Tilt Cove Exploration Drilling Program

Chapter 15: Cumulative Effects

Prepared for:
Suncor Energy

Prepared by:
Stantec Consulting Ltd.
141 Kelsey Drive
St. John's, NL A1B 0L2
Tel: (709) 576-1458
Fax: (709) 576-2126

File No: 121417383

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Stantec

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15.0 CUMULATIVE EFFECTS

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

This chapter of the EIS identifies past, present, and future (certain or reasonably foreseeable) physical activities (i.e., projects or activities) with residual environmental effects that could interact cumulatively with the residual environmental effects of the Project, and assesses the significance of the associated potential cumulative environmental effects on the affected VCs.

15.1 Methods

The CEA Agency's (2015) Operational Policy Statement (OPS), Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012*, was taken into consideration during development of the cumulative environmental effects assessment scope and methods for this EIS. As per the OPS, the following steps of scoping, analysis, mitigation, significance, and follow-up formed the methodology of the cumulative effects assessment.

15.1.1 Scoping

Scoping the assessment of cumulative environmental effects involved:

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

This cumulative effects assessment builds on recent cumulative effect assessments conducted for offshore oil exploration and production projects in Atlantic Canadian waters:

- Terra Nova Asset Life Extension Environmental Assessment Validation Report (Stantec 2019)
- BHP Canada Exploration Drilling Project (2019-2028) Environmental Assessment (BHP 2020)
- West Flemish Pass Exploration Drilling Project 2021-2030: Environmental Assessment (Chevron 2020)
- Nexen Energy ULC Flemish Pass Exploration Drilling Project Environmental Impact Statement (Nexen 2018)
- Newfoundland Orphan Basin Exploration Drilling Program Environmental Impact Statement (BP 2018)
- Husky Energy Exploration Drilling Environmental Impact Statement (Husky Energy 2018)
- Flemish Pass Exploration Drilling Project Environmental Impact Statement (Statoil 2017)
- Eastern Newfoundland Offshore Exploration Drilling Project Environmental Impact Statement (EMCP 2017)
- West White Rose Wellhead Environmental Assessment (Husky Energy 2012)
- Hebron Project Comprehensive Study Report (EMCP 2011)

- Equinor Canada Bay du Nord Development Project EIS (Equinor 2020)
- Regional Assessment of Offshore Oil and Gas Exploratory Drilling East of Newfoundland and Labrador - GIS Decision Support Tool (IAAC 2021)

Additionally, the findings from the report on the Regional Assessment of Offshore Oil and Gas Exploratory Drilling East of Newfoundland and Labrador (Bangay et al. 2020) were reviewed and incorporated into the assessment of cumulative effects as applicable.

15.1.1.1 Valued Components

The assessment of cumulative environmental effects considers all seven of the VCs for which Project-related environmental effects were assessed, as residual environmental effects were predicted for each VC (refer to Chapters 8 to 14). These seven VCs are:

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

15.1.1.2 Spatial and Temporal Boundaries

The OPS (CEA Agency 2015) requires determination of spatial and temporal boundaries for the cumulative effects assessment. The OPS suggests that spatial boundaries encompass potential environmental effects on the selected VC of the designated project in combination with other physical activities that have been or will be carried out. Temporal boundaries should consider future physical activities that are certain or reasonably foreseeable, and the degree to which potential environmental effects of these physical activities will overlap those predicted from the designated project.

The spatial boundaries for the assessment of cumulative environmental effects on each VC consists of the Project Area and RAA as defined in the respective VCs (Chapters 8 to 14). The definition of the RAA is particularly relevant, as it is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future physical activities. The RAA is larger than the spatial boundaries for Project-related effects (i.e., the LAA) to encompass the other physical activities outside of the Project Area and LAA that have potential to interact cumulatively with the Project, as well as to account for the larger movements and distributions of the various biological and socio-economic components.

The temporal boundaries for the Project to be assessed encompass all Project phases, including well drilling, testing, and well decommissioning, suspension and abandonment. Project activities are scheduled to begin as early as Q2 2024 and continue over the temporal scope of the Project. The EIS assumes that planned Project activities may occur year-round within this timeframe, with 45 to 120 days to drill each well. These temporal boundaries are also appropriate for the cumulative effects assessment.

15.1.1.3 Other Physical Activities

In accordance with the OPS (Agency 2015), the cumulative effects assessment includes consideration of other physical activities that have been, are being, and will be carried out in the RAA. With respect to future physical activities that will be carried out, the assessment considers (CEA Agency 2015):

- Future physical activities that are certain (i.e., the physical activity will proceed or there is a high probability that the physical activity will proceed – for example, a proponent has received the necessary authorizations or is in the process of obtaining those authorizations); and
- Future physical activities that are reasonably foreseeable (i.e., the physical activity is expected to proceed – for example, a proponent has publicly disclosed its intention to seek the necessary EIS or other authorizations to proceed).

As noted in the Eastern NL Regional Assessment, the marine environment offshore NL has been and continues to be affected by a variety of natural and anthropogenic influences which have influenced the presence, distribution, abundance and health of marine biota (IAAC 2020). The following list identifies the past, present, and future (i.e., certain or reasonably foreseeable) physical activities within the RAA that have potential to cause residual environmental effects that overlap spatially and temporally with the residual environmental effects of the Project:

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

The physical activities listed above are included in the scope of the cumulative effects assessment, as applicable, with respect to each VC (i.e., where there is potential for a residual environmental effect of the Project to interact cumulatively with a residual environmental effect of another physical activity on the VC). The effects of the previous and ongoing activities, therefore, are reflected in the existing (baseline) conditions and influence the overall sensitivity or resiliency of a particular component (IAAC 2020).

Ongoing production and proposed oil and gas exploration drilling projects are shown in Figure 15-1. Other past, present, and future physical activities identified in Table 15.1 are considered in this cumulative effects assessment as they may result in residual environmental effects that could interact cumulatively with (i.e., overlap spatially and temporally with) the residual environmental effects of the Project within the RAA.

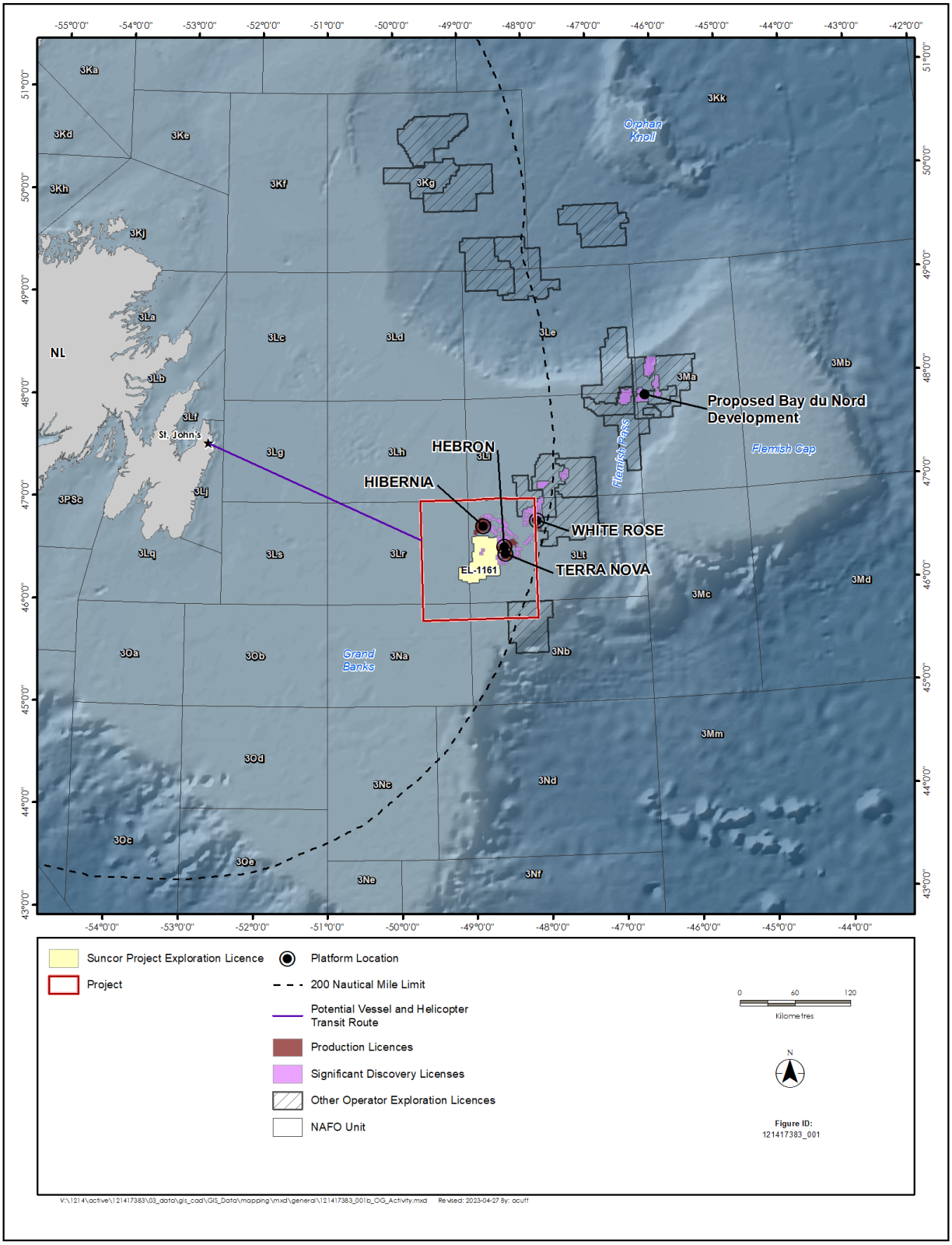


Figure 15-1 Ongoing Production and Proposed Oil and Gas Exploration Drilling Projects

Table 15.1 Other Projects and Activities Considered in the Cumulative Effects Assessment

Project / Activity	Overview	General Spatial and Temporal Considerations of Potential Residual Effects
Hibernia Oilfield, including South Extension	• Discovered in 1979; operated by HMDC; located approximately 315 km east-southeast of St. John's, NL. • Gravity-based structure (GBS) installed on-site in June 1997; production began November 1997. • The Hibernia platform consists of topsides (accommodations, drilling and production equipment), a gravity-based structure, and an offshore loading system. • The completed platform (which stands 224 m high) was towed to the Hibernia oil field and positioned on the ocean floor (in 80 m water depth) in June of 1997 and began producing oil in November 1997. • The project was expanded to include the Hibernia South Extension, which began production in 2011. • On June 26, 2019, HMDC spudded a delineation well in the North West Wedge part of the field. HMDC Hibernia K-39 was followed by a sidetrack well K39Z in August. The results remain privileged (IAAC 2020). • Based on approved development plans for this development, it is expected to continue until 2047 (IAAC 2020).	• This ongoing project is located within the Project Area and approximately 11 km from EL 1161 (see Figure 15-1). • Production activities at this oilfield are planned to extend throughout and beyond the temporal duration of the Project (at least 2040). • Safety (exclusion) zones required around project installations (approximately 17 km²) may result in spatial use conflicts with fisheries and other ocean uses.
Terra Nova Oilfield and Extension Project	• Discovered in 1984; currently operated by Suncor Energy Inc.; located approximately 350 km southeast of St. John's and 35 km southeast of Hibernia. • Production from an FPSO began in January 2002. • Oil production wells were pre-drilled by a semi-submersible MODU. The wellheads and production manifolds are placed in drill centres, which are excavations in the seafloor that protect the equipment from scouring icebergs. • A network of more than 40 km of flexible flow lines is used to convey hydrocarbons to and from the wells. Produced gases are separated from the oil and re-injected into the reservoir to support oil production and for possible future extraction. Crude oil is offloaded from the FPSO onto large shuttle tankers for shipment.	• This ongoing project is located within the Project Area and approximately 7 km from EL 1161 (see Figure 15-1). • Production activities at this oilfield are planned to extend throughout and beyond the temporal duration of this Project (at least 2031). • Safety (exclusion) zones required around project installations (approximately 269 km²) may result in spatial use conflicts with fisheries and other ocean uses.

Table 15.1 Other Projects and Activities Considered in the Cumulative Effects Assessment

Project / Activity	Overview	General Spatial and Temporal Considerations of Potential Residual Effects
	• In May 2019, Suncor and the Terra Nova joint venture owners sanctioned plans to proceed with a project that will extend the life of the FPSO vessel to approximately 2031. The asset life extension project is expected to allow the facility to capture approximately 80 million additional barrels of oil for the Terra Nova partnership. The asset life extension project will take place in 2020 (Stantec 2019). • Based on approved development plans for this development, it is expected to continue until 2031 (IAAC 2020).	
White Rose Oilfield and Extension Project	• Discovered in 1984; operated by Husky Energy Inc; located approximately 350 km east-southeast of St. John's, and approximately 50 km from Hibernia and Terra Nova. • The White Rose oilfield and its satellite extensions are operated using an FPSO. Production began in November 2005; North Amethyst expansion began production in May 2010. • The West White Rose Project (located within the existing White Rose Safety Zone) will be developed using a fixed wellhead platform.	• This ongoing project is located approximately 3 km from the closest edge of the Project Area and approximately 48 km from EL 1161 (see Figure 15-1). • White Rose has been producing oil year-round since 2005. An EA validation was completed in 2020 for the White Rose Asset Life Extension Project to extend the temporal scope of the White Rose Project. The temporal boundaries extend the life of the White Rose Project to an anticipated end of life of production at the end of 2036, with decommissioning, suspension and abandonment activities to follow (Husky 2020). • The decision to proceed with the West White Rose Wellhead was announced on May 31, 2022; construction is expected to resume immediately. • Safety (exclusion) zones required around project installations (approximately 93 km²) may result in spatial use conflicts with fisheries and other ocean uses.
Hebron Oilfield	• Discovered in 1980; operated by EMCP; located approximately 350 km southeast of St. John's and 16 km southeast of Terra Nova. • First oil was achieved in November 2017. • The Hebron field is being developed using a stand-alone concrete GBS in approximately 93 m water depth. • Based on approved development plans for this development, it is expected to continue until 2047 (IAAC 2020).	• This ongoing project is located within the Project Area and approximately 7 km from EL 1161 (see Figure 15-1). • Hebron has been producing oil year-round since 2017 and has an estimated production life of 25 years. • Safety (exclusion) zones required around project installations (approximately 6 km²) may result in spatial use conflicts with fisheries and other ocean uses.

