# Equinor Canada Ltd.

# Central Ridge Exploration Drilling Program

# Abridged EIS

# Responses to Information Requirements

**June 5, 2020**

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Note that revisions to the original Abridged EIS text were made as indicated in **bold and underline**.

# 1.0 PHYSICAL ENVIRONMENT

## 1.1 Information Requirement ECCC-3 / DFO-1

**Reference to EIS Guidelines:** Part 2 – 7.1.2: Marine Environment

**Reference to Abridged EIS:** Section 2.3 Project Location and Designated Project Area / Section 5.2 Bathymetry

**Context and Rationale:** The EIS Guidelines state that the EIS will include a description of available bathymetric information (e.g., maximum and mean water depths) for the site. Bathymetric information is inconsistent in the Abridged EIS. Section 2.3 (page 40) states that "water depths in EL 1159 range from approximately 90 m to 930 m, and EL 1160 ranges from approximately 40 m to 1,020 m." However, Section 5.2 (page 125) states that "water depths in the two ELS range from 100 to 900 m."

**Specific Question / Request for Information:** Clarify the water depth ranges for EL 1159 and 1160.

**Equinor Response:**

Section 5.2 (page 125) text edited to read "**maximum** water depths in the two ELS range from **930 to 1,020 m**."

# 2.0 ACCIDENTS AND MALFUNCTIONS OIL SPILL MODELLING

## 2.1 Information Requirement DFO-24

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1: Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.4 Fate and Behaviour of Potential Spills / Section 15.4.1 Applicability of EL 1135 (shallow- water) and EL 1134 (deep-water) Modelling for Illustrative Purposes

**Context and Rationale:** The EIS Guidelines require an assessment of the effects of potential accidents or malfunctions. Section 15.4 (page 472) of the Abridged EIS states that "all modelled unmitigated subsurface blowouts and batch spills resulted in the same predictions (i.e., surface oil would move eastward due to prevailing westerly winds), and therefore modelling specific to ELs 1159 and 1160 has not been carried out." This is contradicted by the following statement on page 474, "Given the general trend indicated by previous models for oil to move in a southward direction a spill from EL 1159 or EL 1160 is expected to follow the same general trajectory (predominately north to the Gulf Stream)."

**Specific Question / Request for Information:** Clarify the anticipated oil spill trajectory for the Central Ridge Exploration Drilling Project. Include figures that clearly illustrate the predictions. Update the effects assessment accordingly.

**Equinor Response:**

Statement on page 474 has been edited to read, "Given the general trend indicated by previous models for oil to move in a **southward then eastward** direction, a spill from EL 1159 or EL 1160 is expected to follow the same general trajectory **(predominately south then east when it meets the Gulf Stream)**" This is illustrated in Figures 15-1 to 15-4.

There is no need to revise the effects assessment.

## 2.2 Information Requirement DFO-25

**Reference to EIS Guidelines:** Part 1 – Section 3. Scope of the Environmental Assessment / Part 2 – Section 7.6.1: Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.4 Fate and Behaviour of Potential Spills

**Context and Rationale:** The EIS Guidelines state that the "The abridged EIS should... provide a rationale for the applicability of the analysis and conclusions of the Flemish Pass EIS." The Abridged EIS states that 15 of the previously modelled unmitigated oil spill scenarios are applicable to ELs 1159 and 1160 based on water depth and spill rates (page 472). The Abridged EIS does not provide rationale of how the modelling is applicable in terms of oceanographic conditions or fluid characteristics anticipated in ELs 1159 and 1160. Model inputs other than depth and spill rate will influence the spill trajectory which should be discussed, and rationale provided.

**Specific Question / Request for Information:** Discuss the applicability of oceanographic conditions and fluid characteristics in previously modelled unmitigated oil spill scenarios to ELs 1159 and 1160.

**Equinor Response:**

***Oceanographic Conditions***

The oceanographic circulation over the Project Area is dominated by the generally southward flow of the cold Labrador Current, which includes an inshore branch that flows along the Newfoundland coast at speeds approximately 10 cm/s and an offshore branch flowing along the outer edge of the Grand Banks. The inshore branch sometimes meanders over the Grand Banks. The offshore branch of the Labrador Current flows over the upper Continental Slope at depth, and through the Flemish Pass with average speeds of approximately 20 to 25 cm/s. Over parts of the Grand Banks, the mean currents are generally weak (less than 10 cm/s) and flow southward, dominated by wind-induced and tidal current variability (Section 5.5., Abridged EIS).

While the water depths and current speeds and direction can vary considerably across the Project Area, the range of these conditions for EL 1159 and EL 1160 are similar to those considered in the previous modelling (SPA, EL 1134, JDB). Seasonal mean currents from the WebDrogue CECOM (Canadian East Coast Ocean Model) model (DFO 2015) were used in the models. The CECOM model yields currents at five depth levels (surface, 100 m, 500 m, 1,000 m, and bottom).

Wu et al. (2012) conducted an extensive comparison of the CECOM model results and 11 years of observational data, including both qualitative visual comparisons, and quantitative methods based on statistical analysis. Their comparisons indicated that the main circulation features from the observations were successfully reproduced by the model. Furthermore, the comparison indicated particularly good levels of agreement between model and observations in the regions of the Labrador Shelf, Newfoundland Shelf, and the Flemish Pass, with a mean correlation coefficient of 0.91 (ideal value is 1) across all seasons and depths within the Flemish Pass, and an average ratio of kinetic energy difference to the observations of 0.12 (where a lower value is better, and the value of 0.5 indicates "a fair agreement").

The previous modelling for JDB and EL 1134 employed nearby current measurements; at SPA a combination of measured currents from part of the year and CECOM currents was employed.

As an illustration of the range of current speeds for the Grand Banks and Flemish Pass region, spring and fall conditions (when speeds are generally least and greatest) are shown in Figures 1 and 2 below for surface and bottom depths, respectively. Three previously modelled locations (SPA, EL 1134, and JDB) are noted on the maps as are three hypothetical regions within EL1159 and EL 1160 (CR1, CR3, and CR3). These CR regions are generally representative of the locations and water depths within EL 1159 and EL 1160 and the Grand Bank and Flemish Pass and so similar oceanographic conditions are anticipated.

Modelled mean surface current speeds range from approximately 2 cm/s in spring over the Grand Bank southern portion of the Project Area (e.g., at JDB) to approximately 40 cm/s at SPA and 50 cm/s near CR3 in the fall. Near-bottom modelled current speeds are in the 1 to 20 cm/s range, weakest on the Grand Bank and Flemish Cap slopes and strongest along the slope, with 17 cm/s at SPA and 20 cm/s near CR1. Predominant current directions through the Flemish Pass are to the south. The current speeds in the CR regions are generally within the same ranges spanned by the three previously modelled locations and all six locations consistently show a predominantly southerly flow at all depths.

A comparison of bottom currents is shown in Figure 3 below. Bottom currents are relevant for the drift of water-based mud (WBM) cuttings released at the seabed. The range of speeds seen for any of the hypothetical CR regions (green) are generally well-matched by the corresponding range from previously modelled locations (blue).

