetres was identified as the predicted no-effect threshold for non-toxic sedimentation, with a threshold of 1.5 millimetres identified for more susceptible species. In general, cuttings pile thicknesses decrease with distance from the well site, with distributional variations dependent on seasonal hydrodynamics and cutting particle composition and size.

Water-based muds and cuttings would be released approximately two metres from the seafloor, leaving little time for the muds and cuttings to be transported by ambient currents prior to settling. Modelling of water-based muds and cuttings predicted that the majority of water-based muds and cuttings (93 percent to greater than 98 percent) for the deep water well scenario would settle within 100 metres of the well site, with more than 99 percent predicted to settle within 200 metres of the well site in shallower water. Maximum predicted drift distances were 280 metres in deeper water and 260 metres in shallower water.

Cuttings with residual synthetic-based muds would be discharged near the sea surface, increasing potential dispersal distance. Modelling of synthetic-based mud-associated cuttings predicted that approximately 90 percent would settle within 500 metres of the release point in deeper water and approximately 94 percent would settle within 500 metres in shallower water. A small portion of the cuttings may travel farther but approximately 96 percent of cuttings would settle within two kilometres of the well site.

The largest predicted area of total synthetic-based mud cuttings thickness above the 6.5 millimetre predicted no-effect threshold was approximately 0.06 square kilometres (approximately 400 metres by 150 metres) in deeper

continuous sound exposure in fish with swim bladders involved in hearing, Popper et al (2014) proposed a threshold of 170 dB re 1µPa for 48 hour sound exposure level [SEL]) for recoverable injuries, and of 158 dB re 1µPa for 12 hr SEL) for temporary hearing threshold shift.

water and 0.047 square kilometres (approximately 260 metres by 180 metres) in shallower water. For the conservative 1.5 millimetre predicted no-effect threshold, the largest estimated area above the threshold was approximately 0.182 square kilometres (approximately 700 metres by 260 metres) for the deep water site and approximately 0.084 square kilometres (approximately 350 metres by 240 metres) for the shallow water site.

Change in Fish Presence or Abundance (Behavioural Effects)

In response to noise typically associated with drilling activities, fish exhibit a variety of behavioural responses depending on the species, life stage, intensity of sound, distance from source and other factors. Responses include avoidance or attraction by individual fish, as well as possible physiological effects when fish are continuously exposed to noise, which may in turn affect feeding, reproduction and communication. The proponent stated that overall, short-term and low-frequency sounds elicit temporary avoidance due to startling effects, with longer-term avoidance potentially occurring if the sound is of higher frequency or continuous. These effects can be short-lived and transient in nature, and reversible once the sound source has been removed or reduced, decreasing the potential for any detrimental effects. The proponent concluded that the short-term sound effects from drilling, dynamic positioning and other activities would not have overall (population level) adverse effects on fish in the local study area or beyond.

While some fish species avoid sound and light, lighting and other environmental discharges (including any organic waste and food waste material) may result in the attraction of some fish and invertebrate species. Migrating individuals, plankton, and pelagic species may be attracted to the lights of the MODU shining on the water, and invertebrates may become attached to the subsea structure as it provides a surface for colonization. Combined, this may create a “reef effect” in which fish may aggregate near and below the MODU in response to increased foraging and shelter opportunities. Any such positive effects would be temporary as removal of the subsea structure from the well site would usually result in local fish and invertebrate abundance and diversity returning to levels prior to enhancement.

6.1.2. Views expressed

Federal Authorities

The C-NLOPB reviewed the proponent’s drill cuttings modelling and requested rationale to support its use of cuttings data from a well drilled in 1985 as an input to the model when more recent well data exists. DFO also requested clarification on dispersion model inputs and design. The proponent indicated that the 1985 well data was chosen based on criteria including proximity to the licence areas, geological similarities, the availability of particle size information and the use of synthetic-based muds. The proponent presented a discussion of the drilling conditions and standards used in the 1985 well (e.g., drilling fluids, drill bits and other drilling methods and cuttings treatment) compared to more current conditions and standards and how any differences might affect model results. It was noted that current drilling methods and technologies produce cuttings with different particle size distribution patterns (i.e., greater volume of smaller sized particles in newer wells compared to the 1985 well); however, the proponent re-ran the original model using more recent particle size distribution data and the results showed general agreement in the dispersion footprint between the two data sets and no indication of any significant differences in model predictions. The proponent concluded that the original model predictions presented in the EIS are reasonable dispersion estimates.

DFO and the C-NLOPB requested additional information on the proponent’s commitments related to seabed investigation surveys, methodologies to be employed and how drill cuttings dispersion modelling would be used

to inform the surveys. DFO requested clarification related to the criteria that would be used to define coral and sponge aggregations. The proponent confirmed its commitment to complete seabed investigation surveys for each proposed well site prior to the start of drilling to identify sensitive benthic organisms (such as coral and sponges) or habitats. The proponent would submit a well site specific Seabed Investigation Plan to the C-NLOPB and DFO for review and acceptance prior to commencing the investigation. The plan would include coral and sponge species specific to the offshore Newfoundland and Labrador area and information on species that may be present in the planned well site location, if known; the proposed survey methods for hard coral, soft coral and sponges; the proposed survey area(s); and mapping requirements. Further, the proponent committed to providing the C-NLOPB and DFO (for review and acceptance) a post survey summary report, which would include a description of the mitigation to be used based on several factors (e.g., number of living soft corals per a defined area).

The Agency requested information on the likely distance between wells and the potential for overlapping effects of discharges given that the proponent indicated wells could be drilled in close proximity to one another. The proponent predicted the minimum estimated distance between potential wells would be six kilometres and considered potential overlapping effects based on this distance. Dispersion modelling of drill cuttings predicted a small footprint for drill cuttings that limits the potential burial of benthic species to less than 500 metres around the well site. Small quantities (less than four percent) of synthetic-based mud cuttings were predicted to disperse beyond one to two kilometres. The remaining low quantities of cuttings dispersed beyond two kilometres were not predicted to have any potential interactions with fish or fish habitat due to the expected low concentration in the water column and lack of accumulation on the seabed, and there would be no predicted overlapping effects between wells.

DFO provided information on the migration patterns of Atlantic Salmon in the Northwest Atlantic and on the potential effects of the Project. It advised that Atlantic Salmon that spawn in rivers of eastern Canada (including New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador and Quebec) travel throughout the Northwest Atlantic Ocean. As there have been few marine surveys of the species, their oceanic movement is not well understood. Atlantic Salmon in the Northwest Atlantic are found most abundantly west of Greenland and in the Labrador Sea in summer and fall and along the eastern slope of the Grand Banks in spring. Surveys have also detected salmon in waters of the Jeanne d'Arc Basin/Flemish Pass region but in lower abundances than the areas previously noted and only in the spring. DFO further advised that it is possible that some salmon overwinter in the Jeanne d'Arc Basin/Flemish Pass region and that salmon are likely to be present in the Jeanne d'Arc Basin/Flemish Pass region at some times of the year as they migrate through the area, to and from natal rivers. The department advised that monitoring of finfish for the past 25 to 30 years in the Newfoundland and Labrador offshore has revealed no effects on fish health from ongoing oil and gas operations.

DFO advised the Agency that the mitigation measures, monitoring and follow-up programs proposed by the proponent and recommended by the Agency would adequately address the potential effects of the Project on fish and fish habitat.

Additional views expressed by federal authorities overlapped with views expressed by Indigenous groups. Some of these key views and comments are discussed below.

Indigenous Peoples

The Qalipu First Nation, Elsipogtog, MTI, WNNB, Nutashkuan, MFN, and KMKNO submitted comments specific to Atlantic Salmon, including additional information and research for consideration by the proponent and comments on the Project's potential effects. Submissions raised the potential for the project area to be used as foraging and nursery habitat for Atlantic Salmon in addition to being a migration corridor. Similar concerns were also raised by Indigenous groups during workshops help by the Agency in April 2018. The proponent considered and analyzed the additional information sources and concluded that although the new information adds to the data on marine movements and habitat utilization, it does not alter the conclusion from the EIS: spring migration of adult Atlantic Salmon within and near the project area is possible; however, the likelihood of interaction remains low and the environmental effects of routine Project activities on Atlantic Salmon are predicted to be not significant. The proponent acknowledged the gaps in understanding of Atlantic Salmon migration patterns in the North Atlantic and indicated that it would contribute to research on migratory routes within the project area, which includes potential new studies through the Environmental Studies Research Fund (ESRF).

KMKNO recommended that no drilling activities take place between January and August so as not to interact with migratory Atlantic salmon in the project area.

KMKNO and Qalipu First Nation expressed concerns about potential effects on American Eel, stressing the cultural importance of this species and requesting additional information on potential measures to mitigate effects. The proponent recognized that American Eel may migrate through the shallow waters in the project area and noted that general mitigation measures for fish and fish habitat would avoid or reduce potential adverse effects on American Eel.

MTI stated that North Atlantic Swordfish are a commercially and culturally important species and requested a more comprehensive assessment of potential effects, especially given that the species only tolerates small environmental changes. The proponent responded that swordfish generally occupy Canadian waters for foraging from June to October, and that swordfish have been shown to be attracted to marine structures and to low frequency sounds that are typical of offshore operations. Attraction to a MODU may result in increased exposure of individual swordfish to emissions and discharges, and discharges may also reduce visibility in the water and affect the ability to capture prey fish. However, swordfish are a highly mobile species that are also likely able to avoid or leave areas with undesirable or potentially harmful conditions, and the distance from the project area to spawning habitats in the Gulf of Mexico reduces potential interactions with important habitats and critical life stages.

MMS and other Indigenous groups noted that there remains uncertainty associated with the effects of offshore noise on marine life, particularly from seismic activity. MMS noted that research suggests a negative correlation between seismic activity and plankton, which is the very base of the marine food chain. The proponent acknowledged that seismic noise and associated pressure waves have been shown to have effects on larval and adult zooplankton at a range of up to 1.2 kilometres away from the air gun array but noted that most research on the effects of seismic activities on marine species is based on geophysical seismic survey programs. Compared to VSP, geophysical seismic survey programs are longer in duration, cover a larger geographic extent and use a larger sound source. Therefore, the effects associated with VSP associated with the Project are predicted to be smaller than the seismic effects identified in the literature. Further, the proponent stated that the potential effects of seismic activities on plankton are influenced by local ocean currents, plankton species, compressed air source level and configuration, study area and study design. The proponent indicated that its initial effects assessment determination remained unchanged.

Ekuanitshit and MFN requested additional information on the use and potential effects of biocides. The proponent stated that biocides are not consistently used as part of exploration drilling activities but potentially could be used in cooling water systems or sewage treatment systems. The proponent stated that the type of biocide used is specifically selected for the equipment and operational requirements. Any biocides that could be used would be screened and approved in accordance with the *Offshore Chemical Selection Guidelines*. The proponent would identify any biocides proposed for use and the concentrations that may be discharged to sea in its Environmental Protection Plan, which would be reviewed and accepted by the C-NLOPB prior to drilling.

Additional views expressed by Indigenous groups overlapped with those views expressed by federal authorities. Some of these key views and comments were discussed above. A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Agency did not receive comments from the public regarding the potential effects of the Project on fish and fish habitat.

6.1.3. Agency Analysis and Conclusion

Analysis of Effects

The Agency is aware that parts of exploration licence areas included in the Project may support aggregations of sponges and corals. Habitat complexity and biodiversity in deep-sea environments is highly dependent on these long-lived, structure-forming organisms, which provide refuge, nursery and foraging areas for many fish and invertebrate species. Without adequate mitigation, benthic habitat, including corals and sponges, could be affected by the discharge of drilling muds and cuttings from the Project; sedentary or slow moving species may be smothered and the sediment quality may be altered by nutrient enrichment and oxygen depletion at cuttings deposition thicknesses above the 6.5 millimetre threshold for burial effects (the proponent also identified a 1.5 millimetre threshold for more susceptible species). Given the importance and sensitivity of corals and sponges, the proponent would be required to conduct surveys at each well site and around anchor points prior to drilling. If aggregations of habitat-forming corals or sponges or other environmentally sensitive features were identified, the proponent would be required to relocate the anchors or the well and/or redirect cuttings discharges to avoid affecting them, unless not technically feasible. If it is determined that it is not technically feasible to move the well or redirect cuttings discharges, the proponent would be required to conduct a comprehensive assessment of the benthic habitat in consultation with DFO prior to drilling to determine the potential for the harmful alteration, disruption or destruction of coral and sponge aggregations and related options for mitigation to reduce any identified risks.

Fish and fish habitat could also be affected by other marine discharges. The Agency notes that all chemicals would be selected in accordance with the *Offshore Chemical Selection Guidelines* and any discharges would meet or exceed standards set out in the *Offshore Waste Treatment Guidelines* and MARPOL. The implementation of these measures would limit effects on fish.

Continuous underwater sound from operation of the MODU and support vessels may cause recoverable injury or temporary hearing threshold shift in certain species of fish at distances of up to 150 and 330 metres from the source, respectively. Sound may also result in behaviour responses, including avoidance or attraction, and may mask fish sensory abilities. Sound from VSP surveys could also affect fish, including potentially causing injury or

mortality. Sound levels from these surveys may exceed injury thresholds for some species or life stages in the immediate vicinity of the sound source. Mobile species would likely exhibit avoidance behaviour and the surveys would begin with a "ramp up" phase to increase initial avoidance and limit any potential effects. Although fish may temporarily avoid the area, it is predicted that they would not be displaced from important habitats or disrupted during key activities over extended areas or periods. Immobile species or life stages may experience injury and mortality but these effects would be localized.

Certain fish species that could be affected by the Project are of particular importance to Indigenous groups and are used or have been historically used by these groups for traditional purposes, in particular Atlantic Salmon. During the EA, Indigenous groups and the proponent provided information on Atlantic Salmon and its potential interaction with the Project. The Agency notes that DFO reviewed available information and confirmed the uncertainty regarding the at-sea migration patterns and habitat use of Atlantic Salmon. Given the potential for some Atlantic Salmon to occur in areas that overlap with the Project, effects on the species could occur. DFO has advised that potential effects of the Project are expected to be negligible to low and spatially and temporally limited. This prediction is made with a moderate level of certainty given uncertainties about Atlantic Salmon distributions and reasons for population declines. Based on advice from DFO and the C-NLOPB, the Agency also determined that restricting drilling activities during certain times of year was not warranted and would unnecessarily limit the timing of proponent's drilling activities.

Given the uncertainty about Atlantic Salmon and the importance of the species to Indigenous groups, the proponent has indicated it would contribute to research on salmon migration in the project area, perhaps as a collaborative effort or as part of a regional initiative. Additional research on the presence, migration and distribution of Atlantic Salmon may be supported through the ESRF, an initiative funded through levies on frontier lands[5] paid by interest holders such as oil and gas companies. The ESRF is directed by a joint government/industry/public management board and administered by a secretariat which resides in NRCan. The Agency notes that, to address knowledge gaps regarding Atlantic Salmon migration identified during this and other EAs of exploration projects in offshore Newfoundland and Labrador, in May 2019 the ESRF issued a call for proposals for Environmental and Social Studies related to Atlantic Salmon.

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent (Appendix B), expert advice from federal authorities and comments from Indigenous groups and the public, and identified the following key measures to mitigate the Project's effects on fish and fish habitat:

- prepare a pre-drill seabed investigation plan for each well site and submit to DFO and the C-NLOPB for review and approval prior to implementing the survey. The plan should be designed to:
    - collect high-definition visual data to confirm the presence or absence of sensitive environmental features, including aggregations of habitat-forming corals or sponges;
    - identify the equipment used for the surveys, to be operated by a qualified individual; and

[5] Frontier lands are defined as those areas where Canada has the right to dispose of or exploit the natural resources, are situated in the offshore areas of Canada's east and west coasts and the areas north of 60 degrees latitude (ESRF 2016).

  - include information on survey transect length and pattern around each well site, which should be based on applicable drill cutting dispersion model results. Transects around anchor sites should extend at least 50 metres from the extent of each structure.
- based on approved plans, undertake a seabed investigation survey at each well location and around each anchor point prior to commencing drilling a well. Retain a qualified independent marine scientist to provide advice in real-time.
- provide the results of the seabed investigation survey to the C-NLOPB and DFO prior to commencing drilling. In addition, provide a description of additional mitigation and monitoring based on the results of the survey and predicted areas of sedimentation and disturbance. Results of the surveys should be provided to Indigenous groups and posted online for public access.
- if aggregations of habitat-forming corals or sponges or other environmentally sensitive features are identified when undertaking the survey:
  - relocate the anchors or the well and/or redirect cuttings discharges to ensure that the drilling installation, anchors or drill muds and cuttings discharges will not affect them, unless not technically feasible. No drilling should occur before a decision is made by the C-NLOPB and DFO regarding appropriate mitigation and monitoring; or
  - if it is determined, to the C-NLOPB's satisfaction, that it is not technically feasible to relocate the anchors or the well or redirect cuttings discharges, conduct a comprehensive assessment of the potentially-affected benthic habitat in consultation with DFO prior to drilling to determine the potential for non-compliance with the fish and fish habitat protection provisions of the *Fisheries Act* and related options for mitigation to reduce any identified risk.
- select chemicals to be used during the Project in accordance with the *Offshore Chemical Selection Guidelines* and use lower toxicity drilling muds and biodegradable and environmentally-friendly additives within muds and cements, where feasible;
- ensure that all discharges from the MODU meet the *Offshore Waste Treatment Guidelines*;
- transport spent or excess synthetic-based muds that cannot be re-used during drilling operations to shore for disposal at an approved facility;
- ensure that all discharges from supply vessels meet or exceed the standards established in the MARPOL;
- conduct a pre-drill survey with qualified individual(s) at each well site to determine the presence of any unexploded ordnance or other seabed hazards. If any such ordnance or seabed hazard is detected, avoid disturbing or manipulating it and contact the nearest Joint Rescue Coordination Centre and the C-NLOPB prior to commencing drilling to determine an appropriate course of action; and
- implement mitigation listed in Section 6.2 Marine Mammals and Sea Turtles related to the conduct of VSP surveys.

Follow-up

The Agency identified the following measures as part of a follow-up program, to be developed in consultation with the C-NLOPB and DFO, to ensure the effectiveness of mitigation measures and to verify the accuracy of predictions of effects on fish and fish habitat:

- monitor the concentration of synthetic-based muds on drill cuttings to verify that the discharge meets, at a minimum, the performance target specified in the *Offshore Waste Treatment Guidelines*. Report results to the C-NLOPB;

- for the first well on each exploration licence and for any well where drilling is undertaken in an area determined by the seabed investigation survey to be sensitive benthic habitat, conduct specific follow-up monitoring, including:
    - measurement of sediment deposition extent and thickness (e.g., core samples and/or high definition visual data) post-drilling and prior to departing the location to verify drill cuttings dispersion modelling predictions;
    - survey of benthic fauna present after drilling has been concluded;
    - reporting of results, including a comparison of modelling results to in situ results, to the C-NLOPB and DFO; and
    - results should be provided to Indigenous groups and posted online for public access;
- participate in or support research on the presence and distribution of Atlantic Salmon in Eastern Canadian offshore areas and update the C-NLOPB and Indigenous groups annually on research activities. Research initiatives can be explored through organizations such as the ESRF and through input from and collaboration with Indigenous groups; and
- implement the follow-up measures listed in Section 6.2 Marine Mammals and Sea Turtles related to the verification of underwater sound as a result of the Project.

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on fish and fish habitat would be low in magnitude, occur locally and occur continuously or regularly during drilling operations.

Taking into account the implementation of the mitigation measures described above, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on fish and fish habitat.