Table 15.1 Other Projects and Activities Considered in the Cumulative Effects Assessment

Project / Activity	Overview	General Spatial and Temporal Considerations of Potential Residual Effects
Proposed Bay du Nord (BdN) Development Project	• The proposed BdN Development Project is located approximately 450 km east-northeast of St. John's, NL, with a well-defined Core Development Area (450 km²). • Water depths in the Core BdN Development Area range from approximately 1,000 m - 1,200 m. • A Significant Discovery Licence was issued in November 2017, to be operated by Equinor Canada. • The proposed project is a subsea development of 10 to 30 wells in the Core Development Area tied back to an FPSO installation. • Although the project has not yet been sanctioned by Equinor, an EIS was filed in July 2021 and released in April 2022..	• This project is located approximately 164 km from the Project Area and approximately 224 km from EL 1161 (see Figure 15-1). • As currently proposed, the footprint on the sea floor of proposed facilities covers an area of approximately 7 km². A broader project area (approximately 4,900 km²) is associated with potential future development. • An EIS was submitted in 2020; regulatory approval was issued April 6, 2022. Project sanction by Equinor is still pending. Construction would occur over a two to three-year period and production could extend for approximately 12 to 20 years (Equinor 2021).
Offshore Petroleum Exploration - Drilling	• The Eastern NL offshore area is subject to ongoing and planned offshore exploration drilling programs that are in progress or being subject to EA review or recently approved as of the time of writing (see Figure 15-1). The type and amount of offshore exploration activity can vary considerably from year to year. • A total of 510 wells have been drilled in the Canada-NL Offshore Area as of February 28, 2022, including 179 exploration wells, 63 delineation wells, and 271 development wells (C-NLOPB 2022).	• Several other offshore exploration drilling projects in the eastern Newfoundland offshore area have completed their EAs (see https://www.cnlopb.ca/assessments/) • During drilling operations, a safety (exclusion) zone of approximately 500 m radius is maintained around the drilling installation. • Project-specific EAs include modelling studies to predict the zone of influence of effects, but in general, effects from exploration drilling are localized and short-term. • Timeframes for exploration drilling projects generally coincide with the terms of the ELs (maximum nine years), although activity is not continuous during this time and operators may choose to drill only a single well during this time period.
Offshore Petroleum Exploration – Geophysical and Other Exploration Activities	• Includes two-dimensional (2D), three-dimensional (3D) and possibly four dimensional (4D) geophysical data acquisition, as well as associated geological, geotechnical, geochemical, and environmental survey activities. • Programs are proposed and approved through the EA process as multi-year programs covering large offshore areas. The type / level of activity each year can vary and is usually a fraction of the overall scope. For general illustration, over the period 2014 to 2016, an average of approximately 390,000 km of geophysical data was collected	• There are several offshore geophysical and seismic programs in the eastern Newfoundland offshore area in various stages of approval / completion (see https://www.cnlopb.ca/assessments/) • Geophysical programs can be localized (confined to one or more ELs) or regional in nature and can occur over a span of weeks or years, depending on the survey scope. • Although safety (exclusion) zones are not implemented for geophysical surveys, these surveys may result in

Table 15.1 Other Projects and Activities Considered in the Cumulative Effects Assessment

Project / Activity	Overview	General Spatial and Temporal Considerations of Potential Residual Effects
	annually in the eastern NL offshore region, with an average of approximately 35,000 undertaken annually in the Jeanne d'Arc Basin area. • There are several offshore geophysical programs in the Eastern NL offshore in progress, being subject to EA review, or approved as of the time of EIS writing.	spatial use conflicts with fisheries and other ocean uses.
Fishing Activity	• Commercial fisheries within and around the Project are extensive and diverse, as described in detail (including associated mapping) in Sections 7.2 and 7.4 of this EIS.	• Spatial and temporal characteristics of fisheries in the RAA are described in Sections 7.2 and 7.4. of this EIS.
Other Ocean Uses (including Other Marine Vessel Traffic)	• Section 7.3 describes other marine-based activities which occur in the RAA including research surveys, shipping, military exercises, and existing marine-based infrastructure (e.g., telecommunication cables) which have been and will likely continue to be present in the RAA and potentially result in residual environmental effects on VCs.	• Depending on the nature of these activities, the geographic extent, duration and frequency of effects can vary considerably. • Spatial and temporal characteristics of other ocean uses in the RAA are described in Section 7.3. of this EIS.
Hunting Activity	• Wildlife (especially seabird) populations off the coast of NL are subject to hunting activity. Refer to Section 7.4 for more information on Indigenous hunting in the RAA.	• Although little or no hunting activity is expected to occur in the far offshore locations that comprise the Project Area, these activities do affect the bird and seal populations that occur in, and move to and through, the region.

15.1.2 Assessing Cumulative Effects on the Valued Component

The assessment of cumulative effects on each VC includes consideration of the following:

- Past and Ongoing Effects (existing environment): The context for cumulative environmental effects considers the current (existing) condition of the VC, including past natural or anthropogenic factors which may have affected the VC's current condition. Existing conditions in the RAA are described in Chapters 5, 6, and 7 to characterize the setting for the Project, support an understanding of the receiving environment, and provide sufficient context for the cumulative effects assessment by enabling an understanding of how current environmental conditions might be affected by the Project in combination with other past, present, and future physical activities within the RAA.
- Potential Project-related Contributions to Cumulative Effects: Considers how the existing conditions of each VC, as shaped by the residual environmental effects of various past and present physical activities in the RAA, may change following the introduction of the Project (as a result of the potential Project-related residual environmental effects that are described for each VC in Chapters 8 to 14).
- Future Projects and Their Effects: An overview of the potential residual environmental effects associated with other certain or reasonably foreseeable future physical activities in the RAA and consider the spatial and temporal characteristics of these potential residual effects on each relevant VC.

- Potential Cumulative Environmental Effects: The assessment of residual effects from the Project combined with other projects and activities (including special consideration of potential cumulative environmental effects on SAR). The potential for residual environmental effects from the Project to cause a change in cumulative environmental effects that could affect the quality or sustainability of the VC is evaluated. The evaluation considers the context for cumulative environmental effects in the RAA, the nature and extent of the potential cumulative interactions, and technically and economically feasible mitigation measures that Suncor will implement to avoid or reduce potential environmental (including cumulative) effects. Residual cumulative environmental effects are characterized through application of the specific analysis criteria (i.e., magnitude, geographic extent, duration, frequency, reversibility, and context) defined for each VC in its respective VC analysis chapter.

A cumulative effects summary is then provided for each VC. The significance of potential cumulative environmental effects is determined based on the same VC-specific thresholds used for the assessment of Project-related environmental effects in Chapters 8 to 14.

According to the OPS (CEA Agency 2015), the assessment of the environmental effects of accidents and malfunctions must be considered in the assessment of cumulative environmental effects if they are likely to result from the designated project in combination with other physical activities that have been or will be carried out. Potential environmental effects of Project-related accidental events and malfunctions are assessed in Chapter 16. Most of the accidental event scenarios, particularly larger-scale events with the greatest environmental consequences and opportunity to interact cumulatively with effects from other projects and activities, are considered unlikely to occur. Of the identified scenarios, the most likely accidental event which could occur are small operational spills from the MODU. Spill prevention and response procedures will be in place to reduce the risk of spills and associated environmental effects (refer to Section 16.4). Other offshore operators will also implement spill prevention and response measures. In the event that a small batch spill did occur from the Project, it would be unlikely to interact with the residual environmental effects of discharges from other exploration and/or production projects, fisheries, or other ocean uses in such a way that causes a cumulative environmental effect given the implementation of a 500-m radius safety (exclusion) zone surrounding the MODU and anchors and rapid dilution and/or evaporation of discharges. Therefore, cumulative effects from accidents and malfunctions are considered unlikely to happen and are not assessed further in the cumulative effects assessment. Cumulative effects of routine marine discharges are considered for each VC as applicable.

15.1.3 Mitigation, Significance, and Follow-Up

Mitigation, monitoring, and follow-up requirements are discussed as appropriate, in order to reduce adverse cumulative environmental effects. This includes mitigation to be implemented by Suncor to reduce Project-related residual effects, as well as measures required by Suncor and other parties to reduce the contribution of effects from other projects and activities. Information on other projects and activities and their known or likely environmental effects and planned mitigation measures has been obtained through existing and publicly available information sources, as well as relying on the professional experience of the EIS study team. The cumulative effects assessment considers the nature, location, and timing of these other projects and their environmental effects in relation to the Project, as well as environmental protection measures that are known and/or required to be implemented in relation to them, including those required under applicable legislation, regulations, and other requirements.

The significance of potential cumulative environmental effects is determined based on the same VC-specific thresholds used for the assessment of Project-related environmental effects in Chapters 8 to 14. Following the determination of significance, follow-up and monitoring programs are recommended, where necessary, to verify cumulative environmental effects predictions or to assess the effectiveness of proposed mitigation measures.

15.2 Atmospheric Environment

15.2.1 Spatial and Temporal Boundaries

The spatial boundaries for the Atmospheric Environment VC cumulative effects assessment differ than those previously defined in Section 15.1.1.2, which include the Project Area and the RAA. The cumulative effects assessment for the Atmospheric Environment focuses on impacts from the Project and other offshore sources and on offshore receptors within the spatial boundary of the LAA and globally. Due to the distance from the Project to shore (approximately 300 km to St John's, NL) it is not anticipated that the impacts on the atmospheric environment from the Project will act in a cumulative manner with air contaminant emission sources or at receptors located onshore NL. An ESRF study (Stantec 2013) modelled concentrations of NO_2 from offshore production facilities and determined that for the most part, NO_2 emissions generally meet onshore air quality limits at the 500-m safety zone surrounding each production installation.

The temporal boundaries are consistent with those defined in Section 15.1.1.2.

15.2.2 Past and Ongoing Effects (Baseline)

The existing air quality within the LAA, located offshore approximately 230 km east of St. John's, can be generally categorized as good based on the dispersion modelling studies conducted by other offshore operators in the LAA; the results from these studies indicate that the regulatory criteria were always met at receptor locations (Stantec 2010, 2012). The air quality is occasionally influenced locally by exhaust emissions from existing oil production facilities and supporting activities (i.e., support vessels and helicopters), exploration activities and associated support activities (e.g., support vessels and helicopters), and other marine vessel traffic.

To characterize the existing GHG emissions within and surrounding the Project Area, emissions data from existing offshore NL sources were acquired from the Government of Newfoundland and Labrador (nd). Emissions of GHGs from facilities meeting specific emission thresholds are required to be reported on an annual basis to ECCC, through the GHGRP. Reported GHG data was available for the production facilities located within the Project Area (Terra Nova, Hibernia, White Rose, and Hebron) and for two exploration drill rigs (TransOcean Henry Goodrich and TransOcean Barrents) known operate in offshore NL. A summary of the available 2020 reported GHG emissions (2019 for Terra Nova) for each of the existing emission sources is provided in Table 15.2. As of 2020, the exploration drilling rigs TransOcean Henry Goodrich and TransOcean Barrents are not currently operating offshore NL.

Table 15.2 Summary of Existing GHG Emissions Offshore NL – 2019 and 2020

Project/Platform	Annual Emissions (tonnes CO_2e/year)			
	CO_2	CH_4	N_2O	Total
SeaRose FPSO	343,084	17,047	2,232	362,362
Terra Nova FPSO (2019)	491,321	21,126	7,083	519,692
Hibernia Platform	546,920	16,797	3,014	566,731
Hebron Platform	481,611	19,821	3,032	504,464
TransOcean Henry Goodrich Exploration Drill Rig	1,257	2	56	1,315
TransOcean Barrents Exploration Drill Rig	24,992	31	1,118	26,142
Total GHG Emissions (existing sources)	1,889,185	74,824	16,535	1,980,706

Note:
Source: Government of Newfoundland and Labrador (nd)

15.2.3 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 8, routine Project activities and components have the potential to interact with the atmospheric environment from the combustion of fuel (engines, MODU, supply vessels, fixed and mobile deck equipment, and helicopters) and from flaring during well testing. The Project, therefore, has potential to result in the following residual adverse environmental effects on the atmospheric environment:

- A residual change in GHG emissions

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 8.4 and a determination of significance in Section 8.5. With the implementation of mitigation (Section 8.4.2.1), the environmental effects of routine Project-alone activities on GHGs are predicted to be not significant.

The Project GHG emissions have the potential to act in a cumulative fashion with emissions from existing production facilities and other exploration drilling projects offshore NL within or near the Project Area, cumulatively impacting the GHG emissions. The potential cumulative impacts are described in the following subsections.

15.2.4 Future Projects and Activities and Their Effects

Table 15.3 summarizes how present and future projects and activities offshore NL have potential to cause a change in air quality and/or change in GHG emissions within the LAA, thereby interacting cumulatively with the Project affecting the atmospheric environment.

Table 15.3 Atmospheric Environment: Residual Effects from Other Projects and Activities Offshore NL

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Production Projects (Production from Hibernia, Terra Nova, White Rose, and Hebron Oilfields)	• Change in GHG emissions	• Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area combined with the emissions from offshore petroleum production projects during periods of simultaneous operations.
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in GHG emissions	• Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area combined with the emissions from vessels used for Geophysical Survey Programs during periods of simultaneous operations.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in GHG emissions	• Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area combined with the emissions from offshore petroleum exploration drilling programs during periods of simultaneous operations.
Commercial Fishing Activity	• Change in GHG emissions	• Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area combined with the emissions from fishing boats used for commercial fishing during periods of simultaneous operations.
Hunting Activity	• N/A	• N/A
Other Ocean Uses	• Change in GHG emissions	• Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area combined with the emissions from marine vessel traffic during periods of simultaneous operations.

15.2.5 Potential Cumulative Environmental Effects to Greenhouse Gas Emissions

Project-related GHG emissions (presented in Chapter 8) have the potential to cumulatively increase GHG emissions from the area when combined with the GHG emissions from existing offshore development projects in and surrounding the Project Area and other exploration drilling projects.

The 2019 GHG emissions from the Terra Nova production platform (not operational in 2020 and 2021) and 2020 GHG emissions from other existing sources within the Project Area are provided in Table 15.4. Reported GHG data was available for each production facility located within the Project Area (Terra Nova, Hibernia, White Rose, and Hebron) known to be operating offshore Newfoundland.

Table 15.4 2020 Facility Reported GHG Emissions – NL Offshore Area Production Platforms and Drill Rigs

Project/Platform	Annual Emissions (tonnes CO_2e/year)			
	CO_2	CH_4	N_2O	Total
SeaRose FPSO	343,084	17,047	2,232	362,362
Terra Nova FPSO (2019)	491,321	21,126	7,083	519,692
Hibernia Platform	546,920	16,797	3,014	566,731
Hebron Platform	481,611	19,821	3,032	504,464
Total GHG Emissions Existing Production Platforms	1,862,936	74,791	15,361	1,953,249
Tilt Cove (Project being assessed in this report)	62,576	162	501	63,239
Cumulative GHG Emissions (including Project emissions)	1,925,512	74,953	15,862	2,016,488

The total GHG emissions from Project activities are compared to the regional cumulative GHG emissions (including Project), the provincial and federal GHG targets in Table 15.5. The Project will contribute 2.8% of the cumulative regional offshore GHG emissions (Project activities and existing offshore NL sources). The Project will contribute 0.64% of the provincial 2030 GHG target and 0.009% to the Federal 2030 GHG target.

Table 15.5 GHG Emissions in Comparison to Provincial and Federal Targets

	Predicted Annual Project Emissions	Predicted Annual Cumulative Offshore Emissions	2030 GHG Targets	
			Provincial[a]	Federal[b]
	44 kt	1.54 MT	6.9 MT	513 MT
Project Contribution	100%	2.8%	0.63%	0.01%
Notes: [a] Gov NL 2019 [b] ECCC 2019d				

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

With the implementation of mitigation measures (Section 8.4.2.1), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on GHGs are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.3 Marine Fish and Fish Habitat

15.3.1 Past and Ongoing Effects (Baseline)

The Grand Banks of Newfoundland are a highly productive ecosystem. Two major currents, the Gulf Stream and the Labrador Current, cause mixing and upwelling that result in high productivity and diversity. Localized gyres, such as around the Flemish Cap, are particularly productive and result in important feeding and spawning grounds for fish. Many species migrate to this area specifically to feed before returning to spawning grounds. A wide variety of demersal, benthic, and pelagic fish and invertebrate species occur within the Project Area. These species, ranging from zooplankton (mainly larvae), planktivores (e.g., capelin), and large predators (e.g., white shark), play important roles in the ecosystem with many playing different roles at different points in their life histories. Some of these species are of commercial or Indigenous importance in addition to their ecological roles.