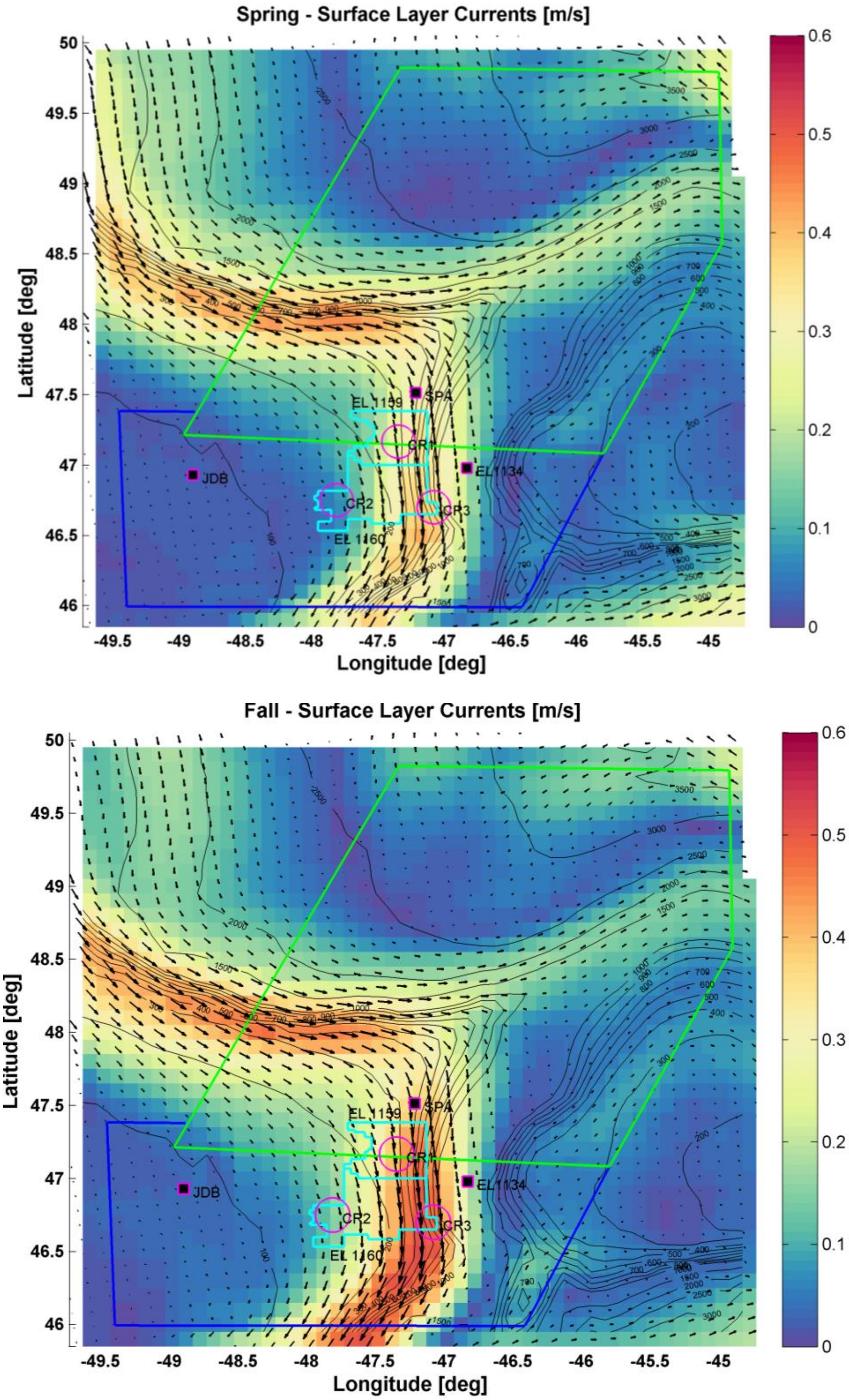



**Figure 1** **Surface Currents, Spring (top) and Fall (bottom)**

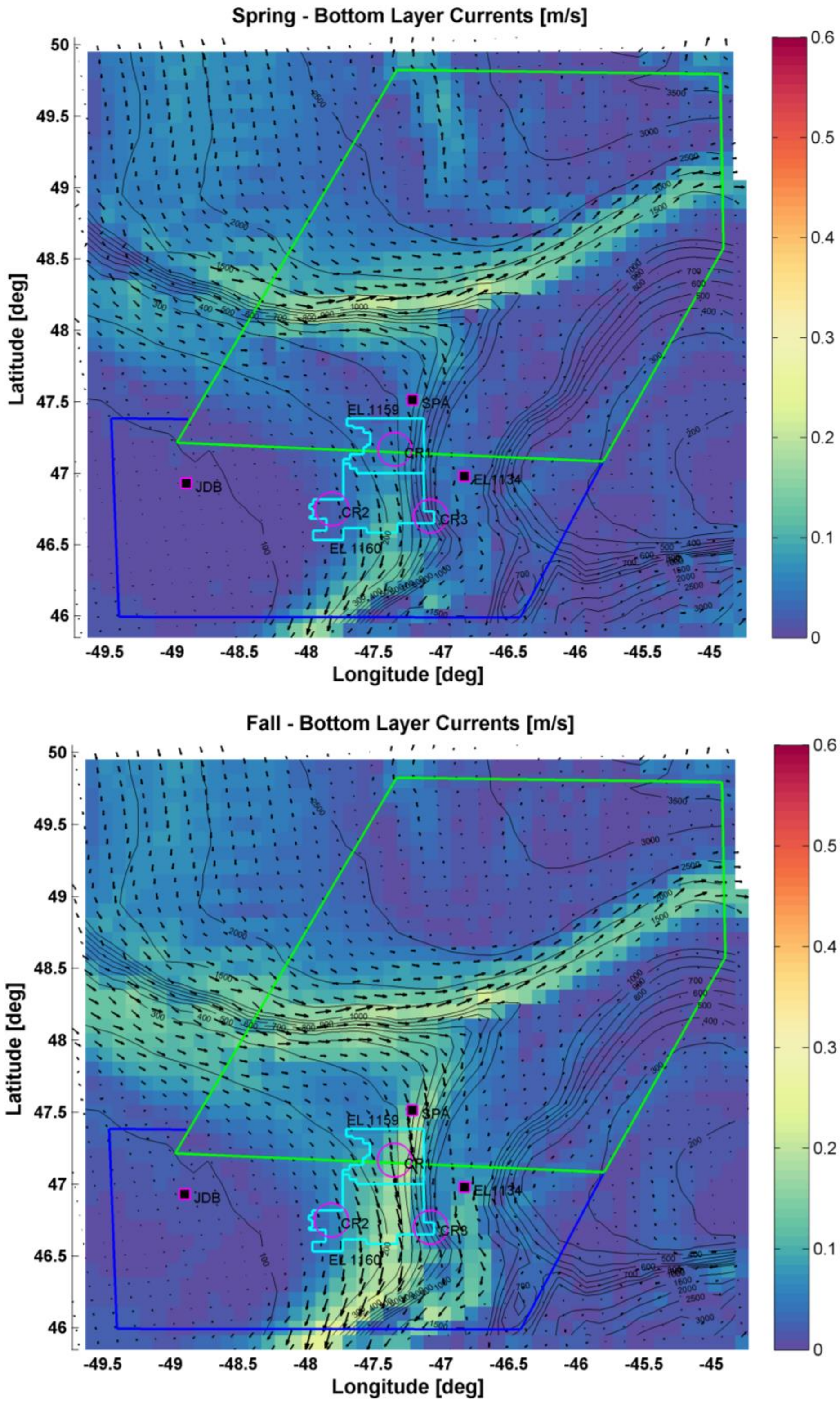
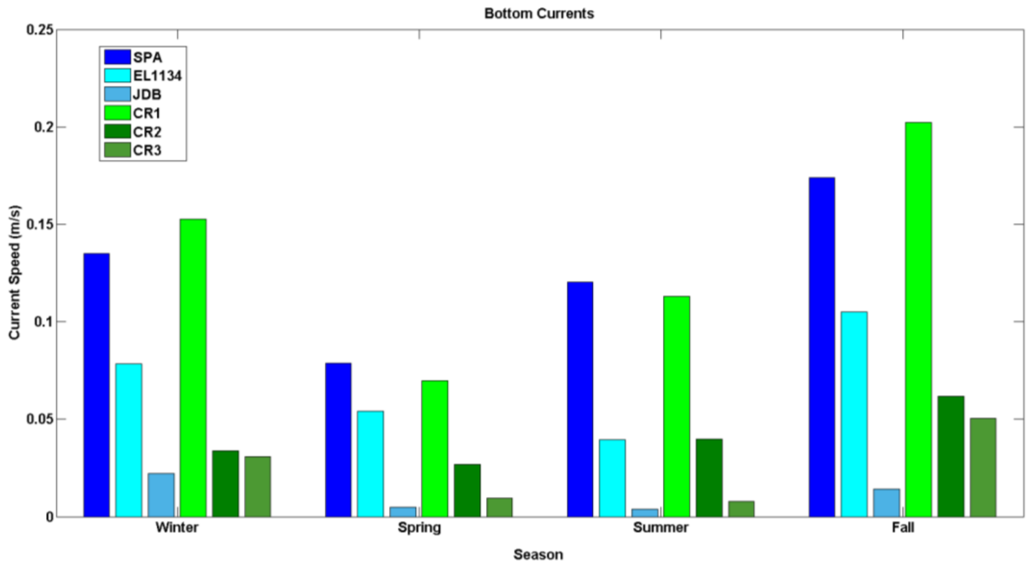



**Figure 2 Bottom Currents Spring (top) and Fall (bottom)**




## Figure 3 WebDrogue Bottom Current Speed Comparison

### *Fluid Characteristics*

The Flemish Pass EIS (Statoil 2017) and Eastern NL EIS (ExxonMobil 2017) (including the EL 1134 Addendum [ExxonMobil 2018]) modelled both Bay du Nord (BdN) and Ben Nevis crude oils (Table 1). These are the two most common crude oils used in modelling in the Eastern NL offshore area.

**Table 1 Physical Properties for the Two Crude Oil Products Used in Modelling**

| Physical Property | Bay du Nord Crude Oil (ELs 1135, 1140, 1142) | Ben Nevis Crude Oil (ELs 1134, 1137) |
|---|---|---|
| Density ($g/cm^3$) | 0.84553 @16°C<br>0.85800 @0°C | 0.87616 @16°C |
| Viscosity (cP) | 5.0 @20°C<br>53.0 @0°C | 3.9 @79.7°C<br>39.655 @5°C |
| API Gravity | 35.85 | 30.6 |
| Pour Point (°C) | -9 | -10 |
| Interface Tension (dyne/cm) | 15.5 | 21.6 |
| Emulsion Maximum Water Content (%) | 72 | 75 |
| Source: modified from RPS 2017 | | |

The physical and chemical parameters of BdN are similar to those of Hibernia crude oil, which was used in previous studies (ESTC, 2001; SL Ross Environmental Research Ltd. 2016). The physical and chemical parameters of Ben Nevis type crude were provided by ExxonMobil, with additional assays and measurements by ESTC (2001), Intertek (2016), and SL Ross Environmental Research Ltd. (2016). The BdN is a slightly lighter crude oil with a higher volatile content, when compared to Ben Nevis (see Figures 4 and 5). However, both BdN (72%) and Ben Nevis (75%) have high max water content when fully emulsified, resulting in extremely similar behaviour. This is reflected the tendency to form stable emulsions that result in thicker oil floating on the surface after the oil has weathered sufficiently (hours to days) in the environment.

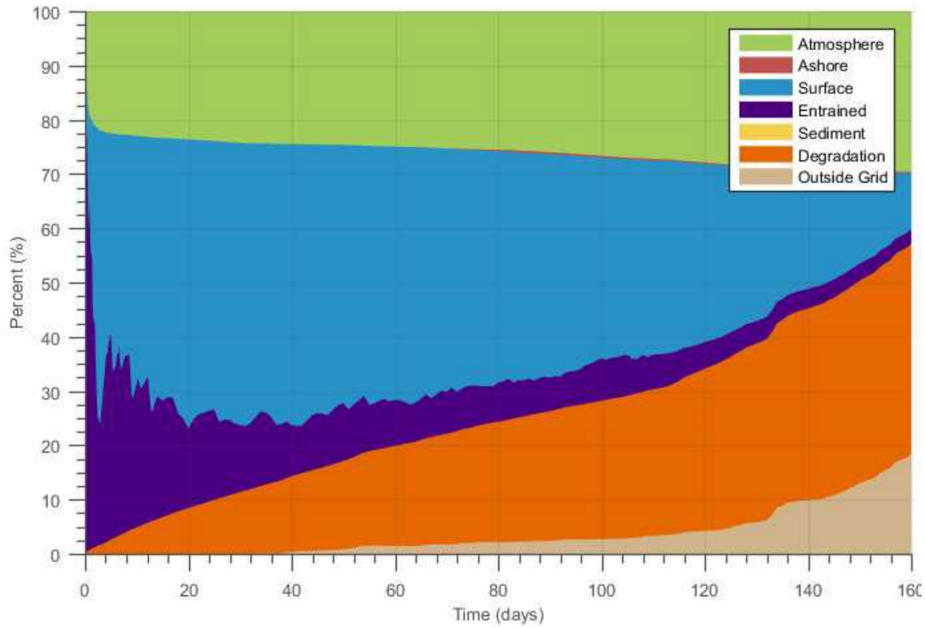



**Figure 4** **Mass Balance Plot of the Representative Worst-case for Shoreline Contact Resulting from a 113-day (bottom) Subsurface Blowout at EL 1134**

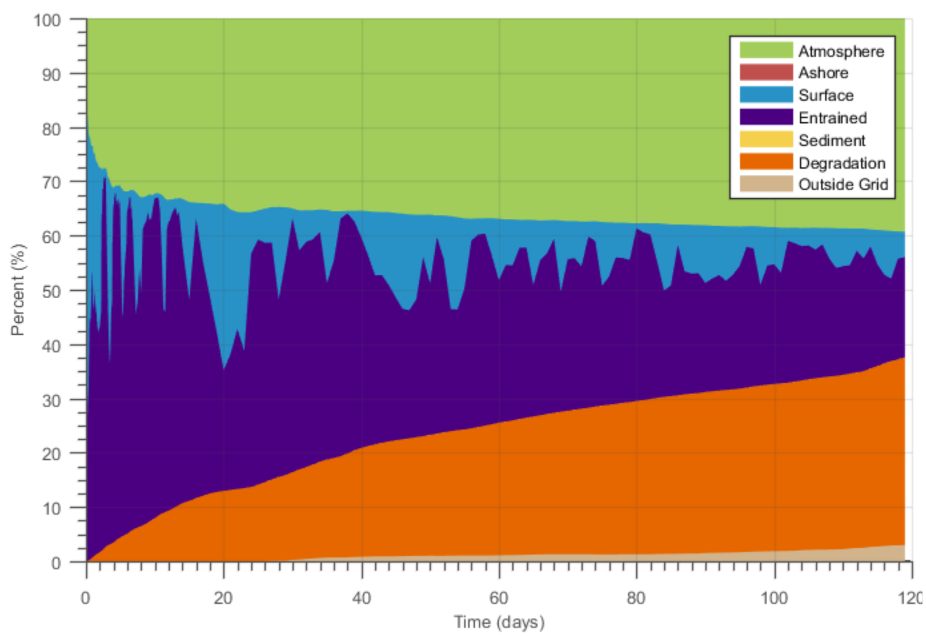


**Figure 5 Mass Balance Plots of the 95th Percentile Shoreline Contact Case Resulting from a 113-day Blowout at EL 1135**

The low viscosity and high soluble content of the BdN and Ben Nevis crude oils result in a relatively large proportion of constituents that have the potential to dissolve into the water column. These crude oils provide conservative approximations of anticipated concentrations in the water following an accidental release and would likely behave similarly in the event of an accidental release, with Ben Nevis crude being the most persistent (RPS 2017).