6.2. Marine Mammals and Sea Turtles

6.2.1. Proponent's Assessment of Environmental Effects

Existing Environment

The Project would take place within the Flemish Pass, which supports a diverse array of marine mammals, including various species of cetaceans and pinnipeds,[6] and sea turtles and contains important feeding and refuge areas, migratory routes, and breeding and whelping areas. Twenty-four species of marine mammals and two species of sea turtles may be found in the project area.

Several species are present in the project area year-round (e.g., Blue Whale, Northern Bottlenose Whale, Sowerby's Beaked Whale and Sperm Whale), while others are present seasonally (e.g., Humpback Whale, Fin Whale, Sei Whale and North Atlantic Right Whale). Some of these species, including the Northern Bottlenose

[6] Cetaceans are aquatic mammals commonly known as whales, dolphins, and porpoises and include mysticetes (toothless/baleen whales) and odotocetes (toothed whales). Pinnipeds are aquatic fin-footed mammals commonly known as seals, sea lions and walrus.

Whale, Blue Whale and North Atlantic Right Whale, are considered at risk (see Appendix D for a full list of species at risk that may occur in the project area or surrounding area).

Predicted Effects

The proponent predicted the following potential interactions between the Project and marine mammals and sea turtles:

- injury or behavioural effects from sound or other disturbances caused by the Project;
- injury or mortality through collisions or other interactions with offshore survey and supply vessels; and
- changes in the availability, distribution or quality of feed sources and the quality of habitats.

Key potential effects on marine mammals and sea turtles that may result from the above interactions are described below.

Risk of Mortality or Physical Injury

The proponent predicted that continuous exposure to sound over a 24-hour period from an operating drilling installation could cause auditory injury[7] in high-frequency marine mammals as far as 3.3 kilometres from the source and as far as 230 metres from the source for other marine mammal hearing groups. They stated that this is not expected to occur because it is unlikely that marine mammals and sea turtles would approach or remain in areas of intense underwater sound.

Impulsive sound, such as that emitted by VSP surveys, could also affect hearing in marine mammals and sea turtles. The proponent estimated exposure to reoccurring, impulsive sound from a VSP survey over a 24 hour period could cause auditory injury in low-frequency hearing group cetaceans at distances of up to 9.66 kilometres from a VSP sound source and up to 380 metres for other marine mammal hearing groups. However, distances from the VSP sound source at which peak pressure levels (i.e., the maximum instantaneous sound pressure level) could result in injury to marine mammals would not likely extend beyond 120 metres. Thresholds for auditory injury for sea turtles have not been identified; however, it is assumed that these thresholds would not exceed those identified for cetaceans.

Explosives would not be used during wellhead abandonment. Cutting of wellheads would be infrequent, localized and of short-term duration and a mechanical cutter is not is expected to produce underwater sound of an intensity or extent to present a risk of mortality or injury.

The proponent stated that marine mammals and sea turtles could be injured or killed if struck by a project vessel and that mysticetes (baleen whales) would be the most vulnerable to vessel collisions. In particular, North Atlantic Right Whales (endangered under the *Species at Risk Act*), Fin Whales (special concern under the *Species at Risk Act*) and Humpback Whales are especially vulnerable to vessel strikes. The North Atlantic Right Whale has low potential for occurrence in the project area, and Fin Whales and Humpback Whales both have high potential for occurrence. The proponent anticipates that the Project would result in a negligible increase in the number of vessel transits over existing levels and estimates two to three project vessel return transits per

[7] The proponent indicated that it used both the US National Oceanic and Atmospheric Administration's *National Marine Fisheries Service Guidelines* (NMFS) (2016) and Southall et al. (2007) to provide guidance on threshold levels of underwater sound for auditory injury in marine mammals. These both present dual metrics for hreshold values [i.e., recommend consideration of both peak sound pressure levels (SPLpeak) and cumulative (over 24 hours) sound exposure levels (SELcum)]. The proponent indicated that conclusions were based on whichever metric was first exceeded.

week for a single MODU. It stated that reducing vessel speed has been shown to reduce the number of marine mammal deaths and severe injuries due to vessel strikes (infrequent at speeds less than 14 knots [25.9 kilometres per hour] and rare at speeds less than 10 knots [18.5 kilometres per hour]). As standard practice, transit speeds of project vessels would be typically between 10 to 12 knots (19 to 22 kilometres per hour) and occasionally 13 to 14 knots (24 to 26 kilometres per hour).

Changes in Habitat Quality and Use

The proponent predicted that the National Oceanic and Atmospheric Administration's behavioural threshold[8] for marine mammals exposed to continuous underwater sound could be exceeded up to 56.8 kilometres from the MODU during summer based on the most conservative estimates and slightly further in the winter.[9] Behavioural disturbances may include changes in vocalizations, diving/respiration, swim speed, foraging behavior, habitat avoidance and changes in migration or movement patterns or activity state. Marine mammals rely on their ability to hear and use underwater sounds to communicate, locate prey and avoid predators, and masking could occur when underwater sound is strong enough to impair detection of these sounds that marine mammals rely on. Mysticetes vocalize primarily at lower frequencies and are therefore expected to be the most susceptible to potential masking from sound produced by the MODU.

The proponent stated that sea turtles have been shown to exhibit short-term physical, physiological and behavioural effects as a result of noise disturbances and appear to be most sensitive to low-frequency sounds such as those from a MODU. Potential effects of a MODU on a change in sea turtle habitat quality or use would generally be expected to include the same effects discussed for marine mammals.

The proponent predicted that the threshold for behavioural disturbance to marine mammals[10] could be exceeded up to 7.9 kilometres from the sound source during VSP. Overall, the proponent indicated that brief exposure to sound pulses from a single VSP survey would not be likely to result in prolonged behavioural disturbance of mysticetes (baleen whales).Odontocetes (toothed whales) generally demonstrate some level of avoidance. While limited data exists regarding behavioural responses of pinnipeds (seals, as well as sea lions and walruses) to sound sources from geophysical activities, avoidance behaviour was noted.

Numerical threshold levels for behavioural disturbance of sea turtles have not been identified; however, because they do not use acoustic sound for foraging or communication, it is thought that threshold levels are unlikely to be lower than those identified for cetaceans. The proponent described that VSP surveys could result in short-term behavioural effects in sea turtles, such as increased and erratic swimming behavior and avoidance behaviour.

Routine marine discharges could result in a temporary reduction in water quality and longer term reduction in sediment quality, which could result in adverse health effects on marine mammals and sea turtles and potential secondary effects from changes to the health, abundance and distribution of marine fish and invertebrate prey species. The proponent concluded that treated marine discharges would result in localized and temporary

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8 120 dB re 1 µPa (decibels relative to a fixed reference pressure of 1 micropascal) root mean square sound pressure level published by the National Oceanic and Atmospheric Administration.

9 $R_{max,}$ which is the maximum range at which the given sound level threshold is encountered in the model.

10 160 dB re 1 µPa root mean square sound pressure level published by the National Oceanic and Atmospheric Administration.

reduction in water and sediment quality but would be unlikely to introduce heavy metals in concentrations harmful to marine mammals and sea turtles. In addition, secondary effects would be expected to be minimal because marine mammals that regularly occur in the local study area are not known to feed on benthos.

6.2.2. Views Expressed

Federal Authorities

DFO indicated that it did not have any significant concerns with the effects of the Project on marine mammals and sea turtles based on the relatively short duration of noise disturbance, the commitment to adhere to the *Statement of Canadian Practice with Respect to the Mitigation of Geophysical Sound in the Marine Environment* and because there is no critical habitat for marine mammal species at risk in the project area. It advised the Agency that the mitigation measures, monitoring commitments and follow-up programs proposed by the proponent and recommended by the Agency would adequately address the potential effects of the Project on marine mammals and sea turtles.

Indigenous Peoples

KMKNO and MMS recommended that the proponent use passive acoustic monitoring[11] or equivalent technology to detect marine mammals in the vicinity of the Project given the limitations of visual observation particularly in case of low visibility (e.g., fog, nighttime). The proponent responded that sound from VSP surveys would create a relatively small radius within which injury threshold values could be exceeded and the ramp up procedure would utilize a very small air gun, which would promote temporary avoidance of the area by mobile species and help to reduce species' exposure to sound above threshold values. Trained observers would conduct visual monitoring to detect marine mammals and sea turtles within a safety zone during VSP surveys and a pre-ramp up watch prior to the start-up of operation of air source arrays. The proponent did not plan using other monitoring measures such as passive acoustic monitoring.

MMS and MTI asked how seismic levels will be kept at a minimum level during VSP. The proponent responded that the minimum sound level would be that at which optimal data could be collected and is based on the individual well in question, the geological target, discussion with the contractor and the C-NLOPB and objectives/requirements associated with the survey. No additional sound reduction is planned by the proponent beyond keeping the seismic sound level at the minimum level possible for successful completion of the program.

KMKNO asked about the feasibility of extending the safety zone during VSP to a radius of one kilometre around the MODU given the number, status and sensitivity of species likely to be present in the area. The proponent responded that extending the safety zone would be challenging particularly during adverse weather that can cause challenges in reliably scanning the area. In addition, marine mammal observers would not be able to reliably identify species from the MODU beyond approximately 500 metres. The proponent stated that VSP surveys are of short duration and would limit starting them during periods of limited visibility.

Multiple Indigenous groups commented on the mitigation measures proposed by the proponent. KMKNO advised that vessels should be required to reduce speeds (ten knot limit) when not in existing shipping lanes or whenever a marine mammal or sea turtle is observed or reported in the vicinity of a vessel. It also recommended

[11] Passive Acoustic Monitoring: means a technology that may be used to detect the subsea presence of vocalizing cetaceans (DFO, 2007).

that the vessel traffic route link with existing shipping lanes at the earliest practicable opportunity. The proponent stated that the offshore Newfoundland area does not have prescribed speed limits or shipping lanes. Speed would be set based on environmental conditions (e.g., wind, waves), planned travel distances and awareness of other shipping traffic, and the proponent would follow operational best practices. If marine mammals and/or sea turtles are observed in close proximity to project activities, the speed or direction of the relevant vessel could be adjusted to reduce potential effects.

MTI suggested that additional mitigation measures be considered to reduce the effects of drilling activities on marine mammals (e.g., avoidance of drilling when North Atlantic Right Whales are more likely to be present [early May to mid-October]; drilling be put on hold if North Atlantic Right Whales were to be observed in close proximity to the MODU). The proponent stated that it would have an environmental protection plan that includes having an environmental observer onboard the drilling unit and that observations for marine mammals and sea turtles would be conducted during offshore activities including VSP.

MMS, Nutashkuan and MTI emphasized the importance of follow-up programs to ensure the effectiveness of mitigation measures on marine mammals, and marine species in general, and noted that the proponent did not confirm whether it intends to implement a follow-up program to verify sound predictions and effects on marine species. The proponent referenced the results of a recent study offshore eastern Newfoundland, which indicated that average sound pressure levels were below the behavioural disturbance threshold for marine mammals at 35 kilometres from the Hibernia platform. Based on recent studies, the proponent responded that uncertainty associated with predicted sound levels is low, the potential for adverse environmental effects is low and confidence in effects predictions and the effectiveness of mitigation is moderate to high. It stated that no specific follow-up related to underwater sound and related effects is planned.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Agency did not receive comments from the public regarding the potential effects of the Project on marine mammals and sea turtles.

6.2.3. Agency Analysis and Conclusion

Analysis of Effects

The Project may adversely affect marine mammals and sea turtles, including species at risk. Several species of marine mammals and sea turtles could be present year-round in the project area, including in the proponent's exploration licences, while others may be present in higher abundance during summer and fall.

Potential interactions include sound from the drilling units or VSP surveys: sound emissions may potentially result in injury or mortality to marine mammals and sea turtles or affect the quality and use of their habitats. Notably, the acoustic environment is of importance to marine mammals as many species emit sound and rely, in part, on their acoustic sense for communication, social interaction, navigation, foraging and predator avoidance. The Project could result in exceedances of thresholds for both auditory injury (as far as 3.3 kilometres from an operating MODU or 9.66 kilometres from the VSP sound source) and behavioural effects (as far as 56.8 kilometres in the summer and slightly further in the winter) in marine mammals. However, auditory injury would require continuous exposure over a 24-hour period and it is not expected that marine mammals would remain in areas that could cause permanent auditory injury.

Although DFO is generally supportive of the proponent's analysis related to marine mammals and sea turtles, it advised that there is uncertainty with respect to predictions related to the extent of sound emissions from drilling units. Given this uncertainty, DFO has advised that it supports that the proponent would be required to verify sound predictions from the drilling unit.

To mitigate the effects of sound emissions from VSP activities, the proponent would follow the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment*. Importantly, the proponent would be required to develop a Marine Mammal and Sea Turtle Monitoring Plan and provide it to DFO for review. The proponent would be required to report the findings of monitoring to government and Indigenous groups.

The Agency notes that the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* requires the use of cetacean detection technology under certain circumstances and conditions. It states that passive acoustic monitoring or equivalent technology must be used if the full extent of a safety zone is not visible or if a survey is in an area where vocalizing cetaceans listed as endangered or threatened in Schedule 1 of the *Species at Risk Act* are likely to be encountered. The Agency notes that the eastern Newfoundland offshore area is known to be foggy and to encounter rough sea states, which could hinder visibility and that species at risk, such as Northern Bottlenose Whales, have potential to occur in the project area. Based on these considerations, DFO has advised that it supports that the proponent be required to use passive acoustic monitoring or equivalent technology, noting that marine mammal species of concern for detection by this technology would include baleen whales (e.g., Blue Whale, Fin Whale, North Atlantic Right Whale), as well as beaked whales (e.g., Northern Bottlenose Whale, Sowerby's Beaked Whale), which may be detected but would be difficult to differentiate by species.

With respect to the size of the safety zone for marine mammal and sea turtle observations during VSP, the Agency notes the request from KMKNO to extend the zone beyond the 500-metre minimum required in the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment*. DFO has advised that the peak threshold for auditory injury would not likely extend beyond 120 metres from the source (based on the proponent's modelling). Thresholds for auditory injury for 24 hours of sound exposure would be reached at greater distances; however, marine mammals and sea turtles would be expected to move away within a 24-hour period. As such, and given that there is no designated critical habitat within the zone of influence for project-related underwater sound from VSP, DFO has recommended the standard 500-metre minimum safety zone for this project. However, it also advised that as a precautionary measure, it would support extending the requirement for immediate shut-down of air source array(s) to include the observation of any marine mammal or sea turtle species within the 500-metre safety zone, as opposed to the minimum requirement of shut-down if a species at risk is sighted.

Marine mammals and sea turtles may be struck by project vessels, resulting in injury or mortality. Specifically, in recent years a number of North Atlantic Right Whale deaths have been reported in the Gulf of St. Lawrence. The incident reports for these deaths suggested trauma from vessel collisions as one of the causes. Although there have been no incidents reported off eastern Newfoundland, the Project may contribute to an increased chance of collisions with species susceptible to strikes. DFO has advised that the Fin Whale, which is regionally abundant and listed as special concern by the *Species at Risk Act*, is the most frequently ship-struck whale species in the world. Other species susceptible to ship strike include the Humpback Whale, which is also regionally abundant, and the endangered North Atlantic Right Whale, for which there is some uncertainty about migration routes and potential presence in the eastern Newfoundland offshore. Following consultation with DFO, the Agency is of the opinion that the slight increase in vessel traffic due to the Project would be unlikely to

substantially increase the probability of collisions. As a precautionary measure, the proponent would be required to limit vessel speeds when a whale or sea turtle is observed or reported in the vicinity of a vessel. DFO has advised that it would support the requirement for vessel speed to be reduced to 7 knots (approximately 13 kilometres per hour) when within 400 metres of a marine mammal or sea turtle.

The proponent should determine whether modified or additional mitigation measures are required based on the results of their monitoring programs, including those listed above. Additional mitigation could also be prescribed by DFO should it be determined that the proponent require a permit under the *Species at Risk Act.*

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent (Appendix B), expert advice from federal authorities and comments from Indigenous groups and the public and identified the following key measures to mitigate the Project's effects on marine mammals and sea turtles:

- conduct VSP surveys in accordance with or exceeding the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment*, including:
    - establishing a safety (observation) zone of a minimum of 500 metres around the sound source;
    - implementing cetacean detection technology, such as passive acoustic monitoring, concurrent with visual observations;
    - gradually increasing the sound source intensity over a period of at least 20 minutes (ramp up), adopting a pre-ramp up watch of 30 minutes whenever survey activities are scheduled to occur and delaying ramp up if a marine mammal or sea turtle is sighted within the safety zone; and
    - shutting down the sound source upon observing or detecting any marine mammal or sea turtle within the 500-metre safety zone.
- to reduce risks of collisions with marine mammals and sea turtles (except during an emergency):
    - limit supply vessels movement to established shipping lanes where they are available; and
    - when and where such speeds do not present a risk to safety of navigation, reduce supply vessel speed to seven knots (13 kilometres per hour) when a marine mammal or sea turtle is observed or reported within 400 metres of the vessel.
- in consultation with DFO, develop a Marine Mammal and Sea Turtle Monitoring Plan which includes marine mammal observer requirements using qualified individuals. Provide the plan to the C-NLOPB and DFO for review and approval 30 days prior to initiating activities. The plan would describe:
    - monitoring during VSP, including information on visual monitoring and specific passive acoustic or equivalent technology monitoring configuration that would be implemented, to enable verification that species that may occur within the safety zone can be detected and to ensure the ability to effectively monitor for all marine mammal vocalization frequencies that may occur within the exploration licences.
- implement all mitigation listed in Section 6.1 Fish and Fish Habitat related to abandonment procedures, chemical selection, disposal of spent synthetic-based muds and waste discharge.

Follow-up

The Agency identified the following measures as part of a follow-up program to ensure the effectiveness of mitigation measures and to verify the accuracy of predictions of effects on marine mammals and sea turtles:

- record and report the activities, observations and results of the Marine Mammal and Sea Turtle Monitoring Plan to the C-NLOPB and DFO;
- promptly report any collisions with marine mammals or sea turtles to the C-NLOPB, DFO and the Canadian Coast Guard Environmental Emergencies Reporting Number (1 800 565-1633) and notify Indigenous groups;
- verify predicted underwater sound levels with field measurements during the first well per exploration licence. Provide the plan on how this would be conducted to the C-NLOPB and DFO in advance of drilling and the monitoring results after well suspension or abandonment, as directed by C-NLOPB and DFO; and
- provide follow-up program results to Indigenous groups and post online for public access.

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on marine mammals and sea turtles would be negligible to medium in magnitude and would occur locally, within the project area, local study area or regional study area. The effects could be both sporadic (e.g., effects from VSP surveys or from vessel collision) or regular (e.g., effects from drilling noise) for the duration of the activity but would cease upon well abandonment.

Taking into account the implementation of the mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on marine mammals and sea turtles.

6.3. Migratory Birds

6.3.1. Proponent's Assessment of Environmental Effects

Existing Environment

Seabirds (e.g., cormorants, gannets, phalaropes, gulls, terns and tubenoses [fulmars, petrels and shearwaters]) are the group of marine-associated birds most likely to be found in the project area. Waterfowl, divers, shorebirds and migratory and/or coastal-associated landbirds may also be found in the project area; however, most of these species tend to prefer coastal habitats and are unlikely to occur frequently in the offshore.

Several bird species at risk have been identified as potentially occurring in the regional study area, including the Ivory Gull and the Red-necked Phalarope (see Appendix D for a list of species at risk potentially occurring in the project area). The proponent also considered the presence of and effects on avian species listed on the International Union for the Conservation of Nature Red List of Threatened Species (e.g., Bermuda Petrel, White-tailed Tropicbird).