Marine fish and fish habitat in the RAA have been and continue to be affected by a variety of natural processes (e.g., water temperature changes, changes in prey species abundance and distribution) and human activities (e.g., shipping and vessel traffic, fishing activities and restrictions, offshore oil and gas exploration and production). These interactions, collectively, have affected the presence, distribution, abundance, and the overall size and health of fish populations. There has been a northward shift in both fish species distribution and commercial fishing industry catch due to warming sea surface temperatures in the Northwest Atlantic (Nye et al. 2009; Pinsky and Fogarty 2012; Pershing et al. 2015). This warming trend, along with restrictions on harvesting, may encourage the return of a groundfish-dominated system (Templeman 2010; Nogueira et al. 2017).

Human activities have interacted with marine fish and fish habitat generally through mortality of fish and/or changes in fish habitat caused by commercial fishing activities. Fish harvesting has occurred near the shores of Newfoundland and Labrador for thousands of years, originally by Indigenous peoples and later also by Europeans who eventually settled on the Island and parts of the Labrador coasts, primarily to harvest fish. Fish populations in the region have been affected by directed catch and bycatch of targeted fish species and/or prey species. From 1980 to 1990, catch effort was high and it became evident that stocks were being over-fished. The period from 1990 to 1992 continued to see major declines in catch weight, and in 1992 a moratorium was put in place for groundfish species. At that point in time, the focus shifted to commercial harvesting of shellfish species (i.e., snow crab and shrimp). Domestically, for approximately the past 20 years, shellfish have filled the void left by the groundfish moratorium; however, the viability of those stocks is beginning to be questioned (DFO 2018; Government of Canada 2018) as declines in the catch weight of these species has been noted in recent years. The use of some fishery techniques (e.g., bottom-trawling) have also resulted in long term changes to benthic habitat (e.g., destruction of corals and sponges). Fisheries management tools, including the use of moratoria or quotas and fishery closure areas, have been implemented to help manage the health of fish stocks and protect fish habitat.

The effects of previous activities and natural environmental influences are reflected in the existing environmental conditions for the Marine Fish and Fish Habitat VC, as described in Section 6.1. This includes considering the current condition (e.g., health or quality) of potentially affected fish populations and their habitats, as well as their potential resiliency or sensitivity to further environmental change.

15.3.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 9, routine Project activities and components have the potential to interact with marine fish and fish habitat from:

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

The Project, therefore, has potential to result in the following residual adverse environmental effects on marine fish and fish habitat.

- A residual change in risk of mortality or physical injury
- A residual change in habitat availability, quality, and use

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 9.3 and a determination of significance in Section 9.4. With the implementation of mitigation (Section 9.3), the residual environmental effects of routine Project activities on marine fish and fish habitat are predicted to be not significant.

15.3.3 Future Projects and Activities and Their Effects

Table 15.6 summarizes how present and future projects and activities in the RAA have potential to cause a change in risk of mortality or physical injury and/or change in habitat availability, quality, and use, thereby affecting marine fish and fish habitat.

Table 15.6 Marine Fish and Fish Habitat: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Hibernia Oilfield	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• Components of the Hibernia Oilfield include the Hibernia Platform and the Hibernia Southern Extension. • The following is an overview of key results from the Hibernia 2018 EEM program (HMDC 2021): - Toxic Microtox responses were observed 6 km away from the Hibernia platform and toxic responses in amphipods up to 0.25 km from the platform. - Sediment chemistry testing has shown barium levels from drill cuttings have reduced from baseline (1994) concentrations as drilling has ceased at Hibernia Southern Extension in 2017 between EEM programs. Elevated levels around the Hibernia Southern Extension drill centre were limited to within 250 m. - Fuel range hydrocarbons were detected in sediments out to 0.5 km from the Hibernia platform and 0.25 km from the Hibernia Southern Extension drill centre. - For the Hibernia Platform, three significant results implying potential project effects were detected in 2018. For Hibernia Southern Extension drill centre, four significant results implying potential project effects were detected in 2018.
Terra Nova Oilfield	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• The components of the Terra Nova Oilfield include an FPSO and a semi-submersible installation (from time to time). • The following is an overview of key results from the Terra Nova 2017 EEM program (Suncor 2019): - Concentrations of barium and hydrocarbons decreased to background levels within approximately 1 and 3 km, respectively from drill centres. - There was evidence of project effects on in-situ benthic invertebrates near drill centres, with abundances of some taxa increasing and abundances of other taxa decreasing near drill centres with higher barium and hydrocarbon concentrations observed. Effects on the most affected taxa were apparent within 1 to 2 km of drill centres. - With the exception of chlorophyll concentrations, analyses of water samples indicated that seawater physical and chemical characteristics at EEM study area stations and reference area stations, located approximately 20 km southeast and southwest of the Terra Nova site, were similar. There was evidence that produced water affected chlorophyll concentration in 2017, this was limited to stations within approximately 0.3 km. - Contamination of Iceland scallop tissue was noted; however, contamination has been decreasing over time and has never translated into tainting of the resource. No contamination or tainting was noted for American plaice and American plaice health, as measured through a combination of health indicators, was similar between the Terra Nova EEM study area and the more distant reference areas. - Results are consistent with EIS predictions (Suncor 1996)

Table 15.6 Marine Fish and Fish Habitat: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
White Rose Oilfield Project	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• The components on the White Rose Oilfield include a FPSO and five excavated drill centres. • The following is an overview of key results from the White Rose 2018 EEM program (Husky Energy 2022): - In general, estimated average threshold distances for both hydrocarbons and barium were greater in earlier EEM years (2004 to 2010) than they have been in more recent years. - The estimated distance over which hydrocarbons concentrations in sediment were correlated with distance from active drill centres (i.e., the threshold distance) extended to an average 2.4 km in 2018. - The distance over which barium concentrations were correlated with distance from active drill centres extended to an average of 1 km. - There was no evidence of project effects on water quality. - Analyses of fish tissue chemistry, taste and fish health characteristics for American plaice and snow crab collected within 4 km of drill centres revealed no compelling evidence of effects of project activities on commercial fish.
Hebron Oilfield	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• The components for the Hebron Oilfield include a drilling and production platform. • The following is an overview of key results from the Hebron 2018 EEM program (EMCP 2021): - There was a slight increase in barium concentration from samples taken in the near-field between 2014 and 2018. Hydrocarbon concentrations were similar between 2014 and 2018. - As produced water was not continuous in 2018, the water component was not a part of the 2018 EEM and will be addressed in subsequent EEM reports. - No hydrocarbons were detected in American plaice fillets. - American plaice livers had significantly higher hydrocarbons in the upper fuel range in 2018, and significantly lower hydrocarbons in the lube range in 2018. Hydrocarbons in the lower fuel range were not detected in American plaice livers. - Overall, several statistically significant differences in fish health indices were detected among American plaice surveyed in 2018. - No significant difference was detected in taste tests conducted on American plaice.

Table 15.6 Marine Fish and Fish Habitat: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of underwater sound in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location. Thus, potentially resulting in a transient and relatively short-term disturbance within localized portions of the survey area. • These types of activities have been carried out widely off eastern Newfoundland, typically use standard equipment and techniques, and are required to meet general environmental protection requirements and mitigation measures as determined through project specific EAs.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on marine fish and fish habitat (refer to Chapter 9). • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations to be affected simultaneously and repeatedly by multiple physical activities. • Acoustic monitoring in targeted areas on the East Coast of Canada found that underwater sound from drilling platforms were measurable for extended periods to ranges of at least 15 km at the seabed in deep water and 35 km in shallow water (Delarue et al. 2018). • With respect to the timeline for recolonization by benthic communities following the deposition of drill muds and cuttings, benthic recovery in relatively shallow waters has been documented as occurring within as few as approximately one to four years (Bakke 1986, Neff et al. 2000, Hurley and Ellis 2004, Renaud et al. 2008, Bakke et al. 2011, Lee et al. 2011).. Benthic recovery following the discharge of drill muds and cuttings, and the completion of offshore drilling projects in general, is anticipated to take much less time since these activities do not entail the removal of large swaths of attached epifauna.
Commercial Fishing Activity	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• Commercial fisheries occur within and around the Project. Although the presence of mobile bottom-contact fishing gear is relatively more transient, the residual environmental effects of this type of commercial fishing activity on marine fish and fish habitat (particularly benthic fish habitat) is generally more disruptive, longer term, and more spatially extensive than the temporary and localized residual effects to fish and fish habitat associated with the use of fixed fishing gear. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from fishing vessels is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury associated with high underwater sound pressure levels.

Table 15.6 Marine Fish and Fish Habitat: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Hunting Activity	• Not applicable	• Not applicable
Other Ocean Uses	• Change in risk of mortality or physical injury • Change in habitat availability, quality, and use	• The highly transitory nature of the vessels of other ocean users reduces potential residual effects on marine fish and fish habitat in any particular location and at any particular time. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from the vessels of other ocean users is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury associated with high underwater sound pressure levels.
Source: Modified from BP 2018; EMCP 2017		

15.3.4 Potential Cumulative Environmental Effects

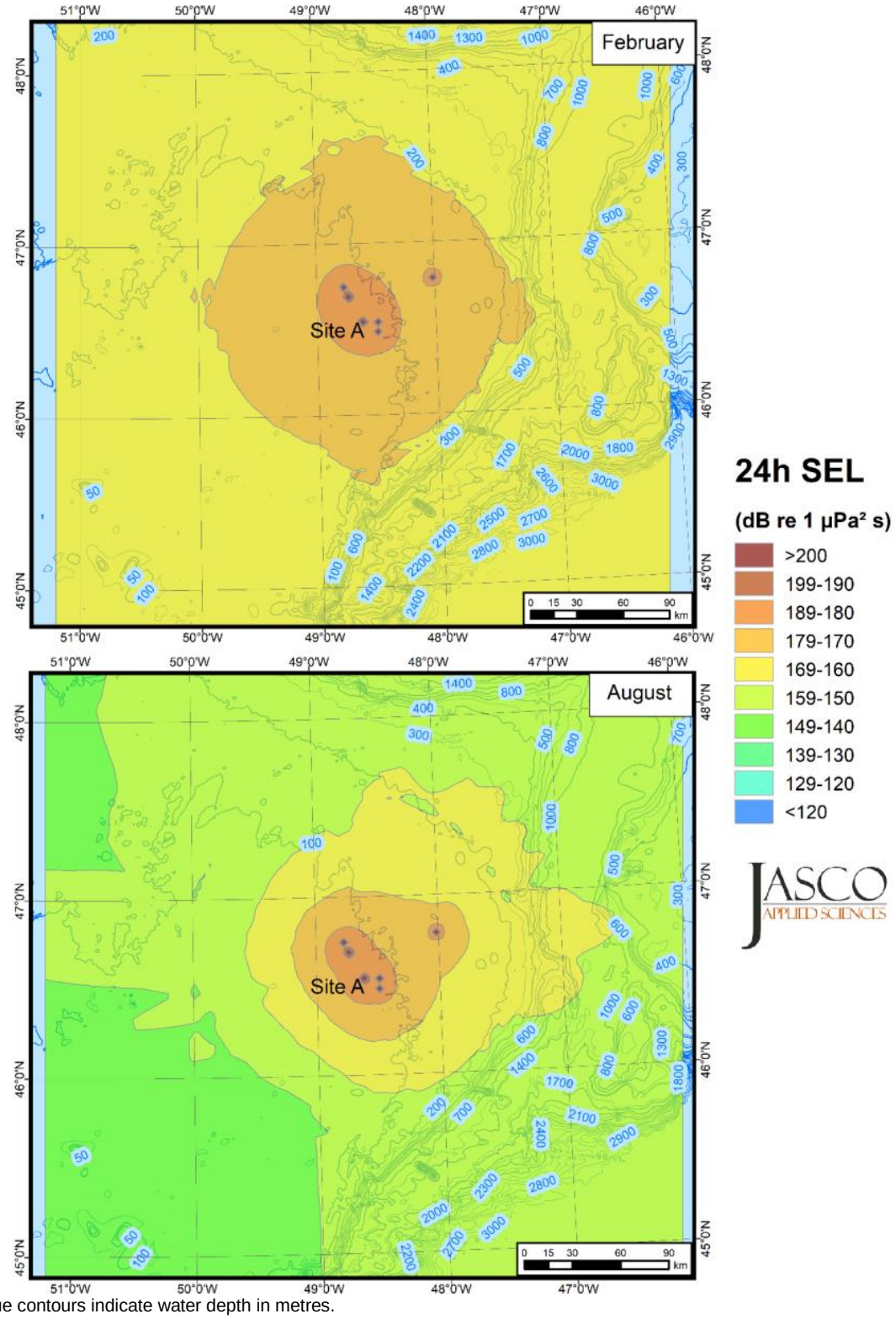
Residual environmental effects from the Project may potentially combine with residual effects from one or more other physical activities potentially resulting in cumulative environmental effects on fish and fish habitat. The potential cumulative environmental effects include a cumulative change in risk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

15.3.4.1 Cumulative Change in Risk of Mortality or Physical Injury

A change in risk of mortality, injury, or health for individual marine fishes and invertebrates may result from potential interactions with the presence and operation of a MODU, VSP, and discharges. In general, offshore exploration drilling projects, production projects, geophysical surveys, commercial fishing and other ocean uses may result in physical injury or mortality to fish and the residual effects from these activities have the potential to combine with residual effects from the Project, resulting in cumulative adverse environmental effects.

The presence and operation of a MODU and VSP may affect sound levels and the quality of the underwater acoustic environment. Changes in mortality or injury may occur from acute changes in sound pressure and/or particle motion for fishes and invertebrates exposed to high sound levels in close proximity to the VSP array. These Project-related environmental effects may interact with other physical activities that similarly result in affects in sound quality in the underwater environment.

There are several production platforms located near the Project (see Table 15.1). Acoustic modelling was conducted by JASCO for the Project and included cumulative sound analysis, which considered the total sound field from the Project added to the sound levels propagating from four other production platforms (Hibernia, Terra Nova, White Rose, and Hebron) and drilling at the Hibernia Southern Extension (Figure 15-2; Table 15.7).



Notes: Blue contours indicate water depth in metres.
Broadband (10-25,000 Hz) maximum-over-depth 24-hour SEL field
Includes along with typical operations (including support vessels) at the five other sites

Figure 15-2 Cumulative Sound Exposure Level from Semisubmersible and Support Vessel at Tilt Cove Site

Table 15.7 Cumulative Sound Field Modelling Sources

Designation	Activity	Broadband SPL (dB re 1µPa)		
		Primary Activity	Support Vessel	Total
Site A: Suncor Project	Dynamic positioning-assist anchored drilling	193.7	178	193.8
S2: Hibernia	Gravity based structure production platform	173.9	178	179.4
S3: Hibernia Southern Extension	Dynamic positioning -assist anchored drilling	193.7	178	193.8
S4: Hebron	Gravity based structure production platform	173.9	178	179.4
S5: Terra Nova	Floating production storage and offloading	183.7	178	184.7
S6: White Rose	Floating production storage and offloading	183.7	178	184.7
Source: Alavizadeh and Deveau 2020				

As illustrated in Figure 15-2 (and Figures 26 and 27 in Appendix D), the presence or absence of any one of these sound sources, including the Project, has a considerable effect on the sound field within a maximum radius of approximately 10 km from the operations site (Alavizadeh and Deveau 2020; Appendix D). The contribution to the sound field becomes less considerable at further distances. The model was run for the months of February and August. As shown in Figure 15-2 (and Figures 26 and 27 in Appendix D), the 24-hour sound exposure level (SEL_{24})=180 dB re 1 μPa^2 contour line extends approximately 30 km further in distance in February with the operation of the Project, compared to without the Project. In August, the extent is approximately 15 km further with the operation of the Project. Although the underwater sound emissions from the Project will be relatively short-term and reversible, Project emissions will contribute to an already disturbed soundscape in the marine environment.