**New References**

DFO (Fisheries and Oceans Canada). 2015. WebDrogue Drift Prediction Model v0.7. Department of Fisheries and Oceans, Canada. Available at: http://www.bio.gc.ca/science/research-recherche/ocean/webdrogue/index-en.php.

ESTC (Environmental Science and Technology Center), 2001. Release Technology Database, Oil Technology Database. Available: http://www.etc-cte.ec.gc.ca/databases/OilProperties/oil_prop_e.html. Accessed: 2016.

ExxonMobil Canada Properties. 2017. Eastern Newfoundland Offshore Exploration Drilling Project Environmental Impact Statement. Prepared by Stantec Consulting Ltd and Amec Foster Wheeler. Available at: https://www.ceaa-acee.gc.ca/050/evaluations/document/121311?culture=en-CA.

ExxonMobil. 2018. Eastern Newfoundland Offshore Exploration Drilling Project (2018-2029) – Environmental Impact Statement Addendum: Addition of EL 1134. Prepared by Wood Environment & Infrastructure Solutions. Available at: https://www.ceaa-acee.gc.ca/050/documents/p80132/125160E.pdf.

Intertek, 2016. Preliminary Laboratory Report for Statoil Petroleum AS. Analysis of water sample from L-76-z. Intertek West Lab AS, Tananger Norway. 23 February 2016.

RPS. 2017. Trajectory Modelling in Support of the ExxonMobil Exploration Drilling Project. Prepared for ExxonMobil, St. John's, NL. 134 pp. + Appendices.

SL Ross Environmental Research Ltd., 2016. Release-related Properties of BdNL-76Z Ti-3 DST Dead Oil. 30 pp. + Appendices.

Statoil Canada Ltd. 2017. Flemish Pass Exploration Drilling Project Environmental Impact Statement. Prepared by Stantec Consulting Ltd and Amec Foster Wheeler. Available at: https://www.ceaa-acee.gc.ca/050/evaluations/document/121309?culture=en-CA.

## 2.3 Information Requirement C-NLOPB-10

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1: Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.4 Fate and Behaviour of Potential Spills

**Context and Rationale:** The Abridged EIS uses modelling results from the Flemish Pass and Eastern Newfoundland EISs. The spill rate and total volume data provided in Table 15.6 of the Abridged EIS for EL 1134 (deep-water well) are not the exact numerical values as used in Table 7.1 of the ExxonMobil, 2018 – Eastern Newfoundland Offshore Exploration Drilling Project (2018-2029)

- Environmental Impact Statement Addendum: Addition of EL 1134, which include the following:
- Numerical data for EL 1134; Subsurface Blowout - Southern Flemish Pass EL 1134 a hypothetical release of 6,010 m³/day (37,800 bbl/day) of Ben Nevis crude oil for 30 and 113 days for a total of 180,292 m³ (1,134,000 bbl) and 679,098 m³ (4,271,400 bbl), respectively.
- The numerical data in Table 15.6 of the Central Ridge Abridged EIS are for a hypothetical release of 6,010 m³/d of (37,800 bbl/day) crude oil for 30 and 113 days for a total 180,300 m³ (1,134,053 bbl) and 679,130 m³ (4,271,599 bbl).

**Specific Question / Request for Information:** Explain the discrepancy between the values reported in the Abridged EIS and the Eastern Newfoundland Offshore Exploration Drilling Project EIS. Update the effects assessment accordingly.

**Equinor Response:**

Revised Table 15.6 (Table 2 below) has been revised.

**Table 2 Revised Table 15.6: Summary of Spill Trajectory Modelling**

| Exploration Licence | Water Depth | Product Type | Spill Rate | Duration | Total Volume |
|---|---|---|---|---|---|
| **Subsurface Blowouts** | | | | | |
| EL 1134* | 1,175 m | Crude | 6,010 m³/d | 30 days | 180,**292** m³ |
| EL 1134* | 1,175 m | Crude | 6,010 m³/d | 113 days | 679,**098** m³ |
| EL 1135* | 362 m | Crude | 24,802 m³/d | 30 days | 744,062 m³ |
| EL 1135* | 362 m | Crude | 24,802 m³/d | 113 days | 2,802,633 m³ |
| EL 1137* | 89 m | Crude | 4,165 m³/d | 30 days | 124,964 m³ |
| EL 1137* | 89 m | Crude | 4,165 m³/d | 113 days | 470,603 m³ |
| EL 1140 | 2,700 m | Crude | 4,980 m³/d | 36 days | 179,280 m³ |
| EL 1142* | 1,100 m | Crude | 15,000 m³/d | 113 days | 1,695,000 m³ |
| **Batch Spills** | | | | | |
| EL 1134* | 1,175 m | Diesel | N/A | Instantaneous | 100 L |
| EL 1134* | 1,175 m | Diesel | N/A | Instantaneous | 1,000 L |
| EL 1135* | 362 m | Diesel | N/A | Instantaneous | 100 L |
| EL 1135* | 362 m | Diesel | N/A | Instantaneous | 1,000 L |
| EL 1137* | 89 m | Diesel | N/A | Instantaneous | 100 L |

**Table 2 Revised Table 15.6: Summary of Spill Trajectory Modelling**

| Exploration Licence | Water Depth | Product Type | Spill Rate | Duration | Total Volume |
|---|---|---|---|---|---|
| EL 1137* | 89 m | Diesel | N/A | Instantaneous | 1,000 L |
| EL 1140 | 2,700 m | Diesel | N/A | Instantaneous | 100 L |
| EL 1140 | 2,700 m | Diesel | N/A | Instantaneous | 1,000 L |
| EL 1142* | 1,100 m | Diesel | N/A | Instantaneous | 100 L |
| EL 1142* | 1,100 m | Diesel | N/A | Instantaneous | 1,000 L |
| Note: Scenarios marked with * can be applied to ELs 1159 and 1160 due to water depths and estimated spill rates. | | | | | |

## 2.4 Information Requirement DFO-26

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1 Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.4.3 Deterministic Results

**Context and Rationale:** Section 15.4.3 (page 483) of the Abridged EIS states that "this is due to the highly volatile and soluble content of the crude oil and diesel product leading to large percentages predicted to evaporate (36% to 39% for EL 1135 and 30% at EL 1134) and dissolve and degrade (25% to 35% at EL 1135 and 39% at EL 1134).

Entrainment into the water column ranged between 8% to 47% at EL 1135 and 3% at EL 1134." It is not clear if the percentages of oil presented refer to Bay du Nord crude or diesel or both. It is also not clear why ranges are provided for EL 1135 but not for EL 1134.

**Specific Question / Request for Information:** Provide clarification on the deterministic scenarios presented, including a clear description of the type of crude or diesel described in the model results. Provide a range of percentages for EL 1134 or explain why a range was not provided.

**Equinor Response:**

Section 15.4.3 (page 483) described the maximum percentage from the 160-day model only. The text is revised to include the maximum percentage from the 45-day model as well as the 160-day model:

"For all representative deterministic scenarios, the amount of oil remaining in surface waters or on sediments at the end of the simulation was less than 5% for the BdN crude oil spills at EL 1135. For most representative deterministic scenarios, the amount of oil remaining in surface waters at the end of the simulation was 10% of the Ben Nevis crude oil at EL 1134. **A large percentage of the crude oil** is predicted to evaporate (36% to 39% for EL 1135 and **26% to** 30% at EL 1134) and dissolve and degrade (25% to 35% at EL 1135 and **19% to** 39% at EL 1134). Entrainment into the water column ranged between 8% to 47% at EL 1135 and 3% **to 7% at** EL 1134. Shoreline contact was minimal for these simulations, where even the 95th percentile shoreline contact case, was predicted to have less than

0.5% of released oil reaching shore from EL 1135 and less than 0.2% of released oil reaching shorelines from EL 1134."

## 2.5 Information Requirement ECCC-22

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1 Effects of Potential Accidents of Malfunctions

**Reference to Abridged EIS:** Section 15.0 Accidental Events

**Context and Rationale:** Section 15 (page 490) of the Abridged EIS states that “batch spills, if any, resulting from the Project would cause a temporary (likely less than 24 hours) decrease in water quality (and thus habitat quality) around the spill site.” Environment and Climate Change Canada noted that the most recent spills that occurred in offshore Newfoundland had surface oil that persisted well beyond 24 hours. Environment and Climate Change Canada requests more recent information to clarify the persistence of oil following a spill based on recent spills in offshore Newfoundland.

**Specific Question / Request for Information:** Provide information related to the persistence of oil following the most recent spills in offshore Newfoundland and Labrador. Considering the most recent spills in offshore Newfoundland and Labrador, discuss the applicability of this information to potential spills during the Project.

Update the effects assessment accordingly.

**Equinor Response:**

Modelling was done on batch spills of 100 and 1,000 L as has been the standard for exploration drilling projects. The three spills recorded in 2018 and 2019 were one to three orders of magnitude larger than those modelled and were associated with production activities. Even so, the largest spill produced a sheen that was only visible for three days, Based on C-NLOPB Incident Reports (https://www.cnlopb.ca/incidents/), the White Rose spill (250,000 L) was reported on November 16, 2018. The November 23, 2018, incident report indicated that no sheens were observed during flights since November 18, 2018; therefore, the observable slicks persisted for three days. A total of 18 oiled seabirds were sighted by November 22, 2018; no oiled wildlife were observed after that date.

Hibernia reported their first spill on July 14 (12,000 L), more than an order of magnitude less than White Rose. By August 1, 2019 (15 days), concentrations decreased to the point that mechanical recovery and dispersion operations were no longer possible. No oiled marine life or seabirds were observed in the vicinity of the spill and its trajectory. Hibernia’s August 17, 2019, spill was an order of magnitude lower again (2,184 L). The sheen had dissipated by August 21 (five days). No oiled marine life or seabirds were observed.

Water quality monitoring was conducted during each of the spills; however, the data have not been made available for review.

Given the size of the spills (relative to the amounts modelled), the rapidity with which the slicks dissipated (due to evaporation, weather conditions (high seas in the case of White Rose’s winter spill), and the numbers of oiled wildlife observed, there is no requirement to update the effects assessment.