Predicted Effects

The proponent predicted the following potential interactions between the Project and migratory birds:

- possible injury or mortality from attraction of birds to MODUs and vessels;
- injury or behavioural effects on birds (particularly diving birds) from exposure to sound within the water column;
- changes in the presence, abundance, distribution and/or health of birds from exposure to discharges from MODUs or vessels; and
- indirect effects due to changes in the availability, distribution and/or quality of food or habitats from disturbances and/or discharges described above.

Key potential effects on migratory birds that may result from the above interactions are described below.

Risk of Mortality or Physical Injury Caused by Attraction to the Mobile Offshore Drilling Unit and Vessels

Migratory birds are known to be attracted to light emissions, including lighting and flares from offshore MODUs, which may result in mortality or injury through collisions or disorientation. Disoriented birds may fly continuously around lights, depleting energy resources, delaying foraging or migration and potentially increasing their susceptibility to predation. Attraction and the resultant effects may be especially pronounced during migration periods and at night or during periods of fog or reduced visibility. There is uncertainty with respect to attraction distances to lighting and flares. Attraction has been demonstrated at distances of less than two kilometres from gas flares and up to five kilometres from production facility lighting; however, attraction from distances much greater than five kilometres cannot be ruled out and up to 16 kilometres away has been stated in some studies.

Leach's Storm-petrels are particularly vulnerable to light attraction and are known to make foraging trips of thousands of kilometres from nest sites during the breeding season. This is the species that is most frequently found stranded on platforms and vessels in and near the regional study area, with the vast majority of strandings occurring in September and October. However, stranded birds are often successfully released.

Potential effects from supply vessel or helicopter lighting were predicted to be similar to those from lighting on the MODU; however, since project vessels are not stationary, light disturbance would be transient and extend across a wider area along the transit route, including areas close to shore, which increases potential for attraction of coastal or land-based bird species. Any disturbance would be transient and short-term and the amount of project-related traffic is generally in keeping with the overall marine traffic that has occurred throughout the region for years and would utilize established routes wherever possible.

Changes in Health or Habitat Quality from Drilling Wastes and Other Discharges and Emissions

The treated discharge of some operational wastes may cause surface sheening, typically under calm conditions. Small amounts of oil from sheens have been shown to affect the structure and function of seabird feathers resulting in loss of buoyancy and hypothermia. Drilling wastes (e.g., cement, water- and synthetic-based muds and cuttings) would be released either at the seafloor or below the surface of the water and would not likely have any effect on birds.

Discharge, including organic wastes, could also potentially attract birds, which may increase the risk of predation, collision and exposure to contaminants or change preferred feeding areas; however, any effect would be short- to medium-term and localized and the implementation of appropriate waste disposal practices would reduce these effects.

Birds could also be displaced from habitat or otherwise disturbed as a result of other project activities, such as noise from the operation of the MODU, VSP surveys and vessel and helicopter transits. These effects are anticipated to be low or negligible in magnitude, localized and short to medium-term.

6.3.2. Views Expressed

Federal Authorities

ECCC provided information on Leach's Storm-petrel and advised that drilling operations emit considerable amounts of light and would be detectable to birds in the area, especially Leach's Storm-petrel. In particular, it raised concern regarding the presence of a new source of artificial lighting along the foraging flight path for Leach's Storm-petrel and other nocturnal seabirds. With respect to potential cumulative impacts on this species, it disagreed with the proponent's assessment methods and advised that, although the likely zone of influence of light from the Project does not overlap with the zone of influence of light from existing production platforms, the Project would create a source of light in an otherwise dark part of the North Atlantic and it would contribute to the cumulative impact of light attraction in the offshore environment as a whole.

ECCC raised concerns regarding potential mass mortality events during flaring and recommended mitigation measures. It advised that the proponent's analysis did not fully consider the episodic nature of these events and that there was limited discussion of mitigation. The proponent responded that mass mortality incidents appear to be very rare and that no mass mortality events have ever been reported at oil and gas operations offshore Newfoundland and Labrador. Nonetheless, the proponent committed to keeping flaring to the minimum amount necessary, use high efficiency burners and use water curtains. It would also conduct routine monitoring to maintain records of bird mortality to enable identification of potential issues related to flares and other lighted structures, and implement further mitigation measures if necessary and in consultation with the C-NLOPB.

ECCC advised that until an adequate estimate of strandings and mortality at offshore infrastructure is obtained, there is uncertainty as to the level of effect on migratory birds. It also provided advice and guidance on the monitoring and follow-up measures that should be implemented. The proponent acknowledged that there is only a moderate degree of certainty about the magnitude of effects from flaring and project lighting on migratory birds and committed to developing a comprehensive and scientifically rigorous program for systematic searches for stranded birds. The proponent committed to having an environmental observer trained by ECCC conduct searches daily and carefully document the search effort.

ECCC advised the Agency that the mitigation measures, monitoring and follow-up programs proposed by the proponent and recommended by the Agency would adequately address the potential effects of the Project on migratory birds.

Indigenous Peoples

Several Indigenous communities, including the NunatuKavut Community Council, MTI and KMKNO, commented on the potential effects of the Project on birds, including: effects on migration patterns and behaviour; effects on habitat from exposure to oil and other discharges and emissions; and interactions with other project components and activities.

The NunatuKavut Community Council and KMKNO expressed concern about the potential effects of flaring on birds, recommending that if there is an alternative to flaring with less environmental effect then it should be used. The proponent considered alternatives to well flow testing with flaring and has left open the possibility of using alternative well testing technology such as using a drill pipe conveyed test assembly which would eliminate the need to flare (see Section 3.2). However, several factors would need to be considered to determine if an alternative testing technology is suitable, including the properties of the reservoir, the data to be

collected, C-NLOPB requirements, the suitability of the alternative technology to complete the test, the availability of the technology, and the economic viability. The C-NLOPB would ultimately determine the required methods of well testing to validate the presence of hydrocarbons. The C-NLOPB advised that using a drill pipe conveyed test assembly or other alternative formation testing technology may be possible depending on site-specific conditions and data requirements.

MTI commented on follow-up and monitoring measures proposed for birds; recommending additions, including onsite observers and use of automated sensors on platforms to reduce uncertainty about seabird attraction to platforms, mortality events and chronic spills and discharges. The proponent confirmed that an environmental observer responsible for wildlife observation and reporting would be present on the MODU and would undertake marine bird observations in accordance with ECCC's monitoring protocols and with the seabird handling permit. The proponent also considered the feasibility of incorporating technology such as radar and thermal imaging into bird monitoring but stated that given the short-term and transient nature of the Project and the fact that visual observation would already be used, these technologies are not economically or technically feasible. Given the limitations of these technologies and uncertainty of the accuracy of the collected data in offshore applications, there would be a need to compare the remotely observed data with document visual observations.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Agency did not receive comments from the public regarding the potential effects of the Project on migratory birds.

6.3.3. Agency Analysis and Conclusion

Analysis of Effects

Although lighting and flaring from the Project would have the potential to affect migratory birds, the limited spatial and temporal nature of the Project would limit the potential for extensive effects on migratory birds in general. Nevertheless, the impact of creating a lit area in a previously dark area could result in adverse effects on sensitive nocturnal species such as the Leach's Storm-petrel or for those whose foraging paths overlap with the project area.

The effect of project lighting or flaring on migratory birds may be different across the regional study area. In portions of the regional study area that already experience higher levels of human activity, such as the southwestern portion where there are existing production platforms, existing sources of artificial lighting are more numerous. However, the Project would be located in a previously undisturbed area of the regional study area with few sources of artificial lighting. Introducing a new source of artificial lighting in a darker portion of the regional study area may have a comparatively larger direct effect on migratory birds than introducing an additional source of artificial lighting to an area with a large amount of existing artificial lighting. Nonetheless, the Project may also increase the cumulative effects of lighting on migratory birds by increasing the cumulative artificial lighting footprint of the offshore environment as a whole.

Bird collisions with lit structures are a known problem, particularly for nocturnal migrants and night-flying seabirds. This problem is of particular concern for Leach's Storm-petrel, which travels thousands of kilometres to foraging areas far offshore, including the project area, and which for which the project lighting would be detectable, regardless of other light sources in the area. Declines in the populations of Leach's Storm-petrel

have also been partially attributed to collisions and strandings and contact with hydrocarbons. The Agency agrees with ECCC that the effects of the Project on birds, and this species in particular, would not necessarily be of low magnitude and the effects predictions cannot be made with a high level of certainty. Attraction to lights may also result in disorientation. Disoriented birds are prone to circling a light source and may deplete their energy reserves, delay foraging or migration and potentially increase susceptibility to predation. To address ECCC's concern related to uncertainty around estimates of strandings and mortality, the proponent would be required to conduct systematic searches for stranded birds on the MODU and supply vessels and to have trained observers on MODUs to observe and report on marine bird presence. Based on these monitoring results and in consultation with relevant authorities, the proponent would then determine if mitigation measures are effective and if additional mitigation measures are required.

Flaring could also have an effect on birds and alternatives should be considered. Alternative formation testing technology, such as using a drill pipe conveyed test assembly could eliminate the requirement to flare. The C-NLOPB advised that use of a drill pipe conveyed test assembly may be possible depending on site-specific conditions and data requirements, and the proponent would be required to use such a method for well flow testing where acceptable to the C-NLOPB. However, if flaring is proposed, the C-NLOPB's *Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area* require the proponent to notify the C-NLOPB of plans to flare including measures to avoid potential effects on migratory birds. Prior to authorizing the flaring, the C-NLOPB would consult with ECCC on the plans and appropriateness of proposed mitigation measures, which may include delaying or altering the timing of the flaring activity.

The Agency notes that the proponent would deploy water curtains during flaring operations to protect the MODU from the generated heat. Water curtains have been required for exploratory drilling projects in offshore Nova Scotia and Newfoundland and Labrador. Although the effectiveness of water curtains in mitigating potential effects from flaring on migratory birds is not fully known, the Agency is of the view that such measures would provide an overall net benefit and would likely keep some birds away from the flare. The proponent would also be required to develop a follow-up program which would include documenting and reporting information on whether the mitigation measures, including the water curtain, were proven effective.

The Agency is of the view that there remain uncertainties regarding the potential effects of project lighting and flaring on migratory birds, including the attraction distance to lighting and flares as well as mortality rates from collisions and strandings and the magnitude of associated effects. Despite these uncertainties and the potential for cumulative effects, the exploration licences and the drilling area itself occupy a small portion of the ranges of migratory bird species, many of which span vast portions of the Northwest Atlantic Ocean. There is no critical habitat identified within the proponent's exploration licences and the Agency notes that key western Atlantic migration routes and flyways are generally closer to the coast than further offshore where the Project would take place. In addition, drilling, evaluation and abandonment or suspension of each well would take approximately 45 to 160 days, limiting the duration of the potential effects. Nevertheless, it is possible that migratory birds, including species at risk, could encounter and be harmed by the Project; therefore, it is important for the proponent to implement mitigation and verify their predictions.

In addition to the effects of project lighting and flaring, drilling wastes and other discharges and emissions may effect migratory birds. For example, the treated discharge of some operational wastes may cause surface sheening under calm conditions and may affect the structure and function of seabird feathers. Wastes would be treated in accordance with the *Offshore Waste Treatment Guidelines* and discharged below the water surface, limiting the effects on surface water quality in the immediate area of the discharge. With proper management of

waste discharge, the likelihood of exposure to surface sheens by marine and migratory birds and any related effects would be low.

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent (Appendix B), expert advice from federal authorities and comments from Indigenous groups and the public, and identified the following key measures to mitigate the Project's effects on migratory birds:

- follow ECCC's (2016) Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada, which identifies procedures for safe capture and handling of different types of birds;
- control project lighting, including the direction, timing, intensity and glare of light fixtures, while meeting operational, health and safety requirements;
- restrict flaring to the minimum required to characterize a well's hydrocarbon potential and as necessary for the safety of the operation;
- where acceptable to the C-NLOPB, conduct formation testing using a drill pipe conveyed test assembly or similar technology rather than formation testing with flaring;
- if formation testing while flaring is required, notify the C-NLOPB to request an authorization at least 30 days in advance of flaring to:
    - determine whether the flaring would occur during a period of migratory bird vulnerability (identified in consultation with ECCC); and
    - identify how adverse environmental effects on migratory birds would be avoided, including opportunities to reduce nighttime flaring (e.g., by starting flaring for shorter periods in the morning as opposed to at night);
- operate a water-curtain barrier around the flare during flaring; and
- implement all mitigation listed in Section 6.1 Fish and Fish Habitat related to chemical selection, waste discharge and the disposal of spent synthetic-based muds, as well as those in Section 6.4 Special Areas related to the maintenance of buffers for supply and support vessels and helicopters over active bird areas and special areas for birds.

Follow-up

The Agency identified the following measures as part of a follow-up program to ensure the effectiveness of mitigation measures and to verify the accuracy of predictions of effects on migratory birds:

- prepare a follow-up program in consultation with ECCC to monitor effects on migratory birds to verify the accuracy of the predictions made during the EA and to determine the effectiveness of the mitigation measures. As part of the follow-up program:
    - conduct monitoring for marine birds from the MODU using a trained observer following ECCC's Eastern Canada Seabirds at Sea Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms;
    - develop, in consultation with ECCC, and implement a protocol for systematic daily monitoring of the MODU and supply vessels for the presence of stranded birds. The protocol would include information on the frequency of searches, reporting procedures and training requirements, including qualifications of those delivering the training;

- if stranded birds are observed, follow ECCC's (2016) Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada;
- document and report the results of any monitoring carried out, including information on the level of effort when no birds are found and a discussion of whether the mitigation measures (e.g., water curtain) were proven effective and if additional measures are required; and
- provide the monitoring and follow-up program and its results to the C-NLOPB and ECCC. Results should be provided to Indigenous groups and posted online for public access.

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on migratory birds would generally be low in magnitude but could be moderate for certain species, such as Leach's Storm-petrel. Residual adverse effects would either be localized within the immediate vicinity of the project activity or component or could extend several kilometres for effects such as those from light emissions. The effects would be short term to medium term for the presence and operation of the MODU and would occur regularly or intermittently for the duration of the Project but would cease upon well abandonment.

Taking into account the implementation of the mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on migratory birds.

6.4. Special Areas

6.4.1. Proponent's Assessment of Environmental Effects

Existing Environment

Special areas (designated because of ecologically or biologically sensitive features) which overlap with the proponent's exploration licences and/or the potential transit route, as well as those within the zone of influence, are listed in Table 4.[12] The zone of influence is defined as a 57-kilometre buffer around the exploration licences and represents the predicted maximum distance at which behavioural effects on marine mammals related to underwater sound may occur. This zone of influence is inclusive of the zones of influence for light (16 kilometres) and drill cuttings dispersion (700 metres by 260 metres maximum area with sediment thickness over 1.5 millimetres). A common defining feature of several of these special areas is the presence of important benthic habitats such as sponge and coral grounds, which are particularly sensitive because of their high biological activity and slow recovery rates. Other special areas include marine habitats for bird, fish, mammal and sea turtle species. Appendix E lists all special areas in the regional study area.

Oil and gas exploration activities are not prohibited within the special areas that overlap with the exploration licences.

[12] Cape Spear Lighthouse and Signal Hill National Historic Sites as well as two Snow Crab Stewardship Exclusion Zones also overlap with the Project's potential transit route but are not listed in the table below because these areas are not designed because of ecologically or biologically sensitive features.

Table 4: Special Areas Within the Zone of Influence[13] of Routine Project Activities

Special Area	Distance from Closest Exploration Licence	Features of the Special Area
Ecologically and Biologically Significant Areas[1]		
Northeast Slope (3L)	54 kilometres from exploration licence 1144 and overlaps with transit route	High aggregations of Greenland Halibut and Spotted Wolfish, which congregate in spring. Concentrations of cetaceans, pinnipeds and corals.
Eastern Avalon	Overlaps with transit route	Capelin spawning beaches, waterfowl areas and fish-eating seabird colonies (Northern Fulmar, Atlantic Puffins, Razorbills, Black-legged Kittiwake, Common Murres, Thick-billed Murres) (Wells et al., 2019). Cetaceans including Killer Whales and mysticetes (Wells et al., 2019), leatherback turtles and seals feed in the area from spring to fall.
Important Bird Areas[2]		
Quidi Vidi Lake	Overlaps with transit route	Important daytime resting site for gulls. Waterfowl are common in winter.
Newfoundland and Labrador Shelves Bioregion Significant Benthic Areas[3]		
Large Gorgonian Corals	Overlaps with transit route	High predicted presence probability for significant concentration of large gorgonian corals.
United Nations Convention on Biological Diversity Ecologically and Biologically Significant Areas[4]		
Slopes of the Flemish Cap and Grand Banks	Overlaps with exploration licences 1144 and 1150 and transit route	Includes NAFO closures to protect corals and sponges and a component of Greenland Halibut fishery grounds in international waters. Contains a high diversity of marine taxa, including threatened and listed species.
NAFO Fisheries Closure Areas[5]		
Flemish Pass /Eastern Canyon (2)	15 kilometres from exploration licence 1144	Closed to protect extensive sponge grounds and large gorgonian corals (i.e., marine fish and fish habitat).
Northwest Flemish Cap (10)	6 kilometres from exploration licences 1144 and 1150	Closed to protect high coral and sponge concentrations (e.g., crinoids, cerianthids and black corals). Includes sea pen fields, which serve as habitat structure in low-relief sand and mud. Habitats provide refuge for small planktonic and benthic invertebrates.
Northwest Flemish Cap (11)	Overlaps with exploration licence 1150	
Northwest Flemish Cap (12)	52 kilometres from exploration licence 1150	

[13] The zone of influence is defined as a 57-kilometre buffer around the exploration licences and represents represents the predicted maximum distance at which behavioural effects on marine mammals related to underwater sound may occur. This zone of influence is inclusive of the zones of influence for light (16 kilometres) and drill cuttings dispersion (700 metres by 260 metres maximum area with sediment thickness over 1.5 millimetres).

Special Area	Distance from Closest Exploration Licence	Features of the Special Area

[1] Under Canadian jurisdiction through pieces of legislation and other processes.

[2] Identified by BirdLife International under program to identify and protect critical bird habitats.

[3] Identified by DFO under its Sustainable Fisheries Framework and the policies within, including the Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas.

[4] Identified by United Nations Convention on Biological Diversity.

[5] Under mandate of the Food and Agriculture Organization of the United Nations and NAFO.