The underwater sources of sound emissions can generate SPLs that may be harmful to fish at close ranges and it is anticipated that some species will be locally displaced by the presence of an approaching vessel, drilling activity, or in the area surrounding VSP or seismic activity. It is expected that most species will avoid underwater sound at levels lower than those at which injury or mortality might occur.

Migratory species (particularly those whose ranges cover a large extent of the RAA) may be sequentially exposed to the residual effects of the Project and the residual effects of one or more other physical activities throughout their life cycle. Project emissions will contribute to an already disturbed soundscape in the marine environment, however, the underwater sound emissions from the Project will be relatively short-term and reversible.

Immobile species and species with very limited ranges, including fish eggs and larvae, may be exposed to the residual effects of the Project and the residual effects of one or more other physical activities either simultaneously or individually over an extended period in a particular location. Underwater sound levels produced by Project-related and various activities being conducted for other projects each may cause a potential cumulative change in risk of mortality or physical injury within a few metres of the respective sound source. The source SPL associated with the MODU used in the acoustic modelling (Alavizadeh and Deveau 2020) for this Project ranged from 187.7 to 196.7 dB re 1 µPa rms. Using the 158 dB re 1 µPa rms received

SPL reported in Amoser and Ladich (2003) as the reference point, modelling results indicate that received levels of 150 to 160 dB re 1 µPa rms from the MODU would occur approximately 78 m (160 dB re 1 µPa rms) to 522 m (150 dB re 1 µPa rms) from the sound source in February, and 81 m (160 dB re 1 µPa rms) to 607 m (150 dB re 1 µPa rms) in August (Alavizadeh and Deveau 2020). Fish that use their swim bladder for hearing are considered the most sensitive to sound and mortality is expected to occur within 134 m of the MODU at 207 dB re 1 μPa^2s with very little seasonal variation (SEL_{24}) (Alavizadeh and Deveau 2020). While these effects would be expected to be in the range of natural variability (not affecting population viability), the sound sources themselves may spatially overlap (based on predicted propagation of underwater sound levels) with other projects in the Project Area.

Drill cuttings discharges that settle on the seafloor have the potential to bury and smother low mobility benthic organisms, and Project-related discharges could cumulatively interact with other projects in the area. Drill cuttings and fluids dispersion modelling are conducted for the Project for summer and fall scenarios. As detailed in Section 9.3.1.3, the burial limit of 6.5 mm for predicted no-effect threshold is exceeded in the near field (within 0.11 km of the wellhead) in the summer scenario (maximum predicted thickness is 7.28 mm covering a maximum area of 0.003 km^2) but not in the fall. The conservative 1.5 mm for predicted no-effect threshold is commonly used for sensitive species, and this threshold is exceeded in the summer up to 0.47 km from the wellhead, and in the fall up to 0.55 km from the wellhead. However, as the 10 mm recoverable threshold is not exceeded in any modelled scenario, non-recoverable burial effects on benthic organisms is not predicted within EL 1161. Project-related drill muds and cuttings, and accordingly, its contribution to cumulative effects of injury and mortality of benthic organisms, is low. Furthermore, on the Grand Banks shelf, the EEM programs at the Hibernia, Terra Nova, and White Rose producing oilfields have been ongoing over the past two decades and provide regional information on sediment toxicity related to historic cuttings discharge. Sediments surrounding the developments have shown limited to no evidence of project-related sediment toxicity (Figure 15-3).

Amphipod survival assays were rarely considered toxic nearby SBM cuttings depositional areas for the Terra Nova development (Whiteway et al. 2014). High survival rates (>90%) for amphipod and juvenile polychaetes in survival assays indicated low toxicity of sediments within 1 km of the Hibernia platform (HMDC 2019). The White Rose EEM programs have shown >80% survival for amphipod survival assays for most sampling stations and indicate that sediments surrounding the development are predominantly non-toxic (Husky Energy 2021). Based on regional data, drill cuttings do not have direct toxicity effects on marine fish and fish habitat. Effects would be low and limited to the Project Area, thereby reducing potential for overlapping effects from other projects or activities.

The change in risk of mortality or physical injury predicted for the Project (albeit low) could also combine with the general mortality and injury effects of commercial fisheries on targeted species and non-targeted bycatch, including the harmful effects that bottom-contact fishing can have on benthic organisms, resulting in adverse cumulative effects. Potential cumulative environmental interactions between the Project and fisheries will be limited by the low level of Project effects and presence of the 500-m radius safety (exclusion) zone excluding other third-party physical activities, as well as the localized nature of the deposition of drill muds and cuttings around the well site.

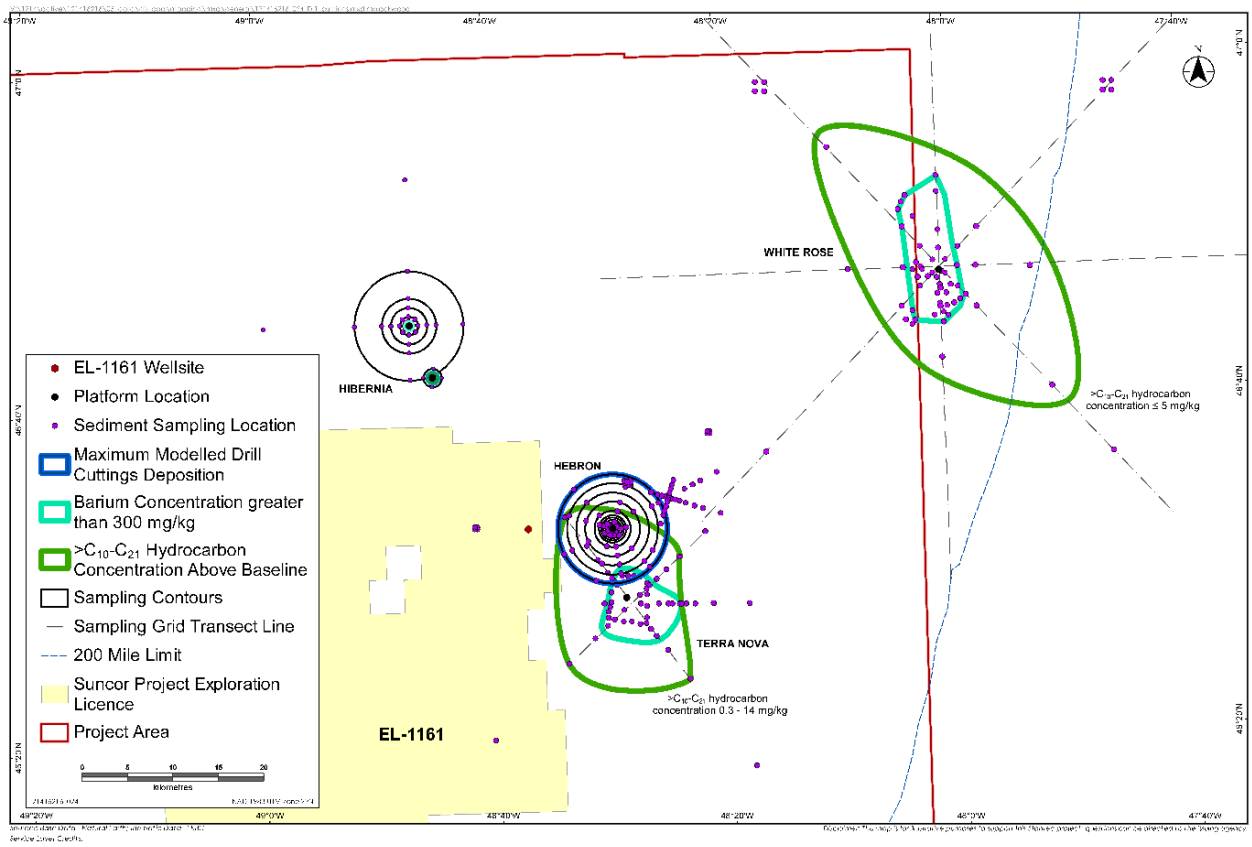


Figure 15-3 Drill Cuttings Monitoring Results

15.3.4.2 Cumulative Change in Habitat Availability, Quality and Use

A change in habitat availability, quality, and use for marine fishes and invertebrates may result from the operation and presence of the MODU, VSP surveys, Project-related discharges, well decommissioning, suspension and abandonment, and supply and servicing operations. The cumulative environmental effects of the Project in combination with other physical activities may therefore include a temporary reduction in the amount of habitat available within the RAA (i.e., due to temporary avoidance of multiple areas at once). This cumulative change in habitat availability, quality, and use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviours.

Effects on change in habitat availability, quality, and use are considered unlikely to substantially disrupt the use of important habitat areas by fish given:

- Underwater sound emissions produced during Project drilling and other offshore petroleum exploration and production drilling projects in the RAA will be generated from a stationary source for the duration of drilling activities at each well. Fish are not expected to approach close enough to these offshore facilities to be exposed to sound levels capable of causing auditory injury; however, the sound emissions may cause behavioural responses such as temporary habitat avoidance or changes in activity state. The localized areas potentially affected by the Project, other offshore drilling projects, and other physical activities represent a relatively small proportion of the total amount of habitat available within the RAA.

- Routine discharges from the Project and from other physical activities will be treated before release in accordance with OWTG (NEB et al. 2010) and MARPOL (as applicable) at levels that are intended to be prevent damage of the marine environment, including marine fish and fish habitat.
- Discharges are expected to be temporary, non-bioaccumulating, nontoxic, and highly diluted. Given that the concentrations of individual discharges are expected to be rapidly diluted in the open ocean, routine discharges from the Project are not expected to cause a substantial cumulative change in habitat quality and use.
- Project-related discharge of drill muds and cuttings are predicted to result in a deposition of sedimentation maximal depositional thickness of 7.28 and 2.64 mm predicted for the summer and fall, respectively, with sediment deposition thickness of 1.5 mm or greater during the summer predicted to extend less than 0.5 km from the wellhead and covered a maximum area of 0.18 km^2. During the fall, 1.5 mm in thickness were predicted to extend less than 0.6 km from the well head and cover a maximum area of 0.08 km^2 (refer to Appendix C).
- Potential cumulative changes in habitat quality and use caused by interaction between Project-related drill waste discharges and the sediments temporarily resuspended during bottom-contact fishing activity outside of the 500-m radius safety (exclusion) zone would likely be negligible based on the limited sedimentation from the Project.
- Potential interactions between Project-related drill waste discharges and underwater sound from the vessels of fisheries and other ocean users operating outside of the 500-m radius safety (exclusion) zone would similarly be limited due to the low water column concentrations of Project-related discharges outside of the safety (exclusion) zone, the exclusion of non-Project activities within the safety (exclusion) zone, and the transient nature of underwater sound associated with vessel movements.
- In general, the presence of Project and non-Project vessels in any particular area is anticipated to be medium-term and transient in nature, thus limiting water quality and sound effects (and associated cumulative changes in habitat quality and use) at any given location, including areas of importance for reproduction, feeding, and migration of fish.

15.3.4.3 Species at Risk

The key potential cumulative environmental interactions between the Project, other physical activities in the RAA, and marine fish SAR are the same as for the non-listed species. There are 22 SOCC potentially occurring within the RAA (Section 6.1; Table 6.6). The American eel is the only species listed under the NL ESA and is listed as vulnerable. Four species are listed under SARA: the Atlantic, spotted, and northern wolffish (Special Concern, Threatened, and Threatened, respectively); and the white shark (Endangered). While the white shark is a rare migratory visitor to the Grand Banks, the three wolffish species have ranges that overlap with the Project Area.

The DFO (2020) recovery strategy for northern and spotted wolffish has identified critical habitat within areas where these species are known to occur. Critical habitat supports important functions and features (e.g., areas for spawning, nursery, rearing, food supply, migration) necessary for survival or recovery for these species (DFO 2020). The RAA intersects with four areas of proposed critical habitat for northern wolffish and four areas of proposed critical habitat for spotted wolffish (Section 6.1; Figure 6-31). Proposed critical habitat is not located within the Project Area and is unlikely to interact cumulatively with the residual effects of other physical activities on wolffish given the geographic distribution of wolffish species is quite large, with high concentrations occurring outside the Project Area.

The adult marine fish SAR or SOCC that may occur within the RAA are highly mobile and given the highly localized and short-term nature of planned Project activities and their likely environmental effects (along with the planned implementation of mitigation measures), the Project is not anticipated to measurably affect them. Potential Project-related residual effects on these SAR / SOCC are expected to be negligible, particularly in comparison to residual effects resulting from commercial fisheries and other threats (DFO 2020). The Project is therefore not predicted to make a measurable contribution to potential cumulative effects on marine fish SAR.

15.3.4.4 Cumulative Effects Summary and Evaluation

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean users that are occurring in the RAA are predicted to cumulatively result in changes to fish mortality, injury, and health and changes in habitat availability, quality, and use that are adverse, but low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 9.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on marine fish and fish habitat are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.4 Marine and Migratory Birds

15.4.1 Past and Ongoing Effects (Baseline)

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

Most of the populations of marine-associated bird species occurring off Eastern Newfoundland are considered generally stable overall, except for the Leach's storm-petrel, which is the most numerous nesting seabird in Newfoundland. Influences of population declines include predation at colonies, high levels of contamination in eggs and other tissues, threats associated with light pollution, and ongoing climate and marine ecosystem changes (Hedd et al. 2018). The Leach's storm-petrel offshore foraging range has been shown to be several hundred kilometres during the breeding season (Pollet et al. 2014; Hedd et al. 2018), and therefore potentially increasing the exposure of the species to various offshore projects and activities and associated threats.

Due to the density of marine traffic off Newfoundland associated with shipping activity between Europe and North America, there is a relatively high amount of persistent oil in the marine environment along Newfoundland coastlines (Wiese and Ryan 2003). Beached bird surveys conducted between 1984 and 1999 indicated that chronic oil pollution along the southeast coast of Newfoundland was among the highest in the world, with murres and dovekies exhibiting the highest oiling rates (Wiese and Ryan 2003). More recent surveys between 2001 and 2013 have shown a decline in oiling rates, mainly due to initiatives undertaken to reduce ship-based oil pollution in Canadian waters (e.g., increased surveillance and enforcement) (Wilhelm et al. 2016).

As of June 2022, NL government introduced new measures to address concerns regarding the double-crested cormorant. Concerns related to the rapidly increasing populations were related to the negative impacts to the native fish populations, property and environmental damage, and conflicts with other sea bird nesting activity (NL Dept. of Fisheries, Forestry and Agriculture 2022). The Department of Fisheries, Forestry and Agriculture are accepting requests for permits to allow the humane, lethal removal of birds from specific areas, such as important fish habitat, water supplies, or aquaculture operations (NL Dept. of Fisheries, Forestry and Agriculture 2022). Additional work is being undertaken to understand the full impacts of double-crested cormorant populations.