## 2.6 Information Requirement IR-3

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1. Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.4.2 Stochastic Modelling Results

**Context and Rationale:** The EIS Guidelines require the proponent to provide information on oil spill fate and behaviour modelling. The potential for shoreline oiling is not clear from the Abridged EIS. Section 15.4.2 describes the results of stochastic modelling at sites in EL 1134 and EL 1135. With respect to potential shoreline contact, page 474 notes a probability of less than 10% in the vicinity of the southern coast of the Avalon Peninsula for a spill originating in EL 1135. However, the probability for shoreline contact for modelling for EL 1134 is not discussed. In Figure 15-6, the probability of shoreline contact for EL 1134 is in the 1025% range in some areas. Page 482 states the “probability of shoreline exposure is very low as less than 1% of the annual scenarios reach the shoreline.”

**Specific Question / Request for Information:** Clarify the potential for shoreline oiling for EL 1134 and ensure the effects analysis considers the worst-case potential for shoreline oiling (which would appear to be that reported for a spill originating in EL 1134).

**Equinor Response:**

Section 15.4.2 (Page 474) is revised to read: “Due to the volume of oil released and the duration modelled, the hypothetical 113-day scenarios were predicted to have the potential to make contact with a long length of shoreline. The probability of oil making contact with shoreline above 1 $g/m^2$ from the 113-day release at EL 1135 was approximately <10% in the vicinity of the southern coast of the Avalon Peninsula. **The probability of oil making contact with the shoreline above 1 $g/m^2$ from the 113-day release at EL 1134 was up to 25% on the Avalon Peninsula and primarily <10% on the northern and southern coasts of Newfoundland.** The oil that is predicted to make contact with shorelines is expected to be weathered, as minimum time estimates for first shoreline oil exposure range from 30 to 31 days from EL 1135 and 8 to 27 days from EL 1134, depending on the location and season (Tables 15.7 and 15.8). The oil that did make its way to shore would likely be patchy and discontinuous. Oil from the subsurface releases is transported by subsurface currents, which have higher potential to transport subsurface oil to the west and southwest prior to surfacing than do surface currents.”

As the oil that is predicted to make contact with shorelines is expected to be weathered and will take a minimum of 8 to 27 days from a spill at EL 1134, the effects assessments do not need to change. Effects are not expected to alter the long-term viability of local or regional VC populations in the RSA. Equinor will apply spill prevention techniques and appropriately scaled response strategies.

## 2.7 Information Requirement C-NLOPB-6 / IR-4

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1: Effects of Potential Accidents or Malfunctions

**Reference to Abridged EIS:** Section 15.5 Environmental Effects Assessment

**Context and Rationale:** The EIS Guidelines require the proponent to consider spill fate and behaviour modelling results in the analysis of environmental effects. The modelling results in Section 15.4.2 of the

Abridged EIS are for spills originating in EL 1134 and EL 1135, selected as the most representative of the fate and behaviour of spills originating in EL 1159 and EL 1160. However, the analysis in Section 15.5 cites the results of spill modelling for spills originating at the Northern Flemish Pass and Eastern Flemish Pass sites, located in EL 1140 and EL 1142. It does not appear that modelling results for ELs 1134 and 1135 are considered when determining potential effects to valued components in Sections 15.5.1 – 15.5.6. As indicated by the C- NLOPB during conformity review, the outcomes of the EL 1134 deep water model are different as to shoreline oiling, predicated concentration, thickness and mass balances and should also be considered within the effects assessment.

Areas affected in Section 15.5 of the Abridged EIS are as follows:

- General references throughout to “Eastern Flemish Pass” and “Northern Flemish Pass” sites are not relevant to modelling results provided in the earlier part of the chapter.
- Time to reach shoreline is reported as “at least 29 days” in the introduction of Section 15.5 (page 488). The minimum time to reach shoreline as reported earlier in the chapter was 8 days (Table 15.8, page 481).
- Section 15.5.2 sites shoreline contact probability of 1-2% (page 490); the probability of shoreline contact for a spill originating in EL 1134 was as high as 15-25% (Table 15-7, page 481).
- Section 15.5.3 states that oil is “extremely unlikely” to reach shorelines, based on Eastern and Northern Flemish Pass site results (page 491). This characterization is not consistent with worst-case results presented earlier in the chapter.
- Section 15.5.4 identifies special areas that could overlap with areas exceeding socioeconomic thresholds for oiling from batch spills and subsurface blowouts, both in the offshore and in predicted shoreline contact areas (page 492-493). The areas identified are identical to those identified in the Flemish Pass Exploration Drilling Project EIS, which relied on the model results for EL 1140 and EL 1142.
- Section 15.5.5 indicates a 2% probability for shoreline oiling (page 494). This is not consistent with modelling results presented earlier in the chapter.

**Specific Question / Request for Information:** Include the outcomes of models conducted for ELs 1134 and 1135 in the effects assessment for the various valued components and within the effects assessment of accidental events. Provide effects analysis and significance determinations based on the representative spill modelling results for EL 1134 and EL 1135. Ensure all references to model results clearly reference the EL in which the modelled spill originated, and that the worst-case model results are considered in the effects analysis. The text should include an updated list of potentially affected special areas, both offshore and at potentially affected shorelines.

**Equinor Response:**

- *Time to reach shoreline is reported as “at least 29 days” in the introduction of Section 15.5 (page 488). The minimum time to reach shoreline as reported earlier in the chapter was 8 days (Table 15.8, page 481).*

Section 15.5 is revised to:

The potential for an oil spill to contact the shoreline is very low. Spill prevention techniques and response strategies will be incorporated into the design and operations for Project activities as part of contingency planning, which will reduce the likelihood of such effects occurring. If a worst-case oil spill were to occur, modelling has indicated that surface oil would take **30 to 31 days from EL 1135 and 8 to 27 days from EL 1134, depending on the location and season (Abridged EIS Tables 15.7 and 15.8), to reach shore**, at which point it will be highly weathered and discontinuous. Given this and the application of mitigation and response measures, it is unlikely that the overall abundance, distribution, or health of affected coastal areas would be significantly affected.

- *Section 15.5.2 sites shoreline contact probability of 1-2% (page 490); the probability of shoreline contact for a spill originating in EL 1134 was as high as 15-25% (Table 15-7, page 481).*

Section 15.5.2 is revised to:

A subsurface blowout represents the accidental event with the greatest potential to affect marine birds, given the potentially large volume of discharged oil, and the possibility for such a spill to have a large geographic extent. **The probability of oil making contact with shoreline above 1 g/m² from the 113-day release was approximately <10% in the vicinity of the southern coast of the Avalon Peninsula (EL 1135) and up to 25% on the Avalon Peninsula and primarily <10% on the northern and southern coasts of Newfoundland (EL 1134). The oil that is predicted to make contact with shorelines is expected to be weathered, as minimum time estimates for first shoreline oil exposure range from 30 to 31 days from EL 1135 and 8 to 27 days from EL 1134, depending on the location and season (Abridged EIS Tables 15.7 and 15.8). The oil that did make its way to shore would likely be patchy and discontinuous.**

Based on vulnerability indices (French-McCay 2009) the mortality rate would range from 35% to 95% for birds that come in contact with the slick in the 0.01-0.1 mm thickness range. Murres and dovekies, which spend most of their time sitting on the water's surface, are most vulnerable (estimated 95% mortality), while species that dive or feed at the water's surface for their prey but otherwise spend little time on the water, including Leach's storm-petrels, great shearwaters, and great skuas, are predicted to have a lower mortality rate of 35%. Black-legged kittiwakes and northern gannets, which do often sit on the water but spend more time in the air than alcids (murres and dovekies), would be expected to have an intermediate mortality rate. As described in French-McCay (2009), a species' behaviour affects its likelihood of being oiled; for example, the amount of time spent on water, exhibiting diving behaviour, and having extended flightless periods (e.g., moulting) or roosting on the water can result in increased oiling if a slick is present. Oiled birds are generally assumed to have a very low survival rate (approximately 0 to 5%). Dispersant use has a net environmental benefit for marine and migratory birds that could encounter surface oil; however, it is acknowledged that dispersants may reduce surface tension at the feather-water interface which can reduce the capacity of insulation provided by feathers. The magnitude of these effects depends on the proximity of wildlife during dispersant application, as well as the effectiveness of the dispersant on the surface oil (National Research Council 2005). Equinor Canada will prepare SIMAs that will evaluate benefits and drawbacks of different spill response tactics, including the use of dispersants.

- *Section 15.5.3 states that oil is "extremely unlikely" to reach shorelines, based on Eastern and Northern Flemish Pass site results (page 491). This characterization is not consistent with worst-case results presented earlier in the chapter.*

Section 15.5.3 is revised to:

Results of the modelling of batch spills (100 or 1,000 L **at EL 1134 or EL 1135**) suggest that both the potential for exposure and the likelihood of adverse effects on marine mammals and sea turtles from a batch release (e.g., fouling, inhalation of vapours) are low. Only animals in the immediate vicinity at the time of the spill may be exposed, and at the concentrations predicted, change in mortality or injury is considered unlikely and changes in health are predicted to be of low magnitude (e.g., temporary inflammation of mucous membranes). Changes in habitat quality or use will likewise be of low magnitude. Batch spills from either **EL1134 or EL 1135** are not expected to affect haulout areas on distant shorelines. While there will be a decrease in water quality around the spill site, this would be short-term until the slick disperses (aided by surface wave action in the offshore environment).

**The probability of oil making contact with shoreline above 1 g/m² from the 113-day release was approximately <10% in the vicinity of the southern coast of the Avalon Peninsula (EL 1135) and up to 25% on the Avalon Peninsula and primarily <10% on the northern and southern coasts of Newfoundland (EL 1134). The oil that is predicted to make contact with shorelines is expected to be weathered, as minimum time estimates for first shoreline oil exposure range from 30 to 31 days from EL 1135 and 8 to 27 days from EL 1134, depending on the location and season (Abridged EIS Tables 15.7 and 15.8). The oil that did make its way to shore would likely be patchy and discontinuous.** Terrestrial areas affected may or may not be used by marine mammals for haul outs. In the extremely unlikely event of shoreline oiling, fur-bearing marine mammals that haul out in the affected area may experience a change in mortality or injury and a change in health upon exposure to hydrocarbons, although it is probable that only a small proportion of local populations would be affected. Potential for change in habitat quality or use of oceanic habitats (i.e., water quality and air quality at the air-sea interface) will be greater near the location of the sub-surface release. The degree of change in mortality or injury and change in health will depend in large part on the occurrence and distribution of marine mammals and sea turtles at the time of the blowout, as well as the duration and extent of oil release (i.e., potential severity of effects will be dependent on the potential for exposure). Depending on the exact nature, extent, and duration of a spill, marine mammals and sea turtles in the spill area are likely to experience a combination of exposures from contaminated air, water, and sediment and via a combination of pathways (inhalation, ingestion, aspiration, and adsorption). Oceanic animals that are closer to the site of the blowout are more likely to be exposed to a more constant flow and higher concentrations of fresher oil, as compared to nearshore species.

- *Section 15.5.4 identifies special areas that could overlap with areas exceeding socioeconomic thresholds for oiling from batch spills and subsurface blowouts, both in the offshore and in predicted shoreline contact areas (page 492-493). The areas identified are identical to those identified in the Flemish Pass Exploration Drilling Project EIS, which relied on the model results for EL 1140 and EL 1142.*

Section 15.5.4 is revised to:

Only two Special Areas overlap with **ELs 1159 and 1160 (UNCBD EBSA Slopes of the Flemish Cap and Grand Bank and Southern Flemish Pass to Eastern Canyons VME).** There are a number of Special Areas offshore Eastern Newfoundland that overlap in whole or in part with the **Northern and Southern Sections of the Flemish Pass EIS Project Area (i.e., part of the RSA) (see Table 14.3)**, including various EBSAs, VMEs and NAFO FCAs. Key potential effects in the unlikely event of an accidental event includes potential changes in environmental features and/or processes, and changes in human use and/or societal value.