Predicted Effects

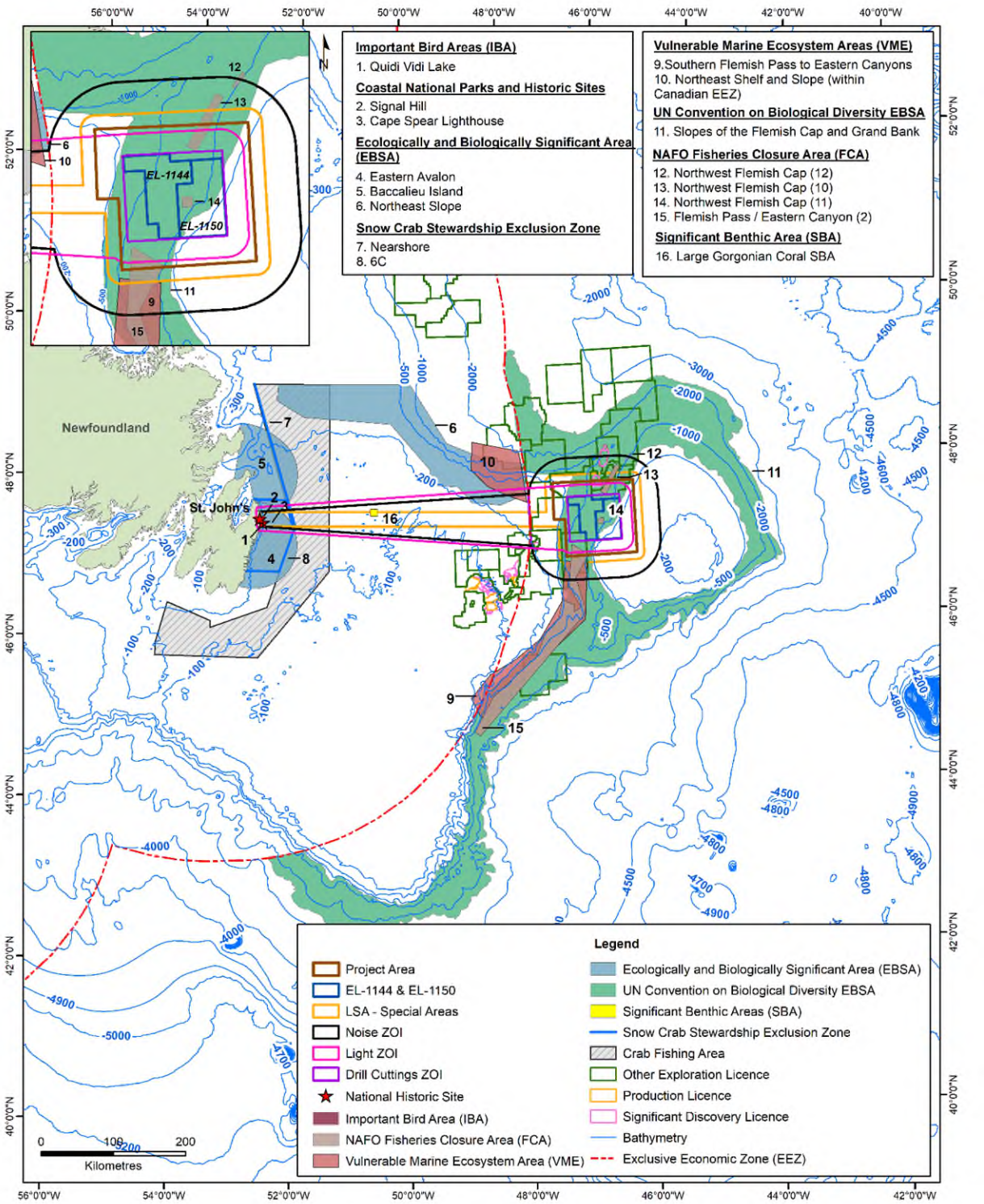
The potential environmental effects of routine project activities on special areas that overlap with the exploration licences, as well as those within the zones of influence for effects, were assessed (Figure 2).

Adverse environmental effects on a special area could degrade its ecological integrity such that it no longer protects the components of the ecosystem for which it was designated (e.g., protection of sensitive or commercially important species). The key potential environmental issues and potential environmental changes to special areas as a result of the Project are as follows:

- the general presence of project components (MODUs, vessels, other equipment) and activities in the offshore environment, including sound, light and other associated disturbances;
- possible effects on water quality and on the seabed (benthic) environment due to physical disturbance of the substrate (and associated sedimentation), the discharge and deposition of drill cuttings and fluids and other potential environmental emissions during planned activities; and
- potential changes in the presence, abundance, diversity and health of marine biota in the area due to potential injury or mortality, or possible behavioral effects. This may include temporary avoidance of areas by marine fish, birds, mammals and sea turtles due to underwater sound or other disturbances, which may alter their presence and abundance as well as disturbing movements/migration, feeding or other activities. There may also be attraction of marine fish, birds, mammals and sea turtles to MODUs and vessels, with increased potential for injury, mortality, contamination or other interactions (e.g., collisions).

Additional information on the effects of project activities within special areas on associated valued components are provided in Sections 6.1, 6.2, 6.3 and 6.6.

Figure 2: Special Areas Intersecting the Zones of Influence for Environmental Effects



Source: CNOOC Petroleum North America ULC

6.4.2. Views Expressed

Federal Authorities

DFO requested clarification on where the greatest concentration of marine mammals can be found in the regional study area. The proponent clarified that marine mammal sightings data, as presented in the EIS, is useful to show the general range of species but cannot be used to infer absolute abundance and density. It stated that the greatest concentrations of marine mammals within the regional study area tend to be found in high-use foraging areas, such as the Ecologically and Biologically Significant Areas.

DFO and ECCC advised that the mitigation measures, monitoring and follow-up programs proposed by the proponent as well as those recommended by the Agency would adequately address the potential effects of the Project on special areas.

Indigenous Peoples

Qalipu First Nation and KMKNO expressed concern about the effects of project related activities on special areas that are adjacent to or overlap with the project area, in particular with respect to sponges and corals as they are easily disturbed and slow to recover. NunatuKavut Community Council also suggested that buffer zones around protected areas should be considered as a means to reduce effects on special areas. The proponent maintained that proposed mitigation measures, including conducting pre-drill surveys and implementing setbacks, would protect special areas and species within these areas.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Fish, Food and Allied Workers Union noted that a small area of exploration licence 1150 is closed to bottom fishing and it recommended that closures intended to focus on marine conservation must restrict all marine industrial activities.

6.4.3. Agency Analysis and Conclusion

Analysis of Effects

Nine[14] special areas that have been identified because of ecologically or biologically significant features overlap with the proponent's exploration licences, the potential transit route or are within 57 kilometres of the exploration licences (i.e., the predicted zone of influence for behavioural effects on marine mammals related to sound).[15] A number of these special areas are protected, at least in part, based on the presence of sensitive benthic features, including aggregations of corals and sponges. These features could be affected by the Project, most notably from local sedimentation and burial due to discharge of drilling muds and cuttings (refer to Section 6.1 for information on how sensitive benthic features could be affected by drilling waste). The proponent predicted

[14] This number includes the three discontinuous areas which together form the larger Norwest Flemish Cap NAFO Fisheries Closure Area.

[15] Additional special areas, such as National Historic Sites and Snow Crab Stewardship Exclusion Zones, may also overlap with the Project's potential transit route but are not designated because of their ecologically or biologically significant features.

that drill cuttings deposition would exceed the most conservative no-effect threshold over a maximum area of approximately 700 metres by 260 metres around the wellhead. Benthic features within special areas that are located more than 700 metres from the exploration licences or that overlap only with the transit route are not expected to be affected by the Project.

All of exploration licence 1144 and 65 percent of exploration licence 1150 overlap with the Slopes of the Flemish Cap and Grand Banks Ecologically and Biologically Significant Area. In addition to having a high diversity of marine species and encompassing all of the current NAFO Fisheries Closure Areas designated to protect corals and sponges, this area is believed to provide a plentiful food source for Northern Bottlenose Whales and Greenland Halibut. In addition, this is the only known area in international waters of the Northwest Atlantic where sponge grounds and sea pen concentrations have been identified, including a new species of Dictyaulus sponge identified in 2013 (UN Environment, n.d.).

Exploration licences 1144 and 1150 are relatively large (combined area of approximately 3326 square kilometres) and drilled wells would result in comparatively limited footprints and zones of potential effects. Further, taken in the context of the much larger area of the Slopes of the Flemish Cap and Grand Banks Ecologically and Biologically Significant Area (approximately 88 000 square kilometres), the exploration licences cover less than four percent of this area and the potential effects of the Project within this special area would be comparatively limited.

The Northwest Flemish Cap NAFO Fisheries Closure Area (11), is entirely located with exploration licence 1150. However, this area is only a portion of the larger Northwest Flemish Cap NAFO Fisheries Closure Area, which is a special area comprised of three discontinuous smaller areas and which was designated to protect high coral and sponge concentrations. The portion located in exploration licence 1150 is only 60 square kilometres compared to the 1696 square kilometre area of exploration licence 1150; however, as noted above, the predicted maximum area of drill cuttings deposition above the most conservative no-effect threshold would not be more than 0.182 square kilometres, which represents a relatively small portion of the special area. Furthermore, the proponent would undertake seabed investigation surveys prior to drilling to determine the presence of sensitive features so that, if technically feasible, it could relocate the well and/or redirect discharges so sensitive features would not be affected.

The Agency is of the view that key mitigation measures for fish and fish habitat (Section 6.1) and marine mammals and sea turtles (Section 6.2) would also mitigate the potential effects within the Slopes of the Flemish Cap and Grand Banks Ecologically and Biologically Significant Area, the Northwest Flemish Cap (11) NAFO Fisheries Closure Area, as well other special areas which may have overlap with the project effects. The Agency notes advice from DFO that habitat-forming aggregations of corals and sponges are not limited to designated special areas and that protections for these features should not be limited to or more robust within special areas. It recommended that coral and sponge surveys and associated site-specific mitigation planning be consistently applied to ensure protection of sensitive benthic habitat at every well site, regardless of special area designation.

As outlined in Section 6.1, the proponent would be required to conduct benthic surveys prior to drilling to determine the presence of aggregations of habitat-forming corals or sponges or any other environmentally sensitive features. Should these features be identified, the proponent would be required to relocate the well and/or redirect discharges to ensure that sensitive features would not be affected, unless not technically feasible. If it is determined that it is not technically feasible to relocate the well or redirect cuttings discharges, the proponent would be required to conduct a comprehensive assessment of the benthic habitat in consultation

with DFO and the C-NLOPB prior to drilling to determine the potential for serious harm or alteration of coral and sponge aggregations and related options for mitigation to reduce any identified risks.

In addition to the mitigation measures that would be consistently applied across all areas of the exploration licences, the proponent would also be required to conduct specific follow-up monitoring when drilling in or adjacent to a special area.

Taking into account these mitigation and follow-up measures, DFO has advised that potential effects to benthic habitat, including within special areas, would likely be negligible.

Other special areas that could be affected by the Project are protected, at least in part, based on the important habitat they provide for migratory birds. For instance, Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity Areas, located within the Eastern Avalon Ecologically and Biologically Significant Area, are approximately 23 and 32 kilometres, respectively, from St. John's, the terminus of the transit route. As described in Section 6.3, helicopters and supply vessels may disrupt birds along the transit route or coastal seabird colonies. Generally, the Agency is of the view that key mitigation measures for migratory birds (Section 6.3) would also mitigate the effects on this and other special areas and the migratory birds found within. ECCC guidelines state that helicopters and other aircraft should keep well away from breeding colonies and that vessels should generally keep a minimum distance of 300 metres from colonies. ECCC further advised that the colonies of greatest concern are the coastal Important Bird and Biodiversity Areas in closest proximity to St. John's. In consideration of those guidelines and the input from ECCC, unless there is an emergency situation, the proponent would be prohibited from operating aircraft over the Witless Bay Islands Important Bird and Biodiversity Area at an altitude of less than 300 metres or motorized vessels within 20 to 100 metres of the area during the nesting season as per Newfoundland and Labrador's *Seabird Ecological Reserve Regulations, 2015*. Supply vessels would use common vessel travel routes where they exist and would not be in the immediate vicinity of either the Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity Areas.

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent (Appendix B), expert advice from federal authorities and comments from Indigenous groups and the public. The Agency expects that mitigation measures proposed for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), and migratory birds (Section 6.3) would also mitigate potential effects on special areas. The Agency identified the following additional key measures to mitigate the Project's effects on special areas:

- restrict helicopter flying altitude to a minimum altitude of 300 metres (except during take-off and landing) over active bird colonies and to a lateral distance of 1000 metres from Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity Areas (unless there is an emergency situation); and
- ensure supply and other support vessels maintain a 300-metre buffer from Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity Areas (unless there is an emergency situation).

Follow-up

The Agency identified the following measures as part of a follow-up program, to be developed in consultation with C-NLOPB and DFO, to ensure the effectiveness of mitigation measures and to verify the accuracy of predictions of effects on special areas:

- conduct specific follow-up monitoring when drilling in special areas, or adjacent to or near a special area, such that drill cuttings dispersion modelling predicts that cuttings deposition could occur within the special area at level above the biological effects threshold. Monitoring would include:
    - measurement of sediment deposition extent and thickness post-drilling and prior to departing the location to verify drill cuttings dispersion modelling predictions;
    - survey of benthic fauna present after drilling has been concluded;
    - reporting of results, including a comparison of modelling results to in situ results, to the C-NLOPB and DFO; and
    - results should be provided to Indigenous groups and posted online for public access;
- implement all mitigation listed in Section 6.1 Fish and Fish Habitat, Section 6.2 Marine Mammals and Sea Turtles, Section 6.3 Migratory Birds and Section 6.6 Commercial Fisheries.

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on special areas would be low-magnitude, occur locally and occur continuously or regularly during drilling operations but would cease upon well abandonment.

Taking into account the implementation of the mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on special areas.

6.5. Species at Risk

6.5.1. Proponent's Assessment of Environmental Effects

Several fish, marine mammal, sea turtle and bird species at risk protected by *the Species at Risk Act* or by COSEWIC have been identified as potentially occurring in the regional study area (see Appendix D for a list of species at risk potentially occurring in the eastern Newfoundland offshore area, including the project area). The proponent also considered species listed by the International Union for the Conservation of Nature. Several of these species may be found in the project area year-round, while others may be present only during certain times of year on a transient basis or be unlikely visitors. For example, many of the identified bird species at risk are shorebirds and land birds, which would not regularly be found in the project area but could be present during fall migration.

The *Species at Risk Act* requires the implementation of management plans, recovery strategies and/or action plans, depending on the category of risk, for species listed as at risk on Schedule 1 of the *Species at Risk Act.* These documents describe the potential threats to the species, habitats and actions required to ensure protection of the species. The proponent took into consideration threats identified in recovery strategies, action plans and management plans and the contribution of the Project to these threats.

The proponent stated that there is no critical habitat for fish, birds, marine mammals or sea turtles in or near the project area. Further, the proponent predicted that the type and nature of the potential effects of the Project on species at risk would be the same as those effects which were assessed in previous sections of the report (i.e., Section 6.1 Fish and Fish Habitat, Section 6.2 Marine Mammals and Sea Turtles, Section 6.3 Migratory Birds).

6.5.2. Views Expressed

Federal Authorities

ECCC and DFO provided advice and comments related to fish and fish habitat, marine mammals and sea turtles, and migratory birds, including information applicable to species at risk and their critical habitat.

DFO required additional information on potential for occurrence and Project interactions with fish species at risk, including a specific assessment of the potential effects of the Project on lumpfish, Smooth Skate (Laurentian-Scotian population), White Hake Cusk, American Plaice and Spiny Dogfish. The proponent provided further information and considered effects on these species.

DFO also required additional information on marine mammals and sea turtles at risk, including seasonal movement patterns and migration corridors, and an analysis of potential effects of the Project on Fin, Killer and Northern Bottlenose Whales and Harbour Porpoise, considering their high or moderate likelihood of occurrence in the project area. The proponent stated that the effects of project activities on these species would not differ from those discussed for marine mammals in general, including effects related to underwater noise, vessel strikes or contaminants.

DFO required the proponent to provide a description of threats identified in applicable recovery strategies and action plans, as well as the contribution of the Project to these threats. The proponent indicated that identified threats for marine mammal and sea turtle species included contaminants, anthropogenic disturbances (physical presence and noise), degradation of habitat, vessel strikes and toxic spills. The proponent noted that the potential for each of these interactions was considered in the effects assessment. The proponent also pointed out that strategies and plans for marine and/or migratory birds identified several major threats that may be associated with project activities: chronic oil pollution from oil and gas exploration and production, habitat loss and degradation (i.e., from oil or contaminant spills) and collision with anthropogenic structures.

ECCC and DFO reviewed the assessments of effects on species at risk and critical habitat provided by the proponent. The departments confirmed that the potential effects on species at risk would be the same as those effects described for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2) and migratory birds (Section 6.3), and that the information provided satisfies requirements under Subsection 79(2) of the *Species at Risk Act*. ECCC and DFO advised the Agency that the mitigation measures, monitoring and follow-up programs proposed by the proponent as well as those recommended by the Agency would adequately address the potential effects of the Project on species at risk.

Indigenous Peoples

Select comments from Indigenous groups related to marine fish (including Atlantic Salmon), marine mammals and sea turtles and migratory birds, including applicable species at risk, are included in Sections 6.1, 6.2 and 6.3. Indigenous groups provided comments on a variety of matters including: monitoring and follow-up; the reporting of injured individuals of bird species at risk; monitoring of water quality to determine potential contamination of species at risk; and whether pre-drill surveys for sensitive species would include identification of species at risk.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Agency did not receive comments from the public regarding the potential effects of the Project on species at risk.

6.5.3. Agency Analysis and Conclusion

Analysis of Effects

Federal species at risk are those that are listed in Schedule 1 of the *Species at Risk Act* as extirpated, endangered, threatened or of special concern. For this EA, and as a matter of good practice, the Agency also considered species that have been identified by COSEWIC as being endangered, threatened or of special concern. Collectively, these are referred to as species at risk for the purposes of this EA.

The Agency examined the Project's potential effects on species listed under Schedule 1 of the *Species at Risk Act* and species identified by COSEWIC (Appendix D). The Agency relied on advice and input from DFO and ECCC, which are the lead federal agencies for administering the *Species at Risk Act* within their respective areas of responsibility (i.e., aquatic species and birds). Based on this input, the Agency is in agreement with the proponent that potential effects on species at risk would be the same as those effects described for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), and migratory birds (Section 6.3).

While there is no critical habitat for any species at risk within the project area, there is proposed critical habitat for Northern and Spotted Wolffish within the regional study area. The amended *Recovery Strategy for the Northern Wolffish and Spotted Wolffish and Management Plan for Atlantic Wolffish*, published in 2018, identifies proposed critical habitats for Northern and Spotted Wolffish. Exploration licence 1144 is the nearest to the proposed critical habitat; at the closest point, it is located approximately 50 kilometres from the proposed Northern Wolffish and Spotted Wolffish critical habitats.[16] At this minimum distance from any potential well site, the proposed critical habitat is outside the predicted zones of influence for drill cuttings dispersion (i.e., a maximum of 700 metres from the well site for cuttings deposition thickness above the most conservative no-effects threshold) and noise effects on fish and fish habitat (i.e., approximately 1.2 kilometres from source for sub-lethal effects of seismic sound on zooplankton; refer to Section 6.1.2 for more information). DFO advised that any potential effects on proposed critical habitat are predicted to be negligible.

Key Mitigation Measures to Avoid Significant Effects

The Agency determined that the measures to mitigate potential effects on fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), and migratory birds (Section 6.3) would also mitigate potential effects on species at risk and critical habitat.

[16] Agency-measured, based on coordinates provided in DFO 2018b. Recovery Strategy for Northern Wolffish (Anarhichas denticulatus) and Spotted Wolffish (Anarhichas minor) and Management Plan for Atlantic Wolffish (Anarhichas lupus) in Canada [proposed]

Follow-up

The Agency determined that the proposed follow-up measures for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), and migratory birds (Section 6.3.) are also appropriate for the species at risk and proposed critical habitat identified in this section.

Agency Conclusion

Taking into account the implementation of the mitigation measures described for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), and migratory birds (Section 6.3), the Agency concludes that the Project is not likely to cause significant adverse environmental effects on federal species at risk.