The effects of previous activities and natural environmental influences are reflected in the existing environmental conditions for the Marine and Migratory Bird VC, as described in Section 6.2. This includes considering the current condition (e.g., health or quality) of potentially affected bird populations and their habitats, as well as their potential resiliency or sensitivity to further environmental change.

15.4.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 10, routine Project activities and components have the potential to interact with marine and migratory birds from the attraction by nocturnally-active birds to the artificial light emitted by the MODU and supply vessels, operational discharges during well drilling, underwater sound emissions from VSP operations, emissions during well testing operations, and interactions with supply vessels and helicopter activities during supply and servicing. The Project, therefore, has potential to result in the following residual adverse environmental effects on marine and migratory birds:

- A residual change in risk of mortality or physical injury
- A residual change in habitat quality and use

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 10.3 and a determination of significance in Section 10.4. With the implementation of mitigation (Section 10.3), the residual environmental effects of routine Project activities on marine and migratory birds are predicted to be not significant.

15.4.3 Future Projects and Activities and Their Effects

Table 15.8 summarizes how present and future projects and activities in the RAA have potential to cause a change in risk of mortality or physical injury and/or change in habitat quality and use, thereby affecting marine and migratory birds.

Table 15.8 Marine and Migratory Birds: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Hibernia Oilfield	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The 2018 EEM water sampling program confirmed the levels of many analytes are elevated in surface samples collected nearest to the discharge point. However, this effect was found to be localized (<50 m) with fast decreasing contaminant concentrations away from the point of discharge (HMDC 2021).

Table 15.8 Marine and Migratory Birds: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Terra Nova Oilfield	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Analyses of water samples collected during the 2017 EEM program indicated that seawater physical and chemical characteristics at EEM study area stations and reference area stations, located approximately 20 km southeast and southwest of the Terra Nova site, were similar (Suncor 2019).
White Rose Oilfield	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The results of the 2018 EEM program did not provide evidence of project effects on water quality (Husky 2022).
Hebron Oilfield	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Discharges from production facilities and supply vessels (e.g., produced water, grey and black water, ballast water, bilge water, and deck drainage deck drainage) are treated, shipped to shore or discharged in accordance with the OWTG and MARPOL
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of underwater sound in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location, thus resulting in a transient and relatively short-term disturbance within localized portions of the survey area.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on marine and migratory birds (refer to Chapter 9). • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations to be affected simultaneously and repeatedly by multiple physical activities. • Lighting attraction effects have been observed to occur within approximately 5 km (Poot et al. 2008) to 15 km (Rodriguez et al. 2014, 2015) from the source. Operational discharges and effects of vessel and aircraft traffic are more localized (Rojek et al. 2007; Hoang 2013). Some seabirds, such as Leach's storm-petrel, have foraging ranges of several hundreds of kilometres and therefore may be exposed to various artificial lighting sources within the RAA (Hedd et al. 2018). • The majority of strandings reported by offshore petroleum operators occur in September and October, corresponding with the departure of Leach's storm-petrel fledglings from the breeding colonies, and with fall landbird migration (Davis et al. 2015). Inclement weather conditions (fog, drizzle) are also associated with greater numbers of strandings.

Table 15.8 Marine and Migratory Birds: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Commercial Fishing Activity	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The presence of mobile bottom-contact fishing gear is relatively more transient in nature than the presence of fixed fishing gear. Mobile fishing gear typically also occupies less space near the surface of the water, where marine and migratory birds may be present, and is therefore relatively less likely to result in accidental bycatch of marine and migratory birds. The residual environmental effects of mobile gear fishing activity on marine and migratory birds is therefore generally shorter term and more localized than the potential residual effects on marine and migratory birds associated with the use of fixed fishing gear. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from fishing vessels is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury associated with artificial night-lighting.
Hunting Activity	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Although hunting is restricted to nearshore areas outside the Project Area, some birds are highly mobile and individuals that occur in the Project Area may also be at risk of mortality due to hunting.
Other Ocean Uses	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The transitory nature of vessel traffic reduces potential residual effects on marine and migratory birds in any particular location and at any particular time. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from vessel traffic is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury associated with artificial night-lighting and high underwater sound levels.

15.4.4 Potential Cumulative Environmental Effects

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

15.4.4.1 Cumulative Change in Risk of Mortality or Physical Injury

The presence and operation of a MODU and supply vessels has the greatest potential to result in changes to risk of mortality or physical injury for marine and migratory birds. Some of these species are known to concentrate around drilling and production platforms as a result of artificial lighting at night, food, and other visual cues. This attraction to platforms potentially makes marine and migratory birds vulnerable to

increased risk of mortality due to physical strikes with structures, stranding on the MODU or supply vessels, predation by other marine bird species, and incineration from flares (Wiese et al. 2001; Ronconi et al. 2015).

The most important potential interactions between marine and migratory birds and the presence and operation of a MODU result from the attraction of nocturnally-active birds to artificial lighting on platforms. Experts on North Atlantic seabirds rank light pollution as the human activity with the third highest risk of negative impacts on seabirds in Atlantic Canada waters, following fisheries bycatch and oiling (Lieske et al. 2019). Cinzano et al. (2001) and Falchi et al. (2016) created an atlas using DMPSP-OLS satellite data to show the spatial distribution of artificial night sky brightness from anthropogenic sources. Offshore exploration drilling and production projects, as well as fishing fleets, were identified as sources of artificial night lighting in the offshore environment. As shown in Figure 3 of Falchi et al. (2016), the Terra Nova, Herbon, Hibernia, and White Rose production platforms are visible on the map of North America's artificial sky brightness with an artificial brightness upwards of 3,560 to 7,130 µcd/m². In the NL offshore area marine birds often strand on fishing vessels, drilling and production platforms, and, to a lesser extent, supply vessels (Baillie et al. 2005; Ellis et al. 2013). Baillie et al. (2005) reported 469 stranded birds (mostly Leach's storm-petrels) at offshore installations and vessels off NL between 1998 and 2002, of which 16 (3%) were reported to have died and 344 (74%) were released; the fate of the remaining birds was not reported.

Artificial night lighting currently in the Project Area include nearby production platforms, fishing, and shipping vessels transiting in proximity. The presence of the MODU would be a new source of night lighting in a region in addition to the artificial lighting currently present from other projects, thereby increasing risk of mortality or physical injury and/or change in habitat quality and use for marine and migratory birds. Some localized and short-term behavioural effects (change in presence and abundance) are likely to occur as a result of the Project and other projects and physical activities. Figure 15-4 shows the zones of influence from Hibernia, Hebron, White Rose and Terra Nova within the Project Area.

Project-related effects are anticipated to be a localized, transient, and short-term cumulative effect to the current projects and physical activities in the area and unlikely to result in adverse effects to marine and migratory birds at the population level. Given that the likely zone of influence of the Project (conservatively set at 15 km diameter; see Section 10.3.2) at one time or location will represent a small proportion of the feeding, breeding or migration area of species, birds will not be displaced from key habitats or during important activities or be otherwise affected in a manner that causes detectable adverse effects to overall populations in the region. It is therefore unlikely that individuals will be attracted or displaced over extended areas or timeframes and is not anticipated to contribute to those of other physical activities in such a way that would cause a substantial cumulative increase in mortality or injury affecting marine and migratory birds.

Suncor, will develop a protocol for systematic, daily searches for seabirds stranded on the MODU and supply vessels, which will include the documentation of search effort. Seabirds found will be recovered, rehabilitated, released, and documented in accordance with the methods in Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2017). Existing and proposed offshore petroleum exploration and development projects (including seismic surveys) are required to conduct surveys and adhere to proper bird handing and release procedures. This not only serves to mitigate potential cumulative environmental effects on marine and migratory birds, but also adds to the cumulative knowledge of bird use and strandings in the region, and the effectiveness of mitigation.

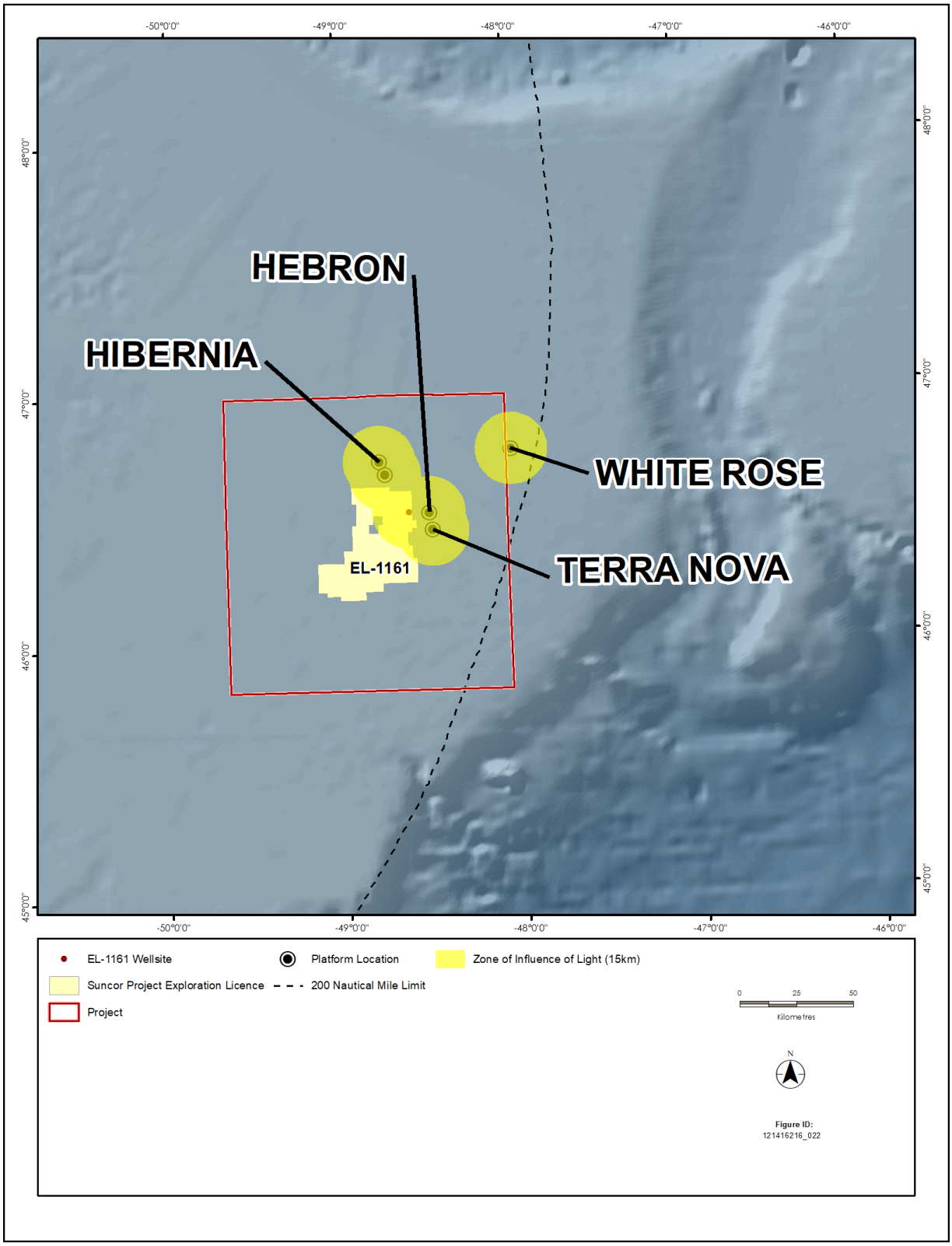


Figure 15-4 Lighting Zones of Influence for Marine and Migratory Birds from Other Projects

The Project may result in a change in risk of mortality or physical injury for marine and migratory birds through exposure to residual hydrocarbons associated with drill muds, cuttings and other discharges. Project discharges will be in accordance with the OWTG and the MARPOL, as applicable, which are standard mitigation measures for existing and proposed oil and gas exploration and production projects. Discharges and emissions from the Project are expected to be temporary, localized, non-toxic, and subject to dilution in the open ocean. The cumulative risk of changes to risk of mortality or physical injury or habitat quality and use due to hydrocarbon contamination through routine discharges from the Project is therefore low.

Underwater sound emissions from Project-related VSP operations will contribute to the underwater sound emissions of other physical activities generating underwater sound in the RAA to potentially result in a cumulative change in risk of physical injury for marine species. Exposure to underwater sound caused by VSP operations is anticipated to be limited by the short duration (i.e., one day) of VSP operations combined with the short duration of submersion by diving marine birds. The effect of loud sounds on seabird hearing is poorly known. Deep-diving birds such as alcids (common and thick-billed murre, razorbill, dovekie, Atlantic puffin) may be at somewhat higher risk of injury (or disturbance) due to exposure to underwater sound from geophysical sound sources than shallow-diving species (northern fulmar, shearwaters); however, based on current scientific knowledge (Stemp 1985; Turnpenny and Nedwell 1994; Lacroix et al. 2003), diving marine and migratory birds appear to be less sensitive to underwater sound emissions than fish, marine mammals, or sea turtles. Marine and migratory birds are therefore assumed to be less susceptible to a potential cumulative change in risk of mortality or physical injury from underwater sound than fish or marine mammals and sea turtles. The change in risk of injury for diving marine birds is highly localized and diminishes with distance from the source.

Although rare, it is possible for helicopter traffic from the Project, offshore geophysical survey programs, other offshore petroleum exploration and production projects, and other ocean users (where applicable) to strike flying birds. The Project may, therefore, contribute to a cumulative change in risk of mortality or physical injury due to potential collisions with marine and migratory birds. The various bird species that occupy the Project Area will not likely be affected by aircraft use, due to its transitory nature and thus, its short-term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years, including that associated with existing oil production and exploratory drilling platforms in the RAA. In general, the residual environmental effects of helicopter traffic from the Project will be so spatially and temporally limited that potential cumulative interactions with the residual environmental effects of other helicopter / aircraft traffic in the RAA will be minimal and are not expected to result in a substantial change in risk of mortality or physical injury for marine and migratory birds. Helicopter activities in support of the Project will only account for a small, incremental increase in overall helicopter / aircraft traffic within the RAA.

15.4.4.2 Cumulative Change in Habitat Quality and Use

Marine and migratory birds, whose ranges cover a large extent of the RAA, may be exposed to various sources of marine discharges and atmospheric sound (i.e., geophysical survey programs, other offshore petroleum exploration and production drilling projects, fisheries, and other ocean users) throughout their life cycle, which may result in a cumulative change in habitat quality and use, when combined with discharges and atmospheric sound generated by the Project.

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

Routine Project activities will not interact with the nearshore environment except for supply and servicing activities. Project interactions, and therefore cumulative effects, with waterfowl, which are commonly found in coastal habitats, will therefore be limited. The use of support vessels and helicopters could result in a cumulative disturbance to marine and migratory birds, particularly for nesting colonies. However, due to the transitory nature of vessels and helicopters the presence of marine traffic at any one location will be short-term. Supply vessels and helicopter traffic will be generally consistent with the overall marine traffic that has occurred throughout the region for years and will observe legislated separation distances from migratory bird colonies. Cumulative interactions with the residual environmental effects of other vessel and helicopter traffic in the RAA are therefore expected to be low and not expected to result in a substantial change in habitat quality and use for marine and migratory birds.

15.4.4.3 Species at Risk

In total, nine species designated at risk provincially or federally, or of conservation concern as assessed by COSEWIC, have the potential to occur in the RAA or the Project Area (Section 6.2; Table 6.5). These species include two coastal waterfowl species, three shorebird species, one phalarope species, two gull species, and one raptor species. An additional eight species, while not designated provincially or federally, occur on IUCN's Red List of Threatened Species. Other shorebird and landbird species at risk in Newfoundland are not likely to occur in the RAA or Project Area.