**Based on modelling results, a 113-day spill at EL 1134 will affect the following special areas (ExxonMobil Canada 2018):**

- **NAFO FCAs: Tail of the Bank (1), Flemish Pass/Eastern Canyon (2), Beothuk Knoll (3), Eastern Flemish Cap (4), Northeast Flemish Cap (5), Sackville Spur (6), Northern Flemish Cap (7), Northern Flemish Cap (8), Northern Flemish Cap (9), Northwest Flemish Cap (10), Northwest Flemish Cap (11), Northwest Flemish Cap (12), Beothuk Knoll (13), 3O Coral Area Closure, Fogo Seamounts (1), Newfoundland Seamounts, and Orphan Knoll.**
- **Eastern Flemish Cap 14**
- **PRMA: South Grand Bank Area, and Virgin Rocks.**
- **Snow Crab Stewardship Exclusion Zone: 8A and 8B.**
- **VMEs: Division 3O Coral Closure, South East Shoal and Adjacent Shelf Edge / Canyons, Beothuk Knoll, Southern Flemish Pass to Eastern Canyons, Flemish Cap East, Northern Flemish Cap, Sackville Spur, Northeast Shelf and Slope (within Canadian EEZ), and Deep Water Coral Area.**
- **UNCBD EBSAs: Seabird Foraging Zone in the Southern Labrador Sea, Orphan Knoll, and Slopes of the Flemish Cap and Grand Bank.**

**A 113-day unmitigated spill at EL 1134 will affect the following shoreline areas (i.e., coastal portions) (ExxonMobil 2018):**

- **IBAs: Grates Point, Baccalieu Island, Cape St. Francis, Witless Bay Islands, Mistaken Point, The Cape Pine and St. Shotts Barren, Cape St. Mary's, Placentia Bay, and Green Island**
- **Coastal Parks / Protected Areas/Coastal Ecological Reserves: Windmill Bight Provincial Park, Dungeon Provincial Park, Marine Drive Provincial Park Reserve, Chance Cove Provincial Park, Gooseberry Cove Provincial Park, Cape Bonavista Lighthouse, Baccalieu Island Seabird Ecological Reserve, Witless Bay Seabird Ecological Reserve, Mistaken Point Fossil Ecological Reserve, Cape St. Mary's Seabird Ecological Reserve, Lawn Bay Seabird Ecological Reserve, and Fortune Head Fossil Ecological Reserve**
- **World Heritage Site: Mistaken Point**

**Modelling indicated that it would take 8 to 27 days for oil to reach shore and it would be highly weathered, patchy, and discontinuous. The time it would take the oil to reach shore would provide adequate time to plan and implement shoreline response measures prior to any shoreline contact by the highly weathered oil.**

**Based on modelling results, a 113-day spill at EL 1135 will affect the following special areas (ExxonMobil Canada 2017):**

- **NAFO FCAs: Flemish Pass / Eastern Canyon (2), Beothuk Knoll (3), Beothuck Knoll (13), Eastern Flemish Cap (4), Eastern Flemish Cap (14), Northeast Flemish Cap (5), Northern Flemish Cap (7), Northwest Flemish Cap (10), Northwest Flemish Cap (11) and Northwest Flemish Cap (12)**

- **VMEs: Southern Flemish Pass to Eastern Canyons, Beothuk Knoll, Deep Water Coral Area, Flemish Cap East and Northern Flemish Cap**

**A 113-day unmitigated spill at EL 1135 will affect the following shoreline areas (i.e., coastal portions) (ExxonMobil 2018):**

- **Placentia Bay / Grand Banks LOMA**
- **EBSA: Placentia Bay Extension**
- **Preliminary Representative Marine Area: Southern Coast of Burin Peninsula and Southwestern Placentia Bay**
- **World Heritage Site: Mistaken Point**
- **Ecological Reserves: Cape St. Mary's, Lawn Bay, Fortune Head, Mistaken Point**
- **IBAs: Cape Pine and St. Shott's Barren, Placentia Bay, Corbin Island, Middle Island; Green Island, Cape St. Mary's, Mistaken Point**
- **National Park Reserve: Sable Island (off the southeast coast of Nova Scotia)**

**Modelling indicated that it would take 30 (coastal Newfoundland) to 50 (Sable Island) days for oil to reach shore and it would be highly weathered, patchy, and discontinuous. The time it would take the oil to reach shore would provide adequate time to plan and implement shoreline response measures prior to any shoreline contact by the highly weathered oil.**

**With spill prevention plans and response strategies in place, including the implementation of shoreline protection measures, potential residual environmental effects of a subsurface blowout the EL 1134 or EL site on Special Areas are predicted to be adverse, low (EL 1134) medium (EL 1134 and EL 1135) in magnitude, short (EL 1134) or medium (EL 1135) to long-term (EL 1134 and EL 1135) in duration, unlikely to occur, within the RSA, and reversible.**

- *Section 15.5.5 indicates a 2% probability for shoreline oiling (page 494). This is not consistent with modelling results presented earlier in the chapter.*

Section 15.5.5 is revised to

In the extremely unlikely event that a blowout occurs, the (conservative, without mitigation) oil spill modelling predicts **the probability of oil making contact with shoreline above 1 g/m² from the 113-day release was approximately <10% in the vicinity of the southern coast of the Avalon Peninsula (EL 1135) and up to 25% on the Avalon Peninsula and primarily <10% on the northern and southern coasts of Newfoundland (EL 1134).** The potential of oil coming into direct contact with Indigenous communities or activities **is limited. The oil that is predicted to make contact with shorelines is expected to be weathered, as minimum time estimates for first shoreline oil exposure range from 30 to 31 days from EL 1135 and 8 to 27 days from EL 1134, depending on the location and season (Abridged EIS Tables 15.7 and 15.8). The oil that did make its way to shore would likely be patchy and discontinuous.** There will be little potential for such biophysical effects on marine-associated resources to translate into any decrease in the overall nature, intensity, distribution, quality or cultural value of these traditional activities by Indigenous communities. For transient species that may encounter spilled materials offshore, the low likelihood of a spill coupled with the probability that a transient species would intersect spilled materials and then travel to an onshore, or nearshore location makes any direct contact or impact unlikely. Therefore, an assessment of potential adverse effects on the health of Indigenous peoples from consumption of contaminated species is not required as there is no credible pathway for an interaction. Spill prevention techniques and response strategies will be incorporated into the design and operations for Project activities as part of contingency planning, resulting in predicted adverse residual effects of neutral to low magnitude, within the RSA, of medium to long-term duration, not likely to occur, and reversible with a moderate to high level of confidence in the effects prediction.

## 2.8 Information Requirement IR-5

**Reference to EIS Guidelines:** Part 2 – Section 7.6.1: Effects of Potential Accidents or Malfunctions / Part 2 – Section 7.4: Mitigation Measures

**Reference to Abridged EIS:** Section 15.1 Spill Prevention and Response

**Context and Rationale:** The EIS Guidelines require the proponent to provide information on contingency and emergency response procedures that would be put in place for the Project. Section 15.1 (page 465-466) of the Abridged EIS notes that spill trajectory modelling assumed the longest capping duration of 36 days. The Agency understands that this was the case for modelling for spills within EL 1140 and EL 1142, associated with the Flemish Pass Exploration Drilling Project (Flemish Pass EIS Appendix E, page 14). However, for the modelling referred to in the Abridged EIS, at EL 1134 and EL 1135, associated with the Exxon Mobile Eastern Newfoundland Exploration Drilling Project (Eastern Newfoundland Exploration Drilling Project EIS, page 1200), the duration assumed for capping was 30 days.

**Specific Question / Request for Information:** Confirm the capping duration for potential spills for the Central Ridge Exploration Drilling Project. Update the effects assessment accordingly.

**Equinor Response:**

Equinor has used the worst-case scenario, which is an unmitigated subsurface blowout flowing for 36 days before a capping stack is installed. There is no requirement to update the effects assessment.

# 3.0 ACCIDENTS AND MALFUNCTIONS DRILL CUTTINGS MODELLING

## 3.1 Information Requirement DFO-05 / C-NLOPB-3 / C-NLOPB-5

**Reference to EIS Guidelines:** Part 1 – Section 3: Scope of the Environmental Assessment / Part 2 – Section 3.1: Project Components / Part 2 – Section 7.1.2: Marine Environment

**Reference to Abridged EIS:** Section 4.5.1 Cuttings Modelling, Table 2.6 and throughout EIS

**Context and Rationale:** The EIS Guidelines state that the “The abridged EIS should... provide a rationale for the applicability of the analysis and conclusions of the Flemish Pass EIS.” Furthermore, the EIS Guidelines state that a description should be provided on the nature, composition and fate of drilling wastes using dispersion modelling. The Abridged EIS states that “Modelling results from ELs 1134, 1135, 1137, and 1142 are suitable to apply to ELs 1159 and 1160, and therefore re-modelling will not be carried out" (page 123). However, there is no rationale provided on how the Flemish Pass modelling is specifically applicable to ELs 1159 and 1160. A description of how model inputs used for the Flemish Pass EIS (e.g. oceanographic conditions, grain size, etc.) are applicable to EL 1159 and 1160 is required to ensure that prediction of effects on benthic habitat and species fall within the range predicted in the Flemish Pass EIS.

In Table 2.6 and throughout Abridged EIS, Equinor provides information on the typical drill mud and cuttings discharge volumes for modelling locations in the Flemish Pass EIS. It is not clear, based on information provided in Figures in the Abridged EIS where the 'Eastern Project Area Modelling Location', 'Jeanne d'Arc Basin Modelling Location' and 'Flemish Pass South Modelling Location' are located, as referenced in Table 2.6. Additionally, these areas are referenced throughout the Abridged EIS, but they are not clearly identified.

**Specific Question / Request for Information:** Provide details on model inputs (e.g. oceanographic conditions, grain size, etc.) and results to support the rationale for how cuttings modelling for the Flemish Pass EIS is applicable to ELs 1159 and EL 1160.

Update text for effects assessment accordingly. Provide a figure with all modelling locations labelled.

**Equinor Response:**

Figure 1-1 in the Abridged EIS includes modelling locations. The 'Flemish Pass South Modelling Location' is located on EL 1134, the 'Southern Project Area Modelling Location' is located on EL 1135, Jeanne d'Arc Basin Modelling Location' is located on EL 1137, the 'Northern Project Area Modelling Location' is located on EL 1140, and the 'Eastern Project Area Modelling Location' is located on EL 1142. A revised Figure 1-1 is provided below as Figure 6 below with the modelling location names indicated.

The primary cuttings model inputs include cuttings particle (grain) size distribution, cuttings volume, cuttings release depth and oceanographic conditions (Sections 2.0 and 3.2 of Amec Foster Wheeler, 2017a, 2017b for EL 1135, EL 1137; Section 2.0 of Amec Foster Wheeler, 2018 for EL 1134).