6.6. Commercial Fisheries

6.6.1. Proponent's Assessment of Environmental Effects

Existing Environment

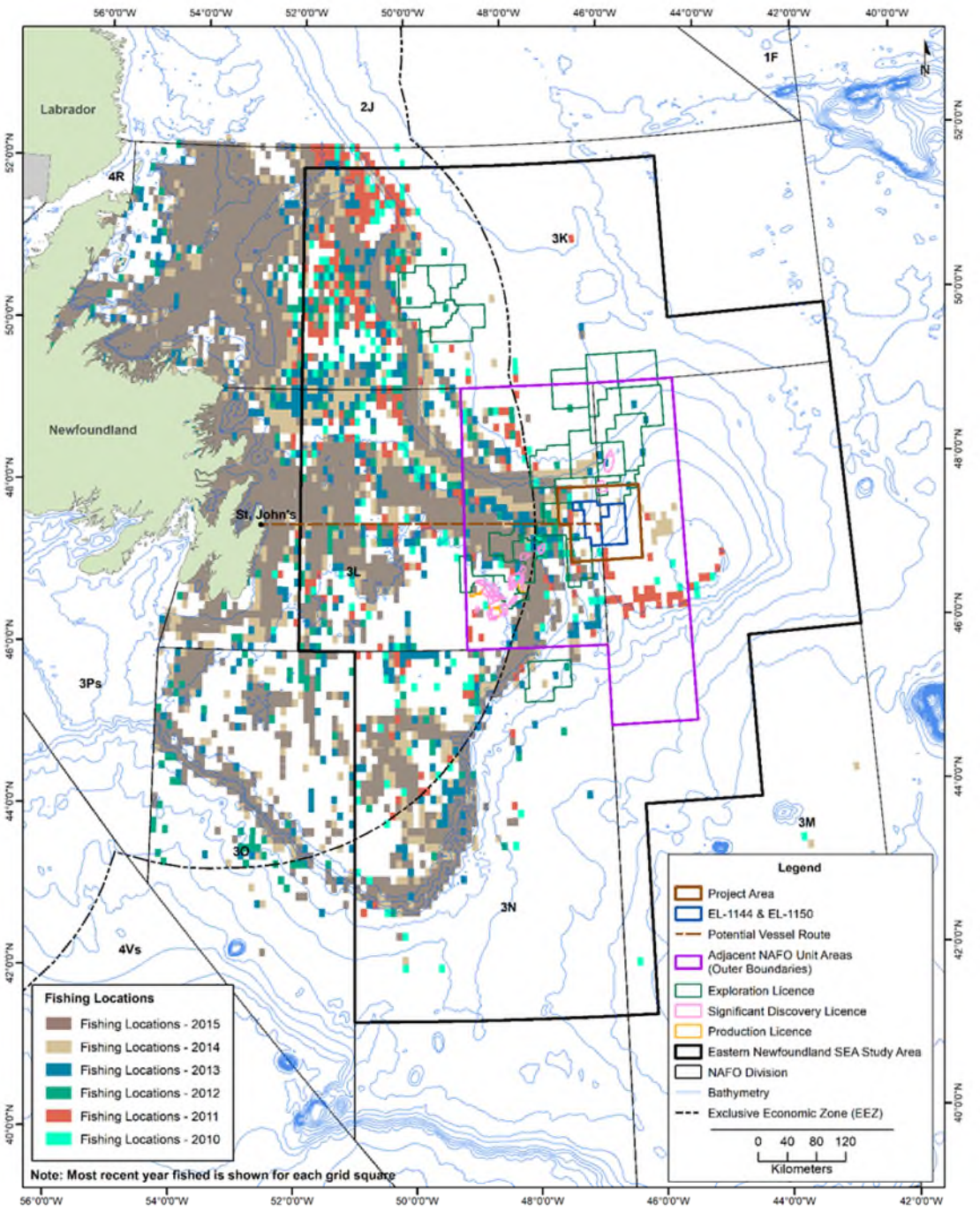
Commercial fishing is an important component of the socioeconomic environment in Newfoundland and Labrador and elsewhere in Atlantic Canada. Offshore Newfoundland and Labrador fishing activity and location vary throughout the year, depending on several factors. While some fisheries within the project area are open year-round, others have fairly well-defined seasons. Exploration licences 1155 and 1150 and the project area as well as portions of the local and regional study area are located outside Canada's exclusive economic zone. As such, there is Canadian domestic (inside and outside the exclusive economic zone) and international fisheries (outside the exclusive economic zone) occurring in the regional study area. Average harvest between 2007 and 2016 from the international fishery, including harvest by Canadian harvesters, overlapping with the regional study area and exploration licences was 96 741 tonnes, of which 66.5 percent was harvested by Canada.

The commercial domestic fisheries occurring offshore Newfoundland and Labrador, operating primarily inside Canada's exclusive economic zone and on the Nose and Tail of the Grand Banks and the Flemish Cap (see Figure 3), include those targeting groundfish, pelagics, shellfish and other invertebrates. In the commercial domestic fishery the average quantity of harvest between 2010 and 2015 was 16 290 tonnes in the project area and adjacent areas. Of this, Snow Crab and Northern Shrimp were the predominantly harvested species, making up approximately 97 percent of the total harvest quantity. Harvest from the project area and adjacent areas also included Greenland Halibut, redfish, Atlantic Herring and Atlantic Cod. Groundfish (Atlantic Halibut, American Plaice, Greysole Flounder) and pelagics (capelin) were harvested in the adjacent areas.

For conservation reasons, the shrimp fisheries in NAFO Divisions 3L and 3M, which overlap the project area, have been halted; however, it is possible that some level of shrimp harvest in these divisions might be reinstated within the temporal scope of the Project. The broader regional study area, has an important component of lobster and other shellfish harvest from coastal waters. In addition, aquaculture facilities are located at various sites around the Newfoundland coast, particularly within Notre Dame Bay.

Figure 3 illustrates domestic commercial harvesting locations off the coast of Newfoundland and Labrador between 2010 and 2015.

Figure 3: Domestic (Canadian) Harvesting Locations, All Species, 2010-2015[17]



Source: CNOOC Petroleum North America ULC

[17] Each colour represents commercial fisheries harvesting locations for that year, with the most recent activity (2015 data) as the top layer. While the top colour represents the most recent year, there can be fishing occurring in certain areas over multiple years, as is the case for much of the offshore area.Source: CNOOC Petroleum North America ULC

Five Indigenous groups in Newfoundland and Labrador hold communal commercial fishing licences[18] for a variety of species that overlap with the project area. Licences include those for inshore and mid-shore groundfish, seal, shrimp, tuna, swordfish, Snow Crab and a pelagic fishery access (herring, mackerel, capelin) which occurs close to shore.

Most Indigenous groups located in Nova Scotia, New Brunswick and Prince Edward Island that are listed in Section 4 hold communal commercial licences within the regional study area, including licences for groundfish, tuna, lobster, swordfish and eel. Of these groups, several hold communal commercial licences for swordfish in areas that overlap with the project area. However, based on landings data from DFO (2011 to 2015), there were no reported landings of swordfish originating from the project area by these groups during this time.

The landings and harvest information presented above includes communal commercial fishing from Indigenous communities.

Predicted Effects

The proponent identified the following potential interactions:

- potential temporary loss of access to established fishing grounds due to Project activities and components, and a resulting decrease in value (economic or otherwise) of these fishing activities;
- possibility of damage to fishing gear, vessels, equipment or other components due to interactions between Project vessels, equipment, emissions or discharges and fishing activities;
- possibility of interference with scheduled government/industry fisheries research activities, which might also affect research results and associated management decisions;
- possibility of price implications resulting from market or consumer perception of a reduced quality of fish products (e.g., taint); and
- possibility of indirect effects on fisheries due to changes in the abundance, distribution or availability of fish species on established fishing grounds.

Access to traditionally used fishing areas can be restricted during exploration drilling through the presence of the safety exclusion zone. During drilling, a safety exclusion zone would be established around the MODU within which commercial fishing and non-project-related vessels and activities would be excluded. The proponent stated that factors that that are considered in determining the size of the safety zone include forecast seasonal weather, sea state severity, water depths, supporting operational activities including additional support vessels and mooring/anchor pattern, if applicable. The proponent stated that as per the *Newfoundland Offshore Petroleum Drilling and Production Regulations* and the *Collision Regulations*, the minimum size for a safety exclusion zone for a MODU installation that utilizes dynamic positioning to remain on station over the well location is a 500-metre radius from the outer edge of the MODU. If anchors are utilized, the *Collision Regulations* state that the safety zone must extend 50 metres beyond the boundaries of the anchor pattern of the installation, which could extend the safety zone to 1000 metres or possibly further. The exclusion zone would be in place for the duration of each well drilled. In certain instances, an additional short-term safety exclusion zone would be established if wellhead removal were to occur at a later date. The proponent noted that assuming the maximum-case, 1000-metre radius safety exclusion zone and up to three MODUs in effect at the

[18] Communal commercial licences are communal licences issued by the Mister of Fisheries and Oceans to an aboriginal organization to carry on fishing related activities. (Section 4(1) Aboriginal Communal Fishing Licences Regulations, SOR 93-332)

same time, the area excluded would be less that 0.2 percent of the project area/local study area and less than 0.0008 percent of the regional study area. While a safety exclusion zone would limit the potential for direct interactions between project activities and commercial fishing, it would temporarily restrict fishing in these areas.

The temporary restriction of access to fishing grounds has the potential to temporarily decrease fishing efficiency or increase costs to fishing in the immediate area as harvesters redirect effort to other grounds and/or vessels navigate around the zone. In addition to the small area affected, the proponent stated that the project area has little domestic commercial fishing compared to other parts of the local study area, regional study area and Grand Banks generally. Further, most harvest in the project area has been conducted using mobile gear, which can maneuver easily around small closed areas. As such, a lower proportion of fish harvesters or incomes may have the potential to be affected.

Project components including wellhead abandonment or temporary suspension, VSP and supply and servicing have the potential to negatively interact with fishing gear. Following drilling and testing at each site, wells would be abandoned or suspended. When abandoning a well, there are a number of factors that are considered when deciding on the removal of a wellhead, including water depth, well design, wellhead design, weather conditions/sea state and availability to participate in wellhead removal campaign with other oil and gas companies. Wellheads that are left in place may protrude above the seafloor and may interact with bottom tending mobile fishing gear, which could result in damage and lost time or catch. The proponent stated that if a wellhead were to be cut above the seafloor, the planned maximum height of wellhead remaining above the seafloor would be 0.85 metres.

6.6.2. Views Expressed

Federal Authorities

The Agency requested information related to the size of the safety exclusion zone. The proponent stated that while the 500-metre radius safety exclusion zone would be the minimum required, most MODUs have been able to operate within this requirement. The proponent does not expect to require a larger than 500-metre safety zone, as it is are not proposing to use more than one MODU and is currently proposing deeper water well locations which would require dynamic positioning and not anchor installation but the decision would be made prior to drilling.

DFO advised the Agency that the mitigation measures, monitoring and follow-up programs proposed by the proponent and recommended by the Agency would adequately address the potential effects of the Project on commercial fishing.

Indigenous Peoples

Sipekne'katik First Nation, KMKNO and Nunastiavut Government asked about the involvement of Indigenous groups in the development of the proposed compensation programs for damaged or lost fishing gear. In addition, Sipekene'katik First Nation noted that there are several differences between communal commercial licences and the commercial licences, requesting that the proponent consider these differences in the development and implementation of the compensation program. The proponent confirmed that the Fishing Gear Damage or Loss Compensation Program would be drafted in accordance applicable C-NLOPB requirements and would be provided to Indigenous groups for review and comment prior to finalizing. The proponent confirmed that while discussion of the compensation program referred to "commercial fishing equipment", the

intent is not to exclude harvesting equipment used by rights holders and would include similar provisions for damage to Indigenous groups fishing equipment, commercial or otherwise in the program.

KMKNO requested further information on the proponent's proposed Indigenous Communities Fisheries Communication Plan, including information on ongoing engagement throughout the life of the Project and mechanisms for adaptive management. The proponent stated that the plan may include, among other things, a process and measures to ensure that issues and concerns can be raised by Indigenous groups during the life of the Project. It also intends that the Plan would be designed to be responsive throughout the life of the Project and contain a mechanism that ensures adaptive management measures can be taken if required. The proponent confirmed that Indigenous groups would be given the opportunity to review and provide comments on the Indigenous Communities Fisheries Communication Plan before it is finalized.

Additional comments from Indigenous groups related to the need for research for fish and fish habitat, including species targeted by commercial fisheries. Comments about the potential effects on fish and fish habitat are discussed in Section 6.1 Fish and Fish Habitat.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Fish, Food and Allied Workers Union requested information about the timing of wellhead removal and potential effects and concerns of temporarily leaving a wellhead in place following initial drilling. Information related to statistics of damage to fishing gear due to the presence of wellheads, if available was also requested. The proponent stated that most exploration and appraisal wells would be permanently abandoned as part of the initial drilling program; however, wellheads could be left in place for one or two years following drilling and in rare cases may remain in place for the duration of the exploration/appraisal phase of the Project. The timing of wellhead removal would be based on the availability of equipment, time of year the well was drilled and water depth. Information on wellheads left in place would be communicated to commercial fishers other marine users and the appropriate authorities through Notice to Mariners for inclusion on nautical charts. The proponent stated that it was not aware of any issues regarding wellheads left in place offshore Newfoundland and Labrador or Nova Scotia based on discussions with regulators, fishing industry representatives and companies involved in administering vessel and gear damage programs.

The Fish, Food and Allied Workers Union commented on the potential physical and socioeconomic effects of the Project on commercial fisheries, including consideration of cumulative effects. Concerns included restricted access to fishing areas and the need to alter fishing to mitigate issues related to increased traffic.

6.6.3. Agency Analysis and Conclusion

Analysis of the Effects

Commercial fishing is a key economic activity offshore Newfoundland and Labrador, including domestic fisheries for groundfish, pelagics, shellfish and other invertebrates. The extent of commercial fishing varies between areas in the Newfoundland and Labrador offshore, as illustrated in Figure 3. There has been little domestic and international harvest recorded within the project area and less within the exploration licence boundaries relative to other areas on or around the Grand Banks. However, it should be noted that harvest locations are influenced by a variety of factors and could occur in different areas in future.

Potential effects of the Project on commercial fisheries include loss of access to fishing grounds, damage to fishing gear, vessels or equipment, interference with surveys and research that support fisheries management, as well as potential effects on fish and fish habitat affecting commercial fisheries. The potential effects of the Project on fish and fish habitat are described in Section 6.1; these are predicted to be low in magnitude, temporary and localized.

Loss of access to fishing grounds could occur if fishers were displaced by safety exclusion zones that would be created around the MODU. Portions of NAFO Divisions 3L and 3M overlap with the exploration licences included in the Project. Only a fraction of NAFO Divisions overlap with applicable exploration licences and only a fraction of this overlapping area would be affected by safety exclusion zones (Table 5). Further, as the proponent is proposing to utilize only one MODU and to drill in deeper water locations that would require dynamic position and not a moored MODU, the safety zone would likely be limited to a 500-metre radius, smaller than if a moored MODU was used.

Table 5: Area and Overlap between Exploration Licences 1144 and 1150, NAFO Divisions and Safety Exclusion Zones

Area and Overlap	CNOOC Exploration Drilling Project
Total Area of Exploration Licences (1144 and 1150)	3326 square kilometres
NAFO Division(s) overlapping with Exploration Licences	3L, 3M
Size of NAFO Division(s) that overlap with Exploration Licences	623 941.92 square kilometres
Size of Safety Exclusion Zone for Single MODU	0.785 square kilometres or 3.14 square kilometres
Combined Size of Exclusion Zones for Two MODUs (not contiguous)	1.57 square kilometres or 6.28 square kilometres
Percentage of NAFO Division(s) that would Overlap with Exploration Licences	0.53 percent
Percentage of NAFO Division(s) that would Overlap with One Safety Exclusion Zone	0.000123 percent or 0.000503 percent
Percentage of NAFO Division(s) that would Overlap with Two Safety Exclusion Zones	0.000246 percent or 0.001 percent
Calculation ranges are based on a minimum safety exclusion zone with a 500-metre radius and a maximum radius of 1000 metres.	

In addition to loss of access for commercial harvesters, project activities have the potential to restrict access for fisheries science research surveys conducted by DFO and ongoing or planned industry surveys. However, with ongoing communication between the proponent and researchers regarding planned project activities and the proponent's commitment to coordinate to the extent possible to not interfere or influence research surveys, the Agency is of the view that potential effects would be mitigated.

Damage to fishing gear could potentially occur as a result of interactions between project vessels and fishing vessels. The proponent would utilize common vessel travel routes where they exist and otherwise follow a direct

route to exploration licences. Within the exploration licence, where drilling associated activity is occurring, most activity would be focused in or near the MODU safety zone. Effective communication between the proponent and fishers would be important to help reduce the potential for interactions and a compensation program would be available in case of an incident.

Following completion of exploration drilling, wells may be suspended or temporarily abandoned. In most cases, the well would be abandoned and the wellhead may be removed. However, if a well is suspended (for a period limited by the C-NLOPB) or if all or a portion of the wellhead remains after abandonment, there is the potential for interaction between wellhead infrastructure and fishing gear, in particular mobile gear such as trawl gear, which could result in damaged or lost gear. As part of a proponent's *Application for Approval to Drill a Well,* required by the C-NLOPB for each well, the proponent would be required to include information on planned well termination (i.e., temporary suspension or abandonment). As part of the approval process, the C-NLOPB would consider the appropriateness of the planned approach to well termination. The C-NLOPB would consider the potential for the wellhead to interfere with fisheries and would require the proponent to engage fishers on their abandonment strategy in case of potential interference. The C-NLOPB would consider geographic location and water depth and would consult DFO if there is uncertainty regarding the potential for interference. If it was determined that interference with fisheries was unlikely to occur and the C-NLOPB was of the opinion that suspension or abandonment with a portion of the wellhead above the mudline was a reasonable approach, fishers would be notified of the wellhead abandonment strategy and location of the abandoned wellhead.

The C-NLOPB has advised the Agency that it is not aware of interference between suspended or abandoned wellhead infrastructure and fishing gear in the past. In the unlikely event that damage or loss of fishing gear was caused by contact with wellhead infrastructure, the proponent would be required to provide compensation to the injured party consistent with its obligations in civil law. C-NLOPB approval of a well termination in which all or a portion of the wellhead is left in place above the seabed does not extinguish the proponent's liability for any damage to fishing gear caused by contact between the wellhead and such gear during fishing activities.

The Agency notes that the proponent has committed to developing a Fishing Gear Damage or Loss Compensation Program, based on best practices, precedents and industry guidelines, as well as in accordance with applicable C-NLOPB requirements to address any unplanned interactions between the Project and commercial fishing equipment, including from suspended or abandoned wellheads. In all cases where spills, debris, dropped objects or other project related activities, including authorized activities, cause damage to fishers, the C-NLOPB would expect the proponent to consider claims in a manner that meets the requirements of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* and the spirit of the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity* and to act in good faith to resolve claims from fishers. If the proponent and a fisher were unable to resolve such a claim, the fisher could seek relief through a compensation claim to the C-NLOPB [if applicable] or through the court. Claims for compensation may be made by domestic fishers as well as international fishers with legal authorization to be undertaking fishing activities in the area. Each claim, whether by a domestic or international fisher, would be evaluated by the C-NLOPB on a case-by-case basis to determine eligibility and the value of compensation.

Supply and servicing operations have the potential to interact (e.g., direct interference and damage to some gear types) with commercial fisheries that may operate within the transit route. The proponent indicated that the risk of interaction in the transit route is greater than the potential for interaction with fishing gear in areas where drilling-associated activities are occurring. Fishing gear, in particular crab pots, set in the transit route area are weighted to the bottom with an attached buoy or buoys at the surface creating potential for entanglement. The

Agency notes however, the supply and servicing vessels would not be towing sub-surface equipment therefore pose no additional risk of conflict.