The main potential cumulative environmental interactions between the Project, other physical activities in the RAA, and marine and migratory bird SAR are the same as for the secure species that comprise the Marine and Migratory Birds VC. However, there is a low potential for SAR or SOCC to interact with the Project because of the low densities of these species in the Project Area, LAA, and RAA (with the exception of Leach's storm-petrel, which is designated vulnerable on the IUCN Red List) and because there are no critical habitats or nesting sites of SAR or SOCC in the RAA. Given the offshore distance of most Project activities, Project interactions with these bird SAR are expected to be negligible, but low for Leach's storm-petrel, and are most likely to occur during species' post-breeding dispersal or migration activities. The Project is not predicted to result in direct or indirect effects, including cumulative effects, on the survival or recovery of federally listed species. Mitigation proposed to recover stranded birds, manage discharges, and restrict supply vessel and helicopter routes (refer to Section 10.3.1.2) will help reduce potential effects on bird SAR. The Project is not anticipated to result in residual adverse effects on marine and migratory bird SAR, and therefore, not anticipated to contribute to cumulative effects on these species.

15.4.4.4 Cumulative Effects Summary and Evaluation

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in adverse changes to marine and migratory bird mortality, injury, and health and changes in habitat quality and use, but these effects are predicted to be low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 10.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on marine and migratory birds are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.5 Marine Mammals and Sea Turtles

15.5.1 Past and Ongoing Effects (Baseline)

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

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

Marine mammals and sea turtles have been affected by human activities through possible hearing impairment or permanent injury or mortality from exposure to high levels of underwater sound and behavioural effects (avoidance) from lower levels of underwater sound or other sources of sensory disturbance (e.g., discharges). These effects may alter the presence, abundance and overall distribution of these species and their health, movements, communications, feeding and other activities. Marine mammals and sea turtles may also be affected by other marine environmental discharges and disturbances, including through physical exposure, ingestion, effects on prey and habitats, and other changes.

In the RAA, there are various ocean users which have been and continue to be active, such as commercial fisheries, shipping and general marine traffic, scientific research, military activities, and offshore petroleum exploration and production activities (including geophysical surveys) (see Chapter 7). These activities, particularly shipping, oil and gas extraction, seismic surveys, and production facilities, have, and will continue to dominate the soundscape in the RAA, as evident by acoustic monitoring that has occurred along the east coast of Canada (Delarue et al. 2018). Other human activities in the RAA including potential interactions with vessel traffic (e.g., operational discharges and collisions) and fishing activity (e.g., collisions with fishing vessels and entrapment or entanglement in fishing gear) have the potential to affect marine mammals and sea turtles.

The effects of previous activities and natural environmental influences are reflected in the existing environmental conditions for the Marine Mammals and Sea Turtles VC, as described in Section 6.3. This includes the consideration of the current condition (e.g., health or quality) of potentially affected marine mammal and sea turtle populations and their habitats, as well as their potential resiliency or sensitivity to further environmental change.

15.5.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 11, routine Project activities and components have the potential to interact with marine mammals and sea turtles from underwater sound produced by operation of the MODU, VSP, supply vessels, and helicopter overflights. These potential sources of disturbance, as well as operational discharges, could result in direct or indirect (e.g., changes in habitat quality) effects on marine mammals and sea turtles. There is also the risk of mortality or physical injury as a result of vessel collisions. The Project could also change the availability, distribution, or quality of prey (see Chapter 9 on assessment of effects on prey species).

The Project, therefore, has potential to result in the following residual adverse environmental effects on marine mammals and sea turtles:

- A residual change in risk of mortality or physical injury
- A residual change in habitat quality and use

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 11.3 and a determination of significance in Section 11.4. With the implementation of mitigation (Section 11.3), the residual environmental effects of routine Project activities on marine mammals and sea turtles are predicted to be not significant.

15.5.3 Future Projects and Activities and Their Effects

Table 15.9 summarizes how present and future projects and activities in the RAA have potential to cause a change in risk of mortality or physical injury and/or change in habitat quality and use, thereby affecting marine mammals and sea turtles.

Table 15.9 Marine Mammals and Sea Turtles: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Production Projects (Production from Hibernia, Terra Nova, White Rose, and Hebron Oilfields)	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Potential residual effects from offshore petroleum production projects are similar to those potentially associated with the Project. However, unlike the Project, production facilities and their associated effects are relatively longer-term in nature.

Table 15.9 Marine Mammals and Sea Turtles: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Acoustic monitoring along Canada's East Coast detected seismic sound over wide areas, particularly north of the Flemish Pass (Delarue et al 2018). • Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of underwater sound in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location, thus potentially resulting in a transient and relatively short-term disturbance within localized portions of the survey area.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on marine mammals and sea turtles (refer to Chapter 11). • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations to be affected simultaneously and repeatedly by multiple physical activities.
Commercial Fishing Activity	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The presence of mobile bottom-contact fishing gear is relatively more transient in nature than the presence of fixed fishing gear. Mobile bottom-contact fishing gear typically also occupies less space at the depths of water that marine mammals and sea turtles are most likely to occur and is therefore relatively less likely to result in accidental bycatch of marine mammals or sea turtles compared to fixed fishing gear which can potentially result in entanglement. The residual environmental effects of mobile bottom-contact commercial fishing activity on marine mammals and sea turtles is therefore generally shorter term and more localized than the potential residual effects on marine mammals and sea turtles associated with the use of fixed fishing gear. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from fishing vessels is expected to be short-term and transient at any given location.
Hunting Activity	• Change in risk of mortality or physical injury • Change in habitat quality and use	• Although hunting is conducted in nearshore areas outside the Project Area, some species are highly mobile and individuals that occur in the Project Area may also be at risk of mortality due to hunting.

Table 15.9 Marine Mammals and Sea Turtles: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Other Ocean Users	• Change in risk of mortality or physical injury • Change in habitat quality and use	• The transitory nature of vessel traffic reduces potential residual effects on marine mammals and sea turtles in any particular location and at any particular time. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from vessel traffic is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury associated with underwater sound and vessel strikes.

15.5.4 Potential Cumulative Environmental Effects

Residual environmental effects from the Project may potentially combine with residual effects from one or more other physical activities (e.g., offshore exploration drilling projects, production projects, geophysical surveys, commercial fishing, hunting and other ocean uses), which could result in cumulative environmental effects on marine mammals and sea turtles, including a cumulative change in risk of mortality or physical injury to marine mammals and sea turtles and/or a change in habitat quality.

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

15.5.4.1 Cumulative Change in Mortality or Physical Injury

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

As discussed in Section 15.3.4, underwater sound emissions from Project-related operations will contribute to the wider area soundscape, which includes underwater sound emissions of other physical activities and may, therefore, potentially result in a cumulative change in risk of mortality or physical injury. The analysis of cumulative environmental effects from underwater sound provided in Section 15.3.4 is also applicable for marine mammals and sea turtles. The MODU will produce continuous (i.e., non-impulsive) sound during operations. The broadband sound source level for the MODU is assumed to be 193.7 dB re 1 µPa @ 1 m SPL_{rms}. Based on published threshold values for auditory injury or PTS for marine mammals (Table 11.4, Section 11.3.1.3), it is highly unlikely that marine mammals would experience hearing damage from sound exposure from a MODU (Alavizadeh and Deveau 2020). Given the expected source SPL_{rms} of 193.7 dB for the MODU, sound levels would not reach the SPL_{peak} auditory injury thresholds for any marine mammal groups. Individuals travelling near one or more of the offshore developments or in close proximity to other

offshore exploration drilling activities may be subject to cumulative effects. While there is overlap and interaction between underwater sound from the Project and other anthropogenic sources, including the production platforms within the Project Area, these effects are likely to be localized in nature without substantial adverse cumulative effects on individuals or populations. PTS / TTS onset thresholds for the high-frequency cetaceans does not extend beyond the Project Area. To mitigate potential effects from VSP operations for the Project, a ramp-up procedure for the air gun array will be implemented in consideration of the SOCP (DFO 2007). Ramp-up will be delayed if a marine mammal or sea turtle is detected within 500 m of the air gun array. Air gun(s) will be shut down if a marine mammal or sea turtle listed as endangered or threatened on SARA Schedule 1, as well as a beaked whale, is detected within the 500-m zone around the array.

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

15.5.4.2 Cumulative Change in Habitat Quality and Use

Similar to the discussion above for marine fish and fish habitat, cumulative effects to change in habitat quality and use may occur as a result of underwater sound and/or marine discharges from human activities. The analysis of cumulative environmental effects from underwater sound and operational discharges provided in Section 15.2.4 for marine fish and fish habitat is also generally applicable for marine mammals and sea turtles. The PTS / TTS thresholds for high-frequency cetaceans do not extend beyond the Project Area. The Project and other physical activities may temporarily reduce habitat availability within the RAA resulting from the potential for temporary avoidance of multiple areas at once.

15.5.4.3 Species at Risk

Five species / populations of marine mammals and two sea turtle species that could occur in the Project Area are listed under Schedule 1 of SARA: blue whale (Atlantic population); fin whale; North Atlantic right whale; northern bottlenose whale (Scotian Shelf population); Sowerby's beaked whale; leatherback sea turtle; and loggerhead sea turtle. These species have been influenced by past activities. In particular, the North Atlantic right whale population was depleted during the industrial whaling era; densities are still low.

The population size of North Atlantic right whale remains low even though it received total international protection from hunting in 1937; population size has been declining since 2010 (Pace et al. 2017; Corkeron et al. 2018; Pettis et al. 2018). For the North Atlantic population, 17 mortalities were reported in 2017 and three in 2018 (Pettis et al. 2018). Twelve of the seventeen mortalities in 2017 occurred in the Gulf of St. Lawrence and five in the US; in 2018, all three mortalities were reported for the US (National Marine Fisheries Service [NMFS] 2019). Eight mortalities have been reported for 2019, as of late August (NOAA 2019). Necropsies showed that four whales had died due to blunt trauma and two drowned because of entanglement (Daoust et al. 2017; DFO 2019). An additional five entanglements were reported between 5 July and 28 August 2017; two whales were disentangled, one shed the gear on its own, and

disentanglement was not possible for two whales (Daoust et al. 2017). There were two mortalities in each of 2020 and 2021 in the U.S. As of 23 March 2022, no mortalities have been reported for 2022 (NOAA 2022). In addition to the 34 mortalities since 2017, there have been 16 seriously injured free-swimming whales reported since 2017, so NOAA considers the unusual mortality event to currently include 50 individuals (NOAA 2022).

The primary threat facing sea turtles in Canadian waters is fisheries bycatch; globally, threats include ship strikes, marine debris, and oil and gas exploration (COSEWIC 2012). Hamelin et al. (2017) reported several incidental captures in fishing gear off Newfoundland, including the Grand Banks. The primary threats for northern bottlenose whales are considered to be entanglement in fishing gear, oil and gas activities, and acoustic disturbance (COSEWIC 2011; DFO 2017a). Tissue contaminant levels possibly related to oil and gas development activities, vessel strikes, and changes to the food supply are also a concern (COSEWIC 2011; DFO 2017a). In the Northwest Atlantic, the biggest threats faced by loggerhead sea turtles include harvesting, bycatch, and artificial lights at nesting beaches (DFO 2017b). Between 1999 and 2006, the Canadian Atlantic pelagic longline fleet reported 701 incidental captures of loggerhead sea turtles, including in the deep water along the edge of the Grand Banks (Brazner and McMilan 2008). Although observer coverage of the area was extensive, no turtles were sighted northeast of the Grand Banks (Brazner and McMilan 2008). Encounters with loggerhead sea turtle in the longline fishery have occurred south of the Flemish Cap during 2002 to 2008 (Paul et al. 2010).

Mitigation measures proposed to reduce underwater sound disturbance associated with VSP airgun source arrays, manage discharges, and reduce supply vessel speeds (refer to Sections 11.3.1.2 and 11.3.2.2) will help to protect marine mammal and sea turtle SAR. These species are highly mobile, and many have large distributional ranges and undertake long migrations. Large seasonal and even daily variations in abundance within the Project Area are therefore likely, and the potential for overlap and interaction with Project activities is likely to be temporary. Project activities will not occur in identified concentration areas or critical habitat.

15.5.4.4 Cumulative Effects Summary and Evaluation

Acknowledging that some marine mammal and sea turtle populations are currently critically endangered or threatened due to a variety of influences, including effects from anthropogenic activities, the Project contribution to these existing effects are expected to be very small. Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in adverse changes to marine mammal and sea turtles mortality, injury, and health and changes in habitat quality and use, but low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 11.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on marine mammals and sea turtles are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.6 Special Areas

15.6.1 Past and Ongoing Effects (Baseline)

Special areas within the RAA include areas beyond the Canadian Economic Exclusion Zone as governed by international agencies and conventions including NAFO, the Food and Agricultural Organization of the United Nations, United Nations Convention on Biological Diversity (CBD) and United Nations Educational, Scientific and Cultural Organization. In addition, BirdLife's Important Bird and Biodiversity Area program has identified various important areas.

Special areas have various conservation objectives and varying levels of protection from human activities including no legal protection or restricted activity (e.g., EBSAs, SiBA), proposed legal protection (proposed critical habitat), specific regulatory protection (e.g., Witless Bay Ecological Reserve) and specific activity restrictions (e.g., no bottom fishing in marine refuge, no crab fishing in snow crab conservation exclusion zones). Special areas with defined benthic conservation objectives have primarily been designated in recognition of past adverse effects from bottom-contact fishing, an activity which is now restricted in many areas to help promote recovery and conservation of benthic habitats. Many of these special areas have been and will continue to be subjected to a high level of marine traffic from shipping, oil and gas production activities, and commercial fishing.

15.6.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 12, routine Project activities and components have the potential to interact with special areas from change to habitat quality (e.g., noise, light, water, sediment quality; and change to the environmental features that define the special area (e.g., physical features, species assemblages, species abundance)). The Project, therefore, has potential to result in the following residual adverse environmental effects on special areas:

- A residual change in habitat quality

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 12.3 and a determination of significance in Section 12.4. With the implementation of mitigation, the residual environmental effects of routine Project activities on special areas are predicted to be not significant.

15.6.3 Future Projects and Activities and Their Effects

Table 15.10 summarizes how present and future projects and activities in the RAA have potential to cause a change in habitat quality, thereby affecting special areas.

Table 15.10 Special Areas: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Production Projects (Production from Hibernia, Terra Nova, White Rose, and Hebron Oilfields)	• Change in habitat quality	• The following are the distances from the production projects to the closest special area, respectively. The Project Area or LAA overlaps some of these special areas (i.e., Virgin Rocks EBSA); however, routine Project activities are not predicted to result in adverse effects to these special areas. - The nearest special area to the Hibernia platform is the Virgin Rocks EBSA, approximately 103 km away. - The nearest special area to the Terra Nova FPSO is the Flemish Pass / Eastern Canyon NAFO VME, approximately 85 km away. - The nearest special area to the *SeaRose FPSO* is the Flemish Cap CBD EBSA, approximately 60 km away. - The nearest special area to the Hebron platform is the Flemish Pass/Eastern Canyon NAFO VME closure, approximately 81 km away.
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in habitat quality	• Acoustic monitoring along Canada's East Coast detected seismic sound over wide areas, particularly north of the Flemish Pass, indicating that geophysical surveys are key source of underwater sound in the existing soundscape of the RAA (Delarue et al 2018). • Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of noise in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location, thus resulting in a transient and relatively short-term disturbance within localized portions of the survey area.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in habitat quality	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on special areas (see Chapter 12). • EAs for other exploration drilling projects in the RAA have identified potential interactions with special areas through an overlap of Project Areas (e.g., BP's Newfoundland Orphan Basin Exploration Drilling Program Project Area overlaps with the Northeast Newfoundland Slope Closure marine refuge and a portion of proposed critical habitat for the northern and spotted wolffish; Nexen's Flemish Pass Exploration Drilling Project Area overlaps a portion of a VME coral and sponge closure area). Furthermore, most projects have identified the St. John's region as a proposed supply base location. Therefore, supply vessel routes to and from the offshore are very similar between projects and therefore overlap similar special areas, particularly in the nearshore. • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations to be affected simultaneously and repeatedly by multiple physical activities.