Drilling methods for any exploration wells planned for EL 1159 and EL1160 are likely to employ similar well designs and schedules to those employed for other exploration drilling in the Project Area. These factors determine the cuttings volumes, drilling discharge schedule (i.e., when materials are estimated to be released to the sea) and releases at the seabed from the conductor and surface sections and from just below the sea surface for intermediate and main sections.

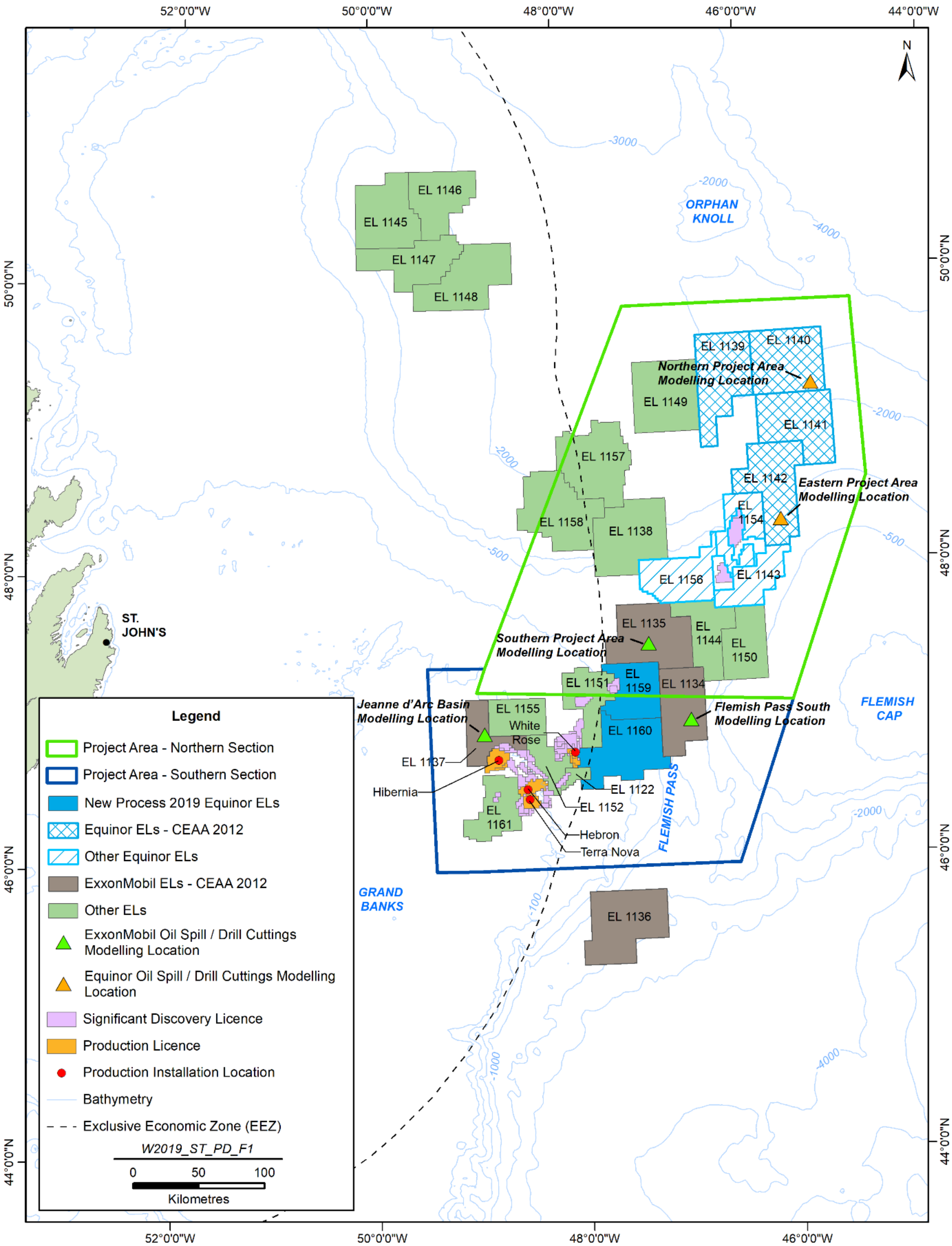



**Figure 6** **Revised Figure 1-1: Project Area**

From the previously completed modelling, estimates of cuttings particle size distributions (percent of the cuttings material that are sands, fines, silts or clays) (PSD) are based on cuttings sample analysis from historical wells in the Project Area (e.g., HMDC Hibernia P-02 and Statoil Canada Ltd. et al Bay de Verde F-67 as reported in the previous modelling studies). Associated with the PSD are estimated cuttings settling velocities. It is reasonable to assume these (drilling program and PSD) model inputs would be similar for EL1159 and EL1160, as they were for the previous modelling completed for EL1135 (site ID SPA for Southern Project Area, on the northeast slope of the Grand Bank and adjacent to the Flemish Pass), EL 1134 (site ID EL 1134 in the Flemish Pass) and EL 1137 (site ID JDB for Jeanne d'Arc Basin, approximately 20 km northwest of Hibernia).

Oceanographic conditions at EL 1159 and EL 1160 are described in IR-DFO-25 Response (Section 2.2) and apply to the drill cuttings model as well as the oil spill trajectory model.

The following provides a brief summary of results taken from the existing modelling for SPA, JDB, and EL 1134 (Amec Foster Wheeler 2017a, 2018).

The discharged WBM cuttings at the SPA location settled within 1.5 km of the well site and averaged 0.3 to 4.0 mm thick, with a maximum thickness of 66 to 80 mm between 100 to 1,000 m from the well site. SBM cutting thicknesses averaged less than 0.01 mm thick, with a maximum thickness of 0.06 mm.

The WBM cuttings at the JDB location settled within approximately 1 to 2 km, with a mean thickness of 8 mm or less and a maximum thickness of 102 mm approximately 210 m from the well site. Approximately one-third of the SBM cuttings settled within 4 km of the well site, with the remaining two-thirds settling within approximately 8 to 16 km. Overall average thickness of settled SBM material was 0.4 mm or less, with a maximum thickness of 2 to 3 mm predicted within 4 km from the well site.

The WBM cuttings at the EL 1134 location was predicted to settle within approximately 1 km of the well site. Mean WBM cuttings thicknesses within 200 m of the well site were predicted to range from approximately 0.4 to 2 mm, with a maximum thickness of 8 to 80 mm (24 to 97 mm between 250 and 410 m out from the well site). The nearest SBM cuttings were predicted to settle is approximately 300 to 2,100 m, with mean SBM cuttings thicknesses less than 0.01 mm at all distances from the well site and maximum thicknesses of approximately 0.03 to 0.04 mm 2 to 5 km from the well site.

The oceanographic regimes and depths encountered within EL 1159 and EL 1160 are therefore similar to those covered by previously modelled locations. Given these similar inputs, and the anticipated similar grain sizes (as applied in the various models), previously modelled location results can be applied for locations in EL 1159 and EL 1160 (e.g., JDB for shallower locations on the Grand Bank, SPA for slope locations, and EL 1134 for deeper portions of the Flemish Pass). Overall, the cuttings footprint predictions from these three sites are applicable in terms of the magnitude of thicknesses and extent of deposition from the well site. As such, modelling for EL 1159 and EL 1160 is not necessary as the results from the closest of the previously modelled sites can be applied.

**New References:**

Amec Foster Wheeler. 2017a. Eastern Newfoundland Offshore Exploration Drilling Project 2018-2030, EIS Appendix G Drilling Mud and Cuttings Dispersion Modelling. Prepared by Amec Foster Wheeler for ExxonMobil Canada Limited, St. John's, NL.

Amec Foster Wheeler. 2017b. Flemish Pass Exploration Drilling Project 2018-2028, EIS Appendix G Drill Cuttings Modelling. Prepared by Amec Foster Wheeler for Equinor Canada Ltd. (Statoil Canada Ltd.), St. John's, NL.

Amec Foster Wheeler. 2018. Eastern Newfoundland Offshore Exploration Drilling Project 2018-2030, EIS Appendix G Addendum Drill Mud and Cuttings Dispersion Modelling, Exploration Drilling, EL1134. Prepared by Amec Foster Wheeler for ExxonMobil Canada Limited, St. John's, NL.

# 4.0 MARINE MAMMALS AND SEA TURTLES

## 4.1 Information Requirement DFO-4 / IR-2

**Reference to EIS Guidelines:** Part 1 – Section 3.2.3: Spatial and Temporal Boundaries / Part 2 – Section 7.3: Predicted Effects on Valued Components

**Reference to Abridged EIS:** Section 4.3.1 Environmental Assessment Study Areas and Effects Evaluation Criteria / Section 10.0 Marine Mammals and Sea Turtles: Environmental Effects Assessment

**Context and Rationale:** The EIS Guidelines require a detailed analysis of the significance of residual environmental effects with consideration of a number of factors, including the geographic extent of potential effects. The Abridged EIS includes a Local Study Area for each valued component to characterize the geographic extent of residual environmental effects. In the Abridged EIS, the definition of the Local Study Area is different than that in the Flemish Pass EIS. Section 4.3.1 (page 116) of the Abridged EIS defines the Local Study Area for all valued components as "the Project Area plus the transit route" (page 116). The Flemish Pass EIS (page 884) defines the Local Study Area for marine mammals and sea turtles as follows: "the offshore Project Area and an appropriately 150 km around it, as well as an approximately 10 km area around the associated vessel and aircraft traffic routes to the ELs". The Local Study Area for marine mammals and sea turtles in the Flemish Pass EIS effects assessment was larger than that of other valued components to encompass the potential zone of influence of sound emissions. The Abridged EIS has not discussed or considered this change in approach in the analysis. Also, the difference in the potential zone of influence for sound emissions for effects on marine mammals is not clear.

**Specific Question / Request for Information:** Confirm whether the Local Study Area for the marine mammals and sea turtles effects assessment for the Central Ridge Exploration Drilling Project is the same as in the Flemish Pass EIS. If not, provide a rationale for the change in the definition of Local Study Area from that used in the Flemish Pass EIS. Indicate how this change may affect the environmental effects analysis and significance conclusions for the Central Ridge Exploration Drilling Project for marine mammals and sea turtles, and any other valued components, as applicable. Update the effects analysis, as applicable. Provide a discussion of whether the Local Study Area is intended to encompass the potential zone of influence of environmental effects on marine species. Update the effects analysis, as applicable. Clearly depict the Local Study Area in a figure (e.g. Figure 4-1).

**Equinor Response:**

The Flemish Pass EIS based its LSA on modelling conducted for the Scotian Basin Exploration Drilling Project (not project-specific modelling), which predicted that sound levels from an operating drilling installation would attenuate to below the NOAA behavioural disturbance thresholds (120 dB re 1 µPa RMS SPL) at distances from the source ranging from 23 km (in summer) to approximately 150 km (winter). The Scotian Basin project's location featured a strong surface channel, created by strong winter water temperature gradients that trapped acoustic energy at the surface, thereby reducing the amount of transmission loss.