The Agency is of the view that the potential effects on commercial fishing, including effects on communal commercial fisheries, could be mitigated through early identification and proper communication of restricted zones (e.g., safety exclusion zones) and information about the location of suspended or abandoned wellheads. The proponent would be required to develop a Fisheries Communication Plan. The plan would be developed in consultation with both Indigenous and commercial fishers and would include but not be limited to communication objectives, participants and key contacts, and would provide guidance and instruction related to ensuring interested parties are kept up to date with respect to operational activities and accidental events and have the ability to provide feedback.

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent, expert advice from federal authorities and comments from Indigenous groups and the public and identified the following key measures to mitigate the Project effects on commercial fisheries:

- in consultation with Indigenous groups and commercial fishers, develop and implement a Fisheries Communication Plan to address communications prior to and during drilling, testing and abandonment of each well. The plan should include:
    - regular updates to provide specific information on plans for project activities and an opportunity for feedback and further exchange of information on specific aspects of interest;
    - information on safety exclusions zones and suspended and abandoned wellheads;
    - procedures to notify fishers a minimum of two weeks prior to the start of drilling each well;
    - information on vessels travelling between Newfoundland and Labrador and exploration licences (e.g., number per week, general route); and
    - procedures for determining the need for a Fisheries Liaison Officer and/or fisheries guide vessels during MODU movement and the use of a Fisheries Liaison Officer during geophysical programs;
- prepare a well abandonment plan, including a wellhead abandonment strategy and submit it to the C-NLOPB for acceptance at least 30 days prior to abandonment of each well. If it is proposed that a wellhead be abandoned on the seafloor in a manner that could interfere with commercial fishing, develop the strategy in consultation with potentially affected Indigenous groups and commercial fishers;
- ensure that details of safety exclusion zones and the locations of abandoned wellheads, if left on the seafloor, are published in Notices to Mariners, provided in Notices to Shipping and communicated to fishers;
- provide information on the locations of any abandoned wellheads, left on the seafloor, to the Canadian Hydrographic Services for future nautical charts and planning;
- ensure ongoing communication with the NAFO Secretariat, using established information exchange mechanisms that are in place with DFO, regarding planned project activities, including timely communication of drilling locations, safety exclusion zones and suspended or abandoned wellheads; and
- implement all mitigation listed in Section 6.1 Fish and Fish Habitat related to providing the results of the seabed investigation survey, wellhead abandonment procedures, selection of chemicals, disposal of spent synthetic-based muds and the discharge of waste.

The Agency also notes that the proponent has committed to developing a Fishing Gear Damage or Loss Compensation Program, based on best practices, precedents and industry guidelines, as well as in accordance with applicable C-NLOPB requirements to address any unplanned interactions between the Project and commercial fishing equipment.

Follow-up

The Agency identified the following measure as part of a follow-up program to ensure the effectiveness of mitigation measures and to verify the accuracy of predictions of effects on commercial fisheries:

- report annually to the C-NLOPB on whether there have been incidents of lost or damaged fishing gear associated with the Project, including project-related vessels.

In addition, the envisioned Fisheries Communication Plan would provide a means of identifying potential issues should they arise.

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on commercial fishing, including communal commercial fishing, are predicted to be low in magnitude, localized and short-term.

Taking into account the implementation of the mitigation measures, the Agency concludes that the Project is not likely to cause significant adverse environmental effects on commercial fisheries.

6.7. Current Use of Lands and Resources for Traditional Purposes and Health and Socioeconomic Conditions of Indigenous Peoples

6.7.1. Proponent's Assessment of Environmental Effects

Existing Environment

Fishing for food, social and ceremonial purposes is an important activity for all Indigenous communities who were included in the EIS. DFO issues fishing licences to communities to authorize fishing activities for food, social and ceremonial purposes, and all Indigenous communities included in the EIS hold these types of licences. Multiple species of fish are or have been harvested for food, social and ceremonial purposes, including Atlantic Salmon, American Eel, mackerel, flounder, gaspereau, lobster, clams, oysters and scallops. The preference for certain species varies across communities and based on regional differences. Many communities also harvest aquatic birds and marine mammals for traditional purposes within their traditional territory. Most Indigenous communities place an important value on these country foods and are of the view that they cannot necessarily be replaced or substituted by other sources or through compensation because of the cultural, social and nutritional qualities of these country foods and harvesting activities.

Through interactions with participating communities and a review of available resources (see Section 4.1.2 for an overview of the proponent's engagement activities), the proponent concluded that no food, social or ceremonial fishing (including marine mammal and aquatic bird harvesting) is taking place in the project area or within the potential zones of influence of the Project under normal operations. Since there is unlikely to be direct geographical overlap between routine project activities and most Indigenous communities' activities, the proponent's assessment focused on marine migratory species of interest that may have potential to interact with the Project and have connections to important areas or activities associated with the traditional use of lands and resources by Indigenous communities.

In addition to food, social or ceremonial fishing, Indigenous communities also hold communal commercial fishing licences. In certain cases, these communal commercial licences do overlap with the project area. The potential effects of the Project on these licences is discussed in Section 6.6.

Predicted Effects

The proponent stated that the project area is located at such a distance from the communities that there is no known use for traditional purposes including food, social or ceremonial fishing taking place within the project area or local study area. Therefore, the proponent predicted that fishing for food, social or ceremonial purposes would not be disrupted as a result of the Project. More broadly, the proponent stated that there is essentially no potential for biophysical effects of the Project to translate into a decrease in the overall nature, intensity, distribution, quality or cultural value of any traditional activities by any Indigenous communities.

The proponent acknowledged that Atlantic Salmon are of particular importance to Indigenous communities in Atlantic Canada and due to their migratory nature, individuals of this species may migrate through the project area before moving to an area that is subject to traditional harvesting activities. The proponent predicted that there would be a very low likelihood of interactions between routine project activities and Atlantic Salmon (see Section 6.1 for additional detail on effects to fish and fish habitat) and that there would be no potential for any interactions to translate into a decrease in the overall nature, intensity, distribution, quality or cultural value of salmon fishing by Indigenous communities.

Given the importance of the species to Indigenous groups, the proponent has committed to contribute to research on the presence and distribution of Atlantic Salmon which includes potential new studies through the ESRF that has issued a new call for proposals on May 15, 2019 for Environmental and Social Studies related to Atlantic Salmon. The proponent has expressed an interest in this or other research being undertaken collaboratively with Indigenous organizations. The results should be made readily available to existing or future regional databases and proactively shared with government, Indigenous groups and the public.

In general, the proponent predicted that effects from routine operations on Indigenous communities and activities would likely be negligible or low due to:

- the localized nature of operational activities;
- the short duration of operational activities;
- the low probability of species interaction with operational discharges and emissions; and
- the limited potential for biological effects if individuals were exposed to discharges.

6.7.2. Views Expressed

MTI and KMKNO noted the lack of primary source data and Indigenous knowledge gathered and utilized by the proponent in its EIS. They recommended that other means of data collection be used, including primary sources of information, to support a more comprehensive understanding of Indigenous land and resource use, fishing activity and socioeconomic conditions and to better inform the resultant effects assessment. The proponent noted that it did invite Indigenous groups to submit such knowledge related to the Project and its potential effects, and has also committed to continue to accept and consider such knowledge or other inputs and perspectives as part of its ongoing engagement initiatives. However, given that the project area is over 400 kilometres from land (and at least 635 kilometres from any Indigenous community) and that no Indigenous groups hold, claim or assert Aboriginal or Treaty rights or otherwise undertake traditional activities within or near the project area, the proponent is of the view that the use of secondary sources of information are sufficient and that it made reasonable efforts to integrate traditional knowledge into the assessment. Despite the proponent's response, KMKNO maintained that, without gathering primary sources of information from Indigenous groups, the proponent's assessment of effects on Indigenous groups, such as health impacts of a spill, is insufficient.

Potential effects to Atlantic Salmon populations was a key concern for all communities. Analysis of the potential effects to salmon is included in Section 6.1 of this report but the linkage of salmon to current use was commented on by many groups. WNNB and Woodstock First Nation stated that the proponent should have considered traditional use of Atlantic Salmon throughout the regional study area rather than only in the project area when evaluating effects of changes to the environment on current use of traditional resources. Further, WNNB and KMKNO commented that potential effects to salmon be carried into the assessment of current use of lands and resources to enable Indigenous communities to review a holistic assessment of current use. The Agency requested further consideration of species of interest to Indigenous communities through the lens of current use including salmon, swordfish and Bluefin Tuna. The proponent reviewed additional information in response to Indigenous concerns but maintained that the assessment and conclusions as presented in the EIS remained accurate.

MTI expressed disagreement with the proponent's assertion that traditional activities are located at a great distance from the project area and stated that this characterization minimizes the importance of the potential impacts of the Project on use by Indigenous communities. Furthermore, MTI noted that there are documented swordfish harvesting locations to the south of the local study area that could be near the Project.

MFN, Première Nation de Nutashkuan and MMS disagreed with the methodology for assessing effects to Indigenous communities put forward by the proponent. Innu de Ekuanitshit questioned the outcome of the effects analysis and are of the view that adverse effects would extend beyond the project area. They requested the proponent to explain how the effects assessment for marine fish and fish habitat directly assessed potential impacts on Indigenous peoples. The proponent stated that it assessed effects to Indigenous peoples through the pathway of potential effects to fish and other marine species. It did not predict any effects extending beyond the project area and predicted no detectable effects at a population level for species.

The majority of Indigenous groups who provided comments were dissatisfied with the proponent's lack of follow-up or monitoring measures for effects on species of cultural importance, and by extension Indigenous communities, and recommend that follow-up or monitoring measures be developed in consultation with all communities. Several groups including NunatuKavut Community Council and KMKNO specified that Indigenous Knowledge should be considered in the design and implementation of follow-up and monitoring plans. Further, NunatuKavut Community Council, MFN, KMKNO and MTI specified that monitoring should be an opportunity for

building capacity in Indigenous communities. MTI stated that monitoring would build confidence in the proponent's assessment and indicated the need for adaptive management if required. The proponent committed to continued engagement with groups and to develop an Indigenous Communities Fisheries Communication plan which may include updates on the monitoring and follow-up programs. In April 2019, a group of proponents of offshore exploration drilling projects in the eastern Newfoundland and Labrador offshore area, including the proponent of this Project, shared a proposed joint Indigenous Communications Plan for comment by Indigenous communities. The Plan shows how the companies propose to communicate with Indigenous communities during exploration operations and in the case of an emergency.

A summary of issues raised by Indigenous groups is presented in Appendix C.

6.7.3. Agency Analysis and Conclusion

Analysis of the Effects

The most likely interaction between Indigenous communities and the Project's routine operations would be related to potential effects on communal commercial fishing activities that could occur in the project area. These potential effects are discussed in Section 6.6 (commercial fisheries).

No food, social and ceremonial fishing was reported in the project area but it occurs in other areas, including coastal regions within the regional study area. However, it is unlikely that Indigenous peoples fishing or harvesting for food, social or ceremonial purposes would come in contact with any project components or realize any adverse impacts in their traditional territories from routine project operations. The proponent would also be required to implement measures to mitigate effects to fish and fish habitat, marine mammals and migratory birds (refer to Sections 6.1, 6.2 and 6.3) such that there would not be a perceptible change to the current use of traditionally valued species (e.g., Atlantic Salmon) or a change in the health and socioeconomic conditions of Indigenous peoples as a result of routine project operations.

The Agency acknowledges that the potential effects from a worst-case accident or malfunction (i.e., an unmitigated subsea blowout event) would be more severe. These are discussed in Section 7.1.

Key Mitigation Measures to Avoid Significant Effects

The Agency determined that the measures to mitigate effects on fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), migratory birds (Section 6.3) and commercial fisheries (Section 6.6) would also mitigate effects on the current use of lands and resources for traditional purposes and the health and socioeconomic conditions of Indigenous peoples.

Follow-up

The Agency has not identified any follow-up measures specific to current use of lands and resources for traditional purposes and health and socioeconomic conditions of Indigenous peoples and notes that there are related measures proposed for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), migratory birds (Section 6.3) and commercial fisheries (Section 6.6).

Agency Conclusion

The Agency determined that the adverse residual environmental effects of the Project on current use of lands and resources for traditional purposes and health and socioeconomic conditions of Indigenous peoples throughout the regional study area would be low/negligible in magnitude.

Taking into account the implementation of the mitigation measures described for fish and fish habitat (Section 6.1), marine mammals and sea turtles (Section 6.2), migratory birds (Section 6.3) and commercial fisheries (Section 6.6), the Agency concludes that the Project is not likely to cause significant adverse environmental effects on the current use of lands and resources for traditional purposes and health and socioeconomic conditions of Indigenous peoples.

7. Other Effects Considered

7.1. Effects of Accidents and Malfunctions

Paragraph 19(1)(a) of CEAA 2012 requires that a federal EA take into account the environmental effects of malfunctions and accidents that may occur in connection with a Project.

7.1.1. Proponent's Assessment of Environmental Effects

The proponent identified a number of potential accident scenarios that could occur, including vessel collisions, dropped objects, loss of MODU stability or structural integrity and loss of well control. Although the causes and consequences of these scenarios can vary, the proponent's assessment mainly focused on the potential effects of an unplanned release of hydrocarbons or synthetic-based drilling muds and/or cuttings as a result of one of these events. The proponent analyzed historical spill data to predict the probability of hydrocarbon releases and conducted spill fate and behaviour modelling for marine diesel batch spills, synthetic-based mud spills and uncontrolled subsea hydrocarbon releases.[19]

Probability of Hydrocarbon Releases

The proponent calculated the probability and potential frequency of hydrocarbon releases based on a review of national and international records of historical offshore spills (Table 6).

Table 6: Probability of Hydrocarbon Release

Hydrocarbon Release Scenario	Spill Probability (Spills per Well Drilled)	Spill Frequency
Subsea Release		
Extremely Large (greater than 150 000 barrels)	0.0000392	1 per 25 510 wells
Very Large (greater than 10 000 barrels)	0.0000784	1 per 12 755 wells
Large (greater than 1000 barrels)	0.0000980	1 per 10 204 wells

Methods for Spill Modelling and Effects Thresholds

Modelling of subsea hydrocarbon releases and batch spills of marine diesel was conducted to predict the fate and behaviour of released hydrocarbons and to inform the assessment of potential effects. In the event of a hydrocarbon spill, the trajectory, fate and resultant environmental effects would be determined by the specific location, timing and nature of the release, as well as the environmental conditions and species present at the time of the event.

The hypothetical releases selected for modelling were chosen based on the potential range of scenarios that could occur. The hypothetical release locations were selected to represent the project area using a number of criteria, including subsurface features, seabed features, water depth, drilling depth, environmental features,

[19] An uncontrolled subsea release of hydrocarbons from the well is sometimes referred to as a blowout.

placement within the exploration licences and proximity to sensitive areas. For the subsea releases, spill durations were based on estimated maximum timelines for spill response measures to stop oil flow (i.e., installing a capping stack could take up to approximately 30 days; mobilizing a MODU, obtaining approvals and drilling a relief well could take approximately 120 days). The modelled scenarios assumed that no response measures would be undertaken to mitigate effects; in a real event, response measures would be implemented immediately.

To analyze the probability of potential effects, specific thresholds for surface oil thickness, shoreline oiling and in-water oil concentration were used (Table 7).

Table 7: Thresholds for Effects from Hydrocarbon Contamination

Threshold Type	Cutoff Threshold	Rationale/Comments
Oil Floating on Water Surface	Surface oil average thickness above 0.04 micrometres	Socioeconomic threshold: A conservative threshold for effects on socioeconomic resources (e.g., fishing may be prohibited when sheens are visible on the sea surface).
	Surface oil average thickness above 10 micrometres	Ecological threshold: Mortality of birds on water has been observed at and above this threshold. Sub-lethal effects on marine mammals and sea turtles are of concern.
Shoreline Oil	Shore oil average concentration above 1.0 grams per square metre	Socioeconomic threshold: A conservative threshold for effects on socioeconomic resources (e.g., shoreline cleanup may be required and shoreline recreation may be affected).
	Shore oil average concentration above 100 grams per square metre	Ecological threshold: Shoreline life has been shown to be affected by this degree of oiling.
In-Water Concentration	In-water concentration above 1.0 micrograms per litre of dissolved polycyclic aromatic hydrocarbons or above 100 micrograms per litre of total hydrocarbon concentration	Socioeconomic and ecological threshold: Effects on both ecological and socioeconomic (e.g., seafood) resources may occur at or above this threshold.

In general, the proponent's modelling results and analysis consider the lower socioeconomic thresholds of concern (see table 7 above for an overview of thresholds used in the analysis).

Fate and Behaviour of a Subsea Hydrocarbon Release

The proponent modelled four different hypothetical subsea hydrocarbon release scenarios representing different release durations (30 and 120 days), release rates and volumes (1 329 000 barrels to 22 080 000 barrels) in both exploration licences. The predicted probability of occurrence of all the subsea hydrocarbon release scenarios modelled is one-in-25 000 wells drilled or less. For all the modelled scenarios, stochastic modelling predicted that areas with the highest potential likelihood (over 90 percent) to exceed the socioeconomic thresholds for effects would be to the east and south of the release sites. For the 30-day release scenarios, 90 percent probability threshold exceedances for surface oil were predicted to extend from approximately 200 to

600 kilometres and exceedances for in water contamination were predicted to extend from approximately 400 to 1200 kilometres. For the 120-day release scenarios, these exceedances were predicted to extend for approximately 2000 kilometres for surface oil and approximately 500 to 1500 kilometres for in water contamination.

The 30-day release scenario in exploration licence 1144 predicted a very small probability (less than three percent) of shoreline oil contamination at Sable Island within 60 days. The 30-day release modelled in exploration licence 1150 was not predicted to make contact with shorelines. For the 120-day release scenarios modelled (predicted probability of occurrence of approximately one-in-25 000 wells drilled or less), average probability of shoreline oil contamination was anywhere between one and 44 percent with minimum time estimates for first shoreline contact between 15 and 159 days. Shoreline contact could occur along the coast of Newfoundland, Labrador, the Azores or Sable Island. The greatest average probability of shoreline oil contamination was along the coast of the Azores, with a minimum time for first shoreline contact between 45 and 61 days.

For the scenarios described above, the proponent also conducted deterministic modelling for single releases under specific, worst-case environmental conditions. For all representative scenarios, the majority of the surface oil (94 to 99 percent) was predicted to either entrain, evaporate or degrade by the end of the simulation time, with less than one to six percent predicted to remain on the surface after 60 days for the 30-day release scenarios and seven to 12 percent after 160 days for the 120-day release scenarios. Even for the worst-case shoreline contact case modelled for the 30-day release scenarios, less than 0.01 percent of the released oil was predicted to reach the shores of Sable Island after more than 50 days. For the 120-day release in exploration licence 1144, shoreline oiling was predicted to occur on Newfoundland and the Azores. The length of shoreline where oil was predicted to exceed one gram per square metre totaled 767 kilometres; however, shoreline oil was predicted to comprise an extremely small portion of the total mass of released oil (less than 0.03 percent). For the 120-day release in exploration licence 1150, shoreline oiling was predicted only to the east of the release site, contacting 634 kilometres of shoreline along the Azores. In all scenarios, oil on the sediments was predicted to be extremely limited, with less than 0.02 percent of the release making its way to the bottom. In many of the scenarios, a small portion (up to two percent) of the released oil mass was predicted to travel outside the model domain.

Potential Effects of Subsea Hydrocarbon Releases on Valued Components

Modelling results were used to assess the potential environmental effects of subsea releases on valued components. For all valued components, the nature and severity of effects would depend on the type, size and location of a spill, the time of year, the timely implementation of mitigation and response measures, and the species present within the affected area.