Table 15.10 Special Areas: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Commercial Fishing Activity	• Change in habitat quality	• Although the presence of mobile bottom-contact fishing gear is relatively more transient, the residual environmental effects of this type of commercial fishing activity on habitat quality and use within special areas is generally more disruptive, longer term, and more spatially extensive than the temporary and localized residual effects to fish and fish habitat associated with the use of fixed fishing gear. Special areas are designated with restrictions to protect habitat from commercial fishing activities. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from fishing vessels is expected to be short-term and transient at any given location.
Hunting Activity	• Change in habitat quality	• Hunting is limited to nearshore areas (and restricted within the Witless Bay Ecological Reserve) and is therefore not anticipated to interact with offshore special areas in and around the Project Area.
Other Ocean Uses	• Change in habitat quality	• The transitory nature of vessel traffic reduces potential residual effects on marine species in any particular location (including in special areas) and at any particular time. • The potential residual change in habitat quality and use associated with sensory disturbance and emissions / discharges from vessel traffic is expected to be short-term and transient at any given location (including in special areas).

15.6.4 Potential Cumulative Environmental Effects

15.6.4.1 Cumulative Change in Habitat Quality

Pathways for cumulative environmental effects on fish and fish habitat, marine and migratory birds, and marine mammals and sea turtles are also applicable to special areas. Zones of influence related to underwater sound (PTS / TTS onset thresholds for the high-frequency cetaceans; see Appendix D), drill cuttings deposition (depositional thicknesses at or above 1.5 mm predicted to be confined within 0.5 km or less of the drill sites, with a maximum affected area at that thickness of 0.18 km^2), and light (influence extends up to 15 km from the MODU [Rodriguez et al. 2014]) are expected to be limited to the Project Area. Therefore, much of the analysis of cumulative environmental effects provided for the corresponding VCs in Sections 15.3, 15.4, and 15.5 is also applicable for special areas.

As noted in Section 15.5.1 and described in Table 12.4, several special areas intersect with EL 1161, the Project Area or LAA including the supply vessel route where marine vessels and aircraft are anticipated to transit. Potential cumulative interactions associated with the presence and operation of the MODU, including discharge of drill muds and cuttings as well as other discharges and emissions, VSP surveys, and well decommissioning, suspension and abandonment activities, would be limited, for the most part, to localized portions of these special areas, whose boundaries overlap with the Project Area. Many of these special areas also overlap with areas for current production platforms as well as proposed future exploration drilling programs, which would be predicted to have similar environmental effects as the Project. The deposition of Project-related discharges of drill muds and cuttings from each well site could combine with the residual environmental effects associated with the productions platforms within the Project Areas and

other physical activities, such as fishing activity, in the RAA, resulting in the disturbance of benthic habitat. However, the extent of benthic disturbance would be localized per well site and, like Suncor, other operators proposing exploration drilling activities in these areas, have committed to conducting seabed surveys prior to drilling to confirm the absence of sensitive environmental features, such as habitat-forming corals or SAR and implementing an appropriate course of action in consultation with regulatory authorities to avoid or reduce adverse effects on these features.

Special areas, whose boundaries overlap with the LAA due to proposed supply vessel routes, may also experience effects on habitat quality associated with marine discharges, sound, and light emissions. The supply vessel and helicopter transport routes proposed for this Project would be similar to those used by existing oil and gas development projects on the Jeanne d'Arc Basin (given commencement at an existing onshore port) and proposed future exploration drilling projects. Therefore, there is potential for cumulative environmental effects on these special areas due to increased marine traffic. These same areas may be simultaneously or sequentially exposed to habitat quality effects from underwater or atmospheric sound from marine vessels and helicopter traffic associated with oil and gas activities, as well as from existing and future fishing and shipping traffic. However, marine vessels and helicopter traffic of other ocean users are subject to the same special restrictions where necessary to protect sensitive marine species and habitats (e.g., adherence to *Seabird Ecological Reserve Regulations, 2015* and federal guidelines in order to reduce disturbance to colonies). Furthermore, the incremental changes to existing traffic volumes due to supply and servicing from the Project will be minor and temporary with effects being short-term and transitory in any one location.

15.6.4.2 Cumulative Effects Summary and Evaluation

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in adverse changes to in habitat quality, but low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 12.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on special areas are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.7 Indigenous Peoples

15.7.1 Past and Ongoing Effects (Baseline)

There were 41 Indigenous groups identified in the EIS Guidelines that may be influenced by routine Project activities and which should be considered in the scope of the EA, including the cumulative effects assessment. This included 5 groups in Newfoundland and Labrador, 13 groups in Nova Scotia, 16 groups in New Brunswick, 2 groups in Prince Edward Island, and 5 groups in Quebec. The key interaction between the Project and these Indigenous groups is related to the potential effects to commercial-communal and FSC fishing through a change in access to and/or availability of harvested species. Several Indigenous communities hold commercial-communal or FSC licences for fishing areas in the RAA or for species that may migrate through the RAA. Although there is no documented FSC licences within the Project Area, some species targeted in FSC fisheries are anadromous and can potentially migrate through the Project Area.

Past and ongoing projects and activities in Eastern Canada have, to varying degrees, interacted with Indigenous peoples, depending on their location, nature, and scale in relation to the communities, activities, and other components and interests of individual Indigenous groups. Past and ongoing projects and activities are reflected in the overview of current socio-economic characteristics and conditions of Indigenous communities provided in Section 7.4. However, given the long and varied history of Indigenous peoples and different Indigenous communities in the region, it is not practical to attempt in this EIS to identify and describe how past and ongoing development projects and other processes and activities have influenced and otherwise affected Indigenous peoples. Where possible and applicable, Section 7.4 identifies how certain socio-economic components, such as traditional land use patterns, may have been influenced by previous and ongoing development activities and other factors.

15.7.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 13, routine Project activities and components have the potential to interact with Indigenous peoples from direct or indirect effects on fished species or through effects on fishing activity (e.g., displacement from fishing areas, gear loss or damage, availability of fisheries resources). To date, no Indigenous community has indicated that they actively fish in the Project Area or LAA, although this does not necessarily mean they will not do so in the future. Although there is no known FSC fishing or harvesting taking place in the Project Area, routine Project activities could interact with migratory fish, bird, or mammal species that may be harvested by Indigenous communities from onshore / nearshore harvesting sites. Adverse effects on fishing or harvesting activities could indirectly lead to changes in health, socio-economic, and well-being conditions or cultural heritage of affected Indigenous communities. The Project, therefore, has potential to result in the following residual adverse environmental effects on Indigenous peoples:

- A residual change in commercial-communal fisheries
- A residual change in current use of lands and resources for traditional purposes

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 13.3 and a determination of significance in Section 13.4. With the implementation of mitigation (Section 13.3), the residual environmental effects of routine Project activities on Indigenous peoples are predicted to be not significant.

15.7.3 Future Projects and Activities and Their Effects

Table 15.11 summarizes how present and future projects and activities in the RAA have potential to cause a change in commercial-communal fisheries and/or change in current use of lands and resources for traditional purposes, thereby affecting Indigenous peoples.

Table 15.11 Indigenous Peoples: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Production Projects (Production from Hibernia, Terra Nova, White Rose, and Hebron Oilfields)	• Change in commercial-communal fisheries • Change in current use of lands and resources for traditional purposes	• Commercial-communal fishing activity has been, and will continue to be, excluded within the safety (exclusion) zones around production facilities and associated infrastructure for the duration of petroleum production from the Hibernia, Terra Nova, White Rose, and Hebron oilfields. The cumulative total of safety (exclusion) zones for these development projects is approximately 280 km² (refer to Table 15.1 for specific details). • Refer to Section 15.3.4 for an overview of results from the Hibernia, Terra Nova, and White Rose EEM programs regarding effects on marine water quality and fish health, contamination, and tainting.
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in commercial-communal fisheries • Change in current use of lands and resources for traditional purposes	• Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of noise in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location, thus resulting in a transient and relatively short-term disturbance within localized portions of the survey area.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in commercial-communal fisheries • Change in current use of lands and resources for traditional purposes	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on Indigenous peoples and communities (refer to Chapter 13). • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations of species of importance to Indigenous fishers / harvesters to be affected simultaneously and repeatedly by multiple physical activities.
Commercial Fishing Activity	• Change in commercial-communal fisheries • Change in current use of lands and resources for traditional purposes	• Various commercial fisheries and commercial-communal fisheries have potential to overlap spatially and temporally in the RAA. Various commercial fisheries and FSC fisheries have potential to overlap spatially and temporally in the RAA.
Hunting Activity	• Change in current use of lands and resources for traditional purposes	• Although hunting is conducted within nearshore areas outside the Project Area, some species of interest to Indigenous harvesters are highly mobile and individuals that occur in the Project Area may also be at risk of mortality (and associated resource depletion) due to hunting.

Table 15.11 Indigenous Peoples: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Other Ocean Uses	• Change in commercial-communal fisheries • Change in current use of lands and resources for traditional purposes	• The transitory nature of vessel traffic reduces potential residual effects on Indigenous fishers in any particular location and at any particular time. • The potential residual change in habitat quality and use for species of importance to Indigenous fishers / harvesters associated with sensory disturbance and emissions / discharges from vessels is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury for species of importance to Indigenous harvesters associated with underwater sound and vessel strikes.

15.7.4 Potential Cumulative Environmental Effects

15.7.4.1 Cumulative Change in Commercial-communal Fisheries

Potential cumulative environmental effects on Indigenous peoples may result in changes to commercial-communal fisheries, primarily related to resource use conflicts through the following pathways:

- Temporary displacement of fishers from customary fishing grounds due to a 500-m radius safety (exclusion) zone around the Project MODU, and the various safety (exclusion) zones associated with other exploration drilling projects and existing and proposed production projects (recognizing safety [exclusion] zones associated with exploration projects are short-term compared to longer term safety [exclusion] zones established for production projects)
- The cumulative risk of incidents of gear loss or damage caused by the Project in combination with other physical activities in the RAA
- Other general space-use conflicts (i.e., between supply vessels, geophysical survey and support vessels, commercial fishing vessels, and the vessels of other ocean users [e.g., scientific research vessels, vessels engaged in military exercises, and cable-laying or cable repair vessels])

Within the Project Area there are several production platforms, as well as offshore petroleum exploration drilling programs proposed with a similar timeframe as the Project in the RAA. Drilling activities will require a 500-m radius safety (exclusion) zone around the MODU, within which commercial-communal fishing activities could be displaced. For the Project, commercial-communal fishing will be excluded from an area of approximately 7 km² for up to approximately 45 to 120 days for each well drilled (12 to 16 wells over the temporal scope of the Project. The safety (exclusion) zones associated with other offshore petroleum exploration and production drilling projects will increase the cumulative area that will be temporarily unavailable to Indigenous fishers and harvesters at any given time during Project activities. As indicated in Table 15.1, there are several additional exploration drilling projects that could occur during the same timeframe of this Project, as well as four production facilities within or near the Project Area. It is assumed, for the purpose of this assessment, that each of these exploration projects would institute a 500-m radius safety (exclusion) zone (approximately 0.8 km²) from which fisheries would be temporarily excluded. It is unknown how many wells will actually be drilled and over what timeframe to be able to calculate an accurate estimate of fishing exclusion zones which could occur in the RAA at any given time. These safety (exclusion)

zones would be in addition to the approximately 380 km² footprint of safety (exclusion) zones associated with existing production projects in the RAA.

In the RAA, there are some fishing restrictions within specific special areas in the RAA, including marine refuges, lobster area closures, NAFO VME closures, a shrimp fishing area (closed to fishing of northern shrimp), and snow crab exclusion zones (see Section 6.4). These also may contribute to potential space-use conflicts among commercial-communal fishers. Within the total area covered by the RAA, special areas that are closed to one or more types of fisheries (as represented by these fisheries closure areas) represent 17% of the RAA. The cumulative areas where fishing activity is restricted due to existing safety (exclusion) zones and fisheries closure areas is shown in Figure 15-5; however, this figure does not show safety (exclusion) zones that would be associated with proposed exploration drilling projects as specific timing and location of wells is not known. Ongoing communication will be required to avoid adverse effects on commercial-communal fisheries that may occur in the RAA and associated health and socio-economic conditions in Indigenous communities.

The presence of supply vessels, competing fishing vessels, seismic vessels and streamers associated with geophysical survey programs, and the marine traffic associated with other ocean users are other sources of potential conflict with commercial-communal fishing vessels within the RAA as a result of space-use conflicts. Project supply vessels are not expected to contribute to space-use conflicts with fishing vessels as Project-related vessel traffic will represent a minor component of total marine traffic in the RAA, occupy a negligible proportion of the total available Indigenous fishing and harvesting area in the RAA, and be short-term and transient in nature. Supply vessels will follow the most direct vessel traffic routes to and from the Project Area.

Indigenous fishers that experience a change in access to their customary fishing areas as a result of the Project in combination with other physical activities in the RAA may be required to temporarily relocate their fishing effort. A temporary relocation could put additional pressure on nearby fishing areas, thereby adversely affecting the competition for remaining fishing areas in the RAA. Fishing effort within and surrounding the Project Area is relatively low and does not include unique fishing grounds or concentrated fishing effort that occurs exclusively within the Project Area. The potential for temporary loss of access to preferred fishing areas as a result of the Project is therefore anticipated to be negligible and is unlikely to have a discernable effect on the overall distribution of fishing effort within the RAA.

Physical activities within the RAA may unintentionally result in damage to fishing gear which has the potential to cumulatively interact with the Project to result in a change in commercial-communal fisheries within the RAA. Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017). Similar compensation plans would be implemented in the event of gear loss or damage by other operators.