Since the Flemish Pass EIS was published, project-specific underwater sound modelling has been conducted for a number of projects based in the Flemish Pass. Chevron Canada conducted modelling for EL 1138 in the west Flemish Pass, approximately 90 km north of the EL 1159 border (Zykov and Alavizadeh 2019.), which has topography more similar to ELs 1159 and 1160 than the Scotian Shelf Gully. That modelling determined an approximately 32 km maximum distance to the behavioural threshold for marine mammals. Modelling conducted for BHP Canada's exploration drilling project in the eastern Orphan Basin (Alavizadeh and Deveau 2019) (ELs 1157 and 1158; located north of Chevron's EL) indicated that project activities would dominate the soundscape within distances of 10 to 40 km from the platform. Modelling conducted for CNOOC's Flemish Pass project (ELs 1144 and 1150, located approximately 45 km northeast and 90 km east from the eastern border of EL 1159, with a similar range of water depths) predicted distances to behavioural thresholds for marine mammals of approximately 48 to 57 km (Matthews et al. 2017).

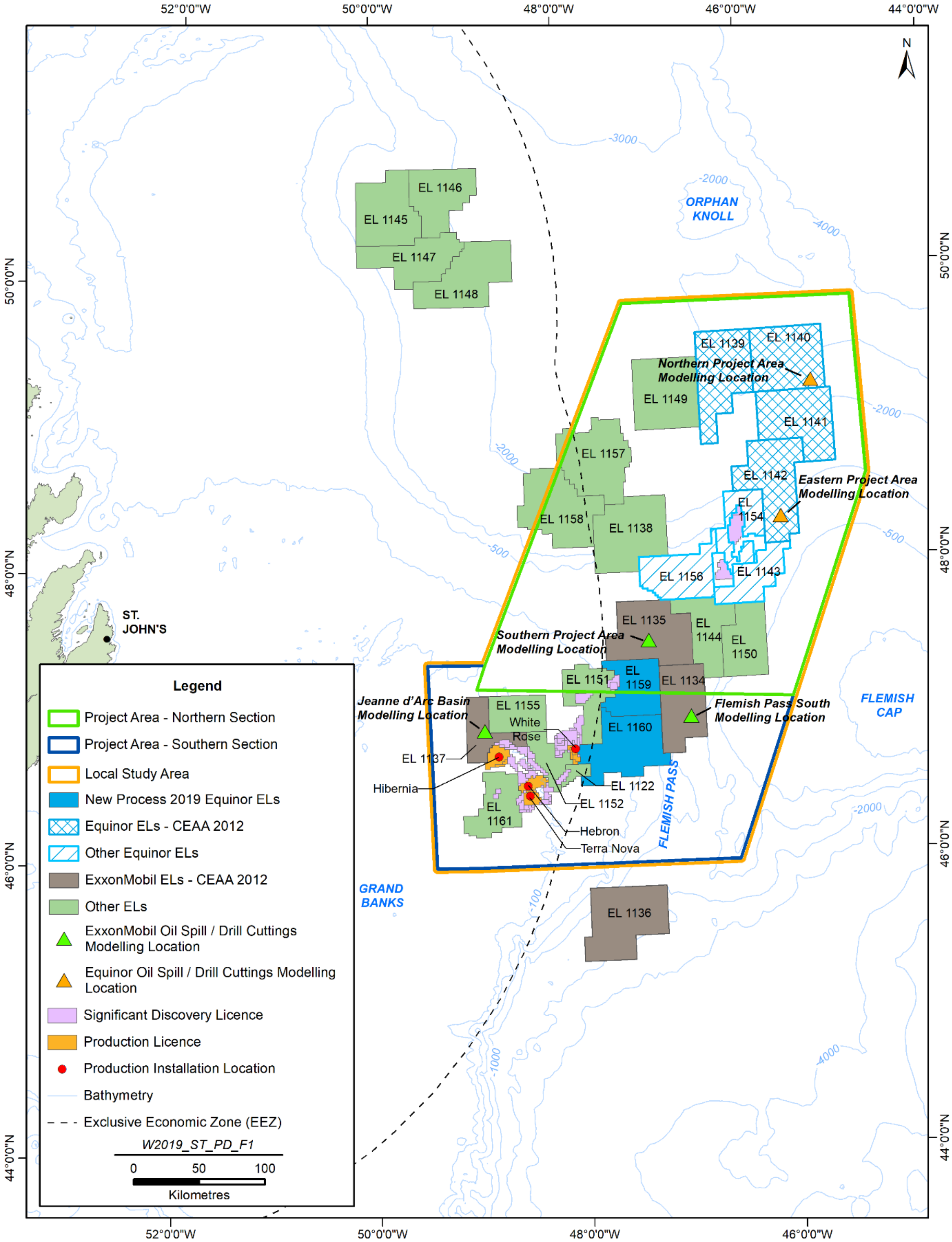
As ELs 1159 and 1160 are more than 50 km from the border of the defined Project Area (Northern and Southern sections, as illustrated in Figure 7 below), the LSA for ELs 1159 and 1160 is defined as the same as the Flemish Pass Project Area (plus the transit route). Routine activities will occur within ELs 1159 and 1160 and the existing (previously assessed) Flemish Pass Project Area provides the buffer for any activities that occur at the very edge of ELs 1159 and 1160. There is no requirement to revise the assessment.

**New References:**

Alavizadeh, Z. and T.J. Deveau. 2019. 2019 BHP Exploration Drilling in the Orphan Basin: Underwater Sound Modelling Report. Document 01832, Version 3.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

Matthews M.-N. R., Z. Alavizadeh, L. Horwich, and M. Zykov. 2017. Underwater Sound Propagation Assessment: Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018–2028). Document 01514, Version 2.0. Technical report by JASCO Applied Sciences for AMEC Foster Wheeler.

Zykov, M.M. and Z. Alavizadeh. 2019. Underwater Sound Associated with Exploration Drilling Offshore Eastern Newfoundland: Chevron's West Flemish Pass Project. Document 01784, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.




## Figure 7 Revised Figure 4-1: Environmental Assessment Study Areas

# 5.0 AIR QUALITY

## 5.1 Information Requirement IR-1

**Reference to EIS Guidelines:** Part 2 – Section 6.3.8.1: Air Quality and Greenhouse Gas Emissions

**Reference to Abridged EIS:** Section 2.9.1 Air Emissions

**Context and Rationale:** The numbers for greenhouse gas emissions in the final paragraph of Section 2.9.1 (page 54) of the Abridged EIS are from Flemish Pass IR-08, but there was additional informal clarification with the proponent on these numbers after the IR phase. The Flemish Pass Environmental Assessment Report states that the Flemish Pass Exploration Drilling Project could emit a total of 141,615 to 207,036 tonnes of CO2 equivalent per year. Additional information is provided in Table 3 of the Flemish Pass Environmental Assessment Report.

**Specific Question / Request for Information:** Confirm whether the numbers used in the Flemish Pass Environmental Assessment Report are applicable to the Central Ridge Project. If these numbers are not valid, provide updated numbers along with an explanation of how they were calculated.

**Equinor Response:**

We confirm that the numbers used in the Flemish Pass EIS are applicable to the Central Ridge Project.

# 6.0 CUMULATIVE EFFECTS

## 6.1 Information Requirement IR-6

**Reference to EIS Guidelines:** Part 2 – Section 7.6.3: Cumulative Effects Assessment

**Reference to Abridged EIS:** Section 14.3 Marine and Migratory Birds (including Species at Risk)

**Context and Rationale:** Section 14.3 (page 458) of the Abridged EIS states that the White Rose production facility is approximately 2 kilometres from the closest edge of EL 1160. While the Abridged EIS does state that there are safety zones for the production facility and the South White Rose Extension, it is unclear as to what Project activities may occur within the safety zones and what the effects of these activities could be.

**Specific Question / Request for Information:** Describe what Project activities potential effects within the safety zones can have that overlap ELs 1159 and 1160. Update the cumulative effects assessment taking into account the potential of overlap for the zone of influence for lighting, sound and marine discharges between the White Rose and White Rose Extension and the Project. Provide a discussion on the distance of the White Rose safety zone from this Project’s ELs and its effectiveness on reducing cumulative effects for each potential source (underwater sound, light emissions, marine discharges, and direct interaction with the benthic environment) for fish and fish habitat, birds, marine mammals and sea turtles.

**Equinor Response:**

The White Rose safety zone in relation to ELs 1159 and 1160 is shown in Figure 8 below. The western-most edge of EL 1160 extends approximately 1 km into the eastern side of the White Rose safety zone (areal extent is 93 km²). Notices to Mariners for the area prohibit unauthorized navigation of the White Rose safety zone; only those activities related to White Rose production is permitted to occur within this safety zone. Therefore, no Project-related activities associated with Central Ridge exploration drilling (including a 500-m Project-related safety zone) can overlap spatially with the White Rose safety zone. Note that the West White Rose Project (White Rose Extension) is located approximately 5 km west of the EL 1160 boundary. Drilling can occur at either the South White Rose Extension Drill Centre or North Amethyst Drill Centre (southern-most drill centres); however, no drilling is currently ongoing or planned for the near future.

As specific drill location(s) have not yet been identified in EL 1160 (or EL 1159), for the purpose of this response it is assumed that Project-related activities could occur in the vicinity of the White Rose safety zone (i.e., within the 200 nautical mile Economic Exclusion Zone).

Residual effects from drilling and production operations in the White Rose production field 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, marine and migratory birds, and marine mammals and sea turtles.

***Marine Fish and Fish Habitat***

Drilling cuttings are discharged and contained within drill centres during drilling operations. When the West White Rose Project is operational, drill cuttings will be discharged at the wellhead platform. Drill cuttings modelling for the West White Rose Project predicted a maximum extent of approximately 5 km to the southeast and northeast; these cuttings were exclusively WBM and settled in thicknesses of 1 mm or less. Cuttings thicknesses within 100 m of the wellhead platform averaged 1.4 cm (maximum 8.6 cm), from 100 to 200 m from the wellhead platform they averaged 1.9 mm (maximum 3.4 mm), and 200 to 500 m from the platform they averaged 1.8 mm (maximum 4.6 mm) (AMEC 2012). In the shallower sections of EL 1160, cuttings deposition would be similar to those modelled for EL 1137, with cutting deposition predicted to extend approximately 1 km to the southeast of drilling (see Section 3.1; response to IR- DFO-05 / C-NLOPB-3 / C-NLOPB-5). Given the predicted depositional amounts and direction, there would be minimal spatial overlap from drill cuttings discharge, and therefore, no cumulative effects anticipated to fish and fish habitat (which is predominantly sand in this section of the Grand Banks).

***Marine and Migratory Birds***

Potential interactions with, and effects on, marine and migratory birds as a result of the Project and other projects and activities in the region relate primarily to possible attraction effects associated with Project lighting, particularly where these may affect the same individuals or populations.