(i) Fish and Fish Habitat

Accidental events could interact with fish and fish habitat by affecting habitat availability and quality, fish mortality, injury and health, and fish presence and abundance. The primary direct pathway of effect on fish would be through exposure to dissolved hydrocarbons in the water column. Acute toxicity effects from exposure may include reduced feeding or larval deformities; however, these effects are generally short-term as many of the most toxic components would volatilize from the oil on the order of days. Chronic, long-term exposure would also have a range of potential effects including impacts on reproduction, growth, disease and survival.

Adult fish could potentially avoid a spill area but juvenile and early life stages of fish and benthic invertebrates in the immediate area of the spill would likely experience sub-lethal and lethal effects. Impacts to these less mobile individuals may result in species-specific effects (e.g., decreased reproductive success, deformities). These and other effects to fish and fish habitat could also amplify decreases in populations of fish already in decline and have implications on other trophic levels and on community composition. Plankton and other microscopic organisms would also not likely be able to avoid a spill; responses would be diverse and dependent on exposure level. Reductions in plankton may in turn reduce foraging opportunities for fish and could have implications for higher trophic levels.

Based on modelling, the potential effects of a large-scale subsea release on fish and their habitats could occur over areas of productive and diverse fish habitats and areas of high abundance and biomass of various fish and invertebrate species, such as the southern Grand Banks, the Flemish Cap and their slopes.

Oil from a subsea release was predicted to generally have limited interaction with sediments; however, interactions with benthic fish and fish habitat, including corals and sponges, would likely occur due to flocculation and sinking events associated with plankton and microbial pathways. Sessile adult and planktonic larvae of coral and sponges have no avoidance mechanisms. Following the Deepwater Horizon spill, indications of coral stress were observed and included partial tissue loss, partial coverage from brown flocculant sourced to the spill and mortality.

(ii) Marine Mammals and Sea Turtles

Marine mammals and sea turtles could experience mortality, injury or changes in health if exposed to hydrocarbons or through consumption of contaminated prey. A change in habitat quality could also result from oiling and associated response measures. Marine mammals and sea turtles in the spill area would likely experience a combination of exposures from contaminated air, water and sediment and via a combination of pathways (inhalation, ingestion, aspiration, adsorption). Oceanic animals that are closer to the site of a subsea release would be more likely to be exposed to a more constant flow and higher concentrations of fresher oil, as compared with nearshore species. Marine mammals and sea turtles demonstrate limited avoidance behaviour to most types of oil.

If oil were to contact shorelines or reach coastal habitats, marine mammals and sea turtles that use potentially affected shorelines and those that prey on seals could experience a change in mortality or injury or a change in health; however, it is probable that only a small portion of local populations would be affected.

(iii) Migratory Birds

The proponent predicted that oil spills and other accidental events could have serious, adverse consequences for marine and migratory birds, leading to potential changes in their presence, abundance, distribution and/or health. Exposure to oil could affect individuals through physical exposure or ingestion or through changes to important habitats and food sources. Marine birds are particularly vulnerable to oil spills as they may spend much of their time upon the surface of the ocean. If oil reaches coastal waters or shorelines, coastal birds could also be at risk.

Possible physical effects of oil exposure on birds include changes in thermoregulatory capability (hypothermia) and buoyancy (drowning) due to feather matting, as well as oil ingestion from excessive preening. Even small amounts of oil from sheens have been shown to affect the structure and function of seabird feathers. Once birds are exposed to oil, even with rescue and cleaning efforts, the chances of

survival are quite low (mortality rates would depend on species behaviour but could be as high as 99 percent). Seabirds generally have relatively long lives and low annual reproductive rates and therefore, mortality of adults can potentially have serious effects on populations.

If oil reaches the shoreline or coastal habitats, consequences for marine birds associated with these habitats may be serious. Without mitigation and response measures, it would take at least 15 days, and likely longer, for oil to reach a shoreline. Considering this timeline and the application of spill response and mitigation measures, oil would likely be weathered and patchy and would only impact a small proportion of local bird populations.

(iv) Special Areas

The proponent identified various special areas located within the regional study area that may be affected by a subsea release (Appendix E). In addition, there is the potential for a worst-case blowout scenario to reach special areas outside the regional study area, including Sable Island National Park Reserve and the Gully Marine Protected Area. These and other special areas are identified and protected due to various factors, including their ecological, historical, socioeconomic value and/or stakeholder and regulatory interest. Potential effects from a spill on a special area could include changes in environmental features and/or processes and changes in human use and/or the societal value of the area. These effects would be closely linked to effects on other valued components, particularly the biological valued components which have been discussed above.

(v) Commercial Fisheries

The proponent predicted that an accidental release of hydrocarbons could interact with commercial fisheries by: resulting in a temporary loss or reduction in access to commercial species; damaging fishing gear; affecting the abundance, distribution or health of commercial fish species; and/or affecting the actual or perceived quality of commercial fish products. Fisheries for various species could be affected and effects could potentially occur in various fishing regions, including NAFO Divisions 3KLMNO (see Section 6.6 for additional detail on the commercial fisheries in the region).

Direct effects from a subsurface release include the potential fouling of fishing gear and vessels in the immediate area of a spill as well as the temporary suspension of commercial fishing activity if fishing areas are closed. A closure could translate into economic effects as fishers may have to delay or cease fishing activity or move to more distant fishing grounds. Furthermore, any change in the abundance, distribution or quality of marine resources could have an effect on commercial fisheries. Tainting could also occur if fish were to be exposed to hydrocarbons and absorb oil-derived substances into their tissues, which could cause unpleasant odours and flavours. Even if fish are determined not to be tainted, spills could affect consumer perceptions of fish harvested in the surrounding area, potentially reducing market value of the product and subsequent economic returns.

(vi) Current Use of Lands and Resources for Traditional Purposes and Health and Socioeconomic Conditions of Indigenous Peoples

An accidental event could have indirect and direct effects on Indigenous communities and activities, including effects on fisheries resources and/or fishing activity and various sociocultural components and activities. A subsea release could discharge a large volume of oil, which could extend beyond the local study area. However, the proponent noted that there are no Indigenous communities or traditional activities located

within or near the project area and oil spill modelling indicated limited potential for oil to reach traditional territories of Indigenous communities. Any potential for effects would be mainly indirect in nature and related to the possibility of marine-associated species that are used by Indigenous groups to be affected by a spill (e.g., Atlantic Salmon, American Eel). The proponent stated that there would be little or no potential for biophysical effects on marine-associated resources to translate into any detectable decrease in the overall nature, intensity, distribution, quality or cultural value of traditional activities by Indigenous communities or other aspects of socioeconomic conditions.

Additional Considerations

(i) Fate, Behaviour and Effects of Batch Diesel Spills and Synthetic-Based Mud Spills

As noted in Table 7 above, the most likely types of spills would be smaller, operational batch spills. These spills can occur during routine use, storage and movement of fuels, and often comprise instantaneous or short-duration discharges. A larger diesel spill could occur as a result of a vessel collision. Based on recent petroleum development experience off Newfoundland and Labrador, spills less than one barrel in size (less than 159 litres) occur somewhat regularly and may occur one to two times per well. Although these smaller spills may occur more often, the median volume is only four litres. A synthetic-based mud spill may also occur as a result of an accidental deck release, a subsurface release through a crack or orifice in a flex joint, riser or lines or a bottom release due to an emergency riser disconnect event.

The proponent also modelled the fate and behaviour of several hypothetical batch spill scenarios of diesel and synthetic-based mud. For the diesel spill scenarios modelled, less than 0.01 percent of the diesel was predicted to remain on the surface after the end of the 30 day simulation, with a significant portion evaporated (40 to 76 percent), a portion in the water column (8 to 14 percent) and the rest degraded (16 to 45 percent). No shoreline oiling and negligible oil on the sediments was predicted.

The effects of a batch diesel spill would be similar to those of a subsurface hydrocarbon release but likely at a much smaller scale in terms of geographic extent and magnitude. Fish, marine mammals, sea turtles and migratory birds in the immediate vicinity of the spill would be exposed to elevated concentrations of hydrocarbons. Mobile species of fish may be able to avoid exposure but certain species, including early life history stages of fish and invertebrates, would not and would be more likely to experience mortality. There would likely be a localized change in species presence and habitat quality.

Spilled synthetic-based mud would behave much differently than spilled oil. Synthetic-based muds are heavy, dense fluids which sink rapidly through the water column resulting in limited effects on the water's surface from a spill. For the synthetic-based mud spills, the predicted area and thickness of the synthetic-based mud footprints varied based on location, surface versus subsurface release, season and density of the mud. Synthetic-based mud spills would likely reach the seafloor within a maximum of one kilometre from the drilling site but this distance would be much less in certain circumstances (e.g., a subsurface release of synthetic-based mud from the blowout preventer would likely reach the seafloor within a maximum distance of 60 metres). The maximum impacted area also varied from 1800 square metres to 9900 square metres. Maximum layer thickness on the sea floor also varied between approximately seven centimetres to 28 centimetres. In general, spills that settled farther from the spill site and over a larger area had smaller deposit thicknesses.

Although the effects of a synthetic-based mud spill on marine mammals, sea turtles and migratory birds would be adverse, they would likely be localized and negligible to low in magnitude. A synthetic-based mud

spill could have greater effects on fish, particularly benthic species, and fish habitat and result in chemical toxicity, bioaccumulation (e.g., uptake of contaminants by fish and the presence or perception of taint) and seabed disturbance (e.g., habitat smothering). Acute toxicity of synthetic-based muds is low but health effects are associated with chronic exposure to synthetic-based muds and cuttings. Benthic species could also be affected by smothering and/or the creation of an anoxic environment. Any potential effects would likely be temporary as synthetic-based muds biodegrade within a few years.

(ii) Effects of Dispersants

Dispersants may be used to respond to spills and although they can accelerate the degradation of spilled oil, they have the potential to increase hydrocarbon exposure throughout the water column (i.e., to plankton and pelagic fish) and eventually the benthic environment (i.e., to demersal fish and benthic invertebrates). Certain concentrations and ratios of dispersants have been shown to reduce the effectiveness of some degradation pathways, which may result in increases in “marine snow” and potential effects on the benthic environment. Chemically dispersed oil may have more pronounced effects on the early life stages of fish and invertebrates than on adults and may be more toxic to corals than untreated oil solutions.

Dispersed oil has similar effects on birds to those of untreated oil (e.g., reduction in insulation capacity and waterproofing of feathers). However, with the application of dispersants, potential exposure to floating oil on the sea surface would be reduced and overall, dispersants mitigate the potential adverse effects of oil on marine and migratory birds compared to untreated oil.

Prevention, Preparedness and Response Measures

The proponent described a variety of measures to reduce the likelihood of accidents and malfunctions, including those related to: engineering and design standards; standard operating procedures; maintenance, inspection and monitoring; as well as measures to ensure the proponent would be prepared for a potential accident or malfunction (Appendix B).

Well Capping and Containment

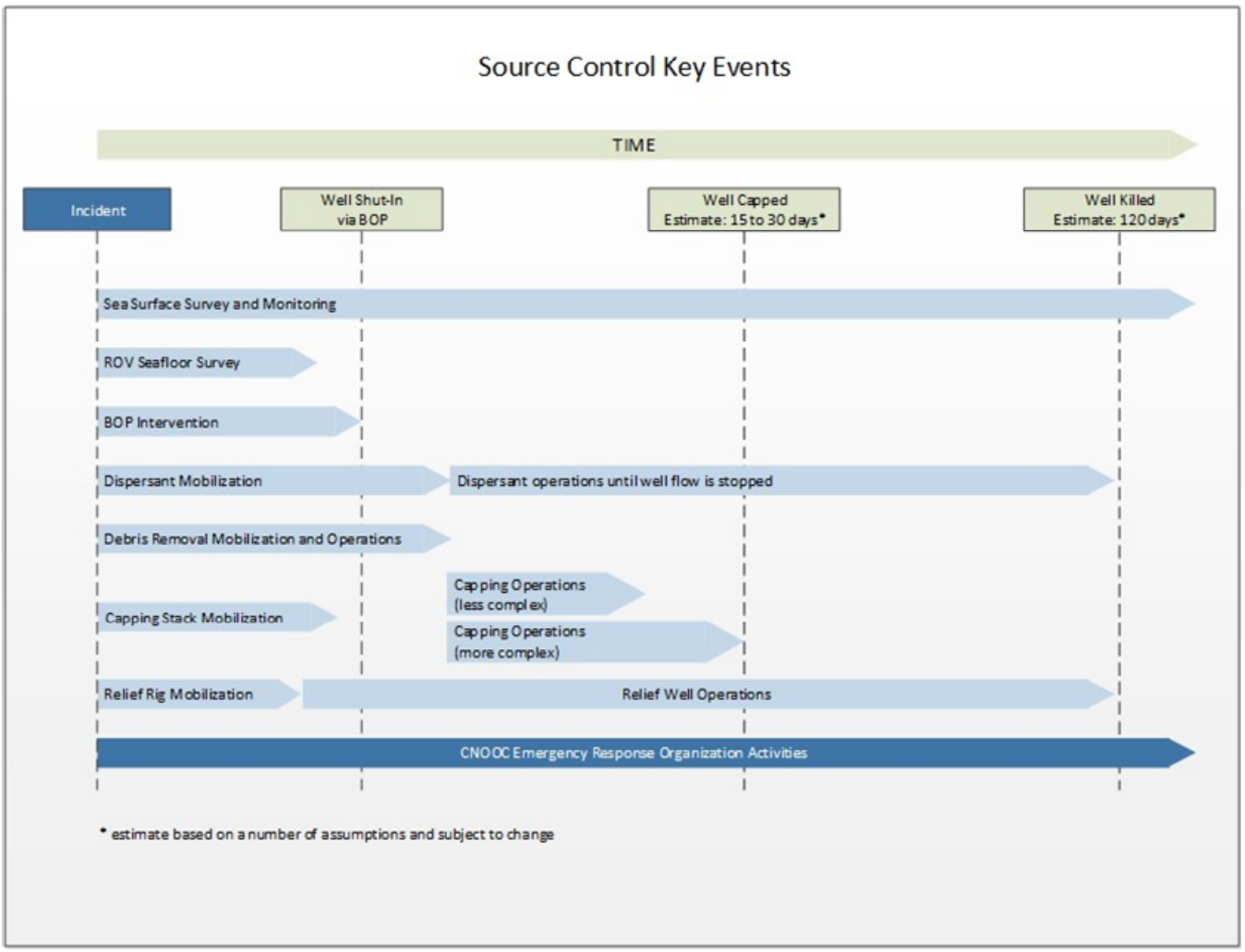
The proponent would have primary barriers to maintain well control and prevent kicks (e.g., continuous monitoring, managing and controlling drilling and formation fluid density, pressure and circulation) and secondary barriers (e.g., blowout preventer system) to regain well control. In the event that these measures fail and an uncontrolled subsea hydrocarbon release occurs, the proponent would immediately commence mobilizing contingency plans, including well capping/containment and relief well operations. A capping stack would be used to temporarily “cap” well flow while work is being undertaken to permanently kill the well (e.g., through drilling of a relief well). The capping stack would have a minimum lifespan of six months to two years, which would provide sufficient time to permanently kill the well.

If required, a capping stack would be sourced from Montrose, United Kingdom and would be transported directly to the well site by a specialized vessel. The proponent would also have access to a contingency capping stack located in Singapore. Air freight would be the shipping mode of choice for the contingency capping stack.

The proponent estimated that mobilization and deployment of the capping stack would range from 15 to 30 days. However, it noted that there are a range of variables that would influence the complexity and timeline of a well capping/containment operation and a number of simultaneous key activities would be

conducted in preparation for deployment of the capping stack (Figure 4). Other variables that would influence the complexity of a well containment operation, and potentially the time required to deploy the capping stack, would include the rate of flow of hydrocarbons, water depth, weather conditions, subsea/sea surface currents, viscosity of hydrocarbons, vessel availability and the state of equipment.

Figure 4: Key Events and Timeline for Capping a Well



Source: CNOOC Petroleum North America ULC

A relief well may also be required to permanently eliminate well flow. The proponent would develop a relief well contingency plan as part of the Well Control Emergency Response Plan. Initiation of relief well drilling would begin at the time of the release and in parallel with the deployment of the capping stack. In the event of a subsea release, the onsite MODU would likely incur damage and consequently, another unit would likely need to be mobilized to drill the relief well. Considering the time for unit mobilization as well as additional activities that would be required (e.g., additional surveying, ranging, well capping), the proponent estimated it could take up to 120 days to drill the relief well.

Spill Response

In addition to the Well Control Emergency Response Plan, the proponent would prepare an Oil Spill Response Plan which would outline potential types and levels of response that would be conducted once a spill is detected. The proponent would engage Indigenous groups and potentially other interested stakeholders in the development of the plan. The proponent has contractual arrangements in place that would allow it to call upon various response contractors and support agencies to provide additional resources, depending on the size and scale of the incident. It would draw on external resources as necessary, which could include private response organizations (e.g., Wild Well Control, Eastern Canada Response Corporation, Oil Spill Response Limited) and mutual aid agreements with other operators. In addition, government agencies, such as the C-NLOPB, the Canadian Coast Guard, ECCC (Environmental Emergencies), DFO, Joint Rescue Coordination Centre, Transport Canada and the Government of Newfoundland and Labrador may provide regulatory oversight, advice or support in the event of a spill. The C-NLOPB would have an oversight role on all response activities and would manage the relationships and interactions with other government agencies, including other jurisdictions and members of the international community, as required.

The proponent would ensure response capability both within and outside Canada's exclusive economic zone and stated that spill response would achieve the same outcomes whether responding within or outside this zone.

Response measures and activities that would be outlined in the Oil Spill Response Plan and which could be implemented in the event of a spill include surveillance and monitoring, mechanical containment and recovery, chemical dispersion, in-situ burning, natural degradation, shoreline protection and clean-up measures, oiled wildlife response, long-term remediation and compensation measures.

The proponent would undertake a spill impact mitigation assessment (also known as a net environmental benefit analysis), which would evaluate the benefits and risks of different response measures. This exercise would involve considering the environmental effects of each response tactic against a base case of no tactical response (i.e., natural attenuation/degradation). Considering whether and how to use chemical dispersants would be a key component of the spill impact mitigation assessment and use of dispersants would require approval from the C-NLOPB.

The proponent must have the financial resources to meet a minimum liability obligation of $1 billion so they have the ability to respond to a serious incident and pay for actual losses or damages as a result of the incident. In addition, the proponent must provide a minimum of $100 million in "financial responsibility" to the C-NLOPB for any costs incurred.

The proponent would implement a follow-up monitoring plan to monitor the effects of a spill and the effectiveness of the response measures. Although the plan would largely depend on the specifics of the actual spill and cannot be described in detail at this time, monitoring could be conducted on fish and fish habitat (e.g., toxicity tests, dispersant effectiveness, oxygen levels), migratory birds (e.g., carcass surveys), marine mammals and sea turtles (e.g., mortality estimations), commercial fisheries (e.g., testing seafood, monitoring fisheries closure areas) and the atmospheric environment (e.g., air quality monitoring).

7.1.2. Views Expressed

Federal Authorities

DFO, ECCC, the C-NLOPB and NRCan reviewed and requested updates to the proponent's spill modelling inputs and results. Following the review, the proponent conducted additional spill modelling work, including conducting fate and behaviour modelling to reflect the worst-case discharge scenario (i.e., the time it would take to drill a relief well), ensuring that models run until defined thresholds are reached and reconsidering the spatial boundaries selected. The proponent repeated its oil spill modelling, increased the release duration from 30 days to 120 days, extended the model duration from 60 days to 160 days and expanded the study area boundaries (i.e., model domain). The proponent also provided additional information regarding the approach and assumptions used to determine the fate and persistence of oil in the environment, the associated model inputs and potential environmental effects.