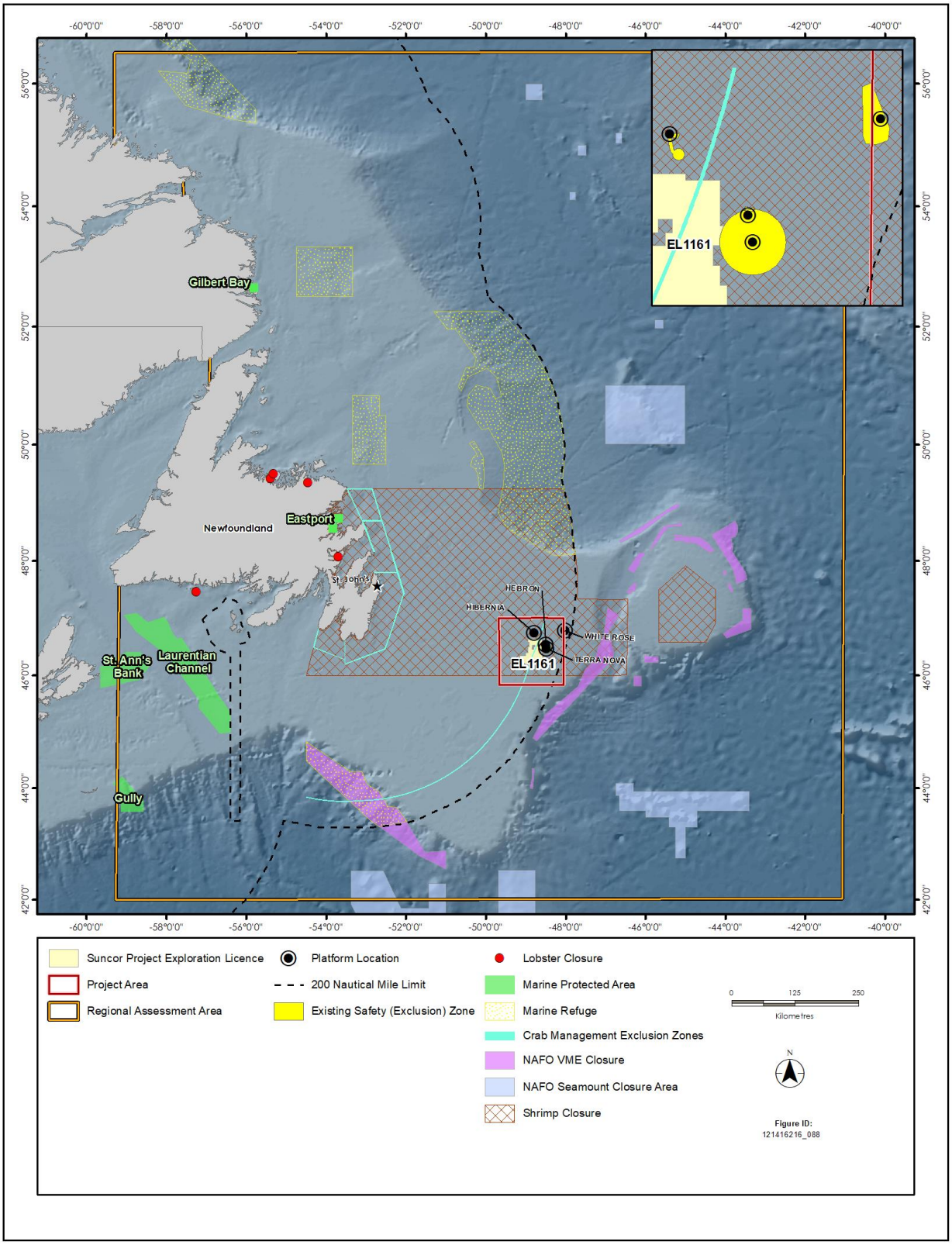


Figure 15-5 Established Safety Zones and Fisheries Closure Areas in the RAA

Suncor will provide details of the safety zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Navigational Warning and Notices to Mariners systems, which is expected to mitigate potential conflicts with Indigenous fishers. Suncor will engage with Indigenous communities to share Project details and facilitate information sharing. This will be accomplished through development and implementation of a Fisheries Communication Plan.

Offshore petroleum production projects also cause environmental effects on fish and fish habitat (including for commercial-communal fisheries resources) due to the generation of underwater sound and water quality effects associated with discharges. These environmental effects on fish and fish habitat are generally not expected to be of sufficient magnitude, duration, or extent to affect catch rates or otherwise cause a change in commercial-communal fisheries.

15.7.4.2 Cumulative Change in Current Use of Land and Resources for Traditional Purposes

While there are no known FSC fisheries in the Project Area, the assessment of cumulative effects on current use of lands and resources considers cumulative effects on migratory fish, bird, and marine mammal species that have the potential to migrate through the Project Area. Potential cumulative environmental effects on Indigenous peoples may result in changes to current use of lands and resources for traditional purposes through environmental effects on marine fish, marine and migratory birds, and marine mammals and sea turtles due to the generation of underwater sound and water quality effects associated with discharges. Atlantic salmon and American eel were noted as having cultural and spiritual importance to the Indigenous communities and are known to occur in the RAA; therefore, potentially affected by cumulative environmental effects. Similarly, Indigenous groups harvest seals for FSC purposes as well as marine birds (such as goose, ducks, loons, seagulls, murres, mergansers, and scoters). However, cumulative effects on marine fish, marine and migratory birds, and marine mammals and sea turtles were found to be not significant (refer to Sections 15.3, 15.4, and 15.5, respectively). Cumulative adverse effects on marine species that could be considered important from an FSC perspective, are not predicted to cause a change in quantity, quality or availability of these resources that could result in a change in health and socio-economic conditions or a change in current use of lands and resources for traditional purposes. Indigenous communities and organizations (over the course of EAs for recently proposed offshore exploration drilling projects) have raised concerns about potential effects on swordfish, bluefin tuna, Atlantic salmon and American eel. Cumulative effects to swordfish, bluefin tuna, Atlantic salmon, and American eel will be similar to those of other mobile fish species. A full assessment of Project interactions on marine fish and fish habitat provided in Section 15.3.

15.7.4.3 Cumulative Effects Summary and Evaluation

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in adverse changes to commercial-communal fisheries and current use of lands and resources for traditional purposes, but negligible to low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 13.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on Indigenous peoples are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.8 Commercial Fisheries and Other Ocean Users

15.8.1 Past and Ongoing Effects (Baseline)

Fish harvesting for commercial purposes in the nearshore and offshore areas of NL has historically been a large industry for both domestic and foreign fleets. From 1980 to 1990, catch effort was high and it became evident that stocks were being over-fished. The period from 1990 to 1992 continued to see major declines in catch weight, and in 1992 a moratorium was put in place for groundfish species. At that point in time, the focus shifted to commercial harvesting of shellfish species (i.e., snow crab and shrimp). Domestically, for approximately the past 20 years, shellfish have filled the void left by the groundfish moratorium; however, the viability of those stocks is beginning to be questioned (DFO 2018; Government of Canada 2018) as declines in the catch weight of these species has been noted in recent years.

SFA 7, which includes the Project Area, has been closed to the shrimp fishery since 2016 as a conservation measure (DFO 2021). NAFO has also prohibited directed fishing for northern shrimp in NAFO Division 3LNO (NAFO 2019) with a recommended directed fishery (5,338 t) in 3M (NAFO 2020).

Past and ongoing projects and activities in Eastern Canada have, to varying degrees, interacted with commercial fisheries and other ocean users, depending on their location, nature, and scale in relation to the activities, and other components and interests of other ocean users. Past and ongoing projects and activities are reflected in the overview of fish activity and other marine uses provided in Sections 7.2 and 7.3.

15.8.2 Potential Project-Related Contributions to Cumulative Effects

As described in Chapter 14, routine Project activities and components have the potential to interact with commercial fisheries and other ocean users from displacement from fishing grounds and loss or damage to gear (which would be compensated as per the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2017). Indirect interactions include those that may result in physical or behavioural effects on commercially fished species, such as changes in fish health or quality, fish avoiding popular fishing grounds due to underwater sound, or changes in water quality (as discussed in Chapter 9). The Project, therefore, has potential to result in the following residual adverse environmental effects on commercial fisheries and other ocean users:

- A residual change in access to or availability of resources

The Project-specific environmental effects assessment for this VC includes a summary of residual environmental effects in Section 14.3 and a determination of significance in Section 14.4. With the implementation of mitigation (Section 14.4), the residual environmental effects of routine Project activities on commercial fisheries and other ocean users are predicted to be not significant.

15.8.3 Future Projects and Activities and Their Effects

Table 15.12 summarizes how present and future projects and activities in the RAA have potential to cause a change in access to or availability of resources, thereby affecting commercial fisheries and other ocean users.

Table 15.12 Commercial Fisheries and Other Ocean Users: Residual Effects from Other Project and Activities in the RAA

Physical Activity	Potential Effects on this VC	VC-specific Spatial and Temporal Considerations
Offshore Petroleum Production Projects (Production from Hibernia, Terra Nova, White Rose, and Hebron Oilfields)	• Change in access to or availability of resources	• Commercial fishing activity and the activities of other ocean users has been, and will continue to be, excluded within the safety (exclusion) zones around production facilities and associated infrastructure for the duration of petroleum production from the Hibernia, Terra Nova, White Rose, and Hebron oilfields. The cumulative total of safety (exclusion) zones for these development projects is approximately 280 km² (refer to Table 15.1 for specific details). • Refer to Section 15.3.4 for an overview of results from the Hibernia, Terra Nova, and White Rose EEM programs regarding effects on marine water quality and fish health, contamination, and tainting (taste tests).
Offshore Petroleum Exploration – Geophysical Survey Programs	• Change in access to or availability of resources	• Although the relatively large survey areas covered by some types of offshore geophysical surveys and the known propagation of sound in the marine environment can increase the potential for spatial interactions between their effects and those of other projects and activities in the RAA, most survey activities operate for a short period of time in any one location, thus resulting in a transient and relatively short-term disturbance within localized portions of the survey area.
Offshore Petroleum Exploration – Exploration and Delineation Drilling Programs	• Change in access to or availability of resources	• Residual effects from other exploration drilling programs are generally anticipated to be similar in nature and extent (including similar spatial and temporal scales) to predicted Project-related residual environmental effects on commercial fisheries and other ocean uses (refer to Chapter 14). • Exploration drilling activities are typically relatively short-term and localized. This can reduce the potential for individuals and populations of commercially important species to be affected simultaneously and repeatedly by multiple physical activities.
Commercial Fishing Activity	• Change in access to or availability of resources	• Various commercial fishing activities have potential to overlap spatially and temporally in the RAA and Project Area.
Hunting Activity	• N/A	• N/A
Other Ocean Uses	• Change in access to or availability of resources	• The transitory nature of vessel traffic reduces potential residual effects on Indigenous fishers in any particular location and at any particular time. • The potential residual change in habitat quality and use for species of importance to Indigenous fishers / harvesters associated with sensory disturbance and emissions / discharges from vessels is expected to be short-term and transient at any given location, as is the potential residual change in risk of mortality or physical injury for species of importance to Indigenous harvesters associated with underwater sound and vessel strikes.

15.8.4 Potential Cumulative Environmental Effects

15.8.4.1 Cumulative Change in Access to or Availability of Resources

Similar to the cumulative effects assessed for Indigenous peoples (see Chapter 15.7), the following cumulative environmental effect mechanisms are also applicable with respect to commercial fisheries and other ocean users:

- Temporary displacement of fishers from customary fishing grounds due to a 500-m radius safety (exclusion) zone around the Project MODU, and the various safety (exclusion) zones associated with other exploration drilling projects and existing and proposed production projects (see Figure 15-5) (recognizing safety [exclusion] zones associated with exploration projects are short-term compared to longer term safety [exclusion] zones established for production projects)
- The cumulative risk of incidents of gear loss or damage caused by the Project in combination with other physical activities in the RAA
- Other general space-use conflicts (i.e., between supply vessels, geophysical survey and support vessels, commercial fishing vessels, and the vessels of other ocean users [e.g., scientific research vessels, vessels engaged in military exercises, and cable-laying or cable repair vessels])

Within or near the Project Area there are four production platforms with a cumulative total of safety (exclusion) zones for these development projects is approximately 280 km². Within the RAA, there are several offshore petroleum exploration drilling programs proposed with a similar timeframe as the Project, as well as proposed production projects. Drilling activities will require a 500-m radius safety (exclusion) zone around the MODU which could cumulatively contribute to restricted fishing areas; however, given the lack of commercial fishing in the Project Area / LAA, cumulative effects from Project related activities is anticipated to be negligible. EL 1161 intersects with the snow crab conservation exclusion zones in Crab Fishing Area 8Bx and the Project Area intersects with the same crab fishing closure. Approximately 17% of the RAA is covered by fisheries closures areas, contributing to the potential space-use conflicts among fishers. Figure 15-2 shows the cumulative areas where fishing activity is restricted due to existing safety (exclusion) zones and fisheries closure areas; this figure does not show safety (exclusion) zones that would be associated with proposed exploration drilling projects as specific timing and location of wells is not known. Ongoing communication will be required to avoid adverse effects on fisheries that may occur in the RAA.

The presence of supply vessels, combined with competing fishing vessels, seismic vessels and streamers associated with geophysical survey programs, and the marine traffic associated with other ocean users, may result in a potential conflict with fishing vessels within the RAA. These sources could cause a change in fisheries as a result of space-use conflicts. Project supply vessels are not expected to contribute to space-use conflicts with fishing vessels as Project-related vessel traffic will represent a minor component of total marine traffic in the RAA, occupy a negligible proportion of the total available fishing area in the RAA, and be short-term and transient in nature.

Fishing effort near the Project Area is relatively low and does not include unique fishing grounds or concentrated fishing effort that occurs exclusively within the Project Area. Underwater sound (see Appendix D), drill cuttings deposition (see Appendix C), and light emissions will not extend beyond the Project Area. The potential for temporary loss of access to preferred fishing areas as a result of the Project

is therefore anticipated to be negligible and is unlikely to have a discernable effect on the overall distribution of fishing effort within the RAA.

Physical activities within the RAA may unintentionally result in damage to fishing gear, which has the potential to cumulatively interact with the Project to result in a change in fisheries within the RAA. Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017). Similar compensation plans would be implemented in the event of gear loss or damage by other operators.

Standard practices for communication among marine users, including the communication of details of the safety (exclusion) zone to the MCTS for broadcasting and publishing in the NAVWARN and NOTMAR systems, is expected to mitigate potential conflicts with fisheries as well as other ocean users. During the drilling program, Suncor will facilitate coordinated communication with fishers. Suncor will share Project details, as applicable, and determine the need for a fisheries liaison officer during mobilization and demobilization of the MODU. This engagement will be coordinated through One Ocean, FFAW-Unifor, OCI, ASP, and AGC. It is assumed that other projects and activities in the RAA, including future projects and activities, will be required to comply with various mitigation measures and regulations. Suncor and other offshore petroleum operators in eastern Newfoundland's offshore area will promote effective communication between the petroleum and fishing industries and thus help mitigate potential cumulative effects on commercial fisheries.

As discussed in Section 15.3, cumulative effects on marine fish (including commercial species) are expected to be low and magnitude and therefore are not anticipated to affect catch rates or otherwise cause a change in availability of fisheries resources for commercial fisheries. Section 15.7.3 provides the analysis of cumulative environmental effects relating to Indigenous commercial-communal fisheries, which is also directly relevant to commercial fishers and other ocean uses.

15.8.4.2 Cumulative Effects Summary and Evaluation

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in adverse changes to availability of or access to resources, but be negligible to low in magnitude, temporary, and localized. With the implementation of mitigation measures (Section 14.3), as well as other mitigation measures being implemented by other proponents, the residual cumulative environmental effects on commercial fisheries and other ocean users are predicted to be not significant. No additional mitigation measures are proposed to address potential cumulative effects.

15.9 Mitigation, Monitoring and Follow-up

VC-specific mitigation, monitoring and/or follow-up programs included as part of the Project-specific environmental effects assessment (Chapters 8 to 14) are also applicable to the cumulative effects assessment. It is assumed that other projects and activities in the RAA, including future projects and activities, will be required to comply with various mitigation measures and regulations, thus also reducing cumulative effects. No additional or revised monitoring or follow-up is required or proposed specifically for potential cumulative environmental effects beyond standard measures that are implemented in the regular course of operations for other projects and activities.

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