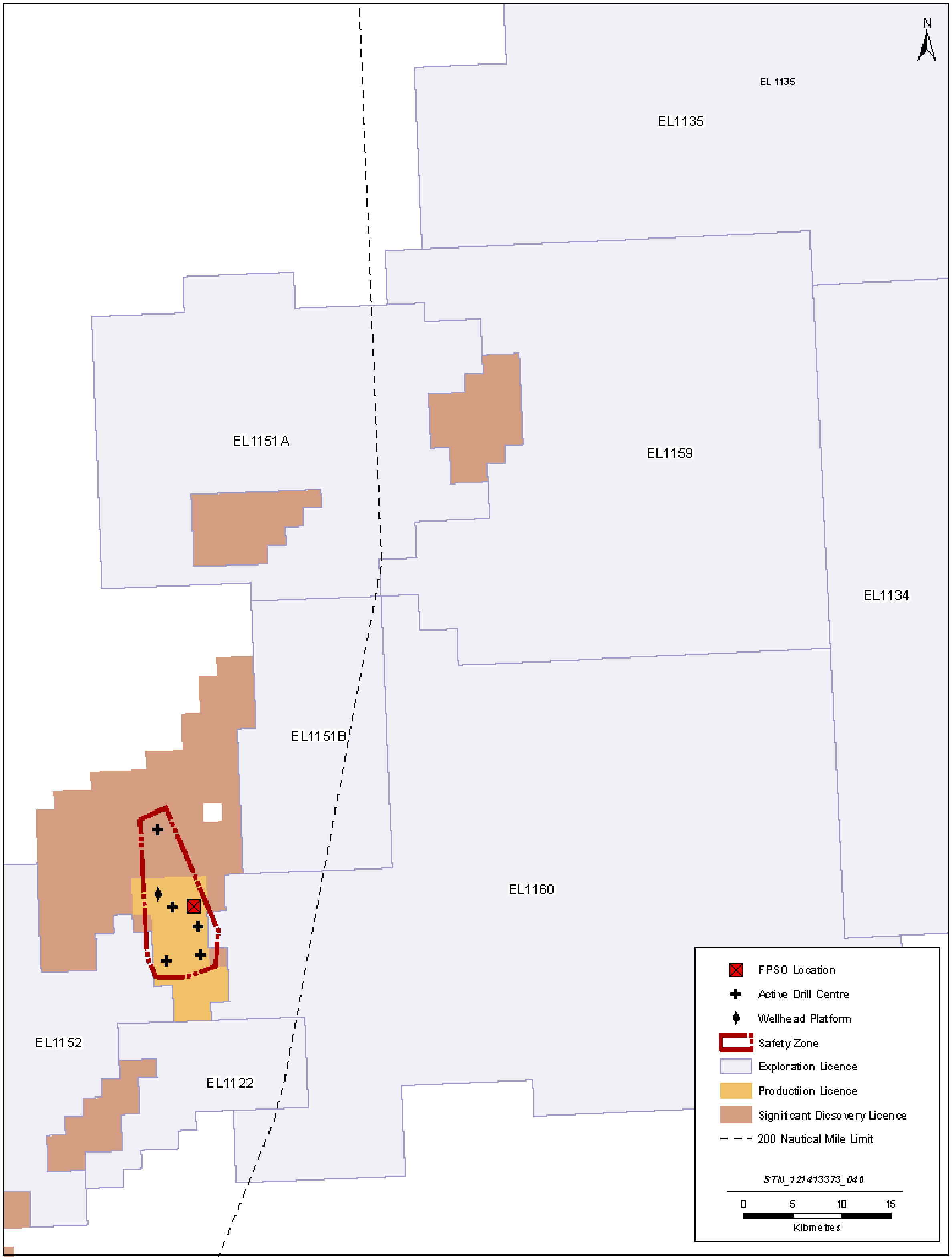



**Figure 8 Location of White Rose Safety Zone in Relation to ELs 1159 and 1160**

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. 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. Using a conservative attraction distance of 15 km (Rodriguez et al. 2014), and assuming that both the White Rose FPSO and a MODU used by Equinor may therefore attract birds over a diameter of 30 km around their respective platforms, the potential maximum 'cumulative effect area' for two projects could conceivably extend over a combined diameter of 60 km.

The potential interactions may be particularly relevant to species like Leach's Storm-petrels, which are vulnerable due to high potential for attraction to lights. The Leach's Storm-Petrel, a species recently designated Vulnerable by the International Union for Conservation of Nature (IUCN), has been noted to be particularly susceptible to attraction to artificial light sources. This species is found in the offshore waters of eastern Newfoundland throughout the year; unlike most seabirds nesting in eastern Newfoundland, breeding adults are known to forage within the Project Area, hundreds of kilometres offshore (Hedd et al. 2018). Populations of four of seven major Atlantic Canadian colonies have decreased; this has been attributed to several factors including predation, ingestion of marine contaminants such as mercury, collisions and strandings due to attraction to lighted structures, and contact with hydrocarbons (BirdLife International 2017). The core foraging areas of four colonies overlapped with the production facilities (Baccalieu Island NL, Gull Island in Witless Bay NL, Country Island NS, and Bird Island NS) (Hedd et al. 2018). The core foraging areas for these Leach's Storm-petrel colonies are extremely large, with foraging trips averaging more than 1,400 km per round trip and more than 500 km from the colonies (Hedd et al. 2018).

Species with greater wintering site fidelity such as common murres nesting in the northwest Atlantic, whose wintering area is concentrated on the Grand Banks, may be more vulnerable than species with greater intercolonial and interannual diversity in wintering areas such as thick-billed murres (McFarlane Tranquilla et al. 2014). However, because the foraging and wintering grounds of marine bird species are so large, if there is an interaction between the Project and marine birds the attraction and/or displacement effects due to the proposed Project and other ongoing projects will potentially disrupt only a small percentage of individuals. The effects are likely to be transient and temporary in nature without significant adverse cumulative effects on individuals or populations.

Seabird observations are collected from observers onboard the production platforms as per the Eastern Canada Seabirds at Sea program protocol (Environment and Climate Change Canada 2016). As an example of observations made from the Terra Nova FPSO, a total of 11,730 individual seabirds were recorded during 732 seabird observation sessions during January 1, 2017 to December 31, 2017 (Suncor Energy 2019). No seabird sightings were made in 20% of all observations due to poor weather conditions limiting visibility. No seabirds were recorded in approximately 43% of the observations. Black-legged kittiwake and great black-backed gull were the two most commonly sighted birds and accounted for approximately 59% of all birds sighted; Leach's storm-petrel were observed during September (PAL Aerospace 2018, in Suncor Energy 2019).

Suncor Energy has a Leach's storm-petrel recovery and release program on the Terra Nova FPSO, and data filed with Environment and Climate Change Canada (ECCC) and C-NLOPB indicate no pattern to the number of birds found on the Terra Nova FPSO in any one year. The recovery and release program on the Terra Nova FPSO records any observed species (not just Leach's storm-petrel). Recorded species include greater shearwater, peregrine falcon, Canada goose, ruddy turnstone, American bittern, thick-billed murre, common murre, unknown murre species, boreal owl, dovekie, Atlantic puffin, and unknown tern and gull species (Suncor Energy 2019). Similar observations are likely made on the *SeaRose FPSO*.

The Project is not anticipated to result in significant adverse effects on marine-associated avian species at risk and is also unlikely to contribute to substantive cumulative effects on these species. There is no identified and designated critical habitat for avian species at risk within the Project Area / LSA; ivory gull and red-necked phalarope are the only such species that have the potential to be found in the area on a regular basis. The ivory gull is generally associated with pack ice, and as such, it is more likely to occur in the northern regions of the Project Area. During fall migration, there is some potential for peregrine falcons and nocturnally migrating landbird species at risk to pass through, but the risk of interactions with this and other projects in the area is low.

***Marine Mammals and Sea Turtles***

Sound associated with production activities in the White Rose field is generated by the FPSO and drilling rigs (when present) and the West White Rose Project (after 2022). There is no seismic (impulsive) generated sound from production activities in the White Rose field. The *SeaRose FPSO* has been operational since 2005, a constant sound source that marine mammals would likely incorporate into their soundscape. Quijano et al. (2017) recorded levels of 110 to 120 dB re 1 μPa recorded in the vicinity of production platforms on the Grand Banks. The National Marine Fisheries Service's (2018) threshold for marine mammal behavioural disturbance to non-impulsive (i.e., continuous) sound (120 dB re 1 μPa) suggests that marine mammals within 35 km of existing production platforms may already be exposed to sound levels capable of causing behavioural disturbance. Many of the marine mammals that could potentially be exposed travel 100 km in a day). The Terra Nova Environmental Assessment (EA) Validation Report (Suncor Energy 2019) recorded sightings in the vicinity of the Terra Nova FPSO, which suggests that not all individual marine mammals avoid the production platforms, even with the capability of doing so. Species observed during Jeanne d'Arc Basin seismic surveys include humpback whale, minke whale, long-finned pilot whale, sei whale, fin whale, white-beaked dolphin, common dolphin, Atlantic white-sided dolphin, harp seal (ExxonMobil Canada Properties 2011).

**Summary**

Although the White Rose oilfield is a long-term operation with similarly long-term environmental disturbances, the localized nature of these effects, and the short-term and localized environmental disturbances that may result from adjacent activities associated with this Project, will reduce the potential for cumulative effects to occur.

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# 7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

## 7.1 Information Requirement ECCC-02

**Reference to EIS Guidelines:** Part 2 – Section 7.1.2: Marine Environment / Part 2 – Section 7.6.2: Effects of the Environment on the Project

**Reference to Abridged EIS:** Section 15.2 Potential Accidental Event Scenarios

**Context and Rationale:** Section 15.2 of the Abridged EIS provides some information on hurricanes and includes mention of bathymetric effects on rogue wave potential. Environment and Climate Change Canada indicated that the possibility of extreme/rogue waves in the region should be considered due to highly varying bathymetry and the ELs being located in a region where post-tropical storms can produce trapped- fetch wave growth.

**Specific Question / Request for Information:** Provide information on the following:

A. Extratropically-transitioning hurricanes, and climatology of 'dynamic fetch' waves associated with these unique but dangerous storms.
B. Types of extreme wave phenomenon (dynamic fetch, rogue).
C. Measures that will be taken to minimize the potential environmental effects of the environment on the Project.

**Equinor Response:**

We recognize that extreme events such as those listed above can occur, and that there are limitations in forecasting such events. The safety performance of offshore rigs is the top priority and heavily regulated. The certification of the rig is carried out by independent third parties, to ensure safe operations year-round. Factors such as those above are therefore addressed in the certification process. Below is the description of the certification process, taken from the Flemish Pass EIS:

"The Operator's drilling installation selection process includes consideration of several factors: drilling target depth, water depth at drilling location, oceanographic and meteorological conditions, and technical capability of a drilling installation to operate in deep water. The drilling installation must be able to operate in the met-oceanographic conditions of the North Atlantic and be winterized should year-round drilling be required. In addition, through the Operator's drilling installation intake process, the Operator confirms that contracted drilling installation conform to company practices and industry standards. In order to operate in the Canada-NL Offshore Area, pursuant to the *Newfoundland Offshore Certificate of Fitness Regulations* under the Accord Acts and the C-NLOPB OA requirements, a drilling installation requires a Certificate of Fitness to be issued from a recognized independent third-party Certifying Authority. The purpose of this additional certification is to provide independent third-party assurance and verification that the drilling installation is fit for purpose, functions as intended, and remains in compliance with the regulations without compromising safety and polluting the environment."