In particular, NRCan noted that the spill model used is limited in its ability to predict the degradation and sinking of crude oil heavy ends and corresponding smothering effects on benthic biota. The proponent acknowledged that this is an active area of research. It stated that the heavy compounds in question degrade slowly and are difficult to measure but that the modelling was conservative in its assumptions and likely overestimated effects. NRCan advised that the model does not consider the contents of the persistent portions of the crude oil and that biodegradation rates are therefore over-estimated; however, NRCan agrees that this is an ongoing area of research and has indicated that it will conduct simulations, publish data and continue discussions with industry to further advance existing models. Despite the potential shortcoming identified by NRCan, DFO and the C-NLOPB are of the view that the model results provide sufficient information to inform the effects predictions and to recommend mitigation and follow-up measures.

NRCan raised concern regarding the potential effects of this persistent portion of crude oil from a spill and required additional analysis from the proponent and possible follow-up measures that would be implemented. The proponent stated that the effects of persistent crude oil on valued components would be comparable to the effects of direct exposure to oil that were considered in the effects analysis. It also provided details on the follow-up monitoring strategies that could be considered for a spill, including measures to monitor effects on the water column, fish and the seafloor.

DFO requested additional information on the potential effects of a spill on special areas, including Sable Island, and on marine mammal species at risk and their critical habitat. The proponent noted that there is a small chance (approximately three percent of simulations) of shoreline oiling above one gram per square metre on Sable Island during winter months. The proponent also noted that there is a small chance oil from a spill would reach the Scotian Shelf and notably the Gully Marine Protected Area, Haldimand Canyon and Shortland Canyon, which provide critical habitat for the endangered Scotian Shelf Population Northern Bottlenose Whale. If oil were to reach these areas, it would be highly weathered and patchy due to the time it would take to reach the area. Although unlikely, effects would be adverse and could be high in magnitude, depending on factors such as volume of the spill and environmental conditions.

The C-NLOPB advised that the usual procedure for installing a capping stack may not be possible in shallow water; since the project area covers water depths less than 500 metres, alternative emergency response options need to be explored. Although the proponent does not anticipate drilling in depths shallower than 700 metres, it stated that water depth is indeed a variable that would directly influence the complexity of a well capping/containment operation and that shallower water wells can pose unique challenges to the installation of a

capping stack. It is unlikely that a vessel would be able to deploy a capping stack from directly above the wellhead in shallow water. In such cases an offset deployment, where the vessel is not directly above the wellhead, would be required and would require additional time and resources. This could be achieved using either a large crane or using specialized equipment.

ECCC and the Agency required additional information regarding the timing of spill response and mobilization of a capping stack, including the proponent's ability to reduce response times and establish a capping stack facility in eastern Canada. The proponent explained that any well control emergency response plan would involve simultaneous initiatives and activities, with the assembly, testing and transportation of the capping stack being one series of activities. The proponent stated that it is unlikely that having a capping stack system in eastern Canada would reduce the overall time to install it because without the necessary facilities, equipment and expertise, the ability to modify the equipment for the specific incident would be limited. In addition, having a facility in eastern Canada with the ability to modify the equipment may not reduce the timeline to cap a well, as other activities would still be in progress prior to the installation of the capping stack, including site assessment/preparation and debris removal (see Figure 4 above). The proponent also considered transporting the capping stack by air but noted that this would not necessarily translate into reduced capping times for a variety of reasons, including the need to break-down and reassemble equipment and increased logistical complexity. The proponent concluded that transportation of the primary capping stack from Montrose, United Kingdom by vessel would be the preferred option; however, transportation of the contingency capping stack from Singapore would be more efficient by air.

Additional views expressed by federal authorities overlapped with views expressed by Indigenous groups. Some of these key views and comments are discussed below.

Indigenous Peoples

MMS asked about the potential for oil from a spill to reach the Gulf of St. Lawrence and/or the Gaspé Peninsula coast. The proponent stated that, based on wind and current data within the region, it is unlikely that oil from a subsea release or a vessel collision would enter the Gulf of St. Lawrence. The modelling conducted supported this conclusion.

Multiple Indigenous groups raised concerns about the potential effects of dispersants. In particular, KMKNO requested additional information on the potential differences between and effects of subsea versus surface dispersant injection. The proponent explained that, compared to surface application, subsea dispersant injection generally results in lower concentrations of dispersed oil, reduces the amount of oil coming to the surface, requires less dispersants and treats all escaping oil from a single release point. The spill impact mitigation assessment would provide information on response options.

Most Indigenous groups raised concerns about the potential effects of an accident or malfunction on Atlantic Salmon. The proponent provided additional information about these potential effects and stated that the majority of areas affected by a spill would experience total hydrocarbon concentrations below levels shown to have behavioural or toxic effects on salmon. In the event of a subsea release, waters with potential higher concentrations would likely be located toward the bottom of the water column and near the release site and salmon would likely avoid these areas. Despite the additional information provided by the proponent and their predictions that the residual environmental effects from an accident or malfunction on fish, including salmon, would not likely be significant, the Agency notes that Indigenous groups continue to express concern regarding potential effects on Atlantic Salmon. Groups have stressed their desire to see Atlantic Salmon populations

recover so harvesting can resume and are concerned that offshore oil and gas exploration could contribute to pressures on populations, particularly in the event of an accident or malfunction. Several Indigenous groups, including WNNB, Woodstock First Nation, Elsipogtog First Nation and MFN, noted that data gaps regarding salmon behaviour and migration patterns still exist and it is important to acknowledge uncertainty and apply a precautionary approach in conducting the effects assessment. Groups have also stated that EAs of offshore exploration drilling projects take a compartmentalized approach and that an ecosystem-based approach should be taken with Indigenous knowledge more sufficiently factored into the assessments. In addition, several groups have noted that, in consideration of recent declines in Atlantic Salmon populations and the possible threat of extinction for some of these populations, any adverse effects on salmon could be of high magnitude, significant and would be an impact on Aboriginal rights.

MTI raised concerns about the potential effects of a spill on both Atlantic Bluefin Tuna and swordfish. Early life stages of these fish would be those most sensitive to exposure to oil; however, spawning and nursery areas for both these species are well beyond the predicted geographic extent of a spill, even in the worst-case unmitigated scenarios modelled. The proponent stated that juvenile or adult swordfish and Atlantic Bluefin Tuna are highly mobile and have wide distributions and would be able to avoid disturbances and search for prey outside areas affected by a spill.

Several Indigenous groups raised concerns related to potential contamination of harvested species in the event of a subsea release, including perceived contamination which could influence dietary changes if country foods were avoided. The proponent stated that the probability of a subsea release would be very low; released oil would likely move eastward; and response measures would likely reduce the magnitude, geographic extent and duration of a spill. The probability of contamination of resources harvested by Indigenous communities would be very low and the proponent maintained that an assessment of the potential effects on the health of Indigenous peoples was not required. However, the Agency is of the view that, in the event of a subsea release, actual and perceived environmental changes could potentially result in effects on socioeconomic conditions of Indigenous peoples, including effects to traditional foods. Following the Deepwater Horizon incident in the Gulf of Mexico, people living in coastal communities demonstrated high levels of anxiety and depression for up to two years following the event, including in areas that experienced little direct oil contamination (American Psychological Association (APA) 2014; Morris et al., 2013). The cause of depression and anxiety was generally reported to be related to income loss (APA, 2014; Morris et al., 2013). The proponent stated that any perceived contamination would be addressed by a post-spill sampling and supporting information program to demonstrate that the various harvested food are not contaminated. The proponent would also engage Indigenous groups in the development of the Oil Spill Response Plan.

Ekuanitshit requested additional information on the potential effects of a spill, including a nearshore vessel collision, on coastal species and habitats. The proponent stated that it is extremely unlikely that oil from a subsea release would reach the shoreline but that adverse effects are possible and the importance of eastern Newfoundland to seabirds cannot be overstated. In the event of a nearshore hydrocarbon spill, the potential effects on this area, if it were to occur, could be severe (refer to effects of hydrocarbons on birds discussed above); however, the proponent reiterated that the magnitude of the effect would depend on the nature of the spill and that response measures would be in place to mitigate potential effects.

KMKNO raised concern and asked about the timing of spill response and mobilization of a capping stack, similar to ECCC and the Agency as discussed above. KMKNO further recommended that the proponent be required to provide up-to-date information to the C-NLOPB prior to drilling and at regular intervals during drilling related to capping stack status and the availability of vessels capable of deploying the capping stack.

KMKNO and MFN asked about the level of involvement of Indigenous groups in the development and implementation of the Oil Spill Response Plan. The proponent committed to sharing its final Oil Spill Response Plan with Indigenous groups for discussion and would consider their input. The proponent also committed to engage with Indigenous groups throughout the life of the Project and to explore opportunities to provide education in oil spill response, which could include training, workshops or exercises to more fully integrate these groups into the Project.

Additional views expressed by Indigenous groups overlapped with those views expressed by federal authorities. Some of these key views and comments were discussed above.

A summary of issues raised by Indigenous groups is presented in Appendix C.

Public

The Fish, Food and Allied Workers Union stated that oil spills are a major threat to the fishing industry. It acknowledged that oil companies have protocols and practices in place to prevent spills from occurring and that regulatory agencies are involved in monitoring these companies but maintained that the threat of an oil spill is imminent. It also noted that the spill impact mitigation assessment and the decision to employ measures such as dispersants require public discussion.

7.1.3. Agency Analysis and Conclusion

Analysis of the Effects

Offshore exploratory drilling happens in a dynamic environment and accidental events associated with these activities have occurred in the past; however, the vast majority of these events have been relatively minor. More serious events, such as a large-scale subsea release, are far less likely to occur but could have major consequences. The Agency understands that the chance of an extremely large spill (greater than 150 000 barrels) occurring during the drilling of any given well is predicted to be one-in-25 000 while the chance of a large spill (greater than 1000 barrels) occurring is estimated as one-in-10 000.

Effects from a subsea release may include sub-lethal or lethal effects on fish, marine birds, marine mammals and sea turtles, including species at risk and their critical habitats. Effects may also include impacts on commercial fisheries, special areas and Indigenous peoples. As such, the proponent would be required to take all reasonable measures to reduce the likelihood of an accidental event and ensure that they are prepared to respond effectively if an accidental event were to occur.

The Agency is aware that the C-NLOPB verifies that proponents have appropriate measures in place for spill prevention and preparedness. The proponent must comply with the requirements of regulations and be able to demonstrate that it meets the C-NLOPB's expectations for facility safety, pollution prevention and emergency response capability. The C-NLOPB has advised the Agency that its authorization of drilling activities would be contingent on its confidence that the proponent has a satisfactory approach to risk management and would take all reasonable measures to minimize the probability of malfunctions and accidents. The proponent would be required to sufficiently demonstrate their preparedness to appropriately respond in the event of an accident or malfunction (e.g., batch spills, subsea releases) including preparation of detailed Oil Spill Response Plans that meet the C-NLOPB's regulatory standards. Among other elements, the Oil Spill Response Plan would

incorporate recommendations and guidance from ECCC, including measures related to wildlife surveillance, wildlife deterrent techniques, and the collection and storage of deceased wildlife.

The proponent would also be required to undertake a spill impact mitigation assessment to consider all realistic and achievable spill response options and identify those techniques (including the possible use of dispersants) that would provide for the best opportunities to minimize environmental consequences. Certain response measures, such as the use of dispersants and in-situ burning, would also require approval from the C-NLOPB prior to actual implementation.

In the event of a subsea release, primary and secondary barriers would be implemented to regain well control and prevent any accidental release of oil but if those barriers fail, the proponent would be required to begin the immediate mobilization of a capping stack and associated equipment to the site. Simultaneous to the mobilization of a capping stack, the proponent would be required to commence mobilization of a relief well drilling installation.

The proponent estimated that mobilization and installation of the capping stack could take anywhere from 15 to 30 days and that having a capping stack system in eastern Canada would be unlikely to reduce the overall time for installation. The C-NLOPB confirmed that capping and containment of a blown out well requires mobilization of equipment to prepare the subsea release site before use of a capping stack. This equipment would be transported by air to begin site preparation, which would include clearing of the site and cutting away of debris to ready the well for capping stack installation. The C-NLOPB has considered the various activities involved in source control and well capping and agrees with the proponent's assessment that the deployment of the capping stack is unlikely to be the critical path determining the overall timeline to put a capping stack in place. The C-NLOPB would require the Well Capping and Containment Plan contain a fulsome discussion of any potential options to reduce overall timelines (e.g., detailed accounting of timelines for mobilization and installation of capping stacks from various locations; review of opportunities to conduct preparatory work that may reduce timelines [e.g., permitting requirements, Canadian Customs and Border Services Agency requirements]). The proponent would be required to review environmental conditions at different times of the year to determine potential impacts on the time required to mobilize a capping stack, resulting in the need for additional mitigation.

The Well Capping and Containment Plan would include information on options and requirements for relief well drilling, including the locations of potential drilling installations that would be available to the proponent to drill a relief well. The proponent would be required to demonstrate that they have arrangements in place to access the necessary drilling installation in a manner that would minimize the time required to drill a relief well, taking into consideration location and logistics. The C-NLOPB would review the plans as part of its authorization process.

The Agency is aware that there have been a number of spills of synthetic-based mud offshore Newfoundland and Labrador over the past 20 years and 136 000 litres of untreated synthetic-based muds were accidentally released offshore Nova Scotia in 2018. The proponent would be required to have appropriate measures in place to prevent batch spills, including spills of synthetic-based mud. Spill prevention and response would be described in the proponent's Environmental Protection Plans and Spill Response Plans, which would be reviewed as part of the C-NLOPB's authorization process.

Despite the measures the proponent would implement to prevent and respond to a spill, the potential effects on fish and fish habitat, marine mammals and sea turtles, and migratory birds could, in a worst-case scenario and under worst-case conditions, result in both individual and population level effects. These effects could be

especially detrimental to populations of species that are particularly sensitive to such an event (e.g., seabirds) or are at risk (e.g., endangered population of North Atlantic Right Whale, Atlantic Salmon (Inner Bay of Fundy population)). The Agency also notes that a large subsea release, although unlikely, could affect special areas and critical habitats. Several of the special areas located within the regional study area (Appendix E) could be affected by a subsea release, including Fisheries Closure Areas, Ecologically or Biologically Sensitive Areas, and various coastal special areas. In addition, special areas outside the regional study area could also be affected, such as Sable Island National Park Reserve, the Gully Marine Protected Area, and Haldimand and Shortland Canyons, as well as international shorelines. Although unlikely, these effects could be of high magnitude.

Indigenous and non-Indigenous fishers with commercial and communal commercial fishing licences could also be affected by accidental spills. A large batch spill or subsea release could result in the closure of fishing areas, the fouling of gear and vessels, a reduction in the marketability of commercial fish products, as well as effects on fish and fish habitat. In addition, Indigenous peoples could be affected if a spill affects species that migrate through the spill area to areas where they are harvested for food, social or ceremonial reasons (e.g., Atlantic Salmon). The Agency agrees with comments from Indigenous groups that, even if effects on these species are relatively minor, perceived contamination may discourage individuals from engaging in certain traditional practices or consuming certain species which may have interacted with a spill. For both Indigenous and non-Indigenous fishers, any damages, including the loss of commercial or food, social and ceremonial fisheries, would require compensation in accordance with the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity*. The proponent would also be required to develop and implement Fisheries Communication Plans, which would include procedures to communicate with fishers in the event of an accident or malfunction. Views provided by Indigenous groups would be considered in the development of the Spill Response Plan and groups would be provided the approved version.

The proponent concluded that, with the potential exception of effects on migratory birds or on special areas protected for migratory birds, residual environmental effects from an accidental event scenario would not likely be significant. The Agency generally agrees with the proponent's characterization of the potential residual effects of an accident or malfunction but after considering the views of Indigenous groups and applying a precautionary approach to its own conclusions, the Agency is of the view that, although very unlikely, the potential effects of a worst-case accident could be significant in relation to additional valued components. For fish and marine mammals, the potential for significant effects is linked primarily to the potential presence of species at risk (e.g., Inner Bay of Fundy Atlantic Salmon, marine mammals and sea turtles species at risk). While uncertainty exists within these predictions (e.g., presence, abundance, migration patterns), even small impacts to a species at risk may be significant at a population level and affect their potential recovery. By extension, this could also result in an effect on the potential ability of Indigenous groups to harvest these species in the future. The Agency notes that the uncertainty may be addressed through further research proposed by the proponent.

Key Mitigation Measures to Avoid Significant Effects

The Agency considered the mitigation measures proposed by the proponent (Appendix B), expert federal advice from federal authorities and comments from Indigenous groups and the public and identified the following key measures to prevent accidents and malfunctions and to mitigate associated effects:

- undertake all reasonable measures to prevent accidents and malfunctions that may cause adverse environmental effects and effectively implement emergency response procedures and contingencies developed for the Project;
- submit a Well Capping and Containment Plan, which includes strategies and measures for well capping, containment of fluids lost from the well and the drilling of a relief well(s), as well as options to reduce overall response timelines;
- develop and implement procedures to provide up-to-date information to the C-NLOPB prior to drilling and during drilling related to the availability of appropriate capping stacks and vessels, and appropriate drilling rigs capable of drilling a relief well at the project site;
- prior to drilling, submit a Spill Response Plan which must include:
    - procedures to respond to an oil spill (e.g., oil spill containment, oil recovery) and spills of other types (e.g., synthetic-based mud or cuttings spill);
    - reporting thresholds and notification procedures;
    - measures for wildlife response, protection and rehabilitation (e.g., collection and cleaning of marine mammals, birds and sea turtles, including species at risk) and for shoreline protection and clean-up, developed in consultation with the C-NLOPB; and
    - specific role and responsibility descriptions for offshore operations and onshore responders.
- provide Indigenous groups with an opportunity to review and provide feedback on a draft version of the Spill Response Plan. Provide the approved version to Indigenous groups and make it publicly available on the Internet prior to drilling;
- conduct an exercise of the Spill Response Plan prior to the commencement of project activities and adjust the plan to address any deficiencies identified during the exercise. Provide results of the exercise to Indigenous groups following its review by the C-NLOPB;
- review and update the Spill Response Plan as required during drilling and before commencing a new well;
- prepare a plan for avoidance of collisions with vessels and other hazards which may reasonably be expected in the exploration licences and submit to the C-NLOPB for acceptance prior to drilling;
- undertake a spill impact mitigation assessment to consider all realistic and achievable spill response options and identify those techniques (including the possible use of dispersants) that would provide for the best opportunities to minimize environmental consequences and provide it to the C-NLOPB for review prior to drilling. Relevant federal government departments would provide advice to the C-NLOPB through the ECCC Environmental Emergency Science Table. Publish the spill impact mitigation assessment on the Internet;
- in the event of an uncontrolled subsea release from the well, begin the immediate mobilization of a capping stack and associated equipment to the site of the uncontrolled subsea release. Simultaneously, commence the mobilization of a relief well MODU;
- if drilling is anticipated in water depths of 500 metres or less, undertake further analysis to confirm the capping stack technology selected can be deployed and operated safely at the proposed depth and submit this analysis to the C-NLOPB for approval;
- compensate for any damages, including the loss of food, social and ceremonial fisheries in accordance with the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity*;
- include a procedure to notify Indigenous groups and commercial fishers in the event of an accident or malfunction in the Fisheries Communications Plan and to communicate the results of any associated monitoring and any potential health risks. Information that is provided to Indigenous groups and fishers needs to present a realistic estimation of potential health risks on consuming country foods, such